SOLV-EX
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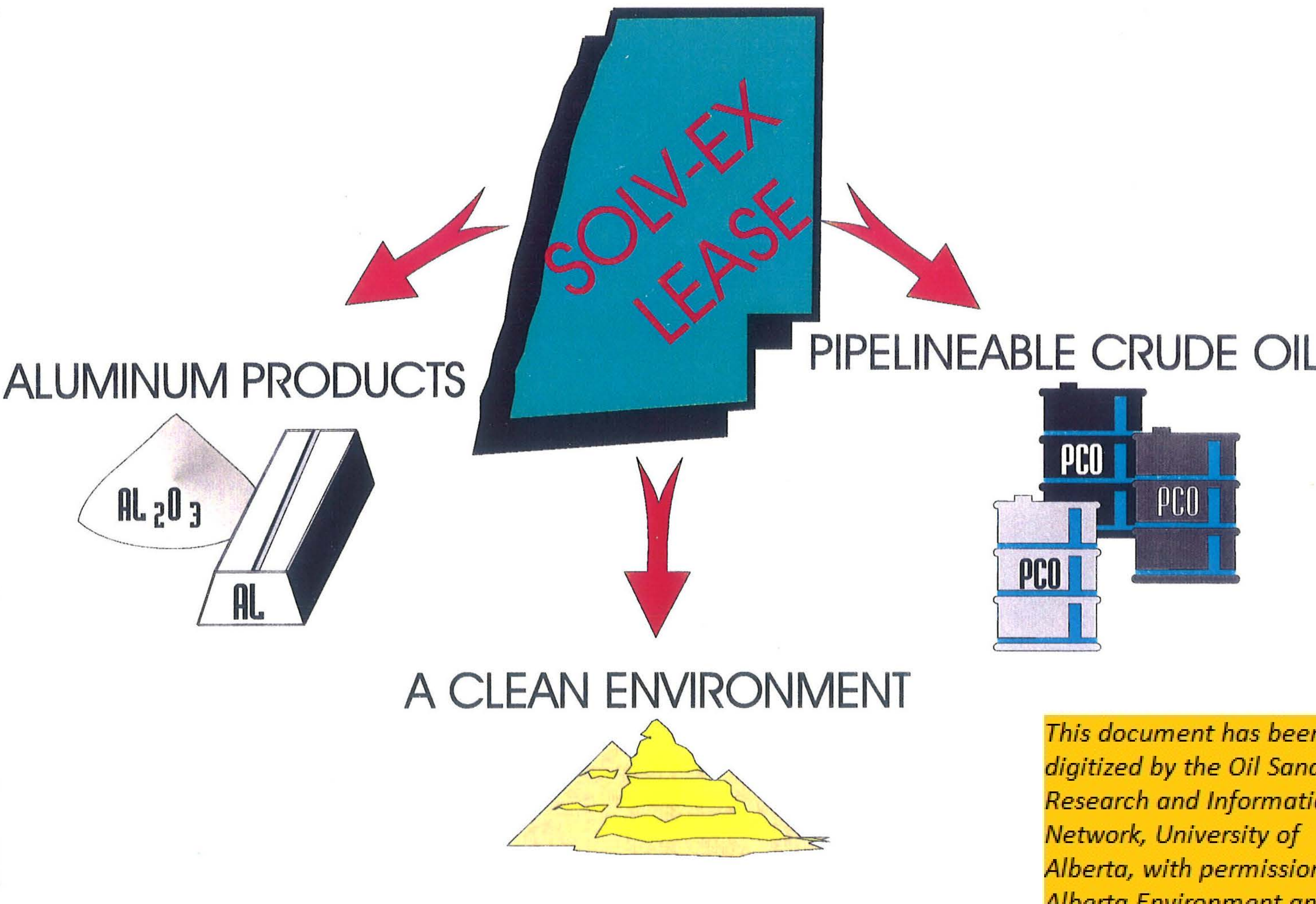
OIL SANDS CO-PRODUCTION EXPERIMENTAL PROJECT SUPPLEMENTAL INFORMATION REGARDING AEUB APPLICATION NO. 950993 AEP APPLICATION NO. 001-17233



OCTOBER 1995

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October 5, 1995

Mr. Larry Brocke
Director of Land Reclamation
Alberta Environmental Protection
3rd Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Dear Mr. Brocke:

Subject: **Application No. 001-17233**
THE OIL SANDS CO-PRODUCTION EXPERIMENTAL PROJECT
LEASE 7276120T05

In response to the Alberta Environmental Protection letter of September 20, 1995 and to the Alberta Energy and Utilities Board letter of September 19, 1995 requesting clarification and additional information on some aspects of the subject project, SOLV-EX (together with BOVAR-CONCORD Environmental) has prepared the attached document.

It is the opinion of SOLV-EX that by combining the responses to the two requests into one single document, it will give the reviewer a more comprehensive set of information. Furthermore, this is in line with the common approach taken by the Applicant, by AEP and by AEUB throughout the application and the review process.

We trust that the information we are now providing meet with the requirements for granting SOLV-EX the conditional approvals to proceed with the construction and the operation of the Oil Sands Co-production Experimental Project. For any further details you may require, please do not hesitate to contact the undersigned at (403) 233-9254.

Yours truly,

SOLV-EX CORPORATION

Aldo Corti, P.Eng.
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c.c. H. Campbell, SOLV-EX

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October 5, 1995

Dr. Richard Houlihan, P.Eng.
Alberta Energy and Utilities Board
640 - 5th Avenue S.W.
Calgary, Alberta
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Dear Dr. Houlihan:

Subject: **Application No. 950993**
THE OIL SANDS CO-PRODUCTION EXPERIMENTAL PROJECT
LEASE 7276120T05

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SUPPLEMENTAL INFORMATION REGARDING ALBERTA ENERGY AND UTILITIES BOARD APPLICATION NO. 950993 AND ALBERTA ENVIRONMENTAL PROTECTION APPLICATION NO. 001-17233
Oil Sands Co-Production Experimental Project on Lease 5

Submitted to

The Alberta Energy and Utilities Board
and
Alberta Environmental Protection

Submitted by

SOLV-EX Corporation
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5 October 1995
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1.0 INTRODUCTION

This submission is in response to a September 19, 1995 letter from the Alberta Energy and Utilities Board (AEUB) and a September 20, 1995 letter from Alberta Environmental Protection (AEP) to the SOLV-EX Corporation.

The AEUB letter contains itemized requests for additional information on the application for an approval under the Oil Sands Conservation Act (referred to as the Application in Section 2.0 of this submission) and the Environmental Impact Assessment (referred to as the EIA in Section 2.0 of this submission). The application and EIA were submitted to the AEUB during late June 1995. The EIA was transmitted by the AEUB to Alberta Environmental Protection (AEP) and other government departments.

The AEP letter contains itemized requests for additional information on the application (referred to as the Application in Section 3.0 of this submission) for an approval under the Alberta Environmental Protection and Enhancement Act (AEPEA). The application was submitted to AEP during July 1995.

The additional information of this submission is presented as follows:

- The itemized requests of the AEUB and AEP letters are presented with answers in Sections 2 and 3, respectively. The answers are prepared by SOLV-EX and BOVAR-CONCORD Environmental (BCE) depending on the nature of the information request.

- Attachments are appended in Appendices A and B for requests requiring detailed discussions and background information. The attachments are numbered using the same item numbers as used in the two letters received by SOLV-EX.

- New figures and tables presented herein are numbered using the item numbers of the AEUB and AEP information requests.

2.0 RESPONSES TO AEUB LETTER

A. General

QA1. Although the experimental program indicates 6 years of testing, it is not clear whether this amount of time is necessary. Please provide additional information that supports the need for a six year test program.

Answer: Six years of testing is required to provide for five years of testing of all three major processing sectors, i.e. bitumen extraction, bitumen upgrading and mineral extraction. The five years do not represent all of the time required for testing various parameters due to the following expectations:

- delays which may occur during commissioning;
- unexpected equipment breakdown or needs for design and equipment modifications; and
- a need for measuring additional process and equipment parameters which may be found to affect the processes.

The experimental program schedule (Figure D-1 of Appendix D of the Application) is designed around the basic processing of three different oil sands grades during periods of six months for each grade. Each six month period will be dedicated to analyze process performance for various combinations of process variables. If additional, important process variables are identified during the program, additional program time will be required. The additional time required will proliferate because it will have to accommodate time for testing all three grades in combination with other process variables.

In our experience, it is prudent to allow time for these occurrences during a test program designed from the experience of operating only pilot versions of some of the processes.

B. Mine Development

QB1. Elaborate on SOLV-EX's plans for mitigating the impacts of mine development on the Athabasca river valley.

Answer: As noted in the EIA, SOLV-EX is making application for approval for a mine, where the proposed setback of the mine from the Athabasca River is 100 m. The optional mine locations were selected based on the depth to overburden and economic costs. Additional drilling completed in August 1995 shows the orebody in these mine locations by the river is suitable for mining. Increased costs associated with the removal of thicker overburden covering oil sands to the east, would make the experimental project unfeasible.

The mine is located in the Athabasca-Clearwater Resource Management Area (RMA; Fort McMurray-Athabasca Oil Sands Subregional Integrated Resource Plan [IRP]; Alberta Environmental Protection 1994). The IRP states that, within this RMA, exploration and development of oil sand resources in the Athabasca River Valley will be considered only if the proponent can demonstrate that mitigation of impacts on resources and values, identified in the following list, can be achieved.

- **Wildlife:** Protect vegetation (wind shelter, ungulate wintering areas, travel corridors), riparian habitat, and habitat diversity.

- **Erosion:** Protect sensitive soils and drainage patterns from erosion or disturbance, and downstream users from sedimentation.

- **Floodplain:** Provide a development setback to at least the 1:100 year flood level and accommodate for natural evolution in the path of the river.

- **Water Quality:** Protect water quality for downstream users including human, fish and other biota, and natural surface and groundwater regimes.

- **Recreation and Tourism:** Protect visual and acoustic aesthetics for river users and recreationists using the river as a travel corridor, and protect characteristic valley horizon.

- **Ecological:** Protect unique physical river valley characteristics (e.g., springs), rare flora and fauna, and critical ecological functions and processes.

- **Traditional Lands:** Protect important traditional land use sites for First Nation People.

- **Historic Sites:** Protect historic resources for scientific, educational and interpretive purposes.

To identify what resources exist and values within the setback between the Athabasca River and the SOLV-EX mine, the following field programs were conducted and information was collected:

- wildlife ungulate aerial and track counts (February 1995),
- rare plant inventory (June 1995),
- tree coring (June 1995),
- inventory for groundwater springs (June 1995),
- vegetation and soil mapping (June 1995),
- an inventory for signs of a wildlife movement corridor (Sept. 1995),
- drilling for geotechnical stability in the mine setback area (Aug.-Sept. 1995), and
- inventory for movement corridors and ungulate use (September 1995).

Based on this field information, it can be concluded that no valuable environmental resources occur within the mine setback area (see below) and that no mitigation to reduce impacts will be required. However, the Athabasca River will be protected by the following measures:

- Leaving a mine setback between the river and the mine pit, at least 100 m at the top of and 300 m at the bottom of the pit. The orebody comprises two distinct layers of oil sands separated by an intermediate central reject layer. Possibility exists that, should the mine pit present lower layer concerns, only the upper layer might be mined by the river. This would present the advantage that the bottom pit by the river would be above the river level,

- Starting mining at an elevation of approximately 10 m above the 1:100 year flood and ice level.

The river valley will be further protected by minimizing the area disturbed by ancillary facilities such as the mine road, and reclaiming the mined area as soon as possible, in phases.

Based on the field information, the following statements can be made on the resources and values within the setback for the proposed SOLV-EX mine.

- **Wildlife:** Within the proposed setback approximately 7 ha (33%) has been disturbed for the Bitumount Historic Site, approximately 5 ha (24%) is white spruce, and approximately 9 ha (43%) is closed black spruce forest. White spruce is common, representing over 10% of the Local Study Area, while closed black spruce represents 2% of the Local Study Area. White spruce and black spruce forests are common and ubiquitous habitat types throughout the region. Important winter range for ungulates in the OSLO area, which is located a few kilometres southwest of the SOLV-EX site, was identified based on modelling to include shrublands, mixedwood forests and aspen, and most forest areas adjacent to shrublands (Section 4.7.2, Table 4.23 of the EIA). Neither white spruce or black spruce in the setback area represent critical wintering areas for ungulates, due to the lack of deciduous browse either within or adjacent to the forest types.

As noted in response to Question QG1, the value of the mine and mine setback areas as a movement corridor is considered low, due the high density of the vegetation which makes access difficult. The northern one-third of the mine setback area has been previously disturbed by the development of the Bitumount Historic Site. Therefore, the development of the mine is not expected to disrupt the movement of wildlife in this region.

- **Erosion**: The soils in the area are not unique and are not sensitive to erosion. Therefore no increased sedimentation to the Athabasca River or its tributaries is expected to occur.

- **Floodplain**: The 1:100 year flood level has been estimated to be 235 m and is located at least 85 m west of the proposed mine boundary (see Figure QB1.1, included in Attachment B1 of Appendix A). The setback will accommodate the natural evolution of the path of the river. The 1:100 year and maximum estimated ice breakup levels were determined from:

  - River surveys by Alberta Research Council (Kellerhals, R., Neill, C.R. and Bray, D.I., "Hydraulic and Geomorphic Characteristics of Rivers in Alberta"),
  - Design water levels computed for the Highway 63 bridge upstream and using map-determined river slopes to extrapolate to the SOLV-EX site,
  - Observations by Alberta Research Council and Alberta Environmental Protection staff during breakup (personal communication), and
  - Streamflow data for the Athabasca River as monitored by Water Survey of Canada at Fort McMurray.

  The 1:100 year flow of 6060 cubic metres per second results in an open water design flood level at the mine site of 233 m. The maximum estimated ice level is 235 m. For the final design and during field surveys, highwater marks visible in the field will be used to confirm or refine these values.

- **Water Quality**: The data collected on geotechnical stability and the potential for connectivity between the mine and the Athabasca River are currently being analyzed. Preliminary indications show that the area is suitable for mining.

Recreation and Tourism: The distance of the setback and the height of the bank and maintained tree buffer will reduce but not eliminate the view from the river of the activities associated with the mine (see Figure QB1.1, included in Attachment B1 of Appendix A). Visual impacts will occur during initial mine stripping and operations, until the first bench located close to the river is partially excavated (see response to QB3). Mining activities are scheduled for fall-winter 1996 when the use of the river will be minimal. By spring break-up, 1997, the mine may have advanced far enough from the rivers edge so activities will not be visible. The water intake on the Athabasca River will be bermed to substantially reduce the aesthetic impacts.

The Bitumount Historic Site will be buffered from the mine facilities by existing spruce and aspen forests, although visitors will pass by the SOLV-EX facilities when they travel by road to this Historic Site.

Noise will be maintained within levels identified in the AEUB Noise Directive (see Section 5.2.6 of the EIA). Noise impacts will include those created during vegetation clearing, mining, plant operation and by increases in vehicle traffic. There are no residences within the area and the spruce, aspen and pine forests (heights up to 18 m) between the mine and plant sites, and the Athabasca River are expected to reduce the noise levels at the water level of the Athabasca River. An electric motor will power the pump to remove water from the Athabasca River which will cause minimal noise disturbance. Construction activities will increase noise levels which will subside when plant operation begins.

- **Ecological**: There are no springs, or rare plants within the setback area. A narrow band of white spruce (maximum of 50 m wide), some > 150 years of age, was identified below the river escarpment. However, none of these trees will be affected by the mine development.

- **Traditional Lands**: Information on traditional land use within the vicinity of the SOLV-EX project was compiled by Fort McKay Environmental Services (1995). Information on furbearer trapping, big game, game bird, fish and berry harvesting sites; trees and plants used for cultural and medicinal use; cabin and trails; and spiritual, sacred burial sites was presented. Although the mine setback, in conjunction with the entire Lease 5 area, was identified as a berry and moose harvest site and is part of Registered Trapping Area 2137, the setback area does not appear to support any other site specific traditional uses.

- **Historic Sites**: The Bitumount Historic Site lies within the northern portion of the setback and SOLV-EX will not be mining this site. An historic resource inventory of the setback area has not yet been completed, but will be designed and phased based on discussions with Alberta Community Development once the project has been approved. The HRIA is expected to be completed prior to July 1996.

QB2. What factors were considered in choosing this location for the proposed mine and what other sites were considered that were east of the highway right-of-way? What are the implications to the project if the mine was located east of the highway right-of-way?

Answer: The factors considered in the location of the proposed mine included (p. 40 of the Application):

- Minimization of initial mine development and mining costs. Costs would be minimized by starting the mine in an area with a low quality factor (as defined on Figure 4-1 of the Application) of a large areal extent. An area with a low quality factor also exists in the southeast area of Lease 5; however, it is characterized by 30 m to 40 m of overburden on top of very good grade ore,

- Minimization of the first year mining costs. Costs would be minimized by starting the mine outside the Bitumount Historic Site where the overburden is thinner.

- Oil Sands Bitumen Content. The relatively higher bitumen content in the oil sands located in the northern part of the potential mining area compared to the southern part, and

- Mine Expansion Space. There would be limited space for mine expansion beyond year six if the mine was started north of the Bitumount Site.

Other factors considered in the selection of the proposed mine area are:

- The area of the proposed mine has been disturbed during the past, and

- Location of a mine in the southeast area of the lease would require diversion of Fort Creek, and would result in increased mining costs and environmental impacts on the watershed.

QB3. Describe the present condition of the proposed development area and the Bitumount historical site. What is it that leads SOLV-EX to think that the visual impact of the proposed facility from the river will be acceptable.

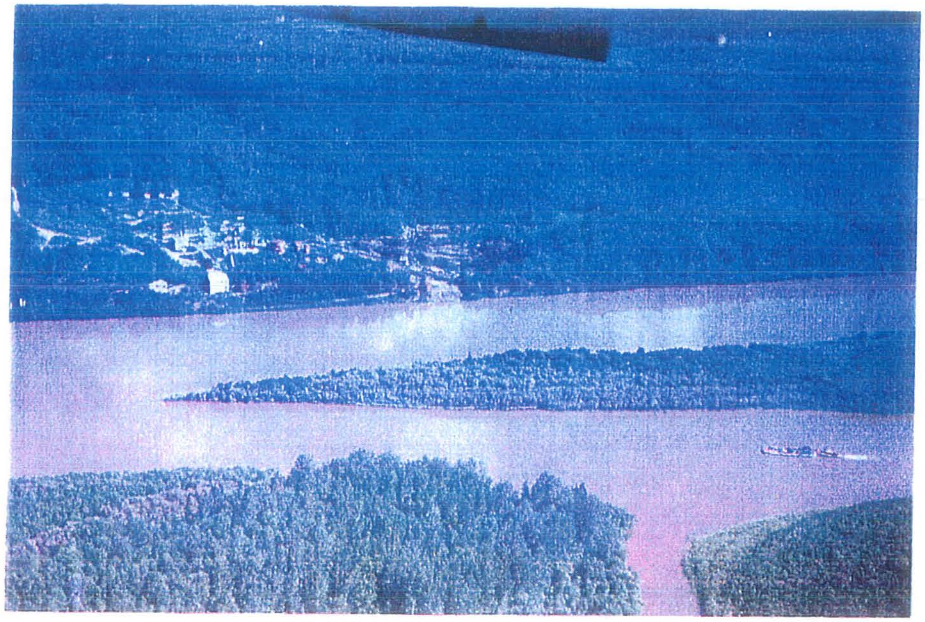
Answer: The present condition of the proposed development area is discussed in Sections 4.0 and 6.0 of the EIA. The proposed development area is dominantly forested with disturbed areas consisting of the following:

- The old winter road right-of way (Figure 2.1 of the EIA),
- Wellsites and cutlines,
- Gravel pits,
- The Bitumount Historic Site, and
- An airstrip

The current condition of the Bitumount Historic Site is shown by the photos presented in Figures B3.1 and B3.2. Except for the construction of a fence to protect the historic buildings and equipment, the site has not been modified since the pilot extraction facilities were shut down in the mid-1950's. The historic mine area, which lies outside the fence and beyond the area designated as the Historic Site, is poorly reclaimed with unlevel terrain representing piles or windows of oil sand, sparse vegetation on exposed oil sands, and uncontrolled surface runoff containing bitumen and sand. SOLV-EX proposes to excavate overburden and oil sands starting at the previously disturbed mine site, and then reclaim this area to meet current reclamation guidelines by AEP. SOLV-EX further proposes to reclaim that part of the Historical Site that was disturbed through mining and abandoned in the 1950's. SOLV-EX is prepared to discuss with Alberta Community Development the opportunities to further improve the present situation of the Historical Site.

Most of the proposed plant site, waste area and tailings areas will not be visible from the Athabasca River. These facilities will be located at elevations of approximately 286 m (river elevation is approximately 225 m) and a minimum of 700 m distance from the river. At 300 m from the river the tops of the trees are at elevation 285 m. Therefore, it follows that only objects at the plant site taller than 80 m may be visible from the Athabasca River.

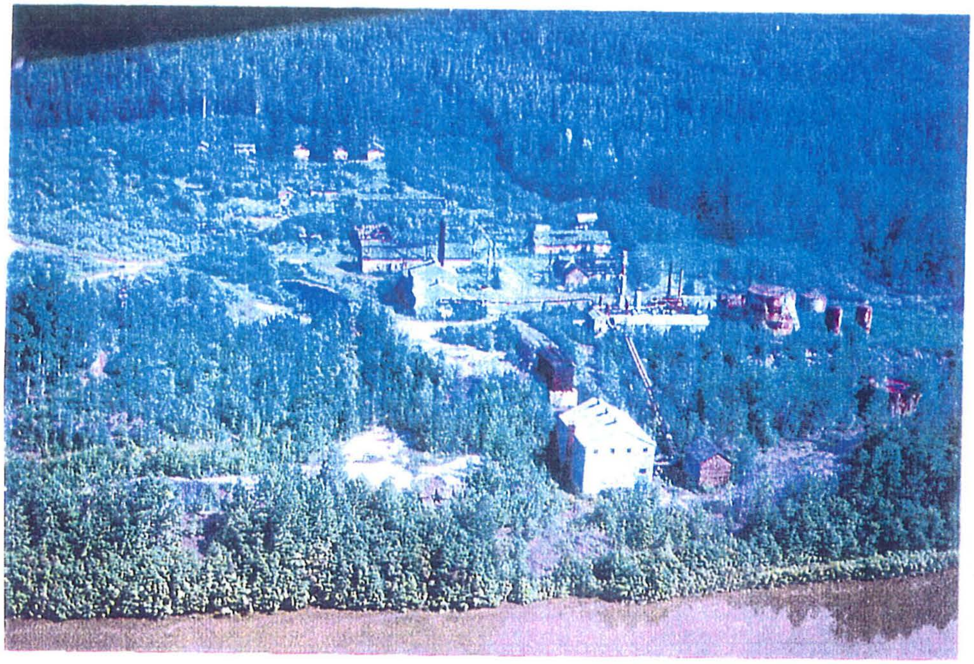
There will only be a short-term period of time (< 6 months) when mining equipment and activity will be occasionally visible from the Athabasca River. Since the tree height between the mine and the river ranges from 3 m (black



The Bitumount Historical Site - The Already Opened Mine to the South (right) of the Processing Plant.

The Bitumount Oil Sands Mine - Prior to Removal of the 500 Tonnes from the Upper Right Portion of the Mine.

FIGURE QB3.1 CURRENT SURFACE DISTURBANCE AT THE BITUMOUNT HISTORIC SITE



The Bitumount Processing Site as Abandoned in the 1950's.

The Bitumount Oil Sands Mine as Abandoned and Before Removal of the 500 Tonnes for Solv-Ex Pilot Plant. The Resource is on the Surface at the Bitumount.

FIGURE QB3.2 CURRENT SURFACE DISTURBANCE AT THE BITUMOUNT HISTORIC SITE spruce to north) to 24 m, with an average of 17 m, and the maximum working height of mining equipment is 12 m, there will be occasions when equipment will be seen. Figure QB1.1 illustrates to scale the level of the Athabasca River, the height of the river bank and the height of the trees in the vicinity of the mine setback. Once the first mine bench, which is located closest to the river, is partially excavated, there should be no visual impacts. Mining activities are scheduled for fall-winter 1996 when the use of the river will be minimal. By spring breakup 1997, the mine may have advanced far enough from the river edge so activities will not be visible.

QB4. What are the environmental and technical differences of the proposed mine sites A and B (as shown on Figure 2.6) near the Bitumount historical site?

Answer: Alternate mine sites A and B are described on page 2-12 of the EIA and in Section 4.0 of the Application. The two mine alternatives show that there is some flexibility in preparing the final mine plan. In fact, the mine pit can be developed further north should the drilling identify some areas of concerns in the south part of the pit. The option can be used should the total reserves available be less than anticipated.

The technical differences are minor as both areas are located above ore which has a low cost of mining due to the relatively thin overburden, relatively thick ore body and relatively high bitumen content. Recent drilling results confirm a preference for mine site A.

The only environmental difference between mine sites A and B is that site B will require the re-routing of the access road to the Bitumount Historic site before the last year of mining.

C. Bitumen Extraction

QC1. What contingencies are there for bitumen clean-up should the froth quality adversely affect the operation of the treaters?

Answer: A surge tank of 1,113 m^3 will be provided. The tank will be equipped with emulsion breaking (in-line) feed facilities as well as a heat supply and withdrawal of bottom sediment for reprocessing through the extraction plant. Should the hold-up in the tank still be inadequate, then flexibility exists in the upgrading unit to accept feed with a higher solids content (2 - 3 wt.%).

D. Mineral Processing

QD1. Table 9.2 of the EPEA application indicates the use of caustic in the mineral extraction process and its disposal to the waste and tailings streams. Comment on the possibility of caustic build-up in the recycle water from tailings and its potential impact on the bitumen extraction process and on the operation of the clarifier to flocculate fines.

Answer: A build-up of caustic will not occur by directing this waste stream to the tailings circuit. The caustic (i.e. sodium hydroxide) will be used for water treatment (i.e. to regenerate the ion exchangers) as described in Section 4.1.5.1.5 of the Application (pp. 4-38 and 4-39). The spend regenerants (including dilute sulphuric acid) will be neutralized to a neutral pH of 7, i.e. the caustic and acid will have formed a dilute salt solution of sodium and sulphate before reaching the tailings circuit. Once the solution reaches the tailing disposal area, part of it will remain with the sand tailings which are expected to retain slurry water at a moisture level of 20 wt.%.

E. Solid Waste Management

QE1. Describe contingency plans for disposing of clay fines when processing high fines oil sands.

Answer: Excess clay that is not required in the mineral extraction plant will be trucked for burial in the tailings disposal area as described in Section 4.4.3 of the Application (bottom of p. 45). As a contingency, a clay-lined (10^{-7} cm/s) and bermed bulk pad will be provided in the bitumen extraction process area (Figure 2-1 of the Application). The bulk pad will provide interim storage for three days of normal excess clay production (6,100 t or 3,050 m^3), in case of adverse weather conditions preventing the direct disposal of the clay cake.

QE2. What are SOLV-EX's contingency plans for utilizing and/or disposing of stored pitch at the time of reclamation. SOLV-EX should address the presence of heavy metals in the pitch and what treatment plans are in place to ensure that these metals do not leach out?

Answer: During operations, the pitch storage pad will be lined prior to pouring the molten pitch and subdrainage piping will be installed below the liner in order to monitor the integrity of the liner by sampling and analysis of the subdrainage during plant operations and beyond decommissioning. Our current plan for the block of pitch left at the time of plant decommissioning is to cover it with an impermeable liner (clay or synthetic liner) and topsoil and revegetate the mound formed.

Heavy metals will be present in the pitch; however, the pitch will be a glass-like, amorphous material which is not expected to product leachate with soluble metals. Metals are not leachable unless the pitch is in intimate contact with low pH water (2 - 3 pH). Rain water in the region is not of low pH and is not expected to become acidic as it flows over the solid pitch. As a contingency, we will provide a surface drainage retention pond for the runoff from the pitch storage pad and monitor the water quality of the collected drainage (refer to p. 4-45 of Section 4.1.6.4 of the AEPEA application). Should heavy metals be identified, we would direct the drainage to the tailings circuit where an increase in pH will precipitate out the metals as solids.

F. Socio-Economic

QF1. Will trucks be used exclusively to transport PCO to markets, or are there opportunities to use available pipeline infrastructure. Has SOLV-EX examined market opportunities more proximate to its operation that could minimize the use of trucks?

Answer: Trucking of PCO and mineral products is our only option for the proposed production rates. Volumes larger than 1674 m^3/sd would be required to make it economically attractive for any pipeline company to build a pipeline to the SOLV-EX site and profitably recover the investment during a six year period production. Railway transport of the PCO and the mineral products has the same limitations, i.e. railway companies need larger production rates over a period longer than 6 years to ensure a return on their investment.

SOLV-EX will work with the M.D. of Wood Buffalo on addressing concerns and mitigating public, truck and highway traffic safety along Highway 63.

We wish to emphasize that our customers will use their truck fleets or hired truck fleets to ship the products south from our gate. Transfer of their products to pipeline or rail transport may occur at the two existing synthetic crude plants or in the Fort McMurray area; however, we will not be in control of this transfer.

QF2. Are there contingency markets for the proposed products (including the by-product sulphates) or off-spec material?

Answer: SOLV-EX currently has a letter of intent from a customer who will purchase our PCO and off-specification hydrocarbons. We also have a letter of understanding in place for the purchase of the three principal mineral products (alumina, ferrous sulphate and potassium sulphate). In addition, we have had discussions with companies expressing interest in purchasing the intermediate double salt product and the by-product sulphate product.

G. Wildlife

QG1. The significance of the area as wintering habitat or as a wildlife movement corridor is referred to in various parts of the EIA report, however, the statements should be reviewed with the information obtained this summer. Discuss the importance of the site as a wintering area or movement corridor for wildlife. What species are most likely to be affected and how may their movement patterns change?

Answer: The significance of the area as winter habitat was discussed in Section 4.7.2.3 (pages 4-98 to 4-103) of the EIA, while the discussion on the movement corridor is based on additional field data collected in the summer/fall 1995.

The most common ungulate in the region is the moose. Habitat factors important for moose in late fall/winter are primarily the availability of deciduous browse (e.g. willow, red-osier dogwood, saskatoon high bush, cranberry) and the presence of thermal cover, which optimally is characterized by > 80% cover and a high component of coniferous trees > 11-15 m in height. The most important winter habitats in the Local Study Area, based on habitat modelling within the region, are edge habitats with shrublands (food source) adjacent to mixedwood and aspen forests (thermal cover). Most of the forests in the mine and setback areas reach average heights of 17 to 18 m which are optimal for providing good thermal cover. As noted in Section 4.7.2, Table 4.23 on page 4-94 of the EIA, shrub habitat covers 7% or 306 ha of the Local Study Area, mixedwood forest covers 17% or 744 ha (coniferous) dominated accounting for 7% of 300 ha of this number), and aspen forest covers 17% or 762 ha. Aspen forest, mixedwood forest and shrublands will account for about 28% (82 ha) of the vegetation types being cleared. Most of the shrublands are located outside the proposed Development Area, and only 47 ha will be cleared. Therefore, although the Local Study Area does provide some winter habitat for ungulates, most of the important shrublands are located outside the Development Area. In addition, the habitat types in the Local Study Area are ubiquitous throughout the region.

To assess the value of the setback for the SOLV-EX mine, the mine and the area north of the mine and adjacent to the Athabasca River as a movement corridor, the areas were inventoried for density of vegetation and ease of access, and for trails and other signs of wildlife use (i.e. browsing/hedging and scats/pellets). Corridors can be relatively broad and consist of several travel lanes. As noted in response to Question QB1, most of the vegetation within the mine setback is white spruce forest and black spruce. Generally the high density of the undisturbed vegetation in the proposed setback and mine areas restrict wildlife access and movement (i.e. no or very poorly defined game trails, and no pellet groups/scats or browsing were evident). However, two linear areas support less vegetation and thus would allow better access. Running parallel to, and 10 to 30 m from the edge of the Athabasca River is a small bench vegetated with alder, red-osier dogwood and poplar, and 100 m from the river is a man-made 3 m wide trail vegetated with grasses or mosses (see Figure QG1.1). However no game trails or signs of browsing/hedging or pellets/scats were evident on the small bench, and the man-made trail did not support any wildlife sign (pellet groups/scats, browse) for several hundred meters. Within the proposed mine area, the newly cleared cutlines and drilling sites (Figure QG1.2) support deer activity (i.e. tracks were observed), which tends to support the hypothesis that the dense vegetation is restricting wildlife movement in the area.

The Bitumount Historic Site occupies the northern one-third of the mine setback area. The fence surrounding the Historic Site extends to within 15 m of the shore of the Athabasca River. This fenced facility historically would have disrupted any movement by wildlife along the river in this area. A poorly developed game trail was observed along the eastern boundary of the Historic Site fence during the field reconnaissance.

In conclusion, the value of the mine and mine setback areas as a movement corridor is low, due the high density of the vegetation which makes access difficult. The northern one-third of the mine setback area has been previously disturbed by the development of the Bitumount Historic Site. The development of the mine is not expected to disrupt the movement of wildlife in this region. However, as noted in the response to Question QG2, we recommend that a winter track monitoring program be conducted to further document the extent of, and changes to any wildlife movement in the area.

QG2. ***What are SOLV-EX's plans to monitor wildlife through the operation of the project to ensure impacts are minimized?***

Answer: Wildlife monitoring is described in Section 5.7.5, on page 5-106 of the EIA. Wildlife monitoring that will be conducted by SOLV-EX will be limited to two programs: documenting the interactions of wildlife species with humans and nuisance species control measures, and conducting winter track inventories to further document the extent of and changes to any wildlife movement that may occur in the Local Study Area. Beaver and moose population inventories have been conducted by other oil sand operators in the area to assess the effects of construction and operations. The results of these monitoring programs have indicated that, although animals have been displaced from the cleared area, they habituate and use habitat in the vicinity of the development. In light of these conclusions, and of the small area of habitat to be removed for the SOLV-EX facilities, no other monitoring programs for wildlife are recommended.

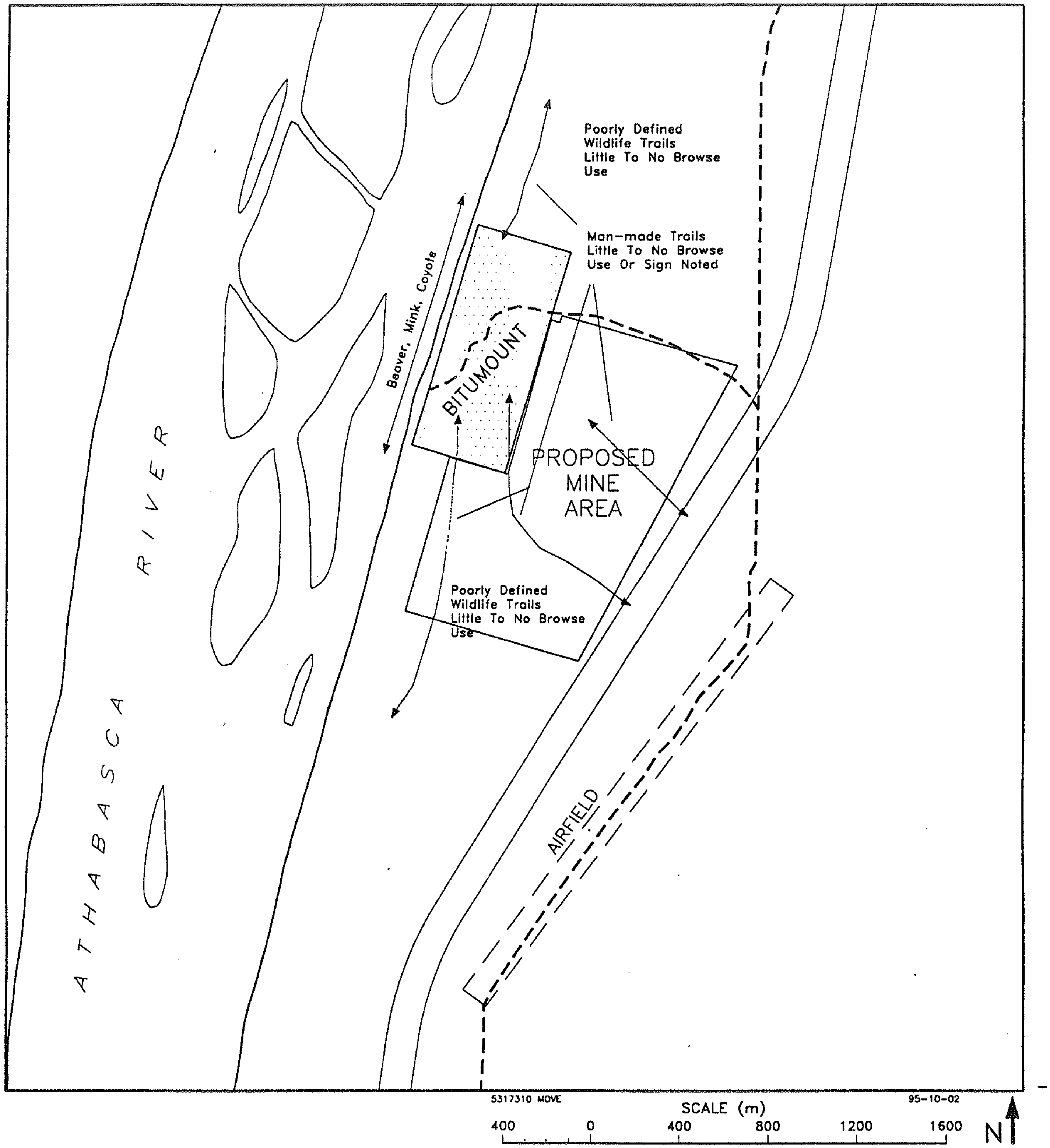
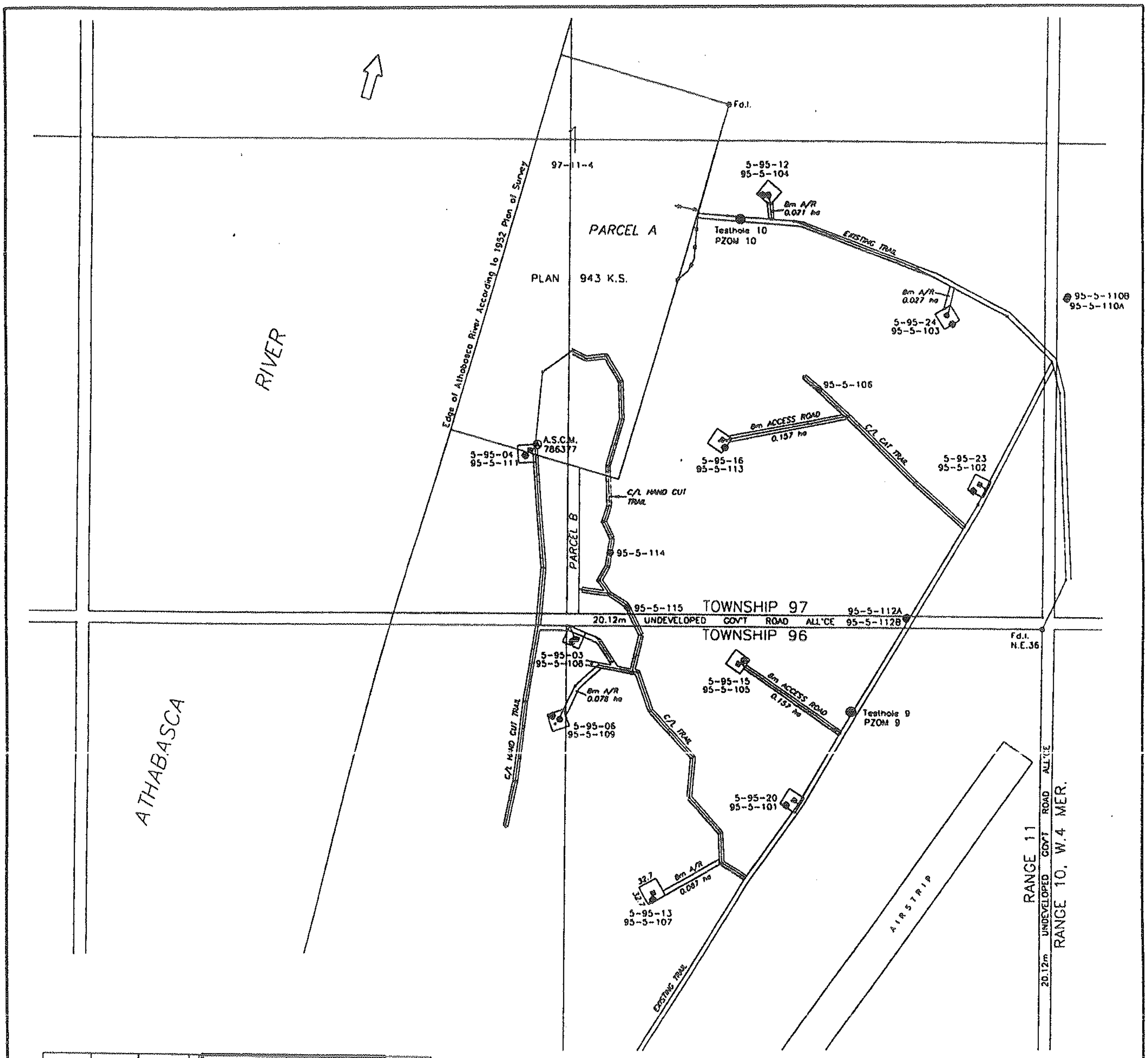


FIGURE QG1.1 WILDLIFE TRAILS



SOLV-EX CORPORATION

FIGURE QG1.2
AS-BUILT LOCATIONS FOR CORE HOLES, BORE HOLES AND ACCESS ROADS

IN TWP'S 96 & 97, RGE'S 10 & 11, W.4 MER.

1995 LEASE 5 EXPLORATION PROGRAM

BITUMOUNT AREA – MUNICIPALITY OF WOOD BUFFALO No.143

METRES 100 50 0 100 200 300 400 500 METRES

DATE :	AUGUST 10th, 1995	JOB NO.: 95-S-7101-2	REV. NO.
CHALLENGER SURVEYS & SERVICES LTD.	EDMONTON / CALGARY	SOLV-EX FILE NO.:	0

5317310 HOLELOCN

95-10-04

QG3. How does SOLV-EX plan to minimize conflict with wildlife during construction and operation of the project? How will the construction and operation of the project avoid or minimize potential for nuisance and related problems?

Answer: The wildlife impacts are described in Section 5.7 of the EIA. SOLV-EX will use several approaches to minimize wildlife conflicts during the construction and operations phases of the Co-production Experimental Project. The two potential types of conflict with wildlife species are: interactions between humans and black bears, and damming of drainways and culverts by beaver which can result in flooding of the project site.

To minimize interactions with black bears, SOLV-EX will: dispose of garbage in bear-proof garbage containers, and educate employees about the dangers of bears and the proper behavior to be followed when a bear is encountered. If encounters with problem bears persist, Alberta Fish and Wildlife will be contacted for advice on how to resolve the problem.

Nuisance problems with beaver should be minimal because only one drainway is located within Lease 5, and currently beaver reside in low numbers and only outside the Development Area (i.e., along Fort Creek and the Athabasca River). However, if beaver do cause flooding, SOLV-EX will initiate a beaver management plan, which would involve having a native trapper holding a Wildlife Damage Permit remove the problem animals.

H. Hydrology

QH1. Describe SOLV-EX's surface water quality monitoring program to identify any potential impacts from mining operations.

Answer: A surface water quality monitoring program was not deemed necessary. Mine drainage will be collected in a settling pond (Figure 4-4 of the Application) with normal pumped discharge to the waste water holding pond located after the plant site. The presence of large volumes of saline pit drainage is no longer a concern, based on recent results of drilling in the proposed mine area which indicates there is no basal aquifer (see response to Question Q11 in Section 3.0). A discharge to the Athabasca River is only expected during a 1:10 year 24-hour duration storm or snowmelt event, when the pond would overflow and direct the drainage towards the Athabasca River. Additional information on occasional discharges (which would require sampling and analysis of water quality in the river) is provided in Section 3.0 (answer to Q24).

QH2. The EIA TOR directs SOLV-EX to, "identify the local fish and aquatic resources of the Athabasca River and Fort Creek. Describe existing information sources, any

deficiencies in the information, and any studies proposed to evaluate the status of the fish resources of the Athabasca River or Fort Creek". The EIA states, "Fort Creek will not be affected by the project and thus baseline data is not presented" (EIA report, Section 4, page 54). Comment on the potential for Fort Creek to be impacted by the proposed project, having regard for factors such as disruption of surface water flows, dewatering, interruption of groundwater flows and sedimentation.

Answer: The location of Fort Creek relative to the proposed development is as shown on Figure 4.15 of the EIA. At its closest point, Fort Creek is located a minimum of 1000 m from the northeast corner of the proposed mine.

The proposed mine will not disrupt or interrupt surface flows into Fort Creek as drainage patterns at the mine are directly into the Athabasca River. Similarly, the proposed development will not cause any sedimentation into Fort Creek.

With respect to possible groundwater issues, the only possible concern is seepage of Fort Creek flows into the pit which, at its ultimate depth, is about 90 m below the bed of the creek at its closest location. In view of the minimum 1000 m buffer between the mine and creek, the potential for seepage, and thus loss of water from Fort Creek into the pit should be minimal. Water levels in Fort Creek will be monitored and more information on this issue will be available once the drilling is completed for the pit dewatering program as part of the detailed mine planning in 1996.

QH3. Show the 1:100 year floodlevel and the proposed mine site in relation to this floodplain on a map.

Answer: As shown on Figure QB1.1 (of Attachment B1, Appendix A).

I. Hydrogeology

QI1. Describe the local groundwater regime addressing the potential for a basal aquifer.

Answer: Groundwater impacts are described in Section 5.4, pages 5-62 to 5-67, of the EIA. Fourteen monitoring wells up to a depth of 80 m were installed within the mine site and setback areas. Water levels and groundwater samples were collected during late August. Also, tests for hydraulic conductivity were conducted on selected monitoring wells.

The groundwater data and the borehole data are being compiled. Once this is complete, we will provide a description of the local groundwater flow regime and address the potential for the basal aquifer. Preliminary review and assessment by our geological consultant suggest that there is no saline water in the bottom part of the McMurray formation. These preliminary findings are based on the absence of water in the cores recovered during drilling of the ten holes (refer to Figure QG1.2) and a review of the downhole logs.

QI2. ***Provide cross-sections from the Athabasca River through the pit across the winter road and plant site and show the final contours of the mined-out area in relation to the Athabasca River. Include the final elevation of the groundwater table at the end of mining. Show and discuss the groundwater gradient and whether there is potential for water to move between the river and the mine pit. Discuss the potential for contamination of the Athabasca River from the mine pit.***

Answer: A conceptual cross-section is shown in Figure 2.5 of the EIA. Figure QB1.1 augments this cross-section, although it shows only the current groundwater gradient. Fourteen monitoring wells up to a depth of 80 m were installed on the site. Water levels and groundwater samples were collected during late August 1995. Also, tests for hydraulic conductivity were conducted on selected monitoring wells.

The groundwater data and the borehole data are being compiled. Once this is complete, we will provide a hydrogeologic cross-section from the mine area to the river. This will be the first step in assessing the groundwater gradient and whether there is a hydraulic connection between the river and mine pit. Until we assess the hydrogeologic data, we cannot comment on the river from the mine pit and final water levels.

QI3. ***In Section 5.4.5 Groundwater Monitoring, SOLV-EX states that it intends to install monitoring wells at the lease area to monitor groundwater quality and water levels. What are proposed locations of monitoring sites, the depths and monitoring intervals (zones), frequency of water level measurements sampling, and sampling parameters?***

Answer:

Groundwater Monitoring Program

The groundwater monitoring program, as outlined in Section 5.4.5 of the EIA, will be designed to meet the following objectives:

- Define the groundwater flow regime in the four development areas,
- Provide groundwater chemistry data,
- Identify potential impact on groundwater quality and levels during plant, mine and disposal site operations, and

- Meet AEP and AEUB requirements.

Based on the proposed locations of the facilities, two groundwater monitoring well networks will be installed:

- Mine area network, and
- Plant and disposal areas network.

The groundwater monitoring networks will consist of a series of monitoring wells (piezometers) placed in locations surrounding potential sources of groundwater impacts (quality and levels). Most of the monitoring wells will be located downgradient from the potential sources of contamination. Upgradient and lateral locations will be required for both background assessment and evaluation of the hydrogeologic setting.

Mine Area

Three monitoring wells will be installed at five locations (i.e. 15 wells) adjacent to the mine area. The proposed five location areas are as follows:

- Background (north of the mine area),
- East and west of the mine area, and
- Two locations south of the mine area (hydraulically downgradient).

Monitoring wells at each location will be installed in the surficial aquifer, intermediate aquifer and the deep aquifer.

Plant and Disposal Areas

Seven locations consisting of one to two monitoring wells (i.e., 7 to 14 wells) will be installed in the vicinity of the plant and disposal areas. The proposed seven locations are as follows:

- Background (north and northwest of the mine waste dump),
- Background (north of the tailings disposal area),
- South of the tailings area (hydraulically downgradient of potential contamination source),
- South of the mine waste dump area (hydraulically downgradient of potential contamination source),
- Hydraulically downgradient of the tank farm,
- Hydraulically downgradient of the pitch and sulphur storage areas, and
- South of the construction camp area (hydraulically downgradient of all plant operations).

Groundwater Sampling

Groundwater sampling will be conducted prior to plant/mine operations and quarterly during the first year of operations. Laboratory analysis will consist of routine potability, trace metals, total petroleum hydrocarbons, parameters specific to site operations, and parameters outlined in the AEPEA approval. After the first year of operations, the sampling frequency and analytical scheme will be reviewed with AEP and modified as necessary.

SOLV-EX will also be available to participate in any task force groups that are formed by oil sand operators in the region, to address groundwater issues.

J. Air Quality

QJ1. Discuss SOLV-EX's intentions to participate in initiatives underway to address potential long and short-term health implications related to air quality in this region.

Answer: SOLV-EX involvement in such initiatives will come through membership on the Regional Air Quality Coordinating Committee (RAQCC). Currently we have approached RAQCC to become a member and we expect that RAQCC will include us on their committee once our project is approved.

3.0 RESPONSES TO AEP LETTER

Q1. Dispersion Modelling Inputs for Suncor and Syncrude Emissions

For the dispersion modelling results presented in Table A6 (Appendix A), please clarify what input parameters were used for Suncor and Syncrude air emissions for each of the models.

Answer: Source emissions from these plants were not modelled with respect to ambient air quality by BOVAR-CONCORD Environmental. Their effect on ambient air quality in the vicinity of the proposed SOLV-EX plant were based on an assessment of measured air quality data for three stations located near the proposed SOLV-EX site (refer to EIA Section 4.1.4.3, p. 3-34). The results of the assessment are the following background levels:

- 16 $\mu g/m^3$ of SO_2
- 11 $\mu g/m^3$ of NO_2

The background values represent twice the maxima of the annual averages measured at anyone of the three stations during their periods of operation between 1977 and 1993. The background values were added to the predicted ground level values based on modelling of the source emissions from the proposed SOLV-EX plant.

Future SO_2 emissions from the Suncor and Syncrude plants as well as SO_2 emissions from the proposed SOLV-EX plant were modelled with respect to sulphate and acidity deposition (refer to EIA Section 5.2.3, p. 5-28).

Q2. Results of Dispersion Modelling

The modelling results in Table A6 (Appendix A), predict ground-level sulphur dioxide (SO_2) concentrations which are near the Alberta ambient guideline level of 450 $\mu g/m^3$, for the Phase II "abnormal" case. To not unduly constrain any future developments in the area, Alberta Environmental Protection (AEP) requests that SOLV-EX use no more than one-third of the remaining airshed assimilative capacity for SO_2 (i.e. one-third of what remains of the 450 $\mu g/m^3$ after the effects of Suncor's and Syncrude's emissions are subtracted). Please provide information to demonstrate that this will be the case with the proposed 60 m main stack or advise us of the stack design parameters that would be necessary to meet such a criteria.

If it is necessary to re-run some of the dispersion models to demonstrate the above, we suggest that the following emission inputs be used:

- ***0.074 t/hr for the SOLV-EX sulphur plant,***
- ***0.114 t/hr for the SOLV-EX acid plant,***
- ***0.060 t/hr for the other SOLV-EX emissions, and***
- ***the future emissions scenario for the Syncrude main stack and the Suncor powerhouse and sulphur recovery plant incinerator stacks.***

Answer: SOLV-EX has reviewed and revised its SO_2 emission terms documented in the Application. BOVAR-CONCORD Environmental (BCE) has modelled the revised emissions from the proposed SOLV-EX plant as well as the future SO_2 emissions expected from the Suncor and Syncrude plants, to meet an ambient SO_2 limit of 150 $\mu g/m^3$. The modelling results show that a 60 m tall stack with an exit gas temperature of 300°C during abnormal operating conditions can provide the dispersion required to meet the 150 $\mu g/m^3$ limit, even with future contributions from the Suncor and Syncrude sources.

The largest SO_2 concentrations resulting from the proposed SOLV-EX operations are predicted to occur in the Fort Hills area about 4 to 5 km northeast of the proposed plant site. The maximum predicted values in the Fort Hills area (caused by SOLV-EX emissions) are not additive with the maximum predicted values attributed to the emissions from the Suncor and Syncrude plants. In terms of maximum predicted SO_2 concentrations only 36% of the air shed is utilized. This value is defined by Suncor and Syncrude, not by SOLV-EX. Therefore, there is plenty of air shed available to future users. Details of the modelling results are included in Attachment 2 of Appendix B.

Table 2.1 lists the SO_2 emission values used in the Application and the revised values for the proposed SOLV-EX plant.

The revised values differ from those suggested by AEP for the following reasons:

- Abnormal operating conditions in the sulphur recovery plant will be the loss of a catalytic stage when the sulphur recovery efficiency drops from 98% to 96%.

- Abnormal operating conditions in the sulphuric acid plant will be the loss of the SO_2 catalytic converter when calciner gas will be routed through the drying tower for complete SO_3 removal and through the caustic scrubber for 90% SO_2 removal.

Table 2.1 Summary of SO_2 Emission Rates from the SOLV-EX Plant

Source	Application Values[a]		Revised Values	
	Normal Operating Conditions (t/sh)	Abnormal Operating Conditions (t/sh)	Normal Operating Conditions (t/sh)	Abnormal Operating Conditions (t/sh)
Sulphur recovery plant incinerator[b]	0.059	0.083	0.026	0.052
Sulphuric acid plant[b]	0.190	0.266	0.063	0.172
Diesel fired heaters	0.060	0.060	0.060	0.060
TOTAL	**0.309**	**0.409**	**0.149**	**0.284**

(a) These values were originally presented to AEP during the SOLV-EX disclosure presentation of December 19, 1994.
(b) Sources will share a common main stack.

- Abnormal operating conditions will not occur simultaneously in the sulphur recovery and acid plants, i.e. the extreme emission rate from the common stack will not exceed 0.198 t/sh (0.026 + 0.172), which will be the scenario of normal operation in the sulphur recovery plant and abnormal, upset conditions in the sulphur acid plant.

Emissions from existing Syncrude & Suncor sources (as projected beyond late 1997) were included as recommended by AEP for both the normal and abnormal emission scenarios and are summarized in Table 2.2.

Table 2.2 Assumed Future SO_2 Emissions and Source Characteristics for the Suncor and Syncrude Plants

Parameter	**Suncor[a] Incinerator**	**Suncor[a] FGD Stack**	**Syncrude[b] Main Stack**
Stack Height (m)	106.7	137	183
Stack Diameter (m)	1.8	7.01	7.9
SO_2 Emission Rate (t/d)	22	28	260
Exit Velocity (m/s)	19.38	13.36	24.15
Exit Temperature (°C)	539	63	235
Location (x, y in m)	9300, -40300	9300, -40500	800, -36200

(a) Based on the Suncor February 1995 Application for Renewal, page 85.
(b) Based on the AEP 90-day rolling average limit listed in the Syncrude licence.

Q3. Flare Stack Height

Table D-A3 (Attachment D), indicates that the proposed flare stack height is 45 m. Why was a height of 45 m chosen? Would a taller flare stack, such as 99 m (used by Syncrude), result in fewer potential exceedences of the 450 μg/m³ hourly SO_2 ambient guideline during flaring events that may arise at the SOLV-EX plant?

Answer: BOVAR-CONCORD Environmental has modelled (using ISCST2) various scenarios of a taller flare stack or fuel addition to the acid gas. We conclude that a taller than 45m stack will not be the means of ensuring compliance with the hourly guideline limit. Plume buoyancy will be the means of ensuring compliance, by adding and burning diesel fuel with the acid gas. Table 3.1 lists the acid gas flaring parameters and modelling results.

Table 3.1 Summary of Acid Gas Flaring Parameters and Modelling Results

Parameter		**AG : FG Volume ratio 1.0**	**AG : FG Volume ratio 1:6**
Gas flow rate	$10^3 m^3/d$	11:51	80.57
Heating Value	MJ/m^3	21.15	31.51
Heat release	GJ/h	10.1	105.8
Effective[(a)]		47.8	53.5
Release height	m	·19.38	
MGLC[(b)] SO_2			
Flat Terrain	$\mu g/m^3$	**1503**	393
Elevated Terrain	$\mu g/m^3$	**3760**	447

(a) Effective release height calculated using Brode's method (55% radiation loss, 45° flame angle).
(b) Maximum ground-level concentration.

Additional details are presented in Attachment 2 which includes the results of the revised results on dispersion modelling (revised Appendix A of the AEPEA Application) and revised source parameters (revised Attachment D of the AEPEA Application).

Q4. *Prevention of Flaring*

The dispersion modelling results in Table A6 (Appendix A) indicate that ambient air quality guidelines may be exceeded during flaring. What design precautions (e.g., equipment redundancy) and operational practices will SOLV-EX be taking to reduce the likelihood of frequency of flaring?

Answer: A standby compressor will be provided between the fractionator and amine plant, to reduce the frequency of flaring sour fuel gas. Addition of fuel to the acid gas (as per answer to Q3) will prevent excessive ambient SO_2 concentrations. In addition, a long duration need to flare acid gas will be prevented by shutting down the upgrading sector within a period of approximately three hours.

Q5. Sulphur Recovery Plant Design

(a) To reduce SO_2 emissions, and in particular, to prevent frequent flaring events, redundancy in the sulphur recovery plant design is required. Alberta Environmental Protection strongly prefers that the SOLV-EX plant have two separate sulphur recovery trains, although a common tail gas clean-up unit may be acceptable. SOLV-EX should either modify the design to include two sulphur recovery trains, or provide information to demonstrate that the proposed design (page 4-14 of the application) will provide equivalent capability to control sulfurous emissions and to prevent flaring.

Answer: SOLV-EX has proposed a sulphur recovery plant with a 98% sulphur recovery efficiency (Section 4.1.2.4, p. 4-14 of the Application) instead of the 96.2% required by the AEUB and AEP according to IL 88-13 (Sulphur Recovery Guidelines for Sour Gas Plants in Alberta). This design provides a redundancy in the sulphur recovery plant which will allow SOLV-EX to reduce the frequency of flaring. If a catalytic stage is down, it can be bypassed and a sulphur recovery efficiency of 96% can be maintained without having to flare acid gas. As demonstrated in our answer to Q2, a drop in efficiency from 98% to 96% does not represent a worst case emission scenario and hence, it will not result in excessive ambient SO_2 concentrations. Refer to our answer for Q4 for the case when the entire sulphur recovery plant is down and necessitates flaring of acid gas.

(b) On page 4-14 it is stated that an upstream ammonia removal system may or may not be provided in the sulphur recovery plant. The sour water acid gas stream must be processed at all times, as the need to flare this stream can readily be prevented by appropriate plant design. We recommend that SOLV-EX include ammonia removal (destruction) in the sulphur recovery plant design.

Answer: SOLV-EX will provide upstream ammonia destruction by continuously routing the gas stream from the sour water stripper to the combustor of the sulphur recovery plant.

Q6. Emergency Releases of SO_2.

Page 3 of Appendix A, indicates that in a worst case, the calciner off-gas from an emergency in the sulphuric acid plant could contain up to an equivalent of 246 t/day of sulphur. In Table A6, modelling results for a potential release from the sulphur acid manufacturing plant show predictions of very high ambient SO_2 levels. Such a release would not be acceptable. Please describe how SOLV-EX would re-design and operate the plant to prevent such an emergency release of SO_2 from arising, and how the plant could be designed and operated to continue meeting the 450 $\mu g/m^3$ hourly SO_2 ambient air quality guideline during a sulphuric acid plant outage.

Answer: Calciner off-gas will not be released directly to the common stack. It will be routed to the drying tower (Figure 4.7 of the Application) for complete SO_3 removal and thereafter to a caustic scrubber for 90% SO_2 removal. Please note that we will provide a caustic scrubber instead of the limestone scrubber shown on Figure 4.8 of the Application.

Scrubber exit gas will be directed to the common stack. The caustic scrubber will be on line when the sulphuric acid manufacturing plant experiences operating problems with the SO_2 converter because it will be operated at all times to polish effluent gas from the final absorber.

The abnormal emission scenario discussed in our answer to Q3 reflects the above noted design and operational changes with respect to the sulphuric acid manufacturing plant. As an additional operational safeguard, we will be capable of stopping double salt feed to the calciner. This safeguard will cause the normal SO_2 mass rate of 41.3 t/sd in the off-gas to decline within the first hour. Consequently, the SO_2 emission rate from the caustic scrubber will also decline below 0.172 t/sh within the first hour of stopping the feed. Also, the molten sulphur feed to the sulphur burners of the acid plant will be stopped during a sulphuric acid plant outage.

Q7. *Sulphuric Acid Manufacturing Plant*

Is SOLV-EX aware of any existing sulphuric acid manufacturing plants that use a recycled SO_2 and SO_3 process stream, to the extent that SOLV-EX is proposing for this plant? If so, please advise us of their location, capacity (if available), type of industrial process, and how the plants handle an acid plant outage. Do any plants use a back-up limestone scrubbing system, such as the one that SOLV-EX is proposing?

Answer: No. We are not aware of the recycling practice and use of limestone scrubbers in the sulphuric acid manufacturing industry. However, efficient SO_3 absorption and removal is a standard design and operational practice in any sulphuric acid manufacturing plant. The metallurgical industry uses caustic and limestone scrubbers for SO_2 removal when treating exhaust streams with large concentrations of SO_2. Caustic scrubbers (using soda ash or caustic) are capable of providing 90% SO_2 removal on very concentrated SO_2 streams. SOLV-EX will make the 90% SO_2 criteria a performance guarantee for potential scrubber suppliers. Scrubber standby recirculation pumps will be provided to ensure reliability of operation.

Q8. ***Limestone Scrubber***

A limestone scrubber, used in the event that the acid plant has to be shut down, is described on page 4-32. Would SOLV-EX only use the limestone scrubber to shut down the plant in an orderly manner, or would it also be used during start-up of portions of the mineral extraction plant? Would it be used at any other time or for any other purpose?

Answer: A caustic scrubber, designed for 90% removal of SO_2 from the drying tower, will be provided. The scrubber will also receive exhaust from the final absorber (Figure 4.7 (Sheet 2 of 2) of the Application) during start-up, shut-down and ongoing operation of the sulphuric acid plant. In essence, the caustic scrubber will be installed as a continuously operating tail gas control unit.

SOLV-EX will submit design and operational information for the selected caustic scrubber system to AEP by July 1, 1996 or earlier.

Q9. ***Limestone Scrubber Efficiency***

How would the performance of the limestone scrubber be measured and assured?

Answer: The performance of the caustic scrubber will be assured by on-line measurement of the scrubber liquid pH and continuous monitoring of the exhaust SO_2 concentration and exit gas flow rate from the scrubber. Control instrumentation will receive pH, SO_2 concentration and gas flow rate signals to automatically adjust the scrubber liquid recirculation rate, caustic addition rate and the number of operational recirculation pumps. Basically, the scrubber will be instrumented to maintain a maximum allowable SO_2 mass emission rate which is less than that stipulated in our AEPEA approval, when making an allowance for the permissible SO_2 emission rate from the sulphur recovery plant.

Q10. ***AEP Guidelines Related to Sulphuric Acid Plant***

In Section 12.2 of the application (page 12-3), SOLV-EX indicates that it will design, build, and operate its plant in accordance with the number of environmental regulations, standards and guidelines, including the AEP 1976 "Guidelines for Limiting Contaminant Emissions to the Atmosphere from Fertilizer Plants and Related Industries in Alberta". Please be advised that the AEP emission limits apply at all times, and that SOLV-EX will need to identify sulphuric acid plant start-up and shut-down procedures that will ensure compliance.

Answer: SOLV-EX is cognizant of the various guideline performance limits for SO_2 (particularly the maximum 7.2 lb SO_2/ton H_2SO_4 for a one-hour period) and the 0.15 lb SO_3/ton H_2SO_4 limit. We also acknowledge that these limits apply during start-up and shut-down conditions. We will use these criteria in specifying our requirements and performance guarantees to the suppliers of the sulphuric acid plant and the caustic scrubber system.

SOLV-EX will submit final design and operational information for the sulphuric acid manufacturing plant to AEP by July 1, 1996 or earlier.

Q11. *Location of Continuous Emission Monitors*

On page D1 of Attachment D, it is indicated that the tail gas ducts from the sulphur recovery plant and the sulphuric acid manufacturing plants will each be equipped with continuous emission monitoring (CEM) equipment. Would it be feasible and desirable to locate one CEM in the tail gas duct for the sulphur acid manufacturing plant and the other CEM in the main stack? A subtraction would need to be done to determine sulphur recovery plant performance, but this arrangement would allow overall emissions from the plant (i.e. from the main stack) to be measured at all times (i.e. under various operating conditions). It would also provide redundancy in continuous monitoring of the largest SO_2 emission source (i.e. the acid plant).

Answer: SOLV-EX has proposed the subject two locations of CEM equipment because we expect that the AEUB and AEP would demand these locations in order to report sulphur recovery efficiencies and sulphuric acid plant emissions in lb SO_2/ton acid. SOLV-EX is prepared to install CEM in the main stack instead of the tail gas duct from the sulphur recovery plant provided that the AEUB is agreeable to this arrangement. In addition, we also wish to reduce estimated SO_2 emission rates from the sulphur recovery plant by the contributions from fuel added to the incinerator, based upon quarterly estimates of the consumed fuel oil amounts and the fuel oil sulphur content.

Q12. *Air Emission Source A6 (Double Salt Dryer)*

In Table D-A2 (Attachment D) the proposed monitoring for air emission sources is listed. The table does not include emission source A6, which is the double salt dryer with a bag filter. What type of monitoring will be done for source A6?

Answer: Source A6 (double salt dryer) monitoring will include initial manual stack testing for NO_x, SO_2, SO_3, particulates and O_2 concentrations as well as exhaust gas temperature and flow rate. Once we have demonstrated to AEP that SO_2 and SO_3 concentrations are negligible, we wish to remove these test parameters. A revised Table D-A2 is included in Attachment 2 of Appendix B to document this monitoring commitment.

Q13. <u>Performance of Particulates Control Equipment</u>

How will proper performance of the proposed particulates control equipment (venturi scrubbers, wet scrubbers, and bag filters) be assured on a day-to-day basis during plant operation?

Answer: SOLV-EX is proposing to monitor the performance by means of the continuously monitored and recorded pressure drops (Δp) across each venturi scrubber and bag filter house, and by the liquid-to-gas (L/G) ratio for other types of wet scrubbers. Continuously monitored rates of recirculation liquid and scrubber stack exit volume flow rates will be used to compute on-line L/G ratios which will be continuously recorded. Particulate emissions (g/kg flue gas) from manual stack testing will be benchmarked against the Δp and L/G parameters as a means for our plant operators to assure ongoing control performance.

SOLV-EX will submit final design and operational information for the scrubbers and bag filter houses by July 1, 1996 or earlier.

Q14. <u>Effluent Limits for Particulates Control Equipment</u>

Several points in the application (pages 9-1, 12-2, and C-1) indicate that particulates control on dusty exhaust and vent emissions will meet a limit of 0.2 g/kg. Please note that AEP will be stipulating a particulates emission limit of 0.20 g/kg, i.e., two decimal places which makes a difference from a compliance standpoint.

Answer: SOLV-EX will ensure that our technical specifications to scrubber and bag filter house suppliers as well as to stack testing service companies stresses the importance of meeting a 0.20 g/kg limit.

Q15. <u>Fugitive VOC Emissions from Equipment Leaks</u>

Will SOLV-EX be giving any design considerations to controlling potential fugitive volatile organic compound (VOC) emissions from equipment leaks e.g., valves, pump seals, compressor seals connections?

Answer: Technical specifications issued by SOLV-EX will include basic requirements for the selection of pumps, compressors, valves, flanges and threaded connections to eliminate or minimize the occurrence of fugitive VOCs. Specifications will be based on the technical background information for the CCME Environmental Code of Practice of the Measurement and Control of Fugitive VOC Emissions from Equipment Leaks (CCME-EPC-73E, October 1993), and the USEPA Handbook for Control Techniques for Fugitive VOC Emissions from Chemical Process Facilities (EPA/625/R-93/005, March

1994). A procedure for a Leak Detection and Repair Program (LDAR) will be prepared for implementation during commissioning of the Bitumen Extraction and Upgrading plants and annually thereafter.

Q16. <u>Control of Air Emissions from Storage Tanks</u>

Page 12-3 indicates that the "CCME Environmental Guideline for Controlling Emissions of Volatile Organic Compounds from Above Ground Storage Tanks" will be used for the tank farm. Page D1 of Attachment D states that all of the tanks in the tank farm will be equipped with single seal internal floating roofs. Please confirm whether the control system as described complies with the requirements of the guideline referenced on page 12-3. Do either the bitumen or pipelineable crude oil have a vapour pressure of 76 kPa or greater at 21.1°C? If so, then the CCME guideline species a vapour control system for the tanks. Also, depending on the type of seal chosen, a single seal may, or may not, be acceptable for internal floating roof systems.

Answer: Anyone of the allowable single seals listed and illustrated in Appendix E of the CCME Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Aboveground Storage Tanks (CCME-EPC-87E, June 1995) will be selected during detailed engineering design based on technical and economic merits. A vapour control system is not planned for any of the tanks in the tank farm because none of the liquids stored will have a vapour pressure (at 21.1°C) that exceeds 79 kPa. The expected maximum saturated vapour pressures (at 21.1°C) are as follows:

- PCO: 69 kPa
- Bitumen: 7 kPa
- No. 2 Fuel Oil: negligible
- Gasoline: 58 kPa (refer to Appendix B of CCME Guidelines)

Vapour control systems will be provided on the storage tanks for the light to medium and oxygenated hydrocarbons in the bitumen extraction building (refer to page 4-7 of the Application) if required based on the CCME criteria for liquid vapour pressure and, tank diameter and volume. This VOC control need will be determined during detailed design and SOLV-EX will consult AEP regarding the interpretation of the CCME guideline requirements.

SOLV-EX will submit final design and operational details on all storage tanks and VOC control systems to AEP by April 1, 1996 or earlier.

Q17. Trucking of Pipelineable Crude Oil (PCO)

Will SOLV-EX be taking any measures to control potentially odourous emissions during the loading and transportation of pipelineable crude oil (PCO)? Will the tank trucks be equipped with an H_2S scrubber or a pressurized tank? Will SOLV-EX be using AEUB General Bulletin GB 94-01, entitled "Trucking of Sour Fluids and Control of Odourous Emissions", as a guideline to address this matter?

Answer: Yes. Our purchaser of the PCO will be required to adhere to GB 94-01 as it pertains to loading of odourous PCO to the tank trucks. Our potential purchaser advises that their current tank truck fleet is equipped with sealed tanks to prevent escape of vapours during PCO transport. As a design option we will consider routing tank truck vapours to our flare header system during loading of PCO. A vapour balancing system between the on-site tanks and tanks of the trucks is another option we will consider during detailed design.

SOLV-EX will submit design and operational details for the selected odour control system to AEP by April 1, 1996 or earlier.

Q18. Potential Odourous Emissions

Does SOLV-EX anticipate any odourous emissions from the pouring and eventual removal of the sulphur block, and from the storage of pitch? Will any measures be taken to control potential odourous emissions from these possible sources?

Answer: Typically, newly-formed sulphur liquid will contain small amounts of H_2S, SO_2, and CS_2, in the total order of 100 to 200 ppm. To reduce the odours from the handling of sulphur during pouring to solid block, the product leaving the sulphur condensers will be stripped of these compounds through agitation in a sealed holding pit. Sufficient residence time will be provided to release as much as gas as possible. The resulting waste gas will be sent to the tail gas incinerator for destruction. The final product liquid, to be poured in a block, will usually contain less than 10 ppm of H_2S. The same equipment will also be used to reduce odours generated during the solid block remelting process.

A similar molten pitch handling system is currently under review and evaluation relative to other design options. SOLV-EX will submit information for the selected pitch handling system and its odour control capabilities to AEP by April 1, 1996 or earlier.

Q19. *Schedule for Potable Water Plant and Sanitary Sewage Treatment System*

During initial site preparation, potable water will be trucked to the site and sanitary sewage wastewater will be removed by truck. Our understanding is that SOLV-EX will eventually construct a potable water plant and a sanitary sewage treatment system, and that details will be submitted to AEP when the design of these systems is completed.

At what point in the project schedule would SOLV-EX require these facilities? When would the design details be submitted to AEP for a detailed review?

Answer: The potable water and sewage systems will be required by March 1, 1996 and SOLV-EX plans to submit design and operational information for these systems to AEP by January 1, 1996.

Q20. *Surface Runoff from Pitch and Sulphur Storage Areas*

Please clarify whether the runoff systems for these areas will be segregated. If not, we suggest that SOLV-EX consider doing so. This would enable runoff treatment (which may be different for each water stream) to be handled separately and possibly easier, due to lower volumes. Please comment on this matter.

Answer: Yes. The runoff systems will be segregated as shown on the block diagram of Figure 28.1, submitted in response to Q28.

Q21. *Sulphur Block Storage*

The application states that sulphur will be stored on either a clay, asphalt or concrete base with a sub-drainage system and ditching to a lined surface retention pond. No details are provided.

Please note that clay has been found to be unsuitable in some applications for sulphur storage, as well as for the runoff management system. It may be preferable to separate the sulphur and its associated runoff from earthen materials to minimize the generation of low pH water. Asphalt has also exhibited problems of rapid degradation when in contact with molten sulphur and acid runoff.

Synthetic liner systems for sulphur management have been successfully used at a number of facilities. These systems normally include a compatible synthetic liner underneath the block, synthetically lined ditches surrounding the block which direct the acidic runoff water to a holding pond, and a double synthetic liner system for the acid water holding pond. A leak detection system is normally placed between the two liners for the holding pond. Neutralization of the collected water is generally performed in a second pond (a neutralization pond). The neutralized water can then be discharged.

This type of system appears to be working effectively at a number of sulphur block storage sites. If an alternative to the above type of system is to be used, SOLV-EX must demonstrate that the proposed system will provide an equivalent level of environmental protection.

Answer: Details are not provided because detailed engineering and issue of construction drawings has yet to commence, as noted in Section 1 of our Application.

We note the preference of AEP for synthetic liners. However, we are concerned about the following disadvantages of synthetic liners:

- Vehicle traffic on the pad during phase II (when the block sulphur will be recovered) will rip or puncture an exposed synthetic liner.

- A sand and gravel cover on the synthetic liner will protect the liner from vehicular damage. However, the sand and gravel cover will likely also introduce soil bacteria (as AEP has experienced with clay liners) which can transform sulphur into acid in the presence of moisture and surface drainage.

A clay liner, when well compacted in several lifts to 0.5 m thickness or more and from well-screened clay, will provide a drainage impermeable and trafficable base. Our rationale for proposing a subdrainage system is to ensure performance and full compliance with soil and groundwater protection criteria. If the liner develops leaks (regardless of liner type), the subdrainage system will minimize groundwater contamination because most of the low pH seepage from the leaks will be collected in the subdrainage system. Collected subdrainage will be directed to the surface drainage treatment system if of low pH.

SOLV-EX will review and assess the environmental performance of sulphur pad liners and pad drainage collection and treatment systems by consulting current sulphur block operators in Alberta. The performance criteria will be groundwater and surface water protection as stated in GB 92-4 and IL 84-11 issued by the AEUB with input from AEP. We note that the requirements of these documents do not exclude the use of clay liners. Regardless, we will report our findings to AEP by January 1, 1996 or earlier as to whether or not synthetic liners have any proven advantages over clay liners.

SOLV-EX will, however, include the following design features in the sulphur pad drainage collection and treatment system:

- well sloped ditches which are lined;

- a double lined holding pond with an intermediate layer of sand draining to a manhole for leak detection;

- a downstream liming and neutralization pond (refer to Figure 28.2 in our response to Q28).

SOLV-EX will submit final design and operational information for the sulphur storage pad to AEP by April 1, 1996 or earlier.

Q22. ***Pitch Storage***

Can SOLV-EX submit additional information to demonstrate that a clay lined storage pad and runoff collection system for pitch storage will offer adequate environmental protection?

Answer: SOLV-EX has proposed the lined pitch storage pad with a subdrainage system and surface drainage settling pond based on the AEUB requirements for bulk pads, documented in Section 9.0 of Guide G-55 (Storage Requirements for the Upstream Petroleum Industry).

The following questions need to be addressed:

(a) ***The expected permeability of the pitch after pouring to a pitch block at the site.***

Answer: Solidified pitch is amorphous like glass and tar and is expected to be impermeable.

(b) ***The expected contaminants from runoff leaching through the pitch block or runoff from contact with the block. Are heavy metals potentially of concern?***

Answer: Contaminants (including heavy metals) in the surface drainage are not expected because the amorphous pitch will not allow intimate contact with drainage from rain or snowmelt through percolation. Heavy metals will be present in the solidified pitch matrix, however, they are not expected to leach from the pitch to the surface drainage because of the lack of intimate contact and more importantly, heavy metals are not leachable unless in contact with low pH water.

(c) ***Type of runoff treatment proposed for the collection system.***

Answer: A lined drainage holding and settling pond with effluent sampling and analysis is proposed, as described on p. 4-45 of the Application. Please also refer to our answer to AEUB QE2 in Section 2.0.

(d) ***The procedures that will be used in forming the pitch block and recovery methods.***

Answer: The pitch will be poured in cells within temporary berms constructed of sand or mine overburden. A bermed cell will typically have the following dimensions: 40 m wide, 35 m long and 5.5 m high and will be filled in approximately 15 days. The berm material will thereafter be reused to construct another cell adjacent to another exposed block of pitch, such that a contiguous block of pitch is formed both horizontally and vertically.

(e) ***A contingency plan if no market can be found for the pitch. The long-term storage implications. How the pitch will ultimately be disposed, if it cannot be marketed?***

Answer: Our contingency plan is to keep pouring the pitch on the pitch storage pad. At the end of operations, the pitch block will be covered with an impermeable liner and topsoil, to revegetate the mound formed (refer to our answer to AEUB QE2).

Q23. ***Surface Runoff Re-use and Treatment***

Runoff from the truck ramp and oil sands crushing area, mine maintenance yard area, bitumen extraction and upgrading areas, tank farm area, sulphur storage pad, and pitch storage pad are to be collected for re-use within the plant via the oily water sewer. What is the alternative if the water cannot be re-used due to some contaminant (such as chloride) being too high to permit recycling?

Answer: Chlorides from saline Basal Aquifer mine drainage was a water recycling quality concern in our Application. However, the preliminary results of a recent drilling program in the proposed mine area show a low potential for this. Chlorides may be present in the surface drainage from the oil sands crushing area due to saline groundwater contact with the oil sands from the bottom mine bench. However, drainage from the oil sands crushing area is not expected to result in very high chloride levels in the waste water holding pond due to dilution from several other streams routed to this pond (refer to Figure 28.2 of our response to Q28).

Should chloride or suspended solids levels in the waste water holding pond be unacceptable for direct recycling to the bitumen extraction process we would direct it to the tailings disposal area via the tailings pump box (as shown on Figure 28.2 of our response to Q28). This arrangement will provide for dilution of the chlorides and more time for settling of fine solids as the ponded area of the tailings disposal area will provide 30 days of retention time versus 24 hours for the waste water holding pond.

Q24. ***Surface Runoff Suspended Solids***

It is stated that approval will be needed to release surface runoff water, which will normally be recycled, if the total suspended solids (TSS) is 10,000 mg/L or more. This high level of suspended solids normally would not be authorized for release. As an example, in the natural gas processing industry, TSS surface runoff limits are 25 mg/L, a number that is achievable under most circumstances.

SOLV-EX should develop a contingency plan for the high TSS (10,000 mg/L) that may be encountered. If a rationale can be provided as to why the TSS levels cannot be reduced lower than 10,000 mg/L, then the requested authorization for release will be reviewed. This does not mean that excess runoff will not be authorized for release, but that SOLV-EX should demonstrate why these high contaminant levels are not treatable.

Answer: Our rationale for wanting an authorized release of silty surface drainage are as follows:

- Historic water quality data for the Athabasca River at Fort McMurray (since 1973) show a peak TSS level of 4110 mg/L, levels of about 1000 mg/L for 10 days/year and a mean level of about 350 mg/L (refer to p. 4-56 of the EIA). Consequently, overland drainage in the basin will occasionally have high levels of TSS. Unfortunately, local historic data are not available for the SOLV-EX site and Fort Creek to identify normally occurring extreme TSS levels in natural overland and creek drainage.

- Our currently proposed treatment of uncontaminated surface drainage is gravity settling in the mine and main plant storm water settling ponds (Figure 4.12 (p. 4-36) and Figure 4.3 (p. 4-6) of the Application). Drainage to these ponds will be managed as shown in Figures 28.1 and 28.2 (with response to Q28), i.e. the settled drainage will normally be directed from the two settling ponds to the waste water holding pond, with the option to direct it to the tailings pump box for further settling in the ponded area of the tailings disposal area. If these arrangements cause the combined makeup water (including water makeup from the river water storage pond (Figure 4.3 (p. 4-6) of the Application) to approach 10,000 mg/L of TSS, we will be forced to reduce water makeup from drainage and increase makeup by means of river water.

- The settling ponds will substantially reduce the TSS level of drainage if the entrained sediment is primarily coarse grain particles. Fine silt and clay particles will, however, take days to settle out of the drainage and may result in occasional high TSS levels if present in the drainage due to a flash flood rainfall. The proportions of coarse versus fine particle suspended solids in the site drainage and its TSS content after settling are not predictable at the design stage. They will not be known before the surface drainage system is in operation. Consequently, we cannot assure any upper level of TSS in the effluent from the two settling ponds.

Our contingency plan is to direct high TSS drainage to the tailings disposal area via the tailings pump box as shown on Figure 28.1. However, we expect situations when we cannot continue doing this due to the 10,000 mg/L criteria on the bitumen extraction water makeup. Consequently, there will be an occasional need to discharge surface drainage from the two settling ponds to the Athabasca River, as shown by the two valved discharges on Figure 28.1.

We propose that the discharge limits for TSS and other naturally occurring constituents of surface drainage and groundwater seepage be limited to naturally occurring levels measured by SOLV-EX in the Athabasca River within a reasonable time frame of the discharge (e.g. surface drainage discharges with a TSS level of 1000 mg/L should be permitted within a week of similar TSS levels occurring in the Athabasca River). We also propose that the following parameters be analyzed and reported for the river and the surface drainage discharge to the river:

- TSS
- COD
- Total dissolved sulphates
- Total dissolved sulphides
- pH

These parameters will serve as good indicators of our ability to segregate uncontaminated drainage from contaminated drainage.

Q25. ***Tank Farm Area Runoff***

The application indicates that the tank farm area will be sloped to one corner where lined ponds will be constructed for surface drainage. The following is required:

(a) *Type of liner?*

Answer: Each dyked area on Figure 4.15 (p. 4-46) of the Application (including the inner dyke slopes) will be clay lined, as documented on page 4-44 of the Application. The slope of each dyked area will be such that drainage can accumulate in one corner or, a clay lined depression may be constructed.

(b) Will there be a secondary liner?

Answer: A secondary liner is not planned because Section 5.2.2 of AEUB Guide G-55 designates the clay lined dyked area as the secondary containment if lined to an in-situ permeability of 10^{-7} cm/s, which we intend to provide.

(c) The criteria for pond sizing?

Answer: 1:10 year storm of 24 hours duration.

(d) Will there be any testing of the water prior to these ponds being released?

Answer: Our plant personnel will visually inspect for oil sheen before pumping it to the oily water sewer system or perimeter ditch drainage system, as documented in Attachment B of the Application (p. B2). Please also refer to Figure 28.1 (with Q28) which shows that surface drainage will ultimately be recycled to process, except for occasions when we need to discharge to the river from the plant (main) storm settling pond. During such occasions, the tank farm drainage will be directed to the API separator and waste water holding pond.

Q26. <u>Tank Farm and Storage Secondary Containment</u>

Section 12.2 states that SOLV-EX will design, build and operate the plant in accordance with the guidelines listed in Section 12.2. This includes the Guideline for Secondary Containment issued by AEP. Please confirm that all above ground storage tanks including sour water storage, bitumen storage, fuel storage, chemical storage, and any other stored liquids that present an environmental risk will comply with this guideline. What leak detection system will be employed for these tanks?

Answer: SOLV-EX fully intends to comply with the subject AEP guidelines by providing AEP with design details for all above ground storage tanks by March 1, 1996 or earlier. We will ensure that our designers fully clarify all requirements of this guideline with AEP relative to AEUB Guide G-55 which also contains requirements and guidance for providing secondary containment and leak detection associated with above ground storage tanks. We note that the AEUB Guide may pertain to "integrated oil sands mining and upgrading schemes" and it covers several of the materials to be stored on the future SOLV-EX site. Unfortunately the AEUB Guide was not available to us in a final and complete form from the AEUB at the time we filed the Application.

Q27. <u>Wastewater Holding Pond Design</u>

It is indicated in the application that the wastewater holding pond and the equalization pond will be clay lined. Due to the type of contaminants these ponds will contain, a single clay liner may not be adequate. A double liner system with at least the top liner

being synthetic, and a leak detection system between the liners, is commonly used as a design for process water holding ponds. Unless significant rationale can be provided to demonstrate that an alternate system will give equal environmental protection, we request that the pond designs be modified to meet the above.

Answer: SOLV-EX will design liners and leak detection systems for the waste water holding and equalization ponds as requested by AEP.

Q28. *Contents of Proposed Ponds*

Please provide a summary for each proposed pond specifying:

(a) water flows and sources of each input stream,

Answer: Figures 28.1 and 28.2 show the waste water flow streams and their sources. Estimated flow rates for sewage, alum sludge and filter backwash are documented in Table 4.6 and Figures 4.6 and 4.8 (as regards tailings) of the Application. Estimated flow rates for various other waste water streams are collectively documented in Table 4.4 of the Application.

(b) expected contaminants and their levels of each input stream, and

Answer: Contaminant characterization by constituent and estimated concentration levels will be submitted to AEP by April 1, 1996 or earlier, when detailed design is completed. Figures 28.1 and 28.2, as well as the Application, represent our conceptual engineering commitment to sound waste and waste water management with the objectives of waste minimization and waste water reuse. Our detailed design will be based on the same principles.

(c) discharge destination of each pond for each contingency.

Answer: Figures 28.1 and 28.2 show the discharge destinations from the various ponds for the following anticipated contingency situations:

- spills in the tank farm area: route drainage to API separator;
- oil contamination of perimeter/internal plant ditch drainage: route to API separator;
- option to route content of the waste water holding pond to the tailings disposal area.

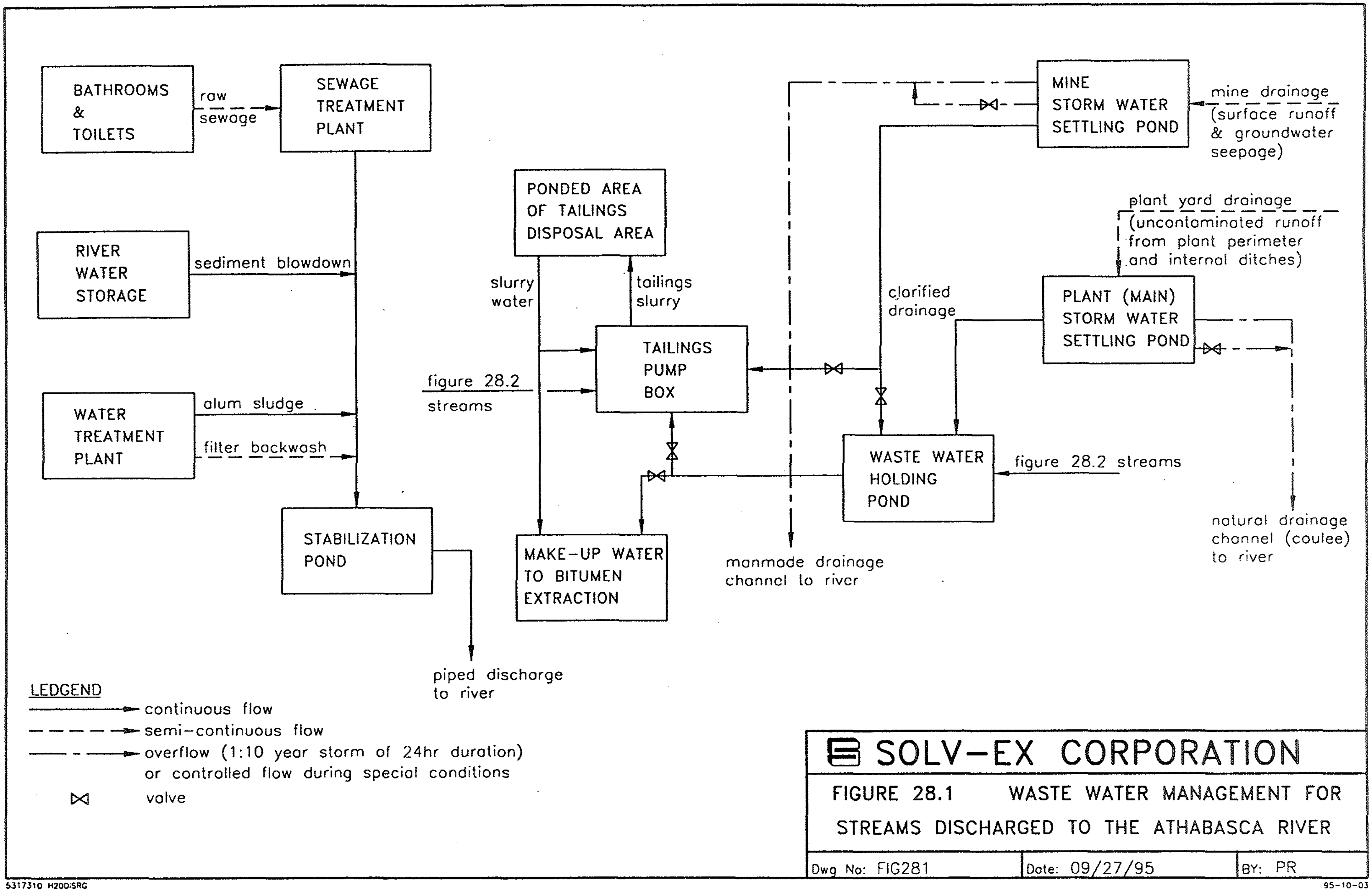
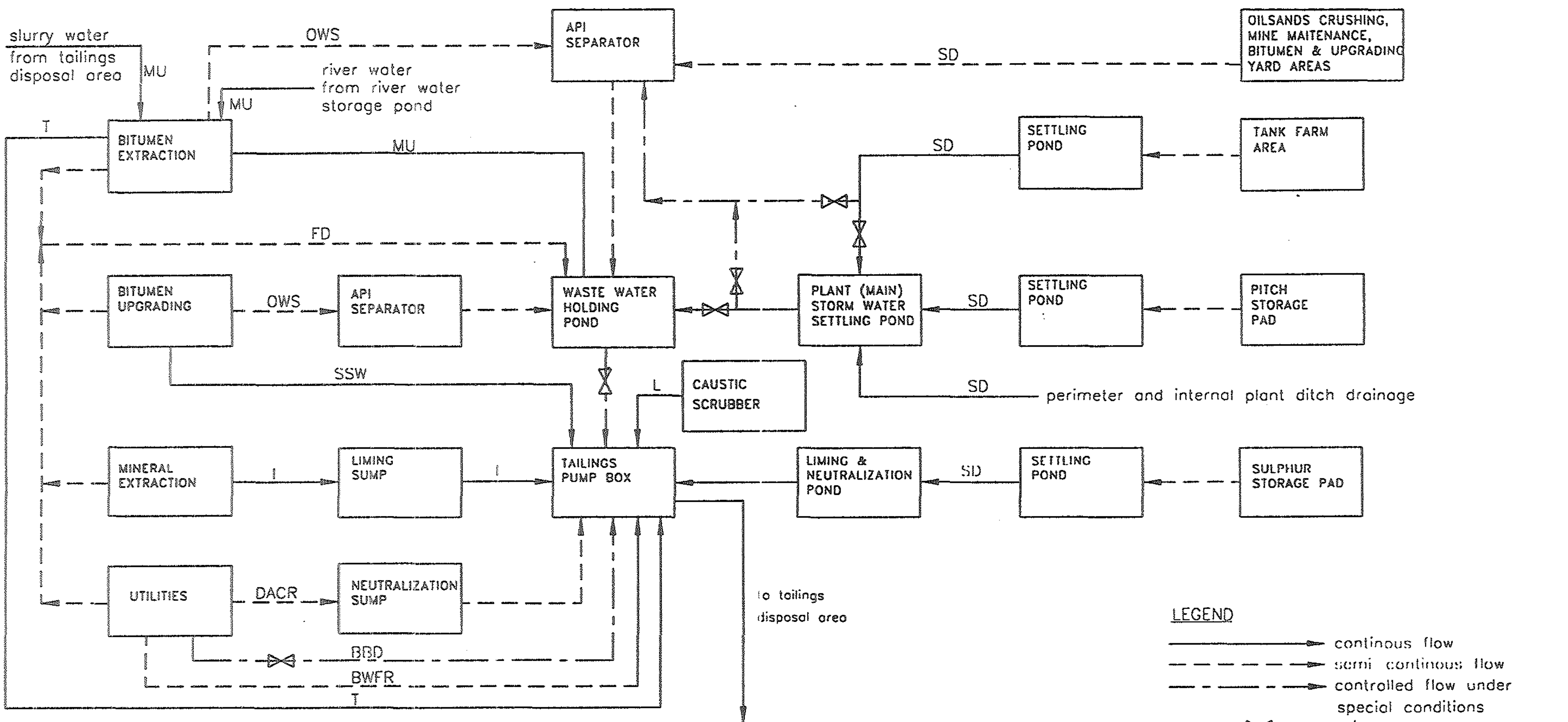


FIGURE 28.1 WASTE WATER MANAGEMENT FOR STREAMS DISCHARGED TO THE ATHABASCA RIVER



ABREVIATIONS

SD – surface drainage
BBD – boiler blowdown
OWS – oily water sewage
FD – floor drainage, including coolant leakage and pump seal water
SSW – stripped sour water
T – tailings
MU – makeup water to bitumen extraction
DACR – dilute acid, caustic and slow rinse from ion exchanger regeneration
BWFR – backwash and fast rinse of ion exchangers
L – liquid containing sodium sulphite and sulphate

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FIGURE 28.2 WASTE WATER MANAGEMENT FOR STREAMS RECYCLED TO PROCESS

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The potential or risk of spills and leaks within process building will be reviewed during detailed equipment design with the objective of preventing contamination of floor areas and hence, minimize contamination of floor drainage.

Q29. *Sediment Accumulations in River Water Storage Pond*

What will be done with the sediment that accumulates in the river water storage pond? If discharge to the Athabasca River is contemplated, it may be preferable to do continuous blowdown of sediment rather than bulk discharge once or twice a year.

Answer: A continuous blowdown via the stabilization pond will be provided, as shown on Figure 28.1.

Q30. *Tailings Disposal Area*

(a) ***We understand the tailings disposal area will be lined with clay where necessary (Section 4.1.1.8 of EPEA application) to establish an in-situ permeability of 1 x 10^{-6} cm/s. Please specify the following:***

(i) ***Areas to be lined, and not lined? Give the appropriate rationale.***

Answer: The entire area will be clay lined.

(ii) ***The thickness of the liner?***

Answer: 0.5 m, or more depending on the measured in-situ permeability obtained after layered compaction of screened clay.

(iii) ***Is the clay made of native materials or is it imported?***

Answer: The source of clay will be from the lease area (refer to Figure 3.1 of the Application). Clay strata have been identified in the plant and mine site areas and are expected to extend beyond them.

(iv) ***Details of how the clay liner will be prepared.***

Answer: The liner will be prepared by compacting clay with water addition in several lifts. The thickness of each lift, optimum water content and amount of compaction will be determined from laboratory Proctor compaction tests.

(b) ***Please provide a summary listing of all waters that will be used as make-up slurry water for transport of the tails. Include the sources and flows of each stream, and the expected contaminants and their levels in each stream.***

Answer: Please refer to our answers to Q28 and Q29.

(c) ***Given that the slurry water will be continuously recycled, will contaminants build up within the tailings disposal area?***

Answer: Contaminants will not build-up linearly in the slurry water over the life of the tailings disposal area. Rather, an equilibrium stage will be reached between input from the tailings pump box and losses to the tailing sands which are expected to retain moisture equivalent to about 20 wt.%, as documented in Section 4.1.1.8 (p. 4-10) of the Application.

(d) ***What are the construction materials for the dikes surrounding the tailings disposal area?***

Answer: Mine overburden.

(e) ***Please provide more details about the water pond within the tailings disposal area and the environmental protection measures that will be used to prevent the seepage of contaminants.***

Answer: The entire tailings disposal area, including the inside of the overburden dykes will be clay lined and a water pond area will be created in one corner inside the dykes, as further described in Section 4.1.1.8 of the Application.

Q31. *<u>Chemicals to be Used On-site</u>*

Can SOLV-EX provide a list of all chemicals that are presently unspecified within the application, such as oxygen scavenger, light/medium hydrocarbons, oxygenated hydrocarbons, boiler water treatment chemicals, emulsion breakers, flocculants, etc.? Also, please provide for each chemical to be used at the plant, the storage location, containment measures and MSDS sheets. If some of this information is presently not available, when can it be provided?

Answer: All of this information will be submitted to AEP by April 1, 1996, or earlier if possible. These chemicals are similar to those used by existing oil sands processors.

Q32. *<u>Wastewater Discharge Information</u>*

(a) ***Will the discharge for sanitary sewage, runoff, etc., be separate or combined?***

Answer: There will be three separate discharge points (as shown on Figure 28.1):

- occasional mine drainage to the Athabasca River;

- occasional plant drainage to the natural drainage channel southwest of the plant site (Figure 4.17 (p. 4-54) of the Application), as documented in Attachment D of the Application;

- continuous discharge from the stabilization pond to the Athabasca River, as documented in Section 4.1.6.7 and Attachment D of the Application.

(b) ***Will the discharge point to the Athabasca River be a centre discharge, bank discharge, a diffuser or some other form of discharge? Please provide a rationale for the chosen method, including the environmental benefits.***

Answer: All three discharge locations will be shore-based bank discharges by submerged piping for the stabilization pond discharge and by rip-rapped channels for the drainage. Our rationale for these methods are as follows:

- shore-based turbulence will rapidly disperse and dilute the stabilization pond discharge, provided the outfall location is carefully selected based on a survey of near shore bathymetry and flow conditions, which will be done this autumn;

- shore-based outfall channels for the drainage are required for flow design and economic reasons as enormous diameter piping would be required for overflow design of the ponds in case of an extreme rainfall event (1:25 to 1:100 year storms).

(c) ***Will the discharge be batch or continuous?***

Answer: The stabilization pond discharge will be continuous. The occasional drainage discharges will be batch type discharges.

(d) ***What are the expected contaminants and their levels in the discharge to the Athabasca River? How will the levels vary due to process upsets?***

Answer: Contaminants and levels are documented in Section 4.5 of the Application for the stabilization pond effluent. The 24-hour retention of the pond will equalize variations in contaminant levels. Regarding the drainage effluent, please refer to answer for Q24.

Q33. *<u>Miscellaneous Wastewater Handling Related Items</u>*

(a) ***Please provide details on any environmental protection measures that will be used at the mine waste dump.***

Answer: The perimeter ditch system will encompass the mine waste dump, as shown on Figure 4.12 (p. 4-36) of the Application, i.e. drainage will be collected and directed to the plant (main) storm water settling pond, and the API separator if need be, as shown on Figure 28.2.

(b) Please clarify the destination of the boiler blowdown and the instrument air/utility blowdown streams.

Answer: Steam-electric power boilers require blowdown to purge minerals from steam condensate which is continuously recycled. Our boilers achieve purging by virtue of the "live steam" injected into the bitumen extraction process. Consequently, we do not expect a need for boiler blowdown. Should there be a need, it will be routed to the waste water holding pond as shown on Figure 28.2. Condensate from air compressors will be drained to the floor drainage system.

(c) Please specify where floor drains from each building will be directed.

Answer: Please refer to Figure 28.2. SOLV-EX will submit plans showing floor and building drainage piping and equipment layouts to AEP by April, 1996 when this design is completed.

(d) How will wastewater resulting from commissioning activities such as hydrostatic test water and washdown water be handled?

Answer: It will be discharged or transferred to the waste water holding pond.

(e) When will SOLV-EX know whether an air separation plant will be constructed at the site to supply nitrogen? What types of wastewater streams would be associated with such a plant? How would they be handled and disposed of?

Answer: An air separation plant will not be provided as originally stated in Section 4.1.5.5 of the Application. The alternative of trucking liquefied nitrogen to the plant site has been chosen.

(f) SOLV-EX indicates that mine depressurization water will be diluted with river water to meet the requirements of AEP. Dilution is not normally an approved method of handling waste waters. Can SOLV-EX provide an alternate plan to handle this water? Is treatment prior to release possible?

Answer: The need for pumping saline groundwater from the Basal Aquifer to depressurize the mine pit bottom does not appear to be required based on preliminary results from core drilling in the proposed mine area (refer to our answer to QI1 in Section 2.0). Consequently, discharge and dilution of saline water will not be required.

Q34. ***Conceptual Conservation and Reclamation Plan***

In general, this section does not provide conceptual plans and maps that illustrate land reclamation and post mine land use. Estimates of the amount of land to be progressively reclaimed starting in 1998 are also not included, as well as a conceptual end pit lake design.

(a) Page 17-5, Section 17.1.3: Please locate the development areas on a photomosaic at a scale of 1:5000. This photomosaic should also outline the AEUB permit boundary.

Answer: Figure 34.1 (foldout drawing in Attachment 34 of Appendix B) is a 1:10,000 topographic map outlining the development areas and showing the surveyed locations and elevations of the plant site.

(b) Page 17-11, Figures 17.24, 17.25: How can the data for the topsoil storage pile in Figures 17.24 and 17.25 be related to the topsoil storage column in Table 17.3?

Topsoil storage volumes should be shown on all of these figures.

Answer: The topsoil storage values in Figures 17.24 and 17.25 are based on an earlier version of the mine plan. The values in Table 17.3 are the most current values.

(c) Page 17-18, Section 2.2.1: Please provide detail on how the ecosystem will be returned. Relying on natural invasion of plant species is not a generally accepted reclamation strategy. A minimum area and quality equivalent to pre-mining disturbance of White Spruce forest is required as reclamation..

Answer: Revegetation will not rely on natural invasion of plant species but will be actively managed to ensure that revegetation is completed according to the revegetation plan outlined in Section 17.4.2.4 (page 17-112).

(d) Page 17-18, Section 17.2.2.1: SOLV-EX should provide a conceptual forest capability for the complete area of disturbance and compare this capability to pre-disturbance conditions.

Answer: The present forest capability of the area to be disturbed is provided in Figure 17.20 (page 17-86). The current capabilities are compared to the conceptual post-disturbance forest capability (Figure 17.8, page 17-31) on page 17-87.

(e) Page 17-18, Section 17.2.2.1: There is ample evidence in the oil sands area to indicate that an initial planting to a grass-legume mixture will create

significant problems for successful tree establishment. How does SOLV-EX intend to overcome this problem?

Answer: The revegetation plan as outlined in the Conceptual C&R Plan (Section 17.2.2.1) is described in more detail in the Revegetation Plan in Section 17.4.2.4 (page 17-112). The establishment of forest growth to meet Free-to-Grow standards is difficult in many parts of the Province as a result of competition from grass and shrub species. Within the SOLV-EX area, it is recognized that the seeding of a grass/legume mix may result in some delays in tree establishment. However, the preliminary establishment of vegetation cover of the exposed sand is essential for the prevention of erosion. SOLV-EX will plant alternate rows of the tree/shrub seedlings with herbaceous vegetation (grass legumes) to solve this problem. The grass/legume mixture will incorporate two strategies to assist in native species establishment and the reduction of competition with tree seedling growth:

- The seeding rate for the grass and legume mix is reduced in the final revegetation plan to encourage native species invasion while still providing sufficient cover to prevent erosion, and

- The fertilization rate is less than optimum for plant growth to limit the competition of agronomic species with native herbaceous and tree species.

- Following stabilization of the exposed soil material, an appropriate site preparation program will be undertaken to assist with the establishment of tree seedlings. The site preparation method chosen will be based on site conditions and the density of grass and shrub vegetation. This will include the exposure of mineral soil of sufficient area to limit immediate direct competition with the tree seedlings. Where required, additional stand tending will be undertaken to ensure that the tree seedlings meet Free-to-Grow standards

(f) ***Page 17-20, Section 17.2.2.1: The last bullet indicates that the 3 ha topsoil stockpile will be redistributed to other disturbed areas, but Table 17.3 shows 150,000 m^3 of topsoil remaining after 2002. Which is correct?***

Page 17-105 indicates the stockpile as being 2 ha. Which is correct?

Answer: 3 ha is correct. The soil replacement plan is described in more detail in section 17.4.2.3 page 17-110 of the Application. The topsoil in the 3 ha stockpile south of the proposed mine will be completely replaced on the mine depending on the condition of the overburden during reclamation. Based on available data, from 0.5 to 1 metre of material will be replaced over the mine site. If at the end of mining there are areas of unsuitable material at the surface, then 1 metre will be replaced. Enough soil will be stockpiled to allow for a replacement of 1 metre of material over all areas. There could be some soil remaining depending on the condition of overburden at the time of reclamation.

Once detailed mine and reclamation planning are completed in the second quarter of 1996, then more specific soil salvage and replacement quantities will be determined.

(g) ***Page 17-20: SOLV-EX proposes a different standard of reclamation material placement for the project. For example, 50 cm of suitable quality reclamation material will be placed on the mine area, 30 cm on the plant site, 30 cm on the cleared areas around the facilities, 30 cm on the external waste dumps and the pipelines will be two lifted. Would SOLV-EX please clarify this.***

Answer: The updated Conceptual Reclamation Plan calls for a salvage of a 30 cm upper lift for all of the areas to be disturbed. A lower lift of 20 cm will be salvaged in the mine area and a temporary salvage of 70 cm of lower lift will be salvaged for the water pipeline. In the event that a natural gas pipeline is built to the site, a temporary salvage of an upper lift of 30 cm and a lower lift of 130 cm will be undertaken.

The maximum depth of soil to be salvaged in the EIA was 1 metre. Deeper soil salvage was not planned because of the following factors:

- The stratigraphy and reclamation suitability of the overburden was not known at the time of preparing the EIA. We are currently evaluating the drilling program data collected this summer and preparing for an overburden testing program, with pending laboratory analyses of the recovered soil samples, to determine the reclamation suitability of the various overburden strata.

- The Alberta Environmental Protection guidelines call for a return of the land to an equivalent capability as existed prior to disturbance. If the existing soils are salvaged and replaced following disturbance, then capability is likely to be maintained.

- In relation to soil replacement, the updated Conceptual Reclamation Plan calls for a replacement of 30 cm of upper lift over all of the disturbed areas. In the mine area, there will also be a replacement of 20 cm of lower lift. In the event that saline overburden is encountered on the surface, there will be 70 cm of lower lift replaced on the mining area.

- The replacement depths of soil are related to the quality of the material that is remaining following disturbance. The conceptual reclamation plan calls for deeper soil replacement on the mining area since the reclamation suitability of the final overburden is not predictable, while for the plant site and other areas, the remaining material will be similar to the original soils.

The final soil replacements requirements will be determined once the detailed mine and reclamation planning is completed in the second quarter of 1996.

(h) ***Page 17-20, 2nd bullet: Please note that the plant site is to be reclaimed according to the Miscellaneous Lease conditions and the Environmental Protection and Enhancement Act, not to Alberta Energy and Utilities Board standards.***

Answer: The reference on the second bullet of page 17-21 was not in relation to reclamation, but regarding abandonment procedures as required by the AEUB when a plant shuts down. We are aware that once the equipment is removed, AEP reclamation requirements will be in effect.

The reclamation of the plant site will follow the conditions as set down in Miscellaneous Lease Application No. MLL 950053. As per condition 21 of the MLL, soil salvage in the 42 ha plant site will involve the following:

- All topsoil shall be stripped and piled separately from woody material and subsoil.

- Sufficient subsoil shall be salvaged to replace 70 cm over the disturbed lands for a total replacement depth of 1 metre.

- Soil stockpiles will be approved by the AEP field person. Currently the soil stockpiles are planned to be located east of the tailings disposal area as shown on Figure 17.3 of the Application and in the 1:10,000 site plan (Figure 34.1, Attachment 34, Appendix B).

Soil replacement for the plant site will include a 30 cm upper lift and a 70 cm lower lift. The upper lift will consist of an equal mixture of poor suitability loamy sand material and peat. For the lower lift, 70 cm of loamy sand mineral material. There will be a net deficit of 71,000 Bank Cubic Meters (BCM) of mineral material and a surplus of 59,000 BCM of peat as outlined in Table 34.1. Deficits and surpluses will be provided and exchanged with materials in the other three development areas and the development corridors.

Table 34.1 Plant Site Material Balance

Type of Reclamation Material	Total Reclamation Material Available (BCM)	Total Reclamation Material Required (BCM)[(a)]	Balance of Required Minus Available (+\-)
Poor Suitability Mineral Soil	286,000	357,000	-71,000
Peat	122,000	63,000	+59,000
Totals	408,000	420,000	-12,000

(a) 30 cm of upper lift will consist of an equal mixture of poor suitability mineral material an peat. The total requirement for reclamation materials in the upper lift will be 63,000 BCM of mineral and 63,000 BCM of peat.

70 cm of lower lift will consist of mineral material. Total mineral reclamation material required for the lower lift will be 294,000 BCM.

Therefore, the total requirement of mineral reclamation material will be 63,000 BCM for upper lift and 294,000 BCM for lower lift, for a total requirement of 357,000 BCM.

The soil types in the plant site area are presented in Figure 34.2 and are adapted from the 1: 20,000 soil map as presented in Figure 17.13 of the Application.

(i) ***Page 17-21: The application indicates that the land surface will be reclaimed with suitable quality surface materials above overburden. This statement implies that tailings will be capped with overburden. Does SOLV-EX propose to cap the tailings with overburden?***

Answer: As described on page 17-21 of the Application, the disturbed areas will be reclaimed with suitable quality soil material. SOLV-EX is currently researching the need for capping the tailings as regards wind blowing and ability to sustain vegetation. When the reclamation suitability of the tailings are better understood, the requirement for capping and the depth of material needed will be determined. This information is expected to be available once detailed mine and reclamation planning is complete in the second quarter of 1996.

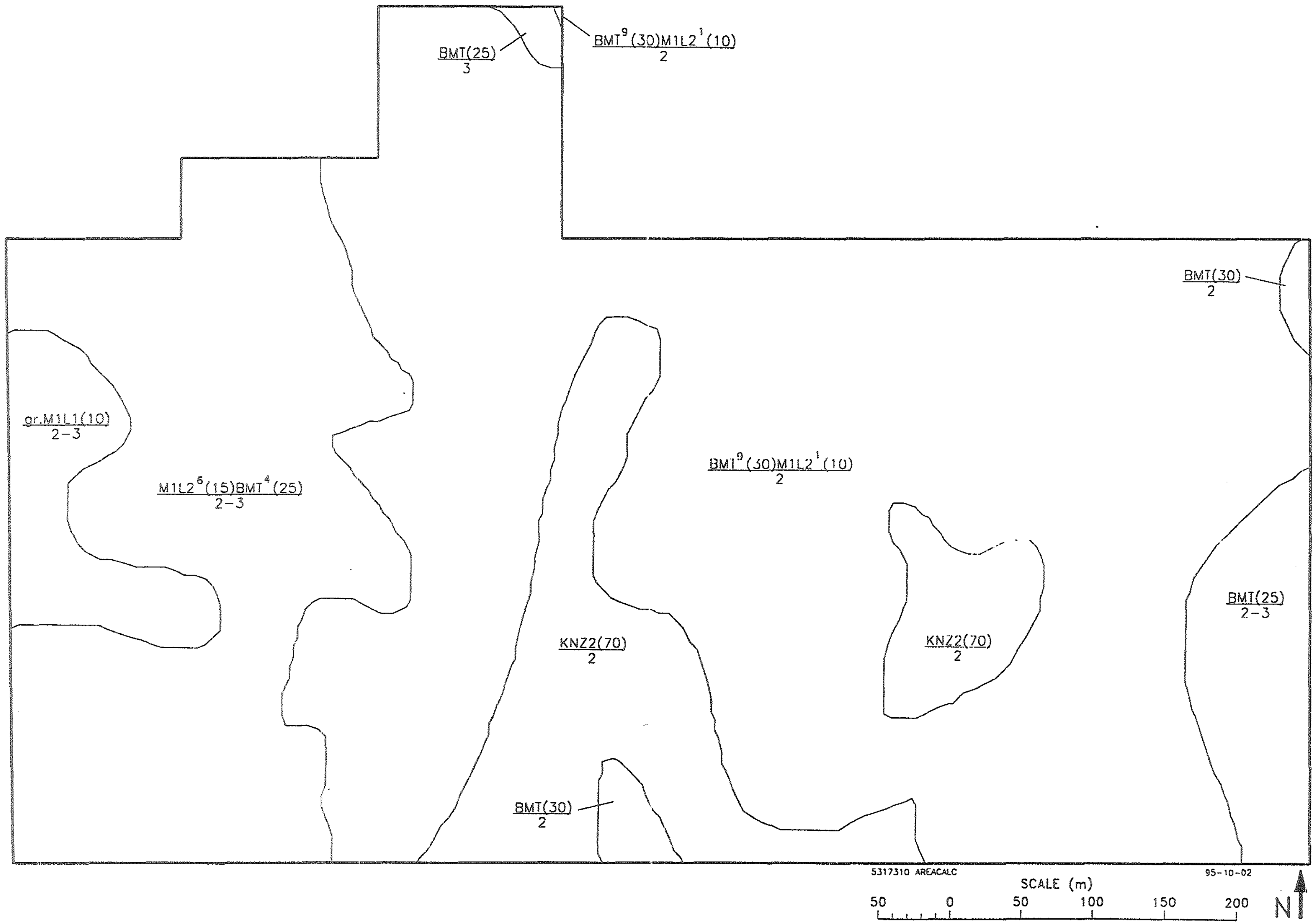


FIGURE 34.2 SOIL SERIES AT SOLV-EX PROPOSED PLANT SITE

(j) ***Page 17-21, Section 17.2.2.1: Roughly what volumes of muskeg, tailings, sand and glacial drift materials will be in the final "mixed" soil?***

Answer: The reclamation procedures are described on page 17-20. The volumes of muskeg, tailings and glacial drift in the final mixed soil will be determined once detailed mine and reclamation planning are complete in the second quarter of 1996.

(k) ***Page 17-22, Table 17.5 shows reclamation material volumes. Is this mineral or organic soil? What are the balances of mineral and organic soils? What depths of mineral and organic soils will be used, and where?***

Normally, one metre of mineral soil is required over unsuitable quality overburden. A direct placement of organics would be the most suitable for soil replacement. Please comment on the feasibility of this method and depths of suitable soil replacement.

Answer: The reclamation material volumes on page 17-22 are a mixture of mineral and organic soils. The final balances of mineral and organic soil available and the depths to be used will be available once detailed mine and reclamation planning is complete in the second quarter of 1996.

SOLV-EX plans to replace a minimum of 1 metre of suitable mineral soil over unsuitable overburden as described in Conceptual Reclamation Plan (Section 17.2.2.1) and the Soil Replacement Plan (Section 17.4.2.3).

Direct placement of organic material is recognized in the mining industry as a practical way to handle muskeg. The best methods to handle muskeg at the mine site will be determined once detailed mine and reclamation planning are complete in the second quarter of 1996.

(l) ***Page 17-22, Table 17.5 indicates that suitable quality soil will not be salvaged from the plant site, access roads, water pipeline, external mine waste area and the external tailings disposal area. Please clarify why all suitable quality soil is not salvaged from all areas disturbed by the development, including the drainage ditches.***

Answer: The material salvage requirements for the areas other than the mine, such as the plant, roads, pipeline and external tailings disposal area are described in Sections 17.2.2.1 and 17.4.1.6. The need to salvage all materials down to 1 metre will be determined once detailed mine and reclamation planning are complete in the second quarter of 1996.

(m) ***Page 17-23: The application discusses three types of soil: Soil #1, Soil #2 and Soil #3. Please outline the physical and chemical properties of these soils and discuss the soil capability of each soil.***

Answer: The physical and chemical properties of the three types of final reclamation soils are described on page 17-23. Additional information will be available upon detailed review of the overburden survey (carried out during August 1995) and soil testing program presently in progress. The results will be used for the completion of the detailed mine and reclamation plan in the second quarter of 1996.

(n) ***Page 17-29: The application indicates an increase in the topography of the landscape. Please discuss the impact of increasing the amount of topographic Class 6 and 7 land and decreasing the amount of Class 2 and 3 land with respect to overall land capability.***

Answer: The impact of increasing the topographic classes in the post-mining landscape is described on page 17-29. The capability of the overall disturbed landscape will be improved do to better drainage, therefore the increase in topography will not have a significant impact on capability. A final evaluation of this will be made once detailed mine and reclamation planning is complete in the second quarter of 1996.

(o) ***Page 17-110, Section 4.2.3: Anticipated physical and chemical characteristics of the replaced subsoil should be discussed and a soils material balance showing materials available versus needed should be provided.***

Answer: The anticipated physical and chemical characteristics of the replaced subsoil is described in Section 17.4.2.3. A confirmation will be available once the results of the detailed overburden survey are evaluated in the detailed mining and reclamation plan which is expected to be available in the second quarter of 1996.

Q35. Access

(a) ***Page 17-1, 5, 7 and 15: Reference is made that Alberta Transportation and Utilities owns the right-of-way for the proposed extension of Highway 63 and that the 14 km Highway 63 upgrade will not be reclaimed since it is part of a permanent public infrastructure. Please note that Highway 63 presently terminates approximately 5.6 km south of the proposed 14 km section. There are no plans to extend it. The proposed road is local in nature and falls under the jurisdiction of the Municipality of Wood Buffalo. Transportation and Utilities is currently transferring the provisional reservation for a future road right-of-way to the Municipality of Wood Buffalo. SOLV-EX should contact the Municipality for their input.***

(b) *Please note that SOLV-EX will be considered the operator of the roadway for the purposes of Part 5 of EPEA and the Conservation and Reclamation Regulation. As such, SOLV-EX is advised that it will have to comply with the requirements of the draft Environmental Protection Guidelines for Roadways.*

(c) ***Page 17-9 contains the statement "A utility corridor that will support an upgraded access road, and a natural gas pipeline, both of which will be constructed by proponents other than SOLV-EX. Access to the proposed project site will be provided by building a road within the existing, cleared right-of-way for Highway 63." This statement needs to be clarified. Who are the "proponents"? It is Alberta Transportation and Utilities' understanding that it will not be developing or providing funding for the development of an access road.***

Answer: (a,b,c) SOLV-EX is currently working with Alberta Transportation and Utilities and the Municipality of Wood Buffalo to come to an agreement on the construction and maintenance of the proposed road to the SOLV-EX facilities.

Q36. Gravel Deposits

(a) ***Page 17-8: Locations, depths of overburden and aggregate and aggregate quality should be sufficiently identified.***

(b) ***Page 17-8 states that "gravel will be provided from the existing Alberta Transportation and utilities gravel pit south of the proposed plant site." At the meeting with Transportation and Utilities in June, 1995 SOLV-EX was advised that access to the deposit by the department or its contractors would need to be addressed. In addition, if SOLV-EX must use land where the gravel is located, stockpiling the aggregate at a mutually agreeable site will be required.***

Answer: A gravel survey of the plant site area was undertaken during August 1995. The results show that sterilization of gravel will be minimal and that the quality of the sterilized gravel is poor. These findings were presented to Alberta Transportation and Alberta Forestry during a meeting on 20 September 1995. Our conclusion from the meeting is that representatives from these departments considered our plant site location to be suitable.

Q37. Construction Camp

Page 17-19, Section 2.1: What impact will a 250 man camp and employees have on the surrounding Bitumount area environment? The alternative of having permanent staff reside in Fort McMurray should be evaluated. If the camp were approved, what mitigative steps would SOLV-EX take to minimize impact on the area?

Answer: The impact of increased employment from the project is described in Section 9 of the EIA. The project is not feasible if all the employees were bused in from Fort McMurray.

The impact of a 250 man camp on the surrounding Bitumount area environment is not expected to be significantly greater than if all the employees are bused. Busing would increase the traffic on the road and increase the potential for wildlife-vehicle collisions. Recreational use of the area is expected to increase due to our employees, however, we would encourage and remind our employees to protect and respect the use of the regional environment and natural resources. We note that the area is currently frequented by many all terrain vehicles, i.e. it is already subject to recreational use.

Q38. <u>Reclamation Plan</u>

(a) ***Page 17-29, Section 17.2.3.1: The first sentence indicates that Figure 17.8 is a "pre-development capability" map. Do you mean the map in Figure 17.19?***

Answer: Yes. The reference to Figure 17.8 should be to Figure 17.19.

(b) ***Page 17-112, Section 4.2.4: More area should be committed to White Spruce Forest. Please provide a plan for the establishment of White Spruce forests with equivalent area and productivity which meets the Land and Forest Service regeneration standards. Table 17.21 indicates that 78 ha is originally White Spruce forest, however the same chart shows that no area would be reclaimed to White Spruce, except where mixed with Aspen. Chart 17-21 shows a total of 247 ha of pre-disturbance Conifer forest with reclamation having a conversion to 118 ha of pure Aspen. The original percentage of conifer forest, preferably to White Spruce should be replaced.***

Answer: The Revegetation Plan is described in section 17.4.2.4 of the Application. The establishment of both Aspen and White Spruce vegetation types will fulfill two objectives:

- The establishment of the regional natural ecosystem processes of White Spruce regeneration within Aspen dominated forests, and
- The provision of wildlife habitat and browse inherent to immature Aspen forests.

Table 17.21 indicates that 78 ha of the development area is presently forested solely by White Spruce and 33 ha of mixed White Spruce and Aspen (total of 111 ha). The reclamation plan requires the establishment of 114 ha

Aspen/White Spruce forest. Within this reclamation area, reforestation will include areas solely reforested with White Spruce, or sites that will be dominated by White Spruce.

Of the existing 78 ha of White Spruce forests, only 3 ha is considered to be merchantible and the remaining stands have low-medium to fair timber productivity ratings, primarily as a result of excess soil moisture. With the projected increase in forest capability following reclamation, it is anticipated that overall productivity of White Spruce will be increased within the Aspen/White Spruce stands.

All Aspen dominated stands will be planted to include some White Spruce. Natural processes require approximately 50 years prior to White Spruce establishment under an Aspen canopy. The inclusion of White Spruce on all sites will accelerate natural succession towards White Spruce dominance, to provide merchantible forests of both Aspen and White Spruce.

Q39. <u>Detailed Conservation and Reclamation Plan</u>

(a) ***Page 17-90, SOLV-EX indicates that the detailed mine planning will be carried out in 1995 and 1996 and thus, the application only provides generic mine plans for each year. In general, the basic information required for a detailed Conservation and Reclamation Plan has not been provided.***

Answer: A detailed mine and reclamation plan will be submitted during the second quarter of 1996 when the August 1995 drilling data have been thoroughly reviewed, assessed and used to design the plan.

Q40. <u>Reclamation Plan</u>

Page 17-110, Section 17.4.2.2: SOLV-EX should provide a detailed final topographic design for areas reclaimed in the first 5 years.

Answer: The post-mining topography is presented on Figure QB1.1 (Attachment B1, Appendix A). A detailed final topographic design for the first five years of mining is still being developed and will be provided with the results of the detailed mine and reclamation plan to be completed during the second quarter of 1996.

Q.41. <u>Capability for Agriculture</u>

(a) ***Page 17-44, Section 3.0: The pre-development site analysis should provide more detail on overburden criteria, such as depths, composition and chemistry.***

We understand that not all overburden inventory and evaluation information is available since SOLV-EX has not done the drilling to determine overburden depths and characteristics. This information should be provided to address overburden availability, management and utilization.

Answer: The preliminary reclamation suitability ratings for the overburden is presented in page 17-53. An overburden drilling program was completed this summer. Currently the results of the program are being analyzed. Once this program is complete, the results will be included with the detailed mine and reclamation planning information during the second quarter of 1996.

(b) ***The soil series map on page 17-45 indicates in the legend that (st) represents stony conditions within 1 metre of the surface, but none are identified on the map. Please clarify why this material is not being salvaged.***

Answer: The soil series map on page 17-45 has two locations where a stony phase was mapped during the field survey, in the eastern portion of the mine area, and the western portion of the plant site. Since the soil survey only included evaluation of soils down to 1 metre, the volumes of gravel available could not be determined but are outlined in Answer to Q33.

(c) ***Page 17-83 indicates that the ratings were based on the Land Capability Classification for Arable Agriculture in Alberta document. What is the rationale for using an agriculture capability rating system for this area of the province?***

Answer: The document Land Capability Classification for Arable Agriculture in Alberta was used for the capability ratings as outlined on page 17-83, since this system provides a quantitative system of rating climate, landscape factors and soil factors in relation to capability. While the Bitumount area is not an agricultural area, the reclamation program will involve establishing agricultural crops such as grasses and legumes initially and then trees and shrubs. The ratings from this system correlate with the forest capability ratings as outlined in sections 17.2.3.1, so using both systems together will provide a useful indicator of the progress of reclamation.

SOLV-EX will consult with Alberta Environmental Protection to choose the final capability rating system that is best suited to the area.

Q42. <u>Tailings Reclamation</u>

Page 17-36, Section 17.2.4.2: Will the 21 m high (p. 4-9) tailings dump be constructed with terraced slopes or one long slope? If terraced, is the 3.5:1 slope for each terrace or for the overall dump?

Answer: The design of the slopes for the tailings dump will probably include one terrace. The final design information will be submitted in the detailed mine and reclamation plan during the second quarter of 1996.

Q43. Surface Drainage

Page 17-121, Section 17.4.2.6: This section requires more detail. Section 17.4.2.2 on pg. 17-110 describes the drainage patterns as being similar to the pre-development state. Will the fresh water spring discussed on pg. 17-60 be re-established to its original route and contour with reclamation? Will water levels in the post-mine lake be maintained by surface run off or from groundwater sources? Will lake overflow make its way to the Athabasca River?

Answer: The surface drainage plans are described on page 17-121. Tailings reclamation procedures are described on page 17-36. The detailed mining and reclamation plan which will be available in the second quarter of 1996, will describe final drainage patterns, the re-establishment of surface water resources and a plan for filling in the end-pit lake. Surface drainage planning may be coordinated in concert with Alberta Community Development due to the location of the Historic Site.

Q44. Groundwater

(a) ***Page 17-105: A quantitative evaluation of the groundwater depressurization requirement should be done to properly assess the possible effect, in terms of quantity and quality; on groundwater in the vicinity of the depressurized areas.***

(b) ***Information on hydrogeological units and groundwater flow are adequate for the assessment of the existing hydrological setting in the project areas. However, one or two cross-sections would provide for a better understanding of the hydrogeology of the area.***

(c) ***Contamination of the Athabasca River and groundwaters by seepage water contact with oil sand in the pit and saline ground water are a concern. This should be addressed.***

Answer: (a,b,c) Groundwater information is described in sections 10.2 and 17.4.1.3 of the Application. A description of the groundwater program that has been undertaken to date is included in the answer to AEUB QI1 through QI13. The analyses of the groundwater data is ongoing and an update on the results of the program will be forwarded to AEP by the end of first quarter 1996.

(d) ***Details on the volumes of water produced, and effects groundwaters will have on the mining area, specifically the mine pit, should be provided. Disposal alternatives other than the Athabasca River should be discussed.***

Answer: The details will be provided during the first quarter of 1996.

Q45. Historic Resources

Page 17-82, Section 17.3.2.4.4: The Historic artifacts of the Fitzsimmons Oil Sands plant located in section 36 of the SOLV-EX lease should be addressed in terms of its protection from disturbance.

Answer: The impact of the SOLV-EX project on historic resources is described in section 7.0 of the EIA.

None of the developments will impact the historic artifacts of the Fitzsimmons oil sands plant located in Section 36.

Q46. Miscellaneous

(a) The reference to Table 17.8 should read 17.9.

Answer: Yes.

(b) Page 17-43, Table 17.13: The Pedocan (1993) reference is not in the reference list.

Answer: The Pedocan (1993) reference is as follows:

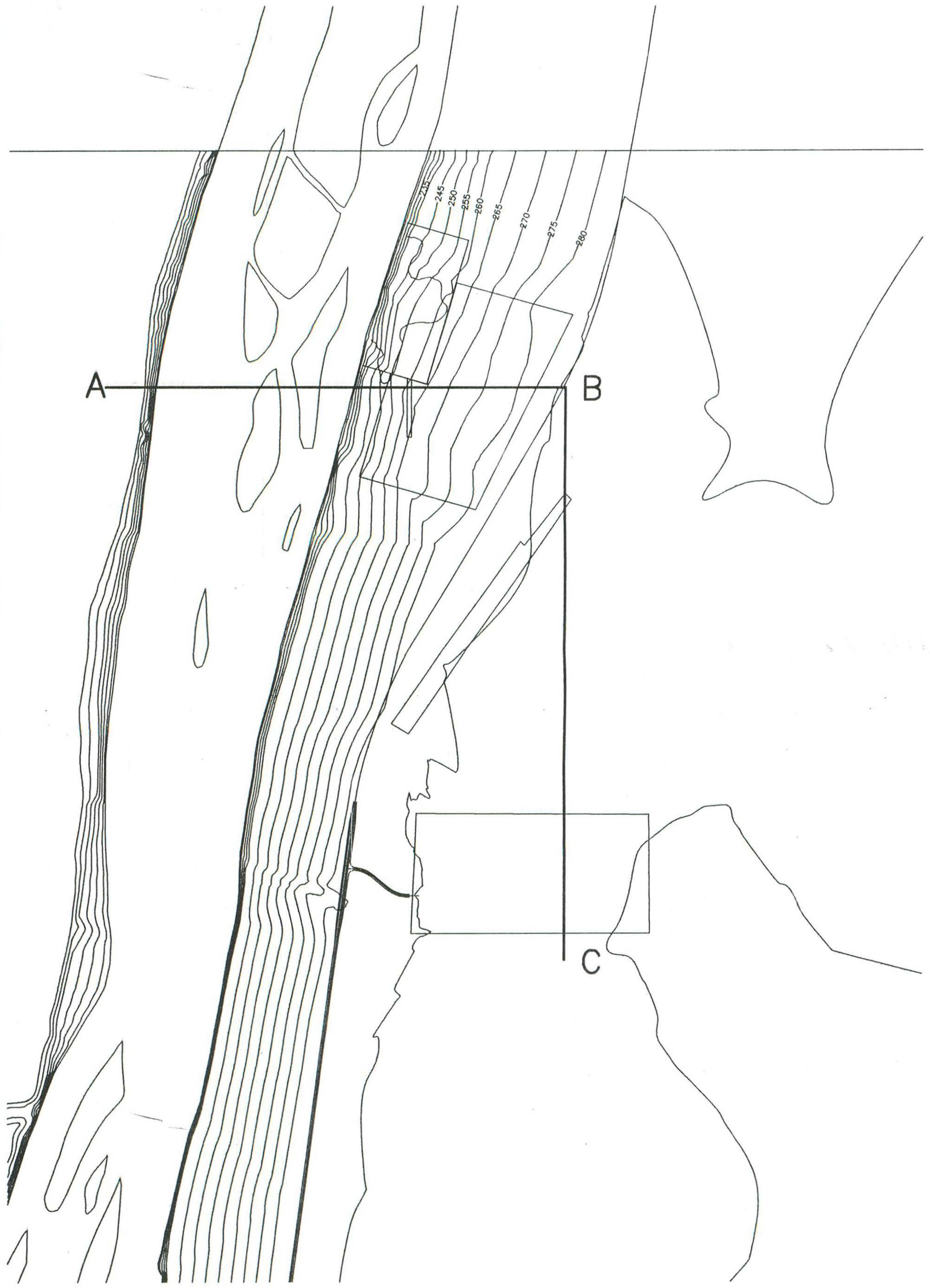
Pedocan Land Evaluation Ltd. 1993. Soil Series Information for Reclamation Planning in Alberta. Alberta Conservation and Reclamation Council Report No. RRTAC 93-7. ISBN 0-7732-6041-2.

APPENDIX A

Attachments for Responses to AEUB Letter

ATTACHMENT B1

Figure QB1.1



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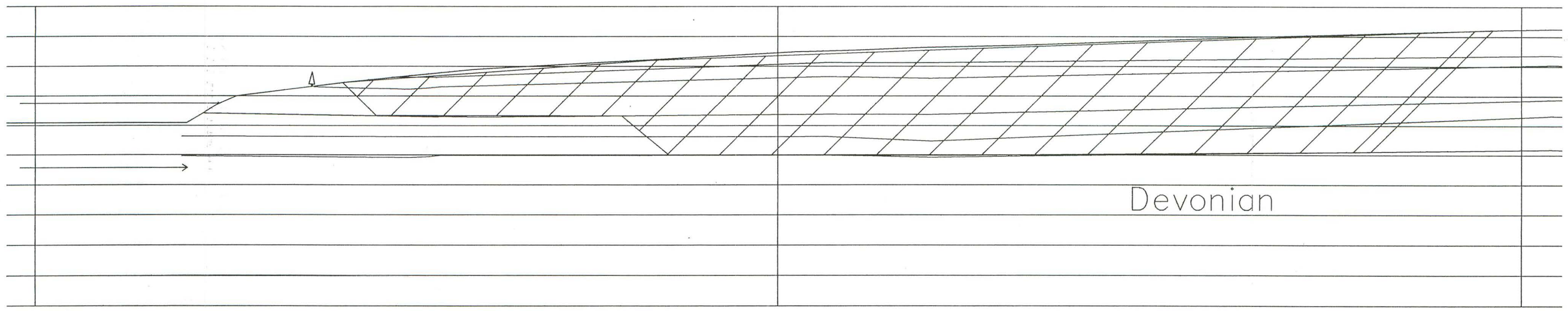

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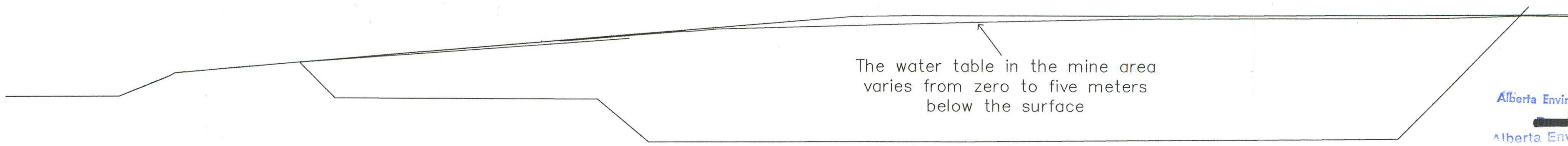


Produced by Oil Sands Evaluations Ltd. for:

SOLV-EX CORPORATION

CROSS-SECTION THROUGH the MINE & PLANTSITE

Dwg No: Figure QB1.1	Date: 10/2/95	Rev: A

APPENDIX B

Attachments for Responses to AEP Letter

ATTACHMENT 2

Results of Revised Dispersion Modelling,
Revised Appendix A, and
Revised Attachment D

SUMMARY OF REVISED DISPERSION MODELLING RESULTS

BCE appreciates AEP's interest in ensuring that the airshed in the Fort McMurray oil sands area has the ability to accommodate additional users. The approach recommended by AEP is somewhat simplistic, however, in that it assumes the following:

- An airshed's capacity can be defined by a one-hour average SO_2 guideline value of 450 $\mu g/m^3$. This assumption ignores the assimilative capacity of an airshed that accounts for the long-term accumulation in the region.
- The maximum predicted concentrations do not vary in space or with time. This is not true, as every plant will have a unique configuration with respect to source, meteorology and adjacent terrain that will result in a maximum predicted value.

The Terms of Reference issued by AEP for the EIA do not explicitly indicate that the SO_2 objective for SOLV-EX should be about 150 $\mu g/m^3$ instead of 450 $\mu g/m^3$. None-the-less, BCE is responding to AEP's request in keeping with the overall objective of not limiting the future use of the airshed.

For the purposes of assessing airshed utilization, BCE has adopted the following approach for SO_2 emissions:

- The Syncrude main stack emissions are based on the 90-day rolling average (AEP licence) value of 260 t/sd and Suncor's powerhouse and incinerator emissions are assumed to be 28 t/sd and 22 t/sd, respectively. The Suncor powerhouse emission value reflects the lowest FGD SO_2 control level reported by Suncor in its AEP application.
- SOLV-EX emissions are based on 98% recovery efficiency in the sulphur recovery plant, the use of diesel fuel for all fired heaters and a design of the sulphuric acid plant to meet the AEP emission guideline limit of 4 lb SO_2/ton H_2SO_4. The corresponding total SO_2 emission rate of 3.6 t/sd (0.149 t/sh) is considered as **normal operating** conditions.
- Abnormal emissions will occur during upset conditions in the sulphuric acid plant when the caustic scrubber will provide 90% SO_2 removal from the exhaust of the drying tower. The corresponding total SO_2 emission rate of 6.2 t/sd (0.258 t/sh; 0.026 t/sh from the sulphur recovery plant, 0.172 t/sh from the caustic scrubber and 0.060 t/sh from the various heaters is considered as **abnormal operating** conditions.

Additional information corresponding to these emissions is provided in attached, revised Appendix A and Attachment D of the AEPEA application.

Revised modelling and assessment are based on the following:

- The ISCST2 model has been selected and the 55% factor is applied to the model predictions. Out of the three models used in the EIA, ISCST2 is the only model that addresses building downwash effects explicitly. The previous ISCST2 model results showed maximum values between those predicted by the other two models (Section 5 of the EIA).

- The ISCST2 model simulates the effect of Suncor and Syncrude emissions in a 40 by 40 km area centred on the SOLV-EX site (Figure A2 of Appendix A). The maximum predicted hourly SO_2 concentrations in the region is 246 $\mu g/m^3$. This value occurs 20 km west of the SOLV-EX site and is associated with elevated terrain (Birch Mountains). A secondary maximum of 155 $\mu g/m^3$ is also associated with elevated terrain (Fort Hills, 5 km northeast of the SOLV-EX site). All the maximum SO_2 values shown in the figure are associated with southerly winds.

- The ISCST2 model was re-run with the SOLV-EX normal and abnormal emissions (Figures A3 and A4, respectively) for both Phase I and Phase II. In Phase II, the maximum value associated with the **normal** case is 146 $\mu g/m^3$. This maximum is associated with Fort Hills and occurs 3.5 km to the northeast of the proposed plant site. The maximum value associated with the **abnormal** case is 149 $\mu g/m^3$ and this value is predicted to occur 5 km to the northeast.

- The ISCST2 model was re-run using Syncrude and Suncor emissions with SOLV-EX normal and abnormal emissions, respectively. Figures A5 and A6 show the results. The addition of the SOLV-EX operation does not change the maximum predicted value of 246 $\mu g/m^3$ which is predicted to occur 20 km west of the proposed SOLV-EX site.

The addition of the SOLV-EX **normal case does not change** the secondary maxima of 155 $\mu g/m^3$. Similarly, the addition of the SOLV-EX **abnormal case does not change** the secondary maximum of 155 $\mu g/m^3$. This is because the maximum value predicted in the Fort Hills area from the combined Suncor and Syncrude operations occurs under south winds and under these conditions the SOLV-EX values are **not** additional. Therefore, the airshed management approach suggested by AEP indicates that in the region where SOLV-EX is expected to contribute, there is 295 $\mu g/m^3$ of airshed available for future users.

AEPEA APPLICATION

APPENDIX A

Results of Revised Dispersion Modelling

A1.0 INTRODUCTION

The emissions of SO_2, NO_x and particulates have been characterized in two ways: by project phase (Phase I and Phase II) and by operating condition (Normal and Abnormal). Since this is a new facility, stack heights and diameters were selected on the basis of screening model predictions. Attachment D, Tables D-A1 and D-A3 describe the sources in Phase II of the facility operation. Tables A1 and A2 of this appendix present the source and process building location information, respectively. In Phase I, the sources of contaminants are limited to the power boilers, turbines and the sulphur recovery plant. Two scenarios of fuel combustion have been characterized for the facility: natural gas and fuel oil No. 2 (or diesel). In order to be conservative in the modelling approach, greater NO_x emissions are associated with the use of natural gas and greater SO_2 and particulate emissions are associated with the use of diesel, and were modelled accordingly. Emission rates are based on stream operations of approximately 8000 hours/year. Modelling conservatively assumes 24-hour per day operation, an overestimation of emissions of about 10%. Emission factors were taken from the U.S. EPA publication AP-42 (4-93) according to the respective heat duty and fuel type.

The air dispersion model chosen to represent this facility was ISCST2. This model is supported by the U.S. EPA. The model was run in regulatory mode for all cases with elevated terrain and 'real' meteorology. Real meteorology was taken from time series data collected from the SandAlta monitoring site over a two-year period. A complete analysis of the site and data are presented in the EIA, Section 4. Terrain elevations were compiled from topographic maps and from digital elevation models produced by the Province of Alberta. All model predictions were multiplied by 0.55 to yield the one-hour average concentration as stated in AEP's Draft Air Quality Model Guideline (1994).

A2.0 NORMAL AND ABNORMAL EMISSIONS OF SO_2

Expected SO_2 emissions from the entire facility can be summarized as follows for the two phases:

SO_2 Source		Phase I Emission Rate		Phase II Emission Rate	
		Normal	Abnormal	Normal	Abnormal
Sulphur Recovery Plant / Tail Gas Incinerator	(t/sh)	0.026[a]	0.052[a]	0.026[a]	0.052[a]
Sulphuric Acid Plant	(t/sh)	0.000	0.000	0.063[b]	0.172[b]
Fired Heaters	(t/sh)	0.020	0.020	0.060	0.060
Total	(t/sh)	0.046	0.072	0.149	N/A
Daily Equivalent	(t/sd)	1.07	1.69	3.58	N/A

[a] Normal 98% sulphur recovery. Abnormal represents 96% recovery.

[b] Normal design to the AEP guideline limit of 4 lb SO_2/ton acid. Abnormal represents 90% SO_2 removal in the caustic scrubber when the SO_2 converter of the acid plant is down.

The incinerator and acid plant effluents will be combined in a common stack to take advantage of the heating capabilities of the tail gas incinerator. All of the emission values are based on combustion of fuel oil containing 0.3 wt.% sulphur. The normal emission rate from the sulphur plant incinerator is based on a continuous 98% sulphur recovery efficiency. An upset in the sulphur plant will be the loss of one catalytic converter in the Super Claus system. The resulting recovery declines from 98% to 96%, a doubling of the SO_2 emission rate during abnormal conditions. An upset in the acid plant will be the loss of the SO_2 converter. The caustic scrubber will remove 90% of the SO_2 in the exhaust from the drying tower during such abnormal conditions. Operationally, simultaneous upset in the two independent plants is improbable. For modelling purposes, the dominant abnormal operation is the acid plant upset condition (Phase II).

In order to account for the existing sources of SO_2 in the area, the Syncrude and Suncor emissions were included with those of SOLV-EX. The following table lists the emission parameters for the existing sources:

Parameter		Suncor[a] Incinerator	Suncor[a] FGD Stack	Syncrude[b] Main Stack
Stack height	(m)	106.7	137.0	183.0
Stack diameter	(m)	1.80	7.01	7.90
SO_2 emission rate	(t/sd)	22	28	260
Exit velocity	(m/s)	19.38	13.36	24.15
Exit temperature	(°C)	539	63	235
Location (x, y, in m)		(9300 - 40,300)	(9300 - 40,500)	(800 - 36,200)

[a] Based on the Suncor February 1995 Application for Renewal, p 85.
[b] Based on the 90-day rolling average licenced for Syncrude.

Item 2 of the AEP letter defines the ambient SO_2 limit for SOLV-EX as one-third of the remaining air shed assimilative capacity (RAAC) during abnormal operations. This can be expressed as follows:

$$\frac{\left(\text{Alberta Guideline } (450) - \text{ Contribution of Existing Sources}\right)}{3} = \text{RAAC}$$

or

$$450 = (3 \bullet \text{RAAC}) + \text{Contribution of Existing Sources}$$

In order to design the stacks at SOLV-EX to meet this requirement, the model input emission rates for abnormal operations at the SOLV-EX plant were multiplied by three and modelled together with the Suncor and Syncrude SO_2 emissions. The result is shown in Figure A1, where the design guideline is 450 $\mu g/m^3$ as described by the above presented equation. In order to determine the maximum ambient SO_2 guideline for SOLV-EX, each of the sources was modelled individually at the meteorological conditions associated with the maximum prediction (shown to occur in the Fort Hills area, approximately 3.5 km northeast of the SOLV-EX site). From this exercise, it was determined that the contribution from Suncor and Syncrude was zero under the conditions causing the maximum in the vicinity of the SOLV-EX site. Thus, from the equation, the effective ambient SO_2 limit for SOLV-EX is 150 $\mu g/m^3$.

The modelling results are shown on Figures A2 through A6 as follows:

- Figure A2: future emission scenario for Suncor and Syncrude plant sources;
- Figure A3: normal Phase II emission scenario for SOLV-EX plant sources;
- Figure A4: abnormal Phase II emission scenario for SOLV-EX plant sources;
- Figure A5: future emission scenario for Suncor and Syncrude plant sources and normal Phase II emission scenario for SOLV-EX plant sources;
- Figure A6: future emission scenario for Suncor and Syncrude plant sources and abnormal Phase II emission scenario for SOLV-EX plant sources.

Each of these figures show isopleths for the maximum hourly value predicted at each grid point (within the 40 km x 40 km area) for the period (approximately 2 years) modelled with real meteorological data collected at SandAlta.

Please note that the results from the stand-alone operation of SOLV-EX cannot be superimposed on the results for the existing sources since the meteorological conditions which creates the maxima are different.

Table A6 summarizes the extreme values of the model predictions for both Phases I and II when considering only the SOLV-EX plant sources.

Reviews, comparisons and analyses of the local maxima on the figures lead to the following findings:

- A maximum of 246 $\mu g/m^3$ is predicted in the Birch Mountains area, west of the SOLV-EX site (Figure A6) during winds from the south. The maximum is attributed to the Suncor and Syncrude sources because it also occurs on Figure A2.
- Local maxima of 146 and 149 $\mu g/m^3$ are predicted in the Fort Hills area northeast of the SOLV-EX site (Figures A3 and A4) during winds from the southwest (when not including emissions from the Suncor and Syncrude plants). Predicted concentrations

in the Fort Hills area, when including emissions from Suncor and Syncrude, do not increase (Figures A5 and A6) because is has been shown that these sources do not contribute to local maxima under the same meteorological conditions.

BCE concludes that the SOLV-EX operation will cause an ambient SO_2 concentration not exceeding 150 $\mu g/m^3$ in the region which meets the revised AEP requirement.

In order to ensure that these predictions are not exceeded, the following operating parameters for the two phases are specified:

- Phase I - under **normal** operation, the sulphur plant incinerator will exhaust into a 0.36 m diameter stack located inside the common stack to achieve the necessary exit velocity. The stack exit temperature will be 538°C, with an exit velocity of 19 m/s.

- Phase I - under **abnormal** operation, the incinerator will exhaust into the small-diameter stack using an increased amount of fuel and combustion air to achieve the necessary exit velocity and momentum. The stack exit temperature will be 538°C, with an exit velocity of 52 m/s.

- Phase II - under **normal** operation, the stack top temperature of the combined stack will be 250°C, with an exit velocity of 19 m/s.

- Phase II - under **abnormal** operation, the stack exit temperature will be increased to 300°C, with an exit velocity of 39 m/s.

A3.0 EMERGENCY RELEASES OF SO_2

Emergency flare release parameters are listed in Table A4 for two flaring scenarios (at source A13):

- flaring of sour fuel gas from upstream of the inlet to the sweetening plant;
- flaring of acid gas (H_2S and CO_2) from upstream of the sulphur recovery plant.

The gas stream compositions are presented in Table A5. Continuous flaring is not planned for the SOLV-EX facility. The emergency flare stack will be equipped with a continuous pilot system to ensure ignition of all combustible gases. The minimum heating value of the combustible releases is estimated at 32 MJ/m^3 (for the acid gas stream), which is well above the Alberta guideline value of 9 MJ/m^3.

ISCST2 was applied with flat and elevated terrain to the two flaring scenarios. Modelling results for flaring are presented in Table A6. Flaring of sour fuel gas is predicted to result in a maximum one-hour ground-level SO_2 concentration less than the Alberta guideline limit. The acid gas has a lower heating value, being primarily H_2S and CO_2. Therefore fuel is added to this stream to increase the plume rise. The resulting ground-level concentration predictions are less than the guideline limit.

A4.0 NORMAL EMISSIONS OF NO_x

The emission factors and rates for all the combustion sources are listed in Table A3 for both phases. The emissions for Phase I were not modelled because it was determined that the emissions for Phase II under natural gas combustion will be larger and produce the worst-case predictions. The results of the ISCST2 model predictions are summarized in Table A6. The Alberta guideline limit for NO_2 is not exceeded.

A5.0 NORMAL EMISSIONS OF PARTICULATES

The particulate emissions for Phase I were not modelled for the same reasons as stated for NO_x. All source emission rates in Table A3 were determined by either the combustion of fuel or by the particle load in the process. In all cases, the maximum emission is limited by the AEPEA Air Emissions Regulation [(124/93 Part 2 8(1)(b)]. Results from the ISCST2 modelling are shown in Table A6. Predicted ground-level concentrations of particulates are less than the Alberta guideline limit.

Table A1. Source Locations Relative to the Main Stack.

Equipment Source No.	Source Location (m) (x,y)
A3	-78,15
A4/A11	0,0
A5	-185,62
A6	-153,-152
A7	-257,-152
A8	-19,-70
A9	-261,-152
A10	-43,-73
A12	-3,-139
A13	320,-260
A15	-238,28
A17	-47,-73
A19	-261,-142

Table A2. Process Building Locations Relative to the Main Stack.

Process Area	Building Peak Height (m)	Base Location[a] (m)			
		SE Corner (x,y)	SW Corner (x,y)	NW Corner (x,y)	NE Corner (x,y)
Bitumen extraction	35	-136,0	-255,0	-255,30	-136,30
Upgrading/Acid plant	15	0,0	-86,0	-86,10	0,10
Leaching and fines storage	23	-150,-71	-215,-71	-215,-56	-150,-56
Crystallization and drying	9	-150,-160	-270,-160	-270-145	-150,-145
Calcining and washing	20	0,-80	-60,-80	-60,-50	0,-50
Water mgmt and storage	16	n/a[b]	n/a[b]	n/a[b]	n/a[b]
Utilities	15	0,-160	-75,-160	-75,-135	0,-135
Mine maintenance	15	-150,-255	-225,-255	-225,-225	-150,-225
Office	5	-250,-255	-280,-255	-280,-240	-250,-240
Warehouse	8	-150,-255	-180,-255	-180,-215	-150,-215
Camp	5	-390,-305	-410,-305	-410,-245	-390,-245
Product storage	15	250,-130	210,-130	210,-90	250,-90
Hydrocarbon tank farm	20	400,-45	200,-45	200,55	400,55
Electrical substation	8	250,-210	210,-210	210,-170	250,-170

(a) For modelling purposes, buildings were divided into multiple levels and more than four corners were allowed. Only the simple outline is reported here.

(b) No tall buildings, multiple tanks only.

Table A3. Source Emission Scenarios for each Contaminant Released to Atmosphere.

Equipment Source No.	Contaminant	Emission Factor (ng/J)	Phase I Emission Rate Normal (g/s)	Phase I Emission Rate Abnormal (g/s)	Phase II Emission Rate Normal (g/s)	Phase II Emission Rate Abnormal (g/s)
A3	NO_x	61.00	1.38	n/a	1.38	n/a
A4	SO_2	131.00	7.25[a]	14.45[a]	7.80[a]	15.00[a]
	NO_x	61.00	0.31	n/a	0.31	n/a
A5	Particulates	[b]	0.00	n/a	3.03	n/a
A6	SO_2	131.00	0.00	n/a	5.54	n/a
	NO_x	43.00	0.00	n/a	1.84	n/a
	Particulates	[b]	0.00	n/a	5.64	n/a
A7	SO_2	131.00	0.00	n/a	0.10	n/a
	NO_x	61.00	0.00	n/a	0.05	n/a
A8	SO_2	131.00	0.00	n/a	1.00	n/a
	NO_x	61.00	0.00	n/a	0.47	n/a
	Particulates	[b]	0.00	n/a	2.16	n/a
A9	Particulates	[b]	0.00	n/a	0.07	n/a
A10	SO_2	131.00	0.00	n/a	0.09	n/a
	NO_x	61.00	0.00	n/a	0.05	n/a
A11	SO_2	[c]	0.00	n/a	17.50	47.80
A12	SO_2	131.00	5.17	n/a	7.42	n/a
	NO_x	43.00	1.72	n/a	2.47	n/a
	Particulates	43.00	1.70	n/a	2.44	n/a
A13	SO_2	[b]	0.00	(varies)	0.00	(varies)
A15	SO_2	131.00	0.00	n/a	1.92	n/a
	NO_x	61.00	0.00	n/a	0.90	n/a
A17	Particulates	[b]	0.00	n/a	0.06	n/a
A19	Particulates	[b]	0.00	n/a	1.07	n/a

(a) These values are the totals from the sulphur plant incinerator plus contributions from the fuel oil combustion.

(b) An emission factor was not used. The emission of particulates is based on the AEPEA regulation limit of 0.20 g/kg effluent.

(c) For source no. A11, the emission of SO_2 is process-determined and is not a function of fuel combustion.

Table A4. Emergency Release Parameters and Gas Stream Properties.

Parameter		Sweetening Plant Inlet Gas	Acid Gas[b] Stream
Gas flow rate	($10^3 m^3$/sd)	49.28	80.57
Sulphur equivalent	(t/sd)	15.07	15.07
Heating value	(MJ/m^3)	53.17	31.51
SO_2 emission	(t/sd)	30.10	30.10
SO_2 emission	(g/s)	348.43	348.43
Exit temperature[a]	(K)	1273.15	1273.15
Exit velocity[a]	(m/s)	20.0	20.0
Stack height	(m)	45.0	45.0
Effective height[a]	(m)	53.67	53.50
Stack diameter	(m)	0.241	0.241
Pseudo diameter[a]	(m)	1.784	1.756

(a) Pseudo diameter and effective release height are based on heat release from Brode's method (55% radiation loss, 45 (flame angle). Temperature and velocity are assumed as 1000°C and 20 m/s.

(b) Includes 69 x 10^3 m^3/d of fuel gas added to 11.5 x 10^3 m^3/d of acid gas.

Table A5. Emergency Release Gas Stream Compositions.

Component	**Sweetening Plant Inlet Gas**	**Acid Gas Stream**
H_2	0.0235	
He	0.0000	
N_2	0.0000	
CO_2	0.0081	0.0347
H_2S	**0.2255**	**0.9653**
H_2O	0.0430	
O_2	0.0000	
C_1	0.2798	
C_2	0.1608	
C_3	0.1207	
iC_4	0.0550	
nC_4	0.0184	
iC_5	0.0000	
nC_5	0.0120	
C_6	0.0475	
C_7^+	0.0000	

Table A6. ISCST2 Modelling Predictions for Ground-Level Contaminant Concentrations due to SOLV-EX plant sources.

	Screening Assessment: Rural, Flat Terrain		**Refined Assessment: Rural, Elevated Terrain**				**Alberta Guideline Limit**
	Phase II		**Phase I**		**Phase II**		
	Normal $\mu g/m^3$	**Abnormal $\mu g/m^3$**	**Normal $\mu g/m^3$**	**Abnormal $\mu g/m^3$**	**Normal $\mu g/m^3$**	**Abnormal $\mu g/m^3$**	**$\mu g/m^3$**
SO_2 Emissions							
Common Stack and Fired Heaters	n/a	n/a	113	148	146	149	150[a]
Flaring of Sour Fuel Gas	392	—	433	—	433	—	450
Flaring of Acid Gas	393	—	447	—	447	—	450
NO_x Emissions[b]							
Common Stack and Fired Heaters	95	n/a	n/a	n/a	72	n/a	400
Particulates[c]							
Dryers and Fired Heaters	97	n/a	n/a	n/a	50	n/a	100

(a) As recommended by AEP.
(b) Concentrations expressed as NO_2.
(c) Referenced to a 24-hour averaging period.

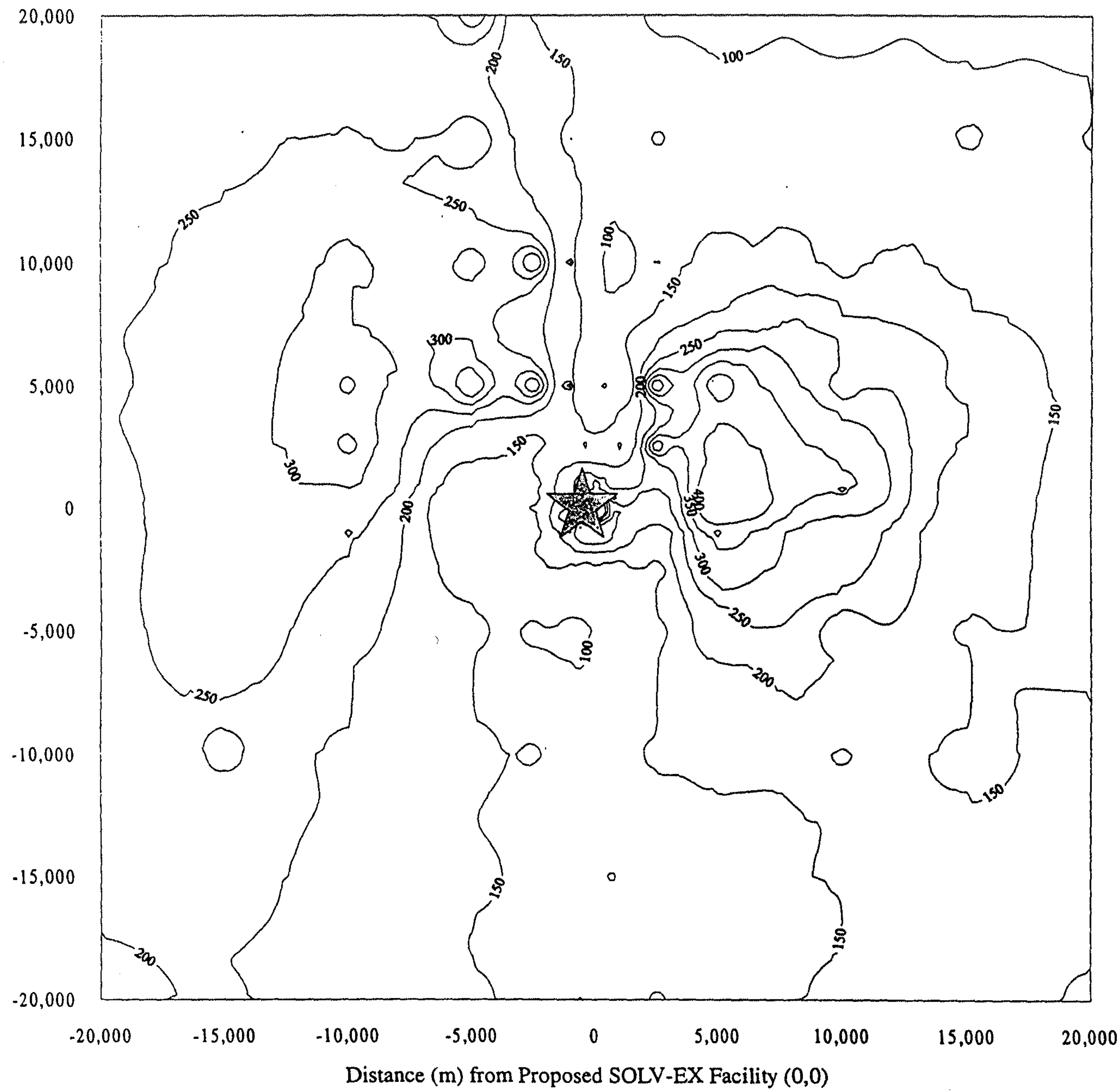
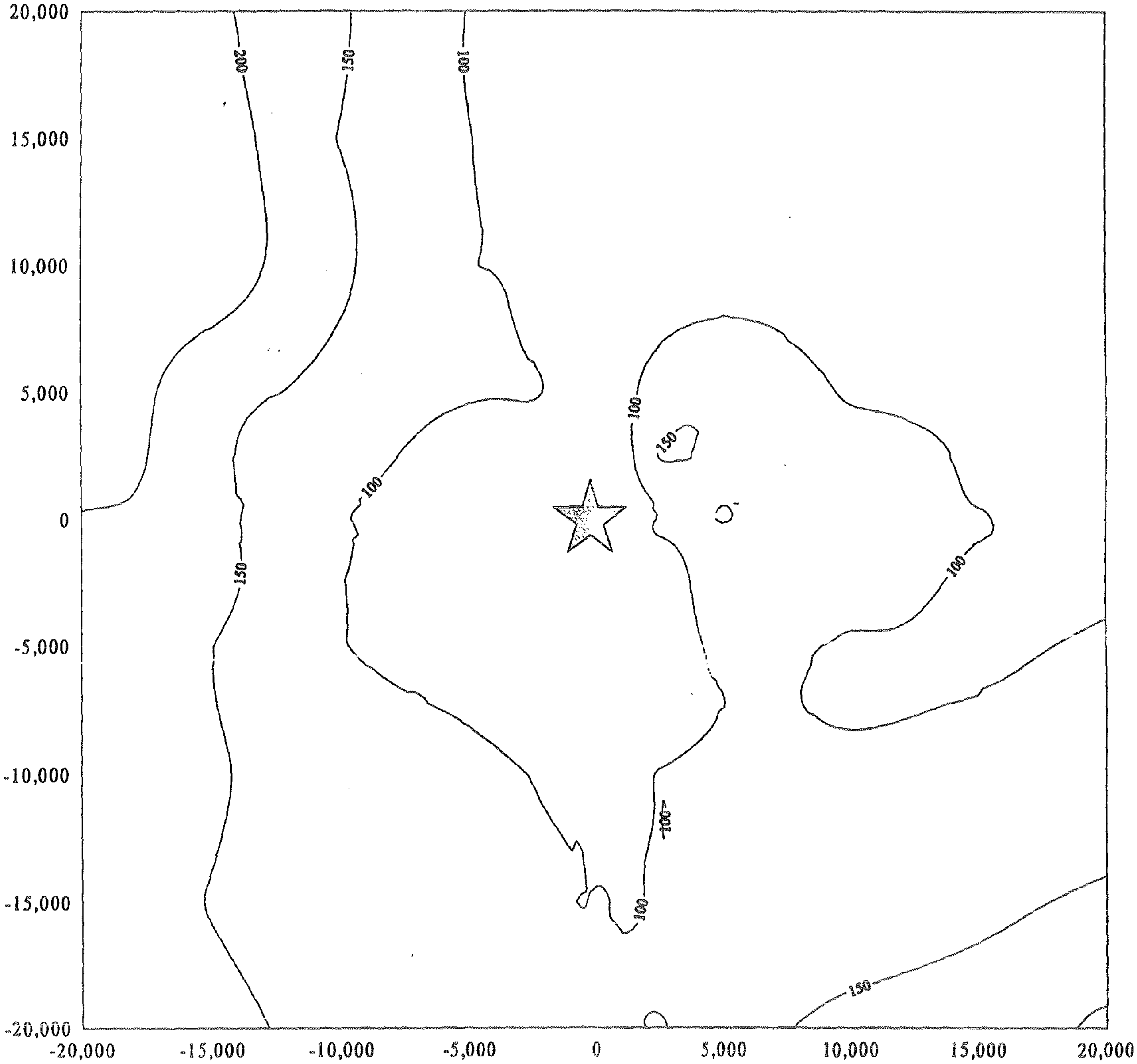


Figure A1. Maximum 1-hour average SO2 concentration (ug/m³) results for the combined operation of the **SOLV-EX (3 x Phase II abnormal), Suncor and Syncrude** facilities as predicted by ISCST2 (rural dispersion, elevated terrain, SandAlta meteorology).



Distance (m) from Proposed SOLV-EX Facility (0,0)

Figure A2. Maximum 1-hour average SO2 concentration (ug/m³) results for the combined operation of the **Suncor and Syncrude** facilities as predicted by ISCST2 (rural dispersion, elevated terrain, SandAlta meteorology).

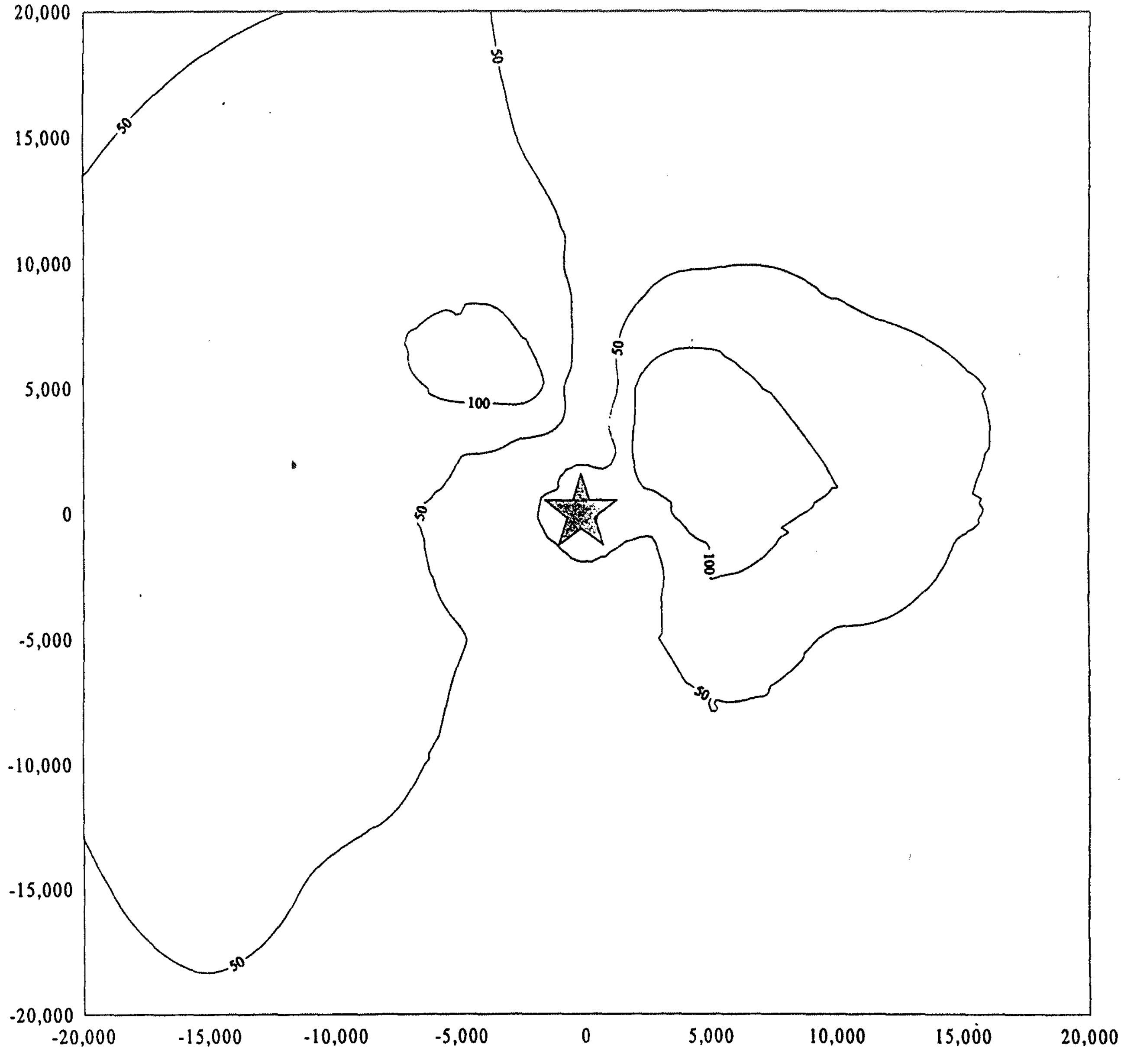


Figure A3. Maximum 1-hour average SO2 concentration (ug/m³) results for the stand-alone operation of the **SOLV-EX (Phase II normal)** facility as predicted by ISCST2 (rural dispersion, elevated terrain, SandAlta meteorology).

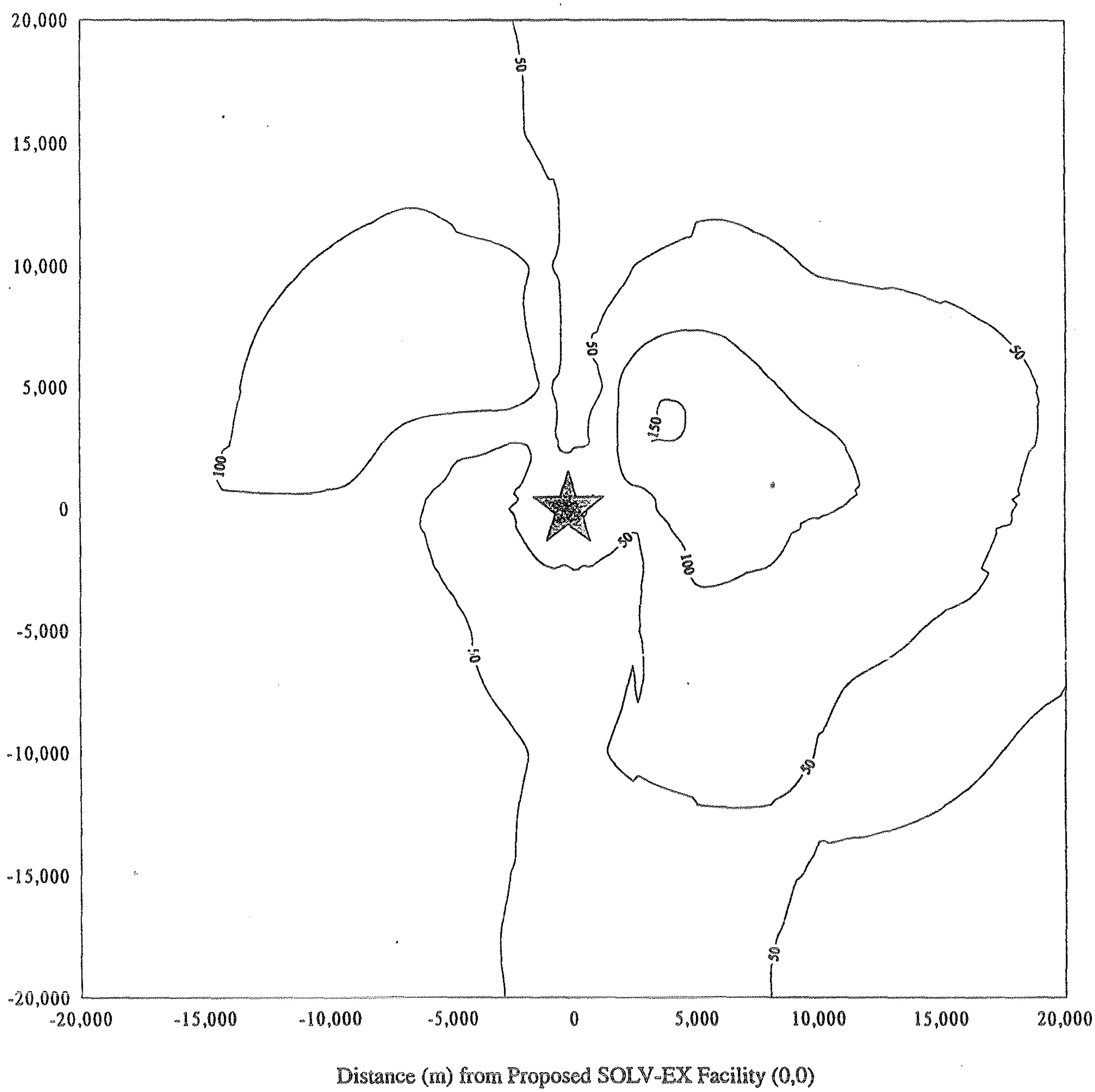


Figure A4. Maximum 1-hour average SO2 concentration (ug/m³) results for the stand-alone operation of the SOLV-EX (Phase II abnormal) facility as predicted by ISCST2 (rural dispersion,elevated terrain, SandAlta meteorology).

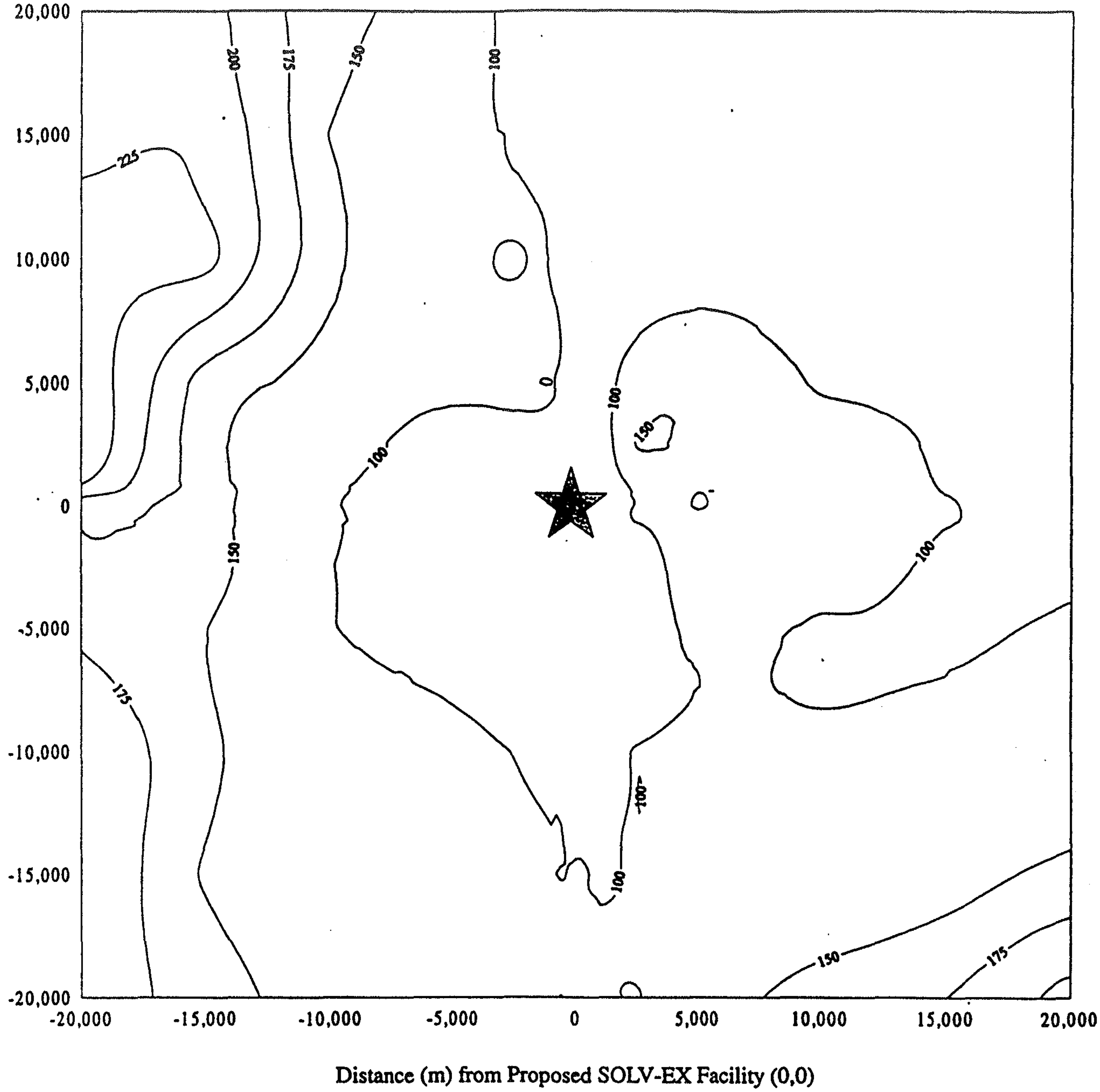


Figure A5. Maximum 1-hour average SO2 concentration (ug/m³) results for the combined operation of the **SOLV-EX (Phase II normal), Suncor and Syncrude** facilities as predicted by ISCST2 (rural dispersion, elevated terrain, SandAlta meteorology).

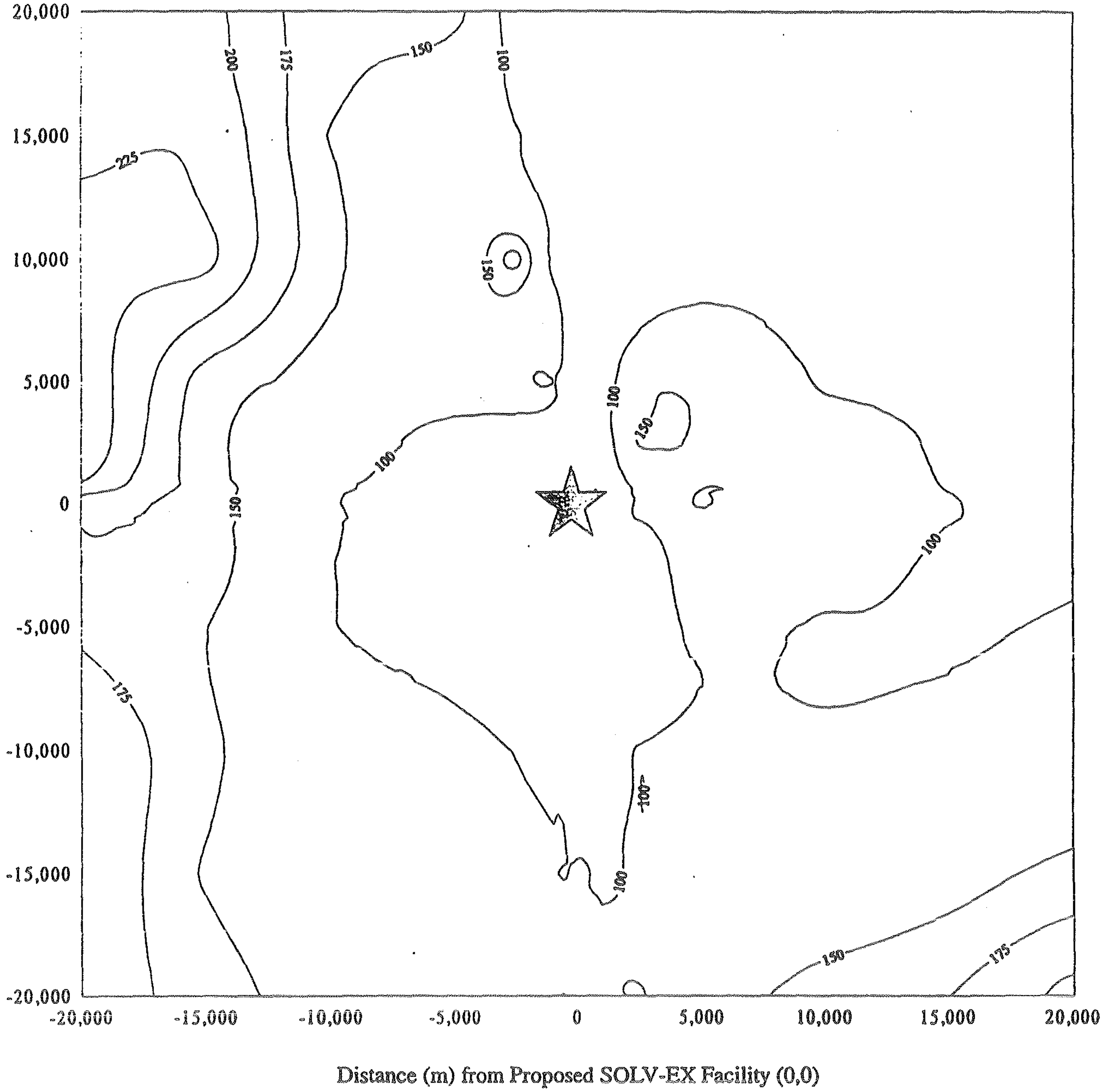


Figure A6. Maximum 1-hour average SO2 concentration (ug/m³) results for the combined operation of the SOLV-EX (Phase II abnormal), Suncor and Syncrude facilities as predicted by ISCST2 (rural dispersion, elevated terrain, SandAlta meteorology).

AEPEA APPLICATION

ATTACHMENT D

Revised Discharge and Monitoring Information

D1.0 LOCATIONS OF DISCHARGES

Waste water (from the stabilization pond) and drainage (from the storm water settling pond) will be discharged to the Athabasca River Basin in Section 25, Range 11, Township 96, West of the 4th Meridian. Storm drainage discharges will be intermittent via the existing coulee (Figure 4.12). Stabilization pond discharges will be continuous (2,028 m^3/sd average) by underground pipeline to a shore-based outfall channel. Details of the pipe size, routing and outfall conditions will be submitted to AEP prior to construction and installation, when engineering design is completed.

D2.0 EFFLUENT MONITORING EQUIPMENT, SAMPLING AND ANALYTICAL PROCEDURES

The requirements will be discussed with AEP once it is familiar with final design information. Sanitary sewage effluent to the stabilization pond will be monitored for daily flow rate, sampled (24 hour composite) and analyzed for daily BOD_5 and TSS.

Suggested effluent monitoring parameters for the stabilization pond effluent are TSS and pH on 24 hour composite.

D3.0 AIR EMISSION SOURCES

Details for the air emission sources shown in Figure 4.18 are listed in Tables D-A1, D-A2 and D-A3. Refer to Appendix A for details on the modelling approach.

The proposed emission source monitoring program is listed in Table D-A2. Source testing of natural gas or diesel fired heaters (sources A7, A10, A3 (sweet fuel gas fired) and A15) is not proposed. Tail gas ducts from the sulphur recovery (source A4) and sulphuric acid manufacturing (source A11) plants will each be equipped with continuous emission monitoring equipment for the parameters shown. Manual testing of the remaining sources is proposed (except the flare stack). With the exception of sources A4, A11 and A5, SO_2 and SO_3 testing is only proposed for the first year of operation (of the mineral extraction facilities), to confirm that the other sources emit negligible SO_2 and SO_3.

Storage tank details are shown in Figure 4.15. All of the tanks will be equipped with single seal internal floating roofs.

Table D-A1. Air Emission Sources[a].

Equipment Source No.	Location on Site Map (Figure 4.18)	Description of the Source	Description of the Equipment Immediately Before the Source	Maximum Emission Rate of the Contaminants				
				SO_2		NO_x		Particulates
				kg/sh	kg/sd	kg/sh	kg/sd	kg/sh
A4/A11	Main Stack	Combined sulphur plant and acid plant emissions	None (absorber upstream of A11 stream)	91.1[b]	2185.9	1.12	26.8	n/a
A7	Crystallization	Heater for $FeSO_4$ dryer	None	0.4	8.6	0.2	4.3	n/a
A10	Calcining & Washing	Heater for K_2SO_4 dryer	None	0.3	7.8	0.2	4.3	n/a
A12/A14	Utilities	Steam boilers and turbines	None	26.7	641.1	8.9	213.4	8.8
A3	Upgrading	Soaker furnace	None	n/a	n/a	5.0	119.2	n/a
A6	Crystallization	Double salt dryer	Bag filter	19.9	478.7	6.6	159.0	20.3
A15	Bitumen Extraction	Heater for clay dryer	None	6.9	165.9	3.2	77.8	n/a
A8	Calcining & Washing	Alumina dryer	Wet scrubber	3.6	86.4	1.7	40.6	7.8
A9	Crystallization	$FeSO_4$ dryer exhaust	Bag filter	n/a	n/a	n/a	n/a	0.3
A17	Calcining & Washing	K_2SO_4 dryer exhaust	Bag filter	n/a	n/a	n/a	n/a	0.2
A5	Leaching & Fines Storage	Clay dryer exhaust	Venturi scrubber	n/a	n/a	n/a	n/a	10.9
A19	Crystallization	By-product sulphate dryer exhaust	Bag filter	n/a	n/a	n/a	n/a	3.9
Total				**148.9**	**536.0**	**26.9**	**645.4**	**52.1**
A13	SE Corner of Plant Site	Emergency flare stack	None[c]	1254.2	30 100	n/a	n/a	n/a

(a) Emission values are for combustion of fuel oil No. 2 in all fired heaters, boilers and turbines except the soaker furnace which burns sweet fuel gas. All values are stream day basis for normal operation in Phase II.

(b) The abnormal emissions for this combined stream are 201.3 kg/sh (including the SO_2 emissions from the combustion of fuel oil in the tail gas incinerator).

(c) The rate of SO_2 released will not exceed the plant inlet rate of sulphur equivalent SO_2 from the bitumen extraction process. This is an intermittent release that would occur under emergency conditions. There will be no continuous flaring operation.

Table D-A2. Air Emission Sources - Monitoring.

Equipment Source No.	Parameters Monitored	Continuous or Manual	Monitoring Method or Equipment Make and Type
A4/A11	SO_2 and O_2 concentrations, exit temperature, total stack flow rate	Continuous	To be determined
A4/A11	NO_x, SO_2, SO_3 particulates and O_2 concentrations, temperature and flow rate	Manual	AEP Source Sampling Code
A12/14	NO_x, SO_2, particulates and O_2 concentrations, temperature and flow rate	Manual	AEP Source Sampling Code
A6	NO_x, SO_2, SO_3 particulates and O_2 concentrations, temperature and flow rate	Manual	AEP Source Sampling Code
A8	NO_x, SO_2, SO_3 particulates and O_2 concentrations, temperature and flow rate	Manual	AEP Source Sampling Code
A9	NO_x, SO_2, SO_3 particulates and O_2 concentrations, temperature and flow rate	Manual	AEP Source Sampling Code
A17	NO_x, SO_2, SO_3 particulates and O_2 concentrations, temperature and flow rate	Manual	AEP Source Sampling Code
A5	NO_x, SO_2, SO_3 particulates and O_2 concentrations, temperature and flow rate	Manual	AEP Source Sampling Code
A19	NO_x, SO_2, SO_3 particulates and O_2 concentrations, temperature and flow rate	Manual	AEP Source Sampling Code
A13	Gas flow rate	Continuous	To be determined

Table D-A3. Air Emission Sources - Physical Characteristics under Normal Operation.

Equipment Source No.	Height of Stack (m)	Diameter of Stack (m)	Temperature of Effluent Stream (°C)	Exit Velocity of Effluent Stream (m/s)	Height of Influential Building (m)
A4/A11[(a)]	60	1.35[(b)]	250[(b)]	18.86[(b)]	15
A7	35	0.20	230	15.58	23
A10	33	0.20	230	14.42	20
A12	33	1.60	230	17.39	13
A3	38	1.20	230	12.45	15
A6	53	1.85	200	18.02	35
A15	53	0.90	230	14.22	35
A8	33	1.0	80	16.69	20
A9	25	0.20	80	12.47	23
A17	33	0.20	80	11.86	20
A5	35	1.20	80	17.67	23
A19	25	0.8	100	17.25	23
A13[(c)]	45	0.241	1000	20.00	n/a

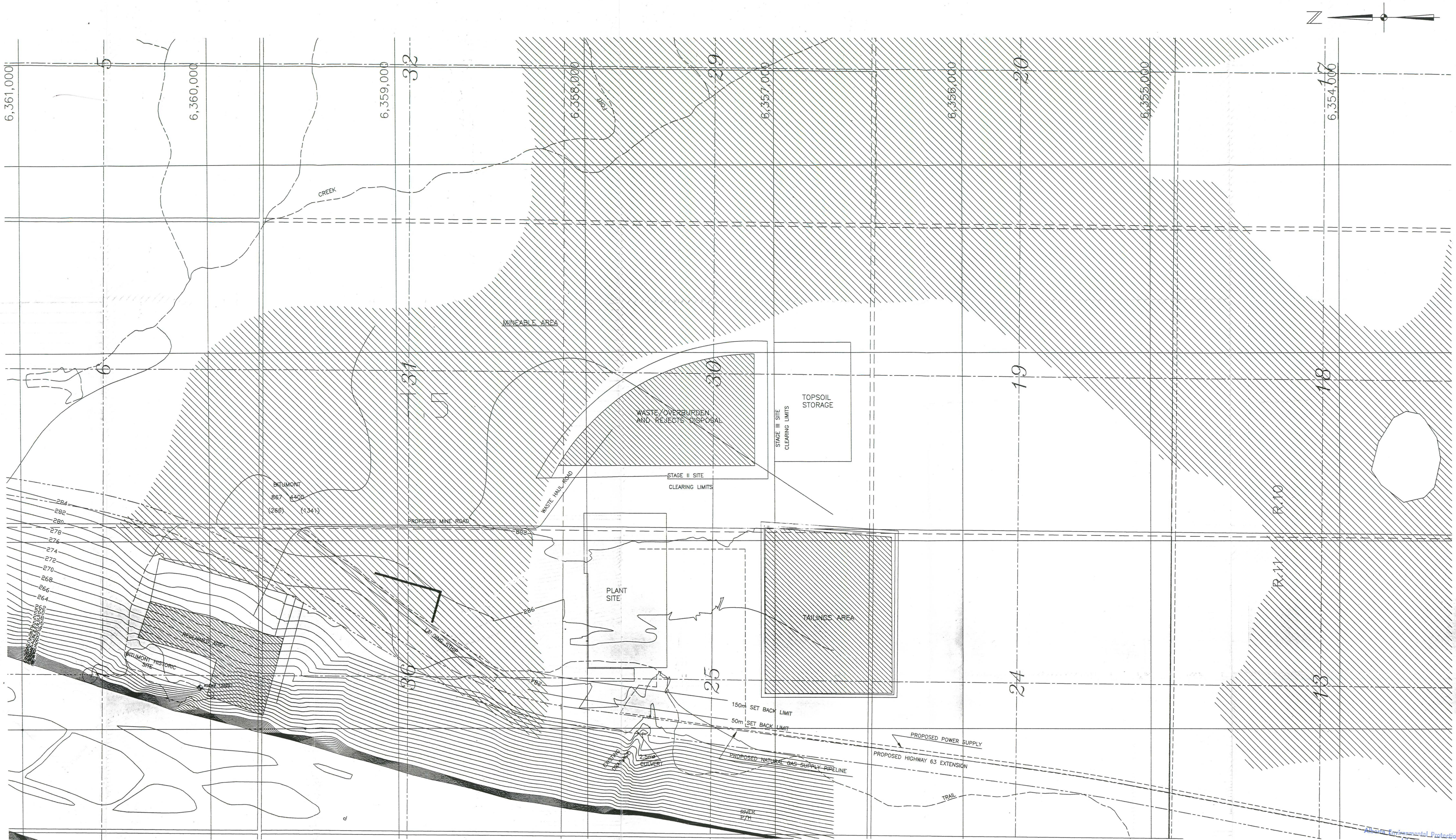
(a) The tail gas from the acid plant will be combined in the main stack, with the sulphur plant tail gas incinerator effluent.

(b) The initial Phase I incinerator stack diameter will be 0.36 m with an exit temperature of 538°C and exit velocities of 18.5 and 52.2 m/s for normal and abnormal operating conditions in the sulphur recover plant. The Phase II exit temperature and velocity will be 38.9 m/s and 300°C during abnormal operating conditions.

(c) Values given are typical for emergency flaring of the sour fuel and acid gas streams. For the latter case, fuel is added to the acid gas as described in Appendix A.

ATTACHMENT 34

Figure 34.1



DRAWING NUMBER	REFERENCE DRAWING

NOTES:

REV.	DESCRIPTION	BY	DATE	CHK'D	APPR'D	CLIENT APPROVAL

ENGINEER'S & PERMIT STAMP

	ENG. MGR. APPR'L.	PROJ. MGR. APPR'L.	CLIENT APPROVAL	DESIGNED	DRAWN	CHECKED	APPROVED
BY					PR		
DATE					10/02/95		

FIGURE 34.1
LEASE 5 SITE PLAN SHOWING SURFACE CONTOURS

SOLV-EX CORPORATION

SCALE	PROJECT	DRAWING NUMBER	REV.
1:10000		SOL-MIN-015	

DISK NO.
CAD DWG. NO.