Appendix B  Accidents and Malfunctions

Attachment B1  Likelihood and Potential Consequences
B1 Introduction

Information previously submitted to the Energy Resources Conservation Board (ERCB) and Alberta Environment, including the 2006 Integrated Application, 2007 Supplemental Information (SI) Project Update and responses to several supplementary information requests from the ERCB, Alberta Environment and stakeholders, addressed accident and malfunctions associated with the project, to varying levels of detail commensurate with the preliminary stage of project design.

Accident and malfunction types identified as requiring further consideration as the design process proceeds were analyzed and discussed in the 2006 Integrated Application and subsequent documentation and cross-references to that information are provided in this appendix.

Unless otherwise stated, the terminology used to describe the likelihood of an accident or malfunction, and severity of potential consequences, should be interpreted qualitatively (i.e., in a relative sense).

For site layout, see AI Project Update, Section 3, Figure 3.3-1.

B2 Mining and Tailings Management

B2.1 Instability of Mine Pit Slopes

Instability of mine pit slopes can result from the presence of potentially weak clay layers, adversely dipping clay or oil sand layers and flow potential in high-grade oil sands areas. Pit slopes are classified as either permanent (i.e., final pit slopes at the pit limits) or temporary (working faces in active areas of the pit). Working faces are typically 15 m in height.

B2.1.1 Design/Mitigation Measures

Permanent ore slopes are designed at 2H:1V, based on previous design and performance experience with oil sands mine pit slopes. Overburden slopes are designed at 3H:1V when no Clearwater clays are present, and at 5H:1V when Clearwater clays are present. However, flatter slopes or buttressing might be required in areas where factors potentially contributing to instability are present. More detailed mapping of weak clay layers and dipping beds will progress during future engineering phases and during operations. The observational approach to maintaining stability will include monitoring and instrumentation of pore pressure and deformation.

Ongoing performance monitoring and mitigation through adaptive management will be used to manage the risks associated with instability of temporary working-face slopes.

Setback distances will be maintained for roads, infrastructure and other facilities, and operations, as well as lease boundaries, to mitigate the consequences of potential crest instability, and to reduce the potential for crest loading.
B2.1.2 Likelihood and Potential Consequences

Failure of a permanent slope could theoretically result in the loss of material at the crest of the slope and deposition into the base of the pit, potentially adversely affecting any infrastructure or facilities in proximity to the pit crest. There could also be effects on the mine operations personnel and equipment within the pit. Given the above design considerations and the implementation of an observational approach, including regular slope monitoring, the likelihood of failure of a permanent slope is remote.

Temporary slopes are typically steeper than permanent slopes and are subject to local instability. Though such local instability is considered relatively likely, the potential consequences of the failure would be minimal because of the height of the bench being worked.

For more information on slope stability mitigation measures, see the AI Project Update, Section 3.4, Table 3.4.1.

B2.2 Failure of Tailings Pond Dykes

The stability of tailings dykes, which are zoned earth-fill structures, is a function of the:

- strength of the foundation clays
- height and crest width of the dykes
- side slope angles
- density and strength of the dyke materials

Failure or instability can occur as a result of underperformance of the foundation materials (e.g., because of pore pressure buildup), inadequate strength of dyke materials, seepage, erosion or overtopping of the dykes. Dedicated Disposal Area (DDA) 1 is an external above-grade structure; DDA 2 is an in-pit structure.

B2.2.1 Design/Mitigation Measures

The tailings dykes are designed conservatively, in accordance with Canadian Dam Association Dam Safety Guidelines, using a minimum factor of safety against geotechnical failure of 1.3. The dyke design incorporates a chimney drain designed to prevent buildup of pore pressures, thus minimizing the potential for any loss of stability. In addition to an ongoing monitoring program comprising instrumentation and visual observation, the tailings structures are subject to yearly geotechnical performance reviews and an arms-length review every five years. The use of proven design and construction practices and an observational approach to stability management will ensure that the likelihood of a dyke failure remains remote. The observational approach relies on previous design and monitoring experience, ongoing monitoring of pore pressures and deformations and responding to abnormal situations with remedial drainage or by constructing toe berms. Furthermore, an appropriate setback distance is provided at the toe of the slopes to accommodate slope flattening or construction of toe berms, should poor foundation performance be detected.

The detailed design stage and approvals process for the tailings dykes will also involve evaluation of various failure types and development of an emergency preparedness plan.
B2.2.2 Likelihood and Potential Consequences

Depending on its location, a catastrophic failure of the external tailings dyke would result in a release of tailings to the surrounding area, which could include the Joslyn Creek Realignment (JCR) channel and associated drainage features, the extraction plant site and the mine pit. A release of sufficient volume in the northwest area of the pond could affect waterbodies downstream of the JCR, including the sediment trapping wetland, the compensation lake and the Ells River. Although the likelihood of this is low, modelling was done to assess the potential consequences of a release of tailings from the northwest area of the pond into the JCR (see Section B2.9). Catastrophic failure of an in-pit dyke would result in a release of tailings and water that would be contained within the pit.

Although the potential consequences of a tailings dyke failure could be significant, the conservative design approach in conjunction with ongoing monitoring, as described above, will ensure that the likelihood of such a failure is remote. The reasonable worst-case with respect to tailings dyke stability would be larger-than-expected deformation, a situation that would be identified during monitoring and immediately mitigated. The risks associated with tailings dyke failure are therefore considered to be low.

For more information on tailings dyke failure mitigation measures, see the 2006 Integrated Application, Volume 1, Section B.3.5.2, the 2007 SI Project Update, Section 3.4.1 and Section 3.4.3 and June 2007 EUB Supplemental Information Request (SIR) 32.

B2.3 Instability of External Disposal Areas

External disposal areas (EDAs) are used for the disposal of overburden and interburden from the mine pit. The stability of the disposal areas is a function primarily of height, slope angle and the strength of materials in the EDA, and the strength of the foundation materials. Instability of the slopes can arise because of inadequate strength or compaction of the waste materials, loss of waste material strength because of liquefaction, failure of the underlying foundation clays, pore pressure buildup or seepage, and erosion.

B2.3.1 Design/Mitigation Measures

Disposal areas are designed using a minimum factor safety against geotechnical failure of 1.3, in accordance with Canadian Dam Association Dam Safety Guidelines. Shallow side slopes are used, ranging from 8H:1V to 20H:1V (depending on disposal area height and the presence of the Clearwater clays). An appropriate setback distance is provided at the toe of the slopes to accommodate slope flattening or construction of toe berms.

The stability of the disposal areas will be managed through an observational approach, whereby pore pressure and deformation will be monitored and mitigation measures will be implemented if necessary. In addition, operational practices will be used to ensure the integrity of the dumped materials placed internal to the slope. Additional localized design features that might be incorporated include shear keys and filter drains.

Disposal area design will be refined during the detailed engineering stage.

B2.3.2 Likelihood and Potential Consequences

Though geotechnical failure of the slopes and foundation materials is theoretically possible, the consequences of such a failure would be relatively low compared with those associated with failure of the tailings dyke. This is because the contents of the external
disposal areas are primarily solid materials and would thus not be expected to flow, although encroachment on roads, the pit crest, the Joslyn Creek and Ells River valleys could occur. Given the conservative design approach, in combination with long-term monitoring, the likelihood of a failure is remote.

The risks associated with instability of the external disposal areas are therefore considered low. The occurrence of abnormal deformation or increased pore pressure would trigger a remedial response that would prevent a major or catastrophic failure.

B2.4 Overtopping of Tailings Dykes

Overtopping of the tailings dykes could occur under extreme precipitation, wind and wave conditions if the freeboard of the dykes is inadequate.

B2.4.1 Design/Mitigation Measures

The external tailings pond dykes are designed with a minimum freeboard of 3 m. This is based on wind and wave analysis conducted in accordance with Canadian Dam Association Dam Safety Guidelines, considering a one in 1000-year wind event during normal operating conditions and a one in 100-year wind event under probable maximum flood (PMF) conditions. The freeboard is therefore considered adequate. In addition, maintaining tailings contingency space and accurately forecasting rates of fluid build will ensure that sufficient freeboard is available.

B2.4.2 Likelihood and Potential Consequences

Overtopping of the tailings dykes could result in the release of process affected water and possible erosion of the dyke slopes causing a potential dyke failure. Runoff would be collected by the perimeter drainage ditches encircling the tailings areas thereby controlling the migration of process-affected water offsite. For a discussion of the consequences of overtopping the drainage ditches, in the event that the capacity of these ditches were exceeded, see Section B2.6. For likelihood and potential consequences of dyke failure see Section B2.2.

Water overtopping the dykes of the in-pit ponds would be contained in-pit. The potential consequences of overtopping the tailings dykes would therefore be low.

Based on the design freeboard, the contingency built into the dyke design and the tailings pond operating practices, as described previously, the likelihood of overtopping is considered remote and the associated risks are therefore low.

B2.5 Seepage Through Tailings Dykes and Ponds

The tailings dykes were designed as zoned earth-fill structures with a central low-permeability core to control seepage. Any seepage that occurs can result in the migration of process-affected water beyond the dykes, and can potentially result in a buildup of pore pressure in the dykes. An increase in pore pressure from seepage has the potential to reduce the strength of dyke materials and foundation soils.

B2.5.1 Design/Mitigation Measures

Measures incorporated in the tailings dyke design to mitigate the effects of seepage include a low-permeability core and chimney drain. Any seepage migrating through the dykes will be intercepted by the perimeter drainage ditches. Seepage at depth would be
minimized by the relatively impermeable nature of the underlying materials, and would be detected through the groundwater monitoring program. Monitoring and instrumentation of pore pressure and deformation would provide the opportunity for mitigating seepage effects on dyke stability by implementing additional drainage measures and flattening slopes or providing toe berms, if required, in response to any abnormal deformation behaviour (see also Section B2.2).

Further detailed seepage analysis will be conducted during final design.

**B2.5.2 Likelihood and Potential Consequences**

A limited amount of seepage is expected to occur under steady-state conditions. For the most part, seepage migration will be intercepted by the perimeter drainage ditches, which will return water to the process area and ensure that migration of process-affected water offsite is managed. Seepage migrating at depth would be detected by the groundwater monitoring program. Environmental assessments conducted (see the AI Project Update, Section 14.11.3.1) indicate that the effects of seepage on the environment would be insignificant.

The worst case associated with pore pressure buildup would likely be increased deformation, which would trigger other mitigation measures as described above. However, given the design of the dyke, the likelihood of pore-pressure buildup because of seepage is also considered low.

The overall potential consequences associated with seepage are therefore expected to be low.

For more information on seepage through tailings dykes, see June 2007 EUB SIR 32 and SIR 137, and AI Project Update, Section 14.5.3.4.

**B2.6 Release of Runoff and Process-Affected Water to Surface Water**

Process-affected water will be stored onsite in tailings ponds, pits, dedicated disposal areas and sand beach areas. Runoff and seepage from the external sand beach area SBA 1, DDA 1, together with seepage and potential releases of process-affected water from the side slopes of the EDAs and various mine facilities, will be intercepted and managed in a system of ditches designed to prevent process-affected water from reaching nearby watercourses. Process-affected water will be collected from the ditches into collection ponds and then pumped back into the appropriate storage areas for reuse. Extreme precipitation, flood or wind events could result in overtopping of the ditches and result in migration of process-affected water beyond the confines of the ditches.
### B2.6.1 Design/Mitigation Measures

Tailings ponds are designed to probable maximum precipitation events to prevent overtopping. Ditches used to collect runoff water from DDA 1, SBA 1, mine pit and all in-pit tailings disposal areas are closed-circuit and are designed to contain the 100-year flood events. These ditches will be constructed an adequate distance from nearby watercourses to minimize potential impacts in the event of an overflow. Collection ponds for process-affected water are also designed to the 100-year flood peak discharge.

### B2.6.2 Likelihood and Potential Consequences

Given their respective designs and the presence of the ditches, runoff from DDA 1, SBA 1, mine pit and in-pit tailings disposal areas, is unlikely to reach surface water. The design separation between ditches containing process-affected water and nearby watercourses will minimize the potential for overland flow to migrate to these watercourses.

Overflow from the ditches would only occur during extreme flood events exceeding this 100-year design criterion. Any potential overflow is expected to cause negligible effects on the quality of the water in the receiving streams. Since any overflow would only occur during extreme events, movement of process-affected water toward watercourses would be facilitated by the associated increased surface runoff from precipitation; however, the process-affected water would also be significantly diluted.

The consequences of a potential overflow from the collection pond would be low, as process-affected water would be diluted by the additional runoff occurring during such an event and diluted in the receiving waters. In addition, surrounding vegetation would tend to filter suspended sediment before reaching watercourses.

The likelihood and consequences of an overflow from the process-affected ditches are therefore considered to be low.

For more information on release of process-affected water from ditches, see:

- AI Project Update, Section 8.4
- June 2007 AENV SIR 170a and SIR 170e
- 2006 Integrated Application, Volume 1, Section B.8.4.1
- 2007 SI Project Update, Section 8.5.1.1 and June 2007, AENV SIR 170f and SIR 170g
- Athabasca Chipewyan First Nation (ACFN) Integrated Application Review SOC 20

### B2.7 Erosion of Pit Lakeshore

A pit lake will be developed at the end of mining. The pit lake will drain into the lower Ells River through the existing Joslyn Creek channel outlet. Erosion of the pit lake shoreline, resulting in decreased shoreline stability, would potentially affect the stability of the shoreline landforms and alter the flow rate and flow path of the pit lake into the Ells River, and could also contribute to sediment loading to the Ells River.

#### B2.7.1 Design and Mitigation Measures

Erosion of the pit lakeshore will be minimized by using littoral vegetation and wave-breaking structures placed along the shoreline. The closure outlet channel of the pit lake will be designed to minimize erosion and achieve long-term stability.
Establishment of natural vegetation in the littoral zone will also stabilize the shoreline and help reduce effects of the erosion processes.

B2.7.2 Likelihood and Potential Consequences

The potential consequences of destabilization of the pit lakeshore are low; minimal human health impacts would result as the output is downstream of the drinking water intake for Fort McKay and no tailings solids will be stored in the pit lake. Although the shoreline will erode to some extent, the planned mitigation measures intended to reduce the shoreline erosion rate will prevent excessive and rapid loss of shoreline, and the likelihood of catastrophic failure of the pit lake because of erosion is therefore considered to be very low. For more information on pit lakeshore erosion, see the AI Project Update, Section 11.2.

B2.8 Erosion or Failure of Closure Landforms

Erosion through downcutting of landform slopes or undercutting of the toe slopes of landforms by reclamation drainage channels could result in decreased stability of closure landforms and possibly affect waste material containment.

B2.8.1 Design/Mitigation Measures

Closure landforms will be contoured to reduce slope steepness and length, thereby reducing the potential for erosion. This will be achieved by landscape contouring to provide dips and swales that will reduce surface flow rates and distances and encourage vegetation development. Closure landforms and drainage channels will be designed to replicate natural systems, and the rate of erosion is expected to be comparable to the natural undisturbed surrounding area.

As vegetation cover becomes established, the magnitude of erosion will decrease, as will the potential for failure. Additional erosion control will be provided in drainage channels, where required, including armouring with rock or granular materials and establishment of vegetation.

B2.8.2 Likelihood and Potential Consequences

Landform design considerations and implementation of erosion control methods over the reclaimed landscape will reduce the potential for erosion in the long term. The likelihood of reclaimed landforms failing or tailings material in the reclaimed landscape being released because of erosion is very low.

For more information on erosion of closure landforms, see the AI Project Update, Section 11.1.

B2.9 Tailings Water Spill to Surface Water

Although it is unlikely, a rupture of the tailings line would be the most probable worst-case release of tailings to the ground surface in the area of the extraction plant site, mine pit or tailings pond. Depending on the rupture location, liquid tailings conditions could:

- be contained and recovered
- enter the soil or groundwater
- result in runoff to the perimeter ditch containment system
In the unlikely event that the capacity of the perimeter ditch system is exceeded, there is potential for tailings water to reach watercourses. However, such a release would have to occur in the northwest portion of Pond 1.

**B2.9.1 Design/Mitigation Measures**

The likelihood of a rupture is low. Such an event would be detected promptly and any liquid release would be subjected to immediate response and recovery measures (see Section B5.1). A major release would be detected by a pressure drop and the line would be shut down within 2 h. Any residual runoff would be intercepted by the perimeter ditch containment system.

The perimeter ditches and associated collection ponds are designed to contain the 100-year flood event and are located an adequate distance from nearby watercourses to minimize the potential for runoff to surface water in the unlikely event that the capacity of the ditch system is exceeded (see Section B2.6). Furthermore, long-plume travel time for any small volume that escapes to the JCR will allow TEPJ to deploy its spill-response equipment to limit the length of stream reach potentially affected.

**B2.9.2 Likelihood and Potential Consequences**

Although the likelihood of a tailings line rupture and resulting runoff to surface water is very low, worst-case modelling was done to assess the potential consequences of a liquid tailings release from the northwest area of the pond into the JCR and to provide information about how long such a spill would take to reach various points along the downstream river systems and what sort of cumulative constituent concentrations might result.

A tailings pipeline rupture located on the northwest face of DDA 1 (see JRP AIR Attachment B1, Figure B1-1) would be intercepted by the perimeter toe ditch system and be recovered before it could travel to the JCR. Under improbable conditions of a simultaneous spill and flood flows greater than the 1 in 100-year event, the DDA 1 toe ditch system could overflow and travel overland and possibly reach the JCR at the northwest location. However, under such conditions the spill would be diluted with natural precipitation and floodwater and be attenuated as it travelled overland toward the channel. Under winter conditions, the spill would be contained on frozen ground and ice, facilitating recovery. For this modelling, it was conservatively assumed that such a spill could reach the JCR without dilution or attenuation.

The modelled spill scenario considered a tailings line rupture that could spill up to 3400 m$^3$ before it was detected and stopped. Such a major rupture would be detected by a pressure line drop and the line would be shutdown within 2 h.

The spill release volume and rate were assumed to be constant over three receiving-stream flows:

- average winter flow (average winter flow in JCR, 7Q10 in other watercourses)
- average (mean annual) flow
- high (two-year flood) flow

These flows represent appropriate surrogates for winter and spring flood (two-year flood) conditions and a mid-range, average flow (mean annual) is considered to provide more informative predictions for low flow.
The hydrologic pathway for this spill would originate at the extreme northwest boundary of the site, adjacent to the northwest portion of DDA 1, just north of the JCR landform. The spill would travel along the channel to the wetland and then the compensation lake, through its outlet channel, into the Ells River and down to the Athabasca River. The spill was modelled in the Athabasca River as far downstream as Embarras.

Chronic toxicity units (TUc) were used to represent the character of the modelled spill. The water quality threshold representing no chronic effects is equal to 1 TUc, equivalent to the No Observable Effects Concentration (NOEC).

Chronic toxicity levels, dilution ratios and travel times for the modelled spill under three flow conditions at several locations downstream of the spill source were evaluated (see Table B2-1). The locations include:

- the inlet of the compensation lake or 8 km from the spill source
- the mouth of JCR or 15 km from the spill source
- the Fort McKay water intake or 27 km from the spill source
- the mouth of the Ells River or 50 km from the spill source
- 3 km downstream of the Ells River or 53 km from the spill source
- 10 km downstream of the Ells River or 60 km from the spill source
- Embarras (132 km downstream of the Ells River or 182 km from the spill source)

Table B2-1  Modelled Spill Statistics

<table>
<thead>
<tr>
<th>Location Downstream of Spill (km)</th>
<th>Chronic Toxicity (TUc)</th>
<th>Dilution Ratio of Original Spill Concentration</th>
<th>Travel Time (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PDC2</td>
<td>Spill</td>
<td>Increase Because of Spill</td>
</tr>
<tr>
<td>Low Flow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compensation lake inlet (8)</td>
<td>0</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Mouth of JCR (15)</td>
<td>0</td>
<td>0.055</td>
<td>0.055</td>
</tr>
<tr>
<td>Fort McKay intake (27)</td>
<td>0</td>
<td>0.039</td>
<td>0.039</td>
</tr>
<tr>
<td>Mouth of Ells River (50)</td>
<td>0</td>
<td>0.038</td>
<td>0.038</td>
</tr>
<tr>
<td>Athabasca River (53)</td>
<td>0.055</td>
<td>0.055</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td>Athabasca River (60)</td>
<td>0.049</td>
<td>0.049</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td>Embarras (182)</td>
<td>0.028</td>
<td>0.028</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td>Average (Mean Annual) Flow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compensation lake inlet (8)</td>
<td>0</td>
<td>0.14</td>
<td>0.14</td>
</tr>
<tr>
<td>Mouth of JCR (15)</td>
<td>0</td>
<td>0.019</td>
<td>0.019</td>
</tr>
<tr>
<td>Fort McKay intake (27)</td>
<td>0</td>
<td>0.0031</td>
<td>0.0031</td>
</tr>
<tr>
<td>Mouth of Ells River (50)</td>
<td>0</td>
<td>0.0030</td>
<td>0.0030</td>
</tr>
<tr>
<td>Athabasca River (53)</td>
<td>0.009</td>
<td>0.009</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td>Athabasca River (60)</td>
<td>0.008</td>
<td>0.008</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td>Embarras (182)</td>
<td>0.005</td>
<td>0.005</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td>High (Two-Year Flood) Flow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compensation lake inlet (8)</td>
<td>0</td>
<td>0.015</td>
<td>0.015</td>
</tr>
<tr>
<td>Mouth of JCR (15)</td>
<td>0</td>
<td>0.0012</td>
<td>0.0012</td>
</tr>
<tr>
<td>Fort McKay intake (27)</td>
<td>0</td>
<td>0.00027</td>
<td>0.00027</td>
</tr>
<tr>
<td>Mouth of Ells River (50)</td>
<td>0</td>
<td>0.00019</td>
<td>0.00019</td>
</tr>
<tr>
<td>Athabasca River (53)</td>
<td>0.002</td>
<td>0.002</td>
<td>&lt;0.000001</td>
</tr>
</tbody>
</table>
Table B2-1  Modelled Spill Statistics (cont’d)

<table>
<thead>
<tr>
<th>Location Downstream of Spill (km)</th>
<th>Chronic Toxicity$^1$ (TUc)</th>
<th>Dilution Ratio of Original Spill Concentration</th>
<th>Travel Time (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athabasca River (60)</td>
<td>PDC$^2$ 0.002 Spill 0.002 Increase Because of Spill &lt;0.000001</td>
<td>Dilution Ratio of Original Spill Concentration</td>
<td>121 83</td>
</tr>
<tr>
<td>Embarras (182)</td>
<td>PDC$^2$ 0.001 Spill 0.001 Increase Because of Spill &lt;0.000001</td>
<td>Dilution Ratio of Original Spill Concentration</td>
<td>165 118</td>
</tr>
</tbody>
</table>

NOTES:

$^1$ Threshold for Chronic Toxicity Units is 1 TUc.

$^2$ Updated Planned Development Case (PDC), without spill, under 2036 snapshot.

Because the extreme low flow (7Q10 ice-cover conditions) in the JCR would be expected to be zero (the channel would be frozen to the bottom), the spill would not likely reach the channel. In the unlikely event it did, it would be captured and remain in the wetland upstream of the compensation lake. Therefore, to model a worst-case winter condition, it was assumed that some flow, equivalent to average winter flows, would be present in the JCR, whereas flows in the Ells and Athabasca rivers would be at 7Q10 levels.

The model results indicate that fish in the compensation lake would not likely be subject to toxic conditions because the spill would have been diluted as it moved through the sediment trapping wetland. The resulting, diluted overflow from the compensation lake would travel to the mouth of the JCR at concentrations well below the chronic toxicity threshold.

Under 7Q10 flow conditions, the low-concentration leading edge of the plume would reach the mouth of the Ells River after 1651 h, whereas the peak concentration of the plume would reach the mouth after 2032 h at a concentration of 0.038 TUc. No significant effects on aquatic life would be expected at the mouth of the JCR or any part of the Ells River under extreme low flows for this modelled spill scenario.

Under annual average flow conditions, the low-concentration leading edge of the plume would take approximately 554 h to reach the mouth of the JCR, with a maximum concentration of 0.019 TUc resulting approximately 190 h later. Time of travel for the low-concentration leading edge and centroid of the plume at the mouth of the Ells River would be between 595 and 762 h, respectively, with a maximum concentration of 0.003 TUc. No significant effects on aquatic life would be expected in any portion of the JCR or the Ells River under annual average flows for this modelled spill scenario.

Under two-year flood flow conditions, the low-concentration leading edge of the plume would take approximately 68 h to reach the mouth of the JCR, with a maximum concentration of 0.0012 TUc resulting about 41 h later. Time of travel for the low-concentration leading edge and centroid of the plume at the mouth of the Ells River would be between 80 and 117 h, respectively, with a maximum concentration of 0.00019 TUc. No significant effects on aquatic life would be expected in any portion of the JCR or the Ells River under two-year flood flows for this modelled spill scenario.
The cumulative spill modelling assumed that the plume would reach the Athabasca River under the full, updated PDC during a 2036 operations snapshot, which included all existing, approved and planned developments, as described in the response to JRP AIR Question 3 (for water quality).

Under extreme low-flow, 7Q10 conditions, it would take the leading edge of the plume 1727 h to reach Embarras. The peak concentration would be indistinguishable from the PDC concentrations of 0.028 TUc and would arrive at this location about 400 h after the leading edge.

It would take the low-concentration, leading edge of the plume 646 h to reach Embarras under annual average flow conditions, with a maximum concentration of 0.005 TUc associated with the centroid after 825 h. This concentration would be indistinguishable from predicted levels without the spill. No significant effects on aquatic life would be expected at any location along the Athabasca River for this modelled spill scenario.

It would take the low-concentration, leading edge of the plume 118 h to reach Embarras under a two-year flood flow, with a maximum concentration of 0.001 TUc associated with the centroid after 165 h. This concentration would be indistinguishable from predicted levels without the spill. No significant effects on aquatic life would be expected at any location along the Athabasca River for this spill scenario.

B3 Water Management

B3.1 Erosion, Flooding or Failure of Joslyn Creek Realignment System

Joslyn Creek will be permanently realigned south of the operations area through a constructed wetland and channel to Ells Tributary 4 (ET4), which will flow into a fish habitat compensation lake before outflow to the Ells River. These constructed surface water features will be protected by landforms placed between the realignment system and the operations area and around the south sides of the wetland and lake.

An extreme flood event, channel icing during winter months or a channel obstruction by debris or landslide could result in erosion, flooding or failure of the system.

B3.1.1 Design/Mitigation Measures

The entire JCR system will meet closure standards before bitumen extraction begins and will be designed for the PMF.

The channels will contain design characteristics similar to the pre-development natural drainage system and will be patterned after natural systems, including similar topographic and soil conditions, riffles and pools, a meandering flow design and a variable channel cross-section. These characteristics will help reduce flow velocity and aid in erosion reduction in the realignment channel, and will also contribute to self-healing after extreme events.

The wetland and lake will help accommodate increases in water volume without flooding the system. Sediment settling in the wetland will reduce sediment concentrations in the channel flows, such that sediment concentrations in the Ells River downstream of the system are not expected to increase during peak flow.

Both the wetland and lake will have sustainable shorelines, and will be constructed to accommodate geomorphic changes and erosion during flood events over the long term.
The landforms are designed for long-term stability, and will be constructed of materials that can withstand long-term erosion and mass wasting processes without compromising stability and utility of the landforms.

The system design will be refined during the detailed design stage of the project.

**B3.1.2 Likelihood and Potential Consequences**

A small amount of erosion and sediment deposition in the constructed channels would be expected to occur as an ongoing process. Although not expected, if significant erosion were to occur, bank failure of the channel could result, with possible impacts on the stability of the landform berms and potential flooding. Erosion could lead to an increase in suspended sediment in the channel, wetland, lake and, possibly, downstream in the Ells River and Athabasca River. The likelihood of significant erosion and failure of the channel is expected to be very low given the geomorphic design approach and ongoing observational monitoring of the system.

Similarly, given the geomorphic design criteria, the potential for overtopping of the channel or landform berms as a result of extreme flood events, which could affect operational facilities or downstream areas, is also very low.

For more information on the Joslyn Creek Realignment (JCR), see the AI Project Update, Section 8.4.2.

**B3.2 Failure of Offstream Storage Pond Dam**

The offstream storage pond (OSSP) will be constructed between the Ells and Athabasca Rivers on the east side of the lease. The pond area will be excavated before filling and this material will be used for dam and dyke construction. Failure or instability of the dam could occur as a result of loss of strength of the foundation or construction material, erosion, overtopping or piping breach. Overtopping could occur during extreme flood events or as a result of extreme wind conditions.

**B3.2.1 Design/Mitigation Measures**

The dam will be designed to have 0.7 m freeboard above the maximum pond operating water level to contain the 1000-year flood event and extreme wind run-up. The pond water level will be controlled by regulating pump inflow and outflow rates.

Suitable material excavated from the pond area will be used to construct a perimeter dam to create the required storage. The dam will be constructed with a minimum separation distance of 50 m from the top of the Ells River valley. The dam will be designed according to Canadian Dam Association Dam Safety Guidelines. Further geotechnical studies before final design will confirm the design basis.

**B3.2.2 Likelihood and Potential Consequences**

As the dam will be designed in accordance with Canadian Dam Association Dam Safety Guidelines, the likelihood of failure or instability of the dam is low. Given that the water level in the pond is controlled by regulating inflow and outflow and the area contributing flood runoff to the pond is small, the potential for overtopping is considered minimal. The consequences of overtopping would be low given that the pond contains raw water. Similarly, the consequences of a piping breach are considered low. Overall, therefore, the risks associated with failure or overtopping of the off stream storage pond dam are low.
For more information on the offstream storage pond, see the AI Project Update, Section 8.4.3.

B3.3 Failure/Plugging of Water Intake Screens

The Athabasca River water intake configuration has been revised based on a site and intake type selection study conducted in collaboration with DFO and Transport Canada during the subsequent design phase to the 2007 SI Project Update. The water intake design is now a bank structure. The works in the river, such as the wingwall, headwall with screens on the intake structure and the wet well, will be sized to accommodate possible future expansion, thus avoiding the need for future additional instream works. Seven intake ports with screens with a total area of 39 m² are located along the headwall of the structure.

Failure of the intake screens could occur through physical damage resulting from ice, rocks, river debris and weathering. Plugging of intake screens could result from the buildup of river sediment and debris. Plugging of intake screens could result from the buildup of river sediment and debris, as well as ice covering the intake screens.

B3.3.1 Design/Mitigation Measures

The intake site was selected to avoid areas that may generate large amounts of frazil ice and areas where slush may collect in large quantities. The intake ports will be placed at an elevation below the 100-year low-flow level to ensure the screens remain submerged and ice free. This will minimize the potential for physical damage to the fish screens from ice and floating debris. In addition, the screens will be recessed and installed at an angle to river flow at a location that is self scouring to minimize the potential for physical impact. Navigational markers will be placed on the structure.

The shape and orientation of the intake structure is based on hydraulic modelling conducted in 2008 and 2009. Inlet velocity follows current DFO guidelines with a high sweeping velocity, again limiting the potential for material to be drawn toward the screens.

In the unlikely event the fish screens become plugged with sediment or ice, the OSSP will have a 90-day storage capacity in order for extraction activities to continue. Sediment could also be removed by localized excavating (dredging) in front of the structure.

B3.3.2 Likelihood and Potential Consequences

Failure of the intake fish screens because of physical damage could result in fish being sucked into the pumps, resulting in direct effects on the fish population (mortality), as well as potential operational problems. Plugging of the screens would not affect the fish population but would have operational consequences as noted above. Based on the locations and design of the screens, the potential for failure or plugging of a screen, and the associated environmental risks, are considered to be very low.
B4 Waste Management

B4.1 Spill or Release from Onsite Landfill or Waste Storage/Transfer Facility

The project will generate solid and liquid waste during construction and operations, although waste generation will be minimized by reduction and recycling practices. Nonhazardous and inert waste will be disposed of in an onsite Class II/III landfill. Hazardous waste will be collected and stored onsite at a transfer station pending shipment to an approved offsite facility.

The potential exists for a spill of liquid waste during collection and storage, or a release of leachate or runoff from a landfill or storage facility. Solid materials could be blown from the surface of the landfill(s) and storage facilities. The potential also exists for cross-contamination from hazardous materials because of poor administration, handling or segregation practices.

B4.1.1 Design/Mitigation Measures

Landfills will be designed and operated in accordance with applicable Alberta Environment requirements for Class II and Class III facilities. Stringent quality control measures will be used during construction, and maintenance and inspections will be carried out during operations to ensure the integrity of the facilities and the associated leachate and runoff collection systems. Handling and segregation operations will be audited to minimize the likelihood of cross-contamination. Storage and transfer facilities for hazardous waste will meet relevant regulatory requirements and have appropriate containment systems.

In the unlikely event of a release, an immediate spill contingency and response plan would come into effect, and any significant effects on subsurface conditions would be identified through monitoring wells that form part of the facility soil and groundwater monitoring program.

B4.1.2 Likelihood and Potential Consequences

As stated above, landfills will be designed and operated in accordance with Alberta Environment requirements and are intended to contain waste; therefore, releases are not expected to occur and the facilities are sited in such a way as to minimize the impact of any potential release. Failure of a containment or leachate collection system could result in a release of leachate or runoff to the soil or groundwater, resulting in potential impacts on soil and groundwater quality. However, given the design requirements as well as monitoring and inspection programs, the likelihood of a release is remote. Landfills will be fenced to minimize the distribution of windblown surface materials.

Any spill or release of hazardous waste would be contained in the storage or transfer area. Failure of one or more components of the containment system could result in a release to the environment; however, the likelihood of such an event is considered to be low. Furthermore, the low-permeability clays present in the subsurface would limit the migration of any spilled substances.

In the event of a release, spill management procedures would also come into effect. Therefore, the risks of environmental effects resulting from spills or releases associated with waste disposal, storage and transfer are considered low.

For more information on waste management, see the AI Project Update, Section 10.4.
B5  Chemicals and Hazardous Materials

B5.1  Accidental Spill or Release of Hazardous Materials During Normal Operations

The primary sources of spills or releases of hazardous materials that could have potential effects on public health or the environment are as follows:

- hydrocarbon tanks and pipelines
- solvent storage
- tailings line
- other chemicals

B5.1.1  Design/Mitigation Measures

Hydrocarbon Tanks and Pipelines

Hydrocarbons stored or transported at the site include bitumen, bitumen slurry, diluent, dilbit (diluent/bitumen mixture) and solvent. These materials are stored in tank farms and are also transported by pipeline to and from the site, around the plant site and between the mine/ore preparation plant and plant site.

Tanks and pipelines will be designed and operated in accordance with regulatory guidelines and best industry practices. Storage areas will be designed with appropriate containment systems, comprising pads, aprons, berms and other areas of the site will be graded and equipped with runoff collection ditches. All tanks and pipelines will be designed with the appropriate corrosion protection and will be subject to regular inspection. Any liquid releases will be subject to immediate recovery in accordance with an oil spill contingency plan and an emergency response plan, both of which will be developed at the detailed design stage. Any hydrocarbons that might enter the soil and groundwater as a result of a spill or release would be identified and monitored as part of the project’s ongoing soil and groundwater monitoring program, with appropriate remediation to ensure no adverse environmental effects result.

Solvent Storage

The solvent storage vessels will be maintained and inspected as required by international standards for pressure vessels. Operation of the storage area will conform to best industry practices, and a spill prevention and contingency plan, as well as an emergency response plan will be in effect. The area is equipped with a firewater deluge and the dyked area is sloped away from the tanks.

The pressurized solvent storage bullets will be buried below ground along with appropriate containment systems, and covered with passive fireproofing. The site-specific emergency response plan, as well as further mitigation measures for the pressurized storage area, will be developed at the detailed design stage.

Tailings Line

The tailings lines are located above ground and will be visually inspected for leaks on a regular basis. The lines will be regularly rotated to minimise failure because of erosion within the pipe. Liquid releases would be subject to an immediate response and recovery plan; residual runoff would be managed by the perimeter ditch system and would not be
expected to leave the site (except under the modelled tailings water spill scenario considered in Section B2.9). With respect to the potential for solvent carryover and ignition, froth treatment tailings lines would be located away from potential ignition sources such as the CNRL road. The spill prevention and contingency plan will be further developed at the detailed design stage.

**Other Chemicals**
Aside from process-related hydrocarbons and solvent, a number of other hazardous chemicals are supplied, stored, used or produced onsite. These include flocculants, defoamer, sulphuric acid, caustic, coolants, lubricants, water and sewage treatment compounds, motor fuels and natural gas.

Areas in which such chemicals are stored or handled are designed with appropriate pads, liners and containment systems. Pipelines and storage systems will be subject to regular inspections and will be operated in accordance with regulatory guidelines and industry best practices. All areas of the plant site are graded and equipped with runoff collection systems. Any releases will undergo immediate response and recovery in accordance with the spill contingency plan and site-specific emergency response plan, which will be developed during the detailed design stage.

Should liquid releases occurring in any areas enter the soil and groundwater within the confines of the site routine soil, and groundwater monitoring will allow for detection of substances that might potentially migrate from the source area(s) and allow for appropriate recovery plans to be executed.

**B5.1.2 Likelihood and Potential Consequences**

**Hydrocarbon Tanks and Pipelines**
Leakage or failure of any component of the tanks and pipeline systems could lead to a release of liquid hydrocarbons. The likelihood of a release of hydrocarbons from the tank farm or pipelines is expected to be low, based on operating practices and maintenance and inspection procedures. Any release would be detected quickly and would lead to immediate implementation of a response and contingency plan. The consequences of a release would depend on the location of the release and the quantity of hydrocarbons involved. As noted above, all tank storage facilities are equipped with appropriate containment systems, and releases from tanks would be recovered and would not be expected to enter the soil or groundwater. Releases from pipelines elsewhere within the plant site, or between the plant site and other project facilities, could enter the soil and groundwater locally if not immediately recovered, but would be contained within the operational areas of the site and would not be expected to affect any offsite surface waterbodies.

**Solvent Storage**
A rupture of the pressurized solvent storage facilities could result in a boiling liquid expanding vapour explosion (BLEVE). Although largely affecting onsite personnel and property, such an event could cause injury to persons on an adjacent section of the CNRL road.

Based on design and mitigation measures incorporated in the storage facility, the likelihood of a BLEVE of the pressurized solvent storage is low. The consequences of a
BLEVE could be significant in the vicinity of the storage facility, although the overall risks to human health (offsite) and the environment would be low.

**Tailings Line**

A rupture of the tailings line could result in a release of tailings to the ground surface in the area of the extraction plant site, mine pit or tailings pond. In addition, in the presence of an ignition source, solvent carryover released from the froth treatment tailings line could ignite. However, the likelihood of a leak occurring in combination with the presence of an ignition source is low.

The likelihood of a tailings line rupture is low, and such an event would be detected through operational inspection program. Depending on the rupture location, liquid tailings conditions might be as follows:

- be contained and recovered
- enter the soil or groundwater
- result in runoff to the perimeter ditch containment system

In the unlikely event that the capacity of the perimeter ditch system is exceeded, there is a potential for tailings water to reach surface waterbodies (see Section B2.6 and Section B2.9). Based on the inspection, containment and contingency measures described in Section B5.1.1, the potential consequences of a liquid tailings release are low.

**Other Chemicals**

Depending on the nature of the other chemicals stored or handled on site (i.e., solid, liquid or gas), all have potential to be released in varying quantities as a result of storage facility leaks, pipeline ruptures, fire or transportation accident. The likelihood of chemicals being released is low as a result of operating practices, inspections, and containment and contingency measures. The consequences of a release depend on the nature and quantity of materials released. Release of solid substances would generally have minimal consequences assuming prompt recovery. Liquid spills and releases outside lined and contained areas could enter the soil and groundwater but, if occurring within the plant site, would be intercepted by ditches to prevent migration outside the plant site area. Spills or releases occurring beyond the limits of the plant site could be transported by surface runoff, but would be intercepted by the perimeter ditches. Gaseous or volatile substances, or chemicals mobilized by means of a fire, could form an airborne plume with the potential for adverse health effects.

Certain spill or release types, such as the inadvertent oversupply of flocculant to a polishing pond, could increase the toxicity of discharges to surface water. In general, using the measures described in Section B5.1.1, the overall risks to public health or the environment resulting from onsite spills or releases of hazardous materials are considered low.
B5.1.3 General Spill Prevention and Contingency Measures

As noted in Section B5.1.1, a spill prevention and contingency plan will be developed during detailed design. In addition, other practices and policies will be implemented that will have a direct bearing on the potential for substance releases and effects on human health and the environment, including:

- compliance with applicable regulations and guidelines
- environment, health and safety program
- integrated loss management program
- environmental protection program
- progressive project management
- corporate and site-specific emergency response plan

For more information on spills or release of hazardous materials, see the 2006 Integrated Application, Volume 1, Section B.10.1 through Section B.10.6.

B5.2 Emissions During Emergency Flaring

Under normal operations, emissions from the project flare stack will be limited to combustion products of natural gas used for purging the flare and operating the pilots. In case of a plant upset, emergency flaring of hydrocarbon vapours might take place, resulting in additional emissions to the atmosphere. A concern has also been raised about the contribution to these emissions of the products of incomplete combustion.

B5.2.1 Design/Mitigation Measures

The emergency flare is designed to limit project emissions as a result of upset conditions. Emergency flaring of hydrocarbon vapours (primarily solvent, bitumen and natural gas) could occur as a result of:

- buildup of excess pressure in the plant (particularly in the froth treatment system)
- failure of the vapour recovery system
- failure of other equipment or controls
- failure because of operator error

For information on emissions during upset flaring, see the AI Project Update, Section 9.

B5.2.2 Likelihood and Potential Consequences

Under normal operating conditions, the contribution of the flare stack to plant site emissions will be negligible.

Modelling (see the AI Project Update, Appendix C) was done to estimate maximum ground-level NO₂ concentrations arising from emergency flaring of a combination of flare gas, solvent and bitumen. Predicted maximum NO₂ concentrations were well below the Alberta Ambient Air Quality Objectives (AAAQO). Because of the relatively high heating values of the vented material, products of incomplete combustion of the flare were not expected, and therefore not quantified. However, ground-level concentrations of products of incomplete combustion, including CO, benzene and toluene, were subsequently estimated and found to be below AAAQO.

Emergency flaring is expected to be of very short duration and low frequency. The risks associated with emissions during upset flaring are therefore expected to be low.
B5.3 Failure of Vapour Recovery Systems

Vessels and process units associated with the storage and use of solvents will be equipped with vapour recovery systems. Malfunction of the vapour recovery systems could result in irregular and short-term emissions.

B5.3.1 Design/Mitigation Measures

In the event that a malfunction of the vapour recovery system cannot be managed through emergency flaring, the relevant process would be shut down.

B5.3.2 Likelihood and Potential Consequences

During short-term upsets of the vapour recovery system, emissions would be routed to the emergency flare. For the likelihood and potential consequences of emergency flaring, see Section B5.2.

For more information on vapour recovery, see the response to October 2007 Secondary EUB SIR 9 and December 2007 Third Round AENV SIR SIR 1.

B6 Road Traffic

B6.1 Traffic Accidents Caused by Increased Traffic Volume

The potential increase in traffic volumes on Highway 63, the CNRL road and in the vicinity of Fort McKay has raised community concerns with respect to safety. Increased traffic could result in an increased incidence of accidents, including potential accidents resulting in a spill of hazardous materials.

B6.1.1 Design/Mitigation Measures

A project camp will be operated to minimize additional traffic between Fort McMurray and the Joslyn Lease. During normal operations, the camp will be operated as a fly-in, fly-out facility, resulting in additional personnel traffic being limited to the area between the camp and airstrip.

During construction, transportation of heavy or oversized loads will be required. TEPJ will consult with affected stakeholders to determine the most appropriate time for such traffic to minimize disruptions.

The entry roads to the facility from the CNRL road are right-hand turns. The exit roads from the facility to the CNRL road will be controlled by a traffic light. Also, TEPJ has contributed to construction of the CNRL road interchange at Highway 63. Speed restrictions will be enforced to minimize the frequency and severity of accidents.

During the construction phase of the project, a level crossing of the CNRL road will be required until a proposed underpass can be constructed for mine traffic to cross beneath the CNRL road. Flagmen and other traffic-control measures will be implemented to control all mine traffic crossing the CNRL road until the underpass is completed.

TEPJ is considering alternatives to transporting fuel and solvent by road to minimize the risk of spills as a result of traffic accidents.
B6.1.2 Likelihood and Potential Consequences

Although there will be increased traffic volumes during construction, operation of the facility is expected to result in a minimal increase in traffic on Highway 63 and the CNRL road. The design and mitigation measures described above will ensure that any increase in traffic volume is controlled and that the potential for traffic accidents and other problems such as spills is low.

For more information on traffic volume and potential for traffic accidents, see the 2006 Integrated Application, Volume 1, Section B.12.4 and Volume 2, Section E.3.1.1 and Fort McKay First Nation (FMFN) Integrated Application Review, Statement of Concern (SOC) 1 and SOC 4.

B7 Other Project Components

B7.1 Excess Release of Solvent to Tailings Pond

Aside from spill, release and plant upset conditions, the main potential process malfunction of concern would be failure of the tailings solvent recovery system or related upset in the froth treatment system that would lead to the release of greater than normal solvent volume to Pond 1 and 2.

B7.1.1 Design/Mitigation Measures

A certain amount of solvent is present in the tailings discharge to the tailings ponds. Solvent levels will be monitored in the tailings stream and at the pond surfaces. In the event of a greater than acceptable release of solvent to the ponds, production would be suspended until planned solvent levels had been restored and the malfunction rectified. Appropriate firefighting systems would be in place. Mitigation measures will be developed further at the detailed design stage.

B7.1.2 Likelihood and Potential Consequences

A failure of the tailings solvent recovery system, though relatively unlikely to occur, would lead to additional solvent being discharged to Pond 1 and 2. The tailings, hence the solvent, will be discharged subaqueously to the pond, which will minimize the solvent levels present at the surface of the pond during such an event. Any solvent present at surface would volatilize and dissipate relatively rapidly.

In the worst case, however, an ignition source, such as the propane cannons, could ignite the solvent vapours, resulting in a fire and release of a smoke plume. The fire would be expected to burn itself out quickly and would not directly affect the surrounding area other than through short-term release of heat and smoke. No significant public health and environmental consequences would be expected to arise from such an event, and therefore, the risks are considered low.

B7.2 Waterfowl Interaction with Tailings Ponds

Tailings ponds and other process waste ponds are often the largest waterbodies in a mine site area, and could be ice free when other waterbodies are frozen. As such, these ponds might be attractive to migratory waterfowl. Birds alighting on the surface of the ponds can suffer injury or mortality after contact with bitumen and other substances, which can be ingested and foul birds’ feathers.
B7.2.1 Design/Mitigation Measures

The primary means of preventing waterfowl interaction with tailings ponds is the use of deterents. Deterents include land-based and floating systems, involving propane-fired cannons, strobe lights, mechanical scaring devices and other features. The density of the systems can be adjusted according to migratory presence or risk. The systems would be mobilized and demobilized seasonally depending on ambient conditions. In addition to the fixed and floating deterrents, a computer-assisted radar detection and deterrent system is proposed. The detection and deterrent systems are expected to minimize the likelihood of adverse encounters; however, bird recovery and treatment plans will also be in place together with monitoring and reporting.

As well, vegetation in the vicinity of the tailings ponds will be managed to discourage nesting and other types of habitat use.

B7.2.2 Likelihood and Potential Consequences

The consequences of waterfowl interaction with the tailings ponds can be significant, as previous incidents have shown that a large number of birds can be affected at one time, with a relatively high mortality rate. The proposed extraction technologies to be used at the project will result in smaller waterbodies in the tailings disposal areas, potentially reducing their attraction to migrating waterfowl. However, the likelihood of waterfowl encounters will be further minimized through vegetation maintenance and the use of a number of detection and deterrent systems.

B7.3 Breach of Site Security

Because of the large extent of the area, the CNRL road bisecting the Joslyn Lease and the impracticality of fencing the entire Lease, the potential exists for trespassers to encroach on the mine and operations areas. Trespassing might be inadvertent (e.g., encroachment by hunters) or might have malicious intent (e.g., for the purpose of protest or inflicting damage).

B7.3.1 Design/Mitigation Measures

Security measures will be implemented at the site, which will comprise a combination of fencing, video surveillance, security patrols and perimeter checks, placement of signs and enforcement of no stopping regulations on the road. The plant site itself will be fenced and gated, and key process areas will be under video surveillance, for both security and process control. Unmanned facilities, such as the river water intake, will be gated and locked and also subject to video surveillance. At the perimeter of the Lease, warning signs will be posted at frequent intervals, and regular patrols and perimeter checks by the site security force and mine supervisors will be conducted to discourage intruders from approaching operating areas such as the mine, tailings pond or disposal areas. Signs will also be posted near ponds and realignment structures warning of unstable ice conditions during winter. Designated safe passage routes for hunters through portions of the Lease area will be identified where possible.

Because points at which the CNRL road crosses mine haul roads or other site roads could be vulnerable to breaches in security, no-stopping regulations will be enforced along the CNRL road in the vicinity of project operations, except for designated areas where visitors can stop to view the facilities.

Access-control measures will be developed further in a subsequent design phase.
B7.3.2 Likelihood and Potential Consequences

The potential consequences of a breach of site security can range from personal injury sustained by the trespasser to property damage to the facilities. In an extreme case, an act of wilful damage could result in a release of substances to the environment with potential for environmental or health impact. As proposed security measures should preclude a significant environmental or health impact because of a security breach, the overall risks associated with a breach of site security are considered to be low. For more information on site security and access control, see the response to June 2007 AENV SIR 62.

B7.4 Impact of Joslyn SAGD Area on the Project

The Joslyn North Mine SAGD operations are currently under suspension. The following are potential interactions between Joslyn SAGD area and the project:

- SAGD steam migration increasing pore pressure in the Pond 1 dyke foundation, decreasing the stability of the dyke
- SAGD steam release creating a crater at the toe of the Pond 1 dyke, decreasing the stability of the dyke
- SAGD steam release to the JCR channel
- penetration of the SAGD cap rock caused by instrumentation drilling at or near Pond 1

B7.4.1 Design/Mitigation Measures

Activities for SAGD are currently suspended. Geotechnical offsets between the SAGD area and the external tailings area are based on an operating SAGD project, and are therefore conservative. Procedures for instrumentation drilling (including existing wells), mine operations and emergency response plans, SAGD blowdown and monitoring will be developed if required before any future SAGD startup.

B7.4.2 Likelihood and Potential Consequences

Although the SAGD activities are currently suspended, the potential consequences of the events identified above are discussed generically herein. High pore pressure beneath the dyke foundation under plausible steam pressure conditions can reduce the geotechnical factor of safety of the dyke below 1.3. Because of the potential consequences of dyke failure, this is considered a high-risk case.

The risks of dyke failure because of crater formation are considered remote, because of the buttressing effect of material remaining in the crater. Steam release to the pit highwall is unlikely because of the lack of continuity of the basal sands to the mine area. Steam release to the JCR, however, does pose a potential risk. Penetration of the cap rock because of instrumentation drilling also poses a potential risk, both to tailings pond and Joslyn SAGD.

Based on tailings pond dyke stability considerations (see Section B2.2) and considerations of other releases (see Section B2.4, Section B2.5 and Section B4.1), the likelihood of a spill or release from the project affecting Joslyn SAGD is considered remote. Similarly there is no plausible spill or release type from Joslyn SAGD that could affect the project. As noted previously, these potential consequences will be evaluated further should SAGD operations be planned in the future.