August 9, 2010

Mr. Dallas Johnson
Environmental Assessment Team Leader
Alberta Environment
Twin Atria, 1st Floor
4999-98th Avenue
Edmonton, Alberta T6B 2X3

Mr. Terry Abel
Executive Manager, Oil Sands Branch
Energy Resources Conservation Board
640-5th Avenue SW
Calgary, Alberta T2P 3G4

Dear Sirs:

RE: Round 3 Supplemental Information Responses
   Jackpine Mine Expansion Project
   ERCB Application No. 1554388; AENV EPEA Application No. 005-00153125
   and 006-00153125; Water Act File No. 00186157
   Pierre River Mine Project
   ERCB Application No. 1554396; AENV EPEA Application No. 001-245358;
   Water Act File No. 00245489

Please find attached the final responses to the Supplemental Information Requests (SIRs), Round 3, provided to Shell Canada Limited (Shell) on July 21, 2010 by Alberta Environment for the proposed Jackpine Mine Expansion and Pierre River Mine Projects.

Electronic copies of this submission will also be available on Shell’s website at http://www.shell.ca/.

If you need any clarifications regarding the submitted information, please contact Margwyn Zacaruk at (403) 384-5194, or the undersigned at (403) 691-3182.

Yours truly,

Shell Canada Energy

[Signature]

Donald Crowe
Manager, Regulatory Approvals
Heavy Oil Development

Encl.

cc. Shawn Denstedt, Osler, Hoskin & Harcourt LLP
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Section 1 – Water

Question No. 1

1. PRM SIR Round 2 Response, SIR 18 e & f, Page 12-14 to 12-17; JME Round 2 Response, SIR 9 a-c, Pages 11-1 to 11-17

Shell describes that the river stage (head) was set equal to topography and it is also understood that the rivers, lakes and tributaries were set as head-dependent flux boundaries in both steady state and transient state groundwater models.

Request

1a How was this boundary (condition) accounted for in assessing impacts on the water level changes in rivers and lakes due to the Project’s activities?

Response:

1a The use of fixed heads set equal to topography in the groundwater model river and lake boundary conditions has a negligible effect on the assessment of impacts to surface water level changes due to the project activities.

For each of the projects, the groundwater model is not coupled to the surface water model. The groundwater model assumes that water levels in rivers and lakes remain invariant in both steady state and transient state simulations until they are removed by mining if located within the mine footprint. This is a reasonable assumption for groundwater quantity assessments, as it leads to more leakage from the water bodies under dewatering scenarios.

Changes in water levels in rivers and lakes were determined based on derived rating curves and HSPF model simulated flows, as described in the EIA Vol. 4A, Section 6.4 and the Jackpine Mine Expansion (JPME) and Pierre River Mine (PRM) Project Update, Section 2.6.3, Table 2.6-11.

The linkage between the groundwater and surface water models was established through the baseflow to the rivers. The surface water model (HSPF) estimated the baseflow to Asphalt Creek, Pierre River, Big Creek and Muskeg River under pre-development conditions; the pre-development baseflow was then used to calibrate the regional groundwater model in conjunction with measured groundwater levels in the Quaternary aquifers, the McMurray Formation, the Basal aquifer and the Methy Formation. The calibration process included the adjustment of hydraulic conductivity and recharge over the study area and the conductance of the river and lake boundaries to match the baseflows and observed water levels.
Predictive groundwater model runs assessed changes in baseflow to the water bodies and these changes in baseflow were then passed to the surface water model (HSPF), which assessed the changes in the water levels in the water bodies.

It is important to note that the variability in the groundwater model's hydraulic parameters (e.g., hydraulic conductivity, river boundary conductance term) far exceed the variability in the surface water levels. As described in the EIA Vol. 4A, Section 6.4 and the Jackpine Mine Expansion and Pierre River Mine Project Update, Section 2.6.3, Table 2.6-11, the variations in surface water levels in the rivers and creeks were in the order of a few centimetres for the different cases analysed. The variability in the groundwater model parameters, in contrast, ranged from 40% for the recharge to a factor of 10 for the hydraulic conductivity (See EIA Vol. 4A, Appendix 4-1. Section 1.2.3.7 for JPME and Section 1.2.4.7 for PRM).
Section 2 – Terrestrial

Question No. 2

2. **PRM SIR Round 2 Response, SIR 21a, Page 12.23**

   Shell states that a 100 m setback will be maintained from streams, around the periphery of the disturbance footprint.

Request

2a Explain, using a diagram where possible, how the 100 m setback will be applied/maintained.

Response:

2a Shell has committed to maintain a minimum of 100 m setback from watercourses around the periphery of the project development area, including ephemeral streams. These setbacks are applied to watercourses that run parallel to the development area to allow the watercourses to be maintained and minimize the effect from the proposed developments. A minimum of 100 m setbacks will be applied to the Muskeg River at Jackpine Mine Expansion (JPME) and to the Pierre River diversion channel, the Unnamed Creek 1 diversion channel, the Eymundson/Asphalt creeks diversion channel, the First Creek diversion channel and the Big Creek diversion channel at Pierre River Mine (PRM). For the Athabasca River, a 250 m setback will be applied at PRM. Figure 2-1 presents the areas where the setback will be applied to watercourses at JPME and PRM.
Question No. 3

3. JME SIR Round 2 Response, SIR 22, Page 12-6

Shell states that they have considered potential mitigation strategies, but that the installation of a barrier or hydrologic break is not expected to be sufficient to mitigate dewatering effects on the lenticular fen. Given the joint panel decision (EUB Decision 2004-089) and subsequent Water Act approval (Water Act Approval 151636) that were issued for the Fort Hills project, and the proposed impacts of the Jackpine Mine Expansion on the adjacent lenticular fen;

Request

3a Discuss how Shell plans to mitigate and monitor the unmined portions of the adjacent lenticular fen.

Response:

3a The lenticular patterned fen located north of Shell’s project does not form part of the McClelland Lake Wetlands Complex.

Shell does not plan to mitigate drawdown of the lenticular patterned fen but has proposed to monitor the lenticular patterned fen as described in AENV SIR 22 (d).

Request

3b Provide a figure detailing the full extent of the potential effects on the lenticular fen, including all areas of potential habitat changes that will occur as a result of the Jackpine Mine Expansion project, and identify any potential cumulative effects on McClelland Lake and the surrounding patterned fen as a result of the Fort Hills and Jackpine Mine Expansion projects.

Response:

3b Figure 3.1-1 from Appendix B of the JPME Round 1 SIRs (December 2009) presents the full extent of the potential drawdown effects from the Jackpine Mine Expansion on the lenticular patterned fen. Figure 3-1 presents an excerpt of Figure 3.1-1 presenting the EIA Update drawdown predictions for Jackpine Mine Expansion.

No cumulative effects on McClelland Lake and the associated fen complex due to the Jackpine Mine Expansion are expected. As stated in Appendix B, Section 3.3 of the JPME Round 1 SIRs (December 2009), based on the conservative modelling approach used to predict the maximum extent of drawdown predictions, the predicted change in water levels for McClelland Lake and the associated fen complex will be less than 1 cm. This predicted change is within
the natural variability of water levels in McClelland Lake and the associated fen complex.
Given this and taking into account Suncor’s requirement to maintain lake levels within the range of natural variability, no cumulative effects are expected.

Request
3c Provide a plan describing how Shell plans to work with Suncor to minimize impacts to McClelland Lake and the surrounding patterned fen.

Response
3c As discussed in SIR 3b, no cumulative effects are expected between McClelland Lake and the associated fen complex. Therefore, Shell sees no reason to develop a plan with Suncor for these sites. Shell does intend, however, to work with Suncor on mitigation plans as may be required for the projects.
Question No. 4

4. PRM SIR Round 2 Response, SIR 49a, Revised Response 449d, Page 13-9

In the revised response to the question of what wildlife movement criteria were included in the design specifications for the proposed Athabasca River bridge, Shell states that passageway landscaping will be conducive to wildlife travel for a variety of species.

Request

4a Describe any studies that have been conducted, or any monitoring that has occurred around other bridges which helped to inform the design characteristics of this bridge specifically to ensure wildlife passage.

Response

4a This information has been provided in Appendix 5-5 Wildlife Movement of the EIA. Specifically, the tool box described by Huijser et al. (2007) included a discussion of long bridges and tunnels to promote wildlife movement as well as the use of underpasses that offer safe crossing opportunities for wildlife. Many examples are cited including I-75 in Florida, US Highway 93 in Montana, and large underpasses in the Netherlands. Clevenger et al. (2002) discussed the efficacy of a variety of different underpasses and overpasses along the TransCanada Highway to promote wildlife movement. Finally, Dodd and Gagnon (2007) examined the role of fencing in promoting the use of wildlife passageways similar to that proposed as mitigation for the Athabasca River bridge. Fencing was also discussed in Huijser et al. (2007).

In addition, previous responses to PRM Round 1 SIRs 449a ii and SIR 458c i included references to studies that have been conducted and monitoring that has occurred that helped to inform the design characteristics of the planned wildlife passageway under the Athabasca River bridge. Specifically, Clevenger’s work along the TransCanada Highway in Banff National Park was cited. This study includes high way bridges over the Bow River and other drainages that also provide for wildlife passage on either bank. Donaldson’s work in Virginia also examined similar issues in that state. In SIR 458c i, reference was made to monitoring under Suncor’s bridge across the Athabasca River to their East Bank operations. The remote camera data indicate that species are not only using the corridor along the east bank of the river but also the narrow passageway under the bridge (<10 m from the water’s edge) to travel north and south along the Athabasca River corridor.
Since the submission of the EIA in 2007, Bissonette and Cramer (2008) produced an exhaustive evaluation of the use and effectiveness of crossing structures for the U.S. Transportation Research Board in Washington. The research team developed guidelines for the selection, configuration, location, monitoring, evaluation, and maintenance of wildlife crossings. Clevenger and Huijser (2009) prepared the “Handbook for Design and Evaluation of Wildlife Crossing Structures in North America”. Their recommendations for the dimensions of wildlife underpass designs are consistent with those proposed for the Athabasca River bridge. In addition, Clevenger et al. (2009) provided an update from his continuing research on the Trans Canada Highway in Banff National Park, which further underlines that wildlife underpasses similar to that proposed for the Athabasca River bridge provide for wildlife movement. Finally, recent monitoring under the recently constructed Steepbank River bridge which connects Suncor’s North Steepbank Extension Mine to the rest of their East Bank Operations have documented moose and black bears using the 4 m wide passageways on either side of the river (Golder, unpublished data).

References


FHWA/MT-07-002/8117-34. Prepared for Western Transportation Institute, Montana State University – Bozeman.

Request

4b Provide a figure illustrating the conceptual design scheme for the Athabasca River Bridge with as much specificity as possible. Indicate on the figure what area is intended for wildlife travel.

Response

4b As stated in the response to PRM SIR Round 2 SIR 49a, detailed engineering specifications are considered part of activities planned following project approval and as such are not currently available. However, preliminary drawings of the conceptual design are shown in Figure 4-1.
Question No. 5

5. PRM SIR Round 2 Response, SIR 54, Page 13-17

Shell described the clearing required for the raw water intake and buried pipeline as 80-230 m wide. Shell also describes that the clearing and infrastructure associated with the Raw Water Intake is predicted to have a filter effect on wildlife movement.

Request

5a Explain what factors are contributing to this large range of 80-230 m (150 m).

Response:

5a The large range described in the response to PRM SIR Round 2 SIR 54 reflects that, unlike a pipeline crossing with a relatively uniform width, a water intake requires an area with width large enough to construct and decommission a water intake facility. While most of the corridor will be 80 m in width along the utility corridor to the intake, the intake facility may require a width up to 230 m to accommodate the facility itself and additional areas required for its construction and decommissioning. Figure 5-1 illustrates the clearing associated with the existing Muskeg River Mine water intake for comparison purposes.

Request

5b Given that the raw water intake and pipeline are located in the Athabasca River Valley Corridor, describe Shell’s plans to re-vegetate the portions of the buried pipeline right-of-way and associated clearings that are not required for ongoing maintenance/operation.

Response:

5b Areas cleared for the raw water intake and associated pipeline will be reclaimed and revegetated unless they are required for maintenance and operation, or Alberta Sustainable Resource Development (ASRD) requires that access or pipeline offset areas must be kept clear. At the time that these areas are cleared, merchantable timber will be removed as per Northland Forest Products Ltd. and Alberta-Pacific Forest Industries Inc.’s annual allowable cuts, and smaller woody material will be brushed and cleared to the perimeter or located in piles. In areas where soil will be disturbed, upland surface soil and mineral subsoil (or potentially peat-mineral mix) will be salvaged and stockpiled for use in reclamation.
Once construction work is complete, those areas of the intake area and pipeline that are eligible for reclamation will have reclamation soils replaced (if required due to soil disturbance) and coarse woody debris applied. Decisions on application of a nurse crop or revegetation in addition to natural regeneration will be made in relation to plans for specific areas of the intake and pipeline, and will be described in reclamation plans for the ASRD permit applications once detailed design work is completed.
Question No. 6

6. **PRM SIR Round 2 Response, SIR 58a, Page 13-21**
   Shell described how length as well as the width of corridors affects their functionality. Shell suggested that the 250 m wide corridor at the Pierre River Mine is sufficient because it is relatively short, just 8 km. There was no mention however of the 17 km long corridor described in the EIA Volume 5, Appendix 5-5, Section 3.3, Page 6 that will be formed between the Pierre River Mine, External Tailings Disposal Area, Raw Water Intake and the Athabasca River. That corridor begins at the point where the 250 m wide corridor ends, together forming an approximately 25 km long corridor that varies in width from 250 m to 3.5 km and which is infiltrated by infrastructure such as a bridge, the raw water intake, and other infrastructure associated with the Project. In addition, there are other projects located up-stream and down-stream from this one which also constrict wildlife use of the river valley down to narrow corridors along the river.

**Request**

6a Considering the regional context of multiple projects located along the Athabasca River, all of which have contributed to a constriction of wildlife movements, describe the predicted effectiveness of the Pierre River Mine Project corridor for facilitating wildlife use and movement.

**Response:**

6a Impacts to wildlife movement were assessed in consideration of a 25 km long corridor that varies in width from 250 m to 3.5 km, as described in Appendix 5-5 of the EIA. As discussed in Section 5 of Appendix 5-5, this 25 km long corridor is predicted to be sufficiently effective to maintain genetic connectivity.

**Request**

6b Provide a map of the Pierre River Mine Project wildlife corridor with up-stream and down-stream corridors along both sides of the river clearly indicated to help demonstrate the predicted connectivity of habitat along the Athabasca River in the Regional Study Area.

**Response:**

6b Figure 6-1 depicts potential wildlife movement pathways on either side of the Athabasca River in and around Shell’s existing, approved and proposed developments in the Planned Development Case.
Request

6c How does the corridor length compare to other corridors examined in the studies that Shell cited in this and other related SIR responses (including Hannon et al. 2002)?

Response:

6c This corridor in total is longer than those that have been previously discussed. Corridor length is an important parameter affecting corridor effectiveness because increased corridor length may result in decreased wildlife movement from one end of the corridor to the other (i.e., decreased corridor effectiveness). However, the total length of the corridor is only important if the corridor is isolated along its entire length, that is, entry and egress by wildlife can only occur at each end. This corridor is not isolated along its entire length and wildlife movement in and out of the corridor can occur in 2 wide areas (1.5 to 4 km) along the 25 km length (see Figure 6-1 referenced in Response 6b).

Request

6d Provide support for the assertion that the corridor is short relative to the dispersal capabilities of wide ranging species, particularly for those species known to occur in the region.

Response:

6d The corridor is short relative to the recorded dispersal distances of wide ranging species occurring in the region, particularly when the numbers of entry and exit points to the corridor are taken into account. The following information supports the view that corridor length is short relative to dispersal capabilities of wide ranging species occurring in the region.

- Wolves have home ranges in excess of 1,000 km² and documented dispersals have been in excess of hundreds of kilometers e.g., 670 km, north of Fort Smith in the N.W.T. to Cold Lake, AB (Van Camp and Gluckie 1979).
- Wolverines have large home ranges, up to 2,034 km² for adult males in Ontario (over a nine-month period) (Magoun et al. 2005). Male wolverines moved an average of 13.8 km per day, with a maximum daily movement of 53 km, while females moved an average of 7.3 km per day with a maximum of 28 km ) (Magoun et al. 2005). Average dispersal distances in Sweden and Norway were 51 km for males and 60 km for females (Vangen et al. 2001).
• Male black bear home ranges in northeastern Alberta were over 50 km² (Ruff et al. 1976) and dispersal distances in a recent summary ranged from 22 to 62 km (Costello 2010).

• Canada lynx dispersal distances in the Northwest Territories ranged from 17 to 930 km straight line distance (Poole 1997).

• Documented fisher dispersal distances in Maine were 4.1-19.5 km (Arthur et al. 1993).

References:


Question No. 7

7. **PRM SIR Round 2, SIR 72B, Page 13-67; JME SIR Round 2, SIR 37c, Page 12-43**

For PRM Shell stated that if shoreline vegetation growth occurs in the ETDA after production begins, the vegetation will be removed with herbicide, and muskeg mats that rise to the ETDA surface will be covered with tarpaulins until they sink. For JME Shell states that they will be salvaging minimal peat from the ETDA footprint...The remaining peat will be buried under coarse sand tailings (CTS) beach areas.

The JME SIR asked whether Shell will be removing muskeg prior to filling of the tailings ponds. Shell responded that they will be removing minimal peat.

Request

7a What is meant by minimal peat? Explain qualitatively and quantitatively.

Response:

7a The use of the word “minimal” was intended to describe the volume of material that met the peat removal criteria outlined below and which would be subsequently placed in stockpile for later reclamation activities. Quantities and timing of peat salvage are presented in the reclamation material balances in the soil salvage plans and reflect the criteria used in salvage determination, as described below.

As indicated in the soil salvage plans for the Pierre River Mine (PRM) (Jackpine Mine Expansion and Pierre River Mine Project Application, Volume 5, Appendix 5-2) and the Jackpine Mine Expansion (JPME) (Jackpine Mine Expansion and Pierre River Mine Project Update, Appendix 2), volumes of peat salvaged for reclamation purposes are planned on the basis of Clause 3.7.14 of the Environmental Protection and Enhancement Act Approval No. 20809-01-00 for the Muskeg River Mine. Clause 3.7.14 requires that “other coversoil” be salvaged when there is insufficient upland soil to meet reclamation requirements, and Shell has optimized the location, timing and volume of peat removal under External Tailings Disposal Areas (ETDAs) on both proposed mines using the following criteria:

- to prevent disturbing the geotechnical properties of the muskeg and the surrounding starter dyke walls when these are critical in the ETDA design;

- priority was placed on the surface layer of peat, as per discussions with ASRD in 2007, 2008 and 2009 regarding texture and seed bank properties; and
reclamation material balances show a large volume of peat material in excess of that required for reclamation activities. Priority was placed on salvage of peat materials closest in time to direct placement or minimal time in stockpile, up to the maximum volume required for reclamation in addition to upland soils as per Clause 3.7.14 of the Environmental Protection and Enhancement Act Approval No. 20809-01-00 for the Muskeg River Mine. Peat available during later mine pit advance will meet the material volume requirements for reclamation, at a time closer to reclamation activities in the area.

Request

7b Why is Shell not salvaging the muskeg in the External Tailings Disposal Area (ETDA) for use in reclamation?

Response:

7b Shell will be salvaging peat-mineral mix from the ETDA footprints according to the set of criteria described in the response to SIR 7a.

Request

7c Given that muskeg will only be minimally removed prior to addition of tailings, describe in detail how Shell will ensure that muskeg mats will not rise to the surface and potentially become an attractant for wildlife.

Response:

7c The JPME North EDTA will utilize the flexibility afforded by the on-going operations during commissioning of the facility. Shell will endeavour to employ dense streams such as Course Sand Tailings (CST) to fill the JPME North ETDA and anticipates that a large majority of the muskeg materials will be buried under volumes of sand and tailings sufficient to prevent floatation. Further, these activities will be scheduled during times (fall season) which minimize the possibility of bird and wildlife interaction. Any muskeg mats that arise during filling will be identified on a daily basis and appropriately responded to as quickly as possible. Shell currently employs a tailings team dedicated to operating and monitoring the ETDAs. Additionally, a bird crew monitors the EDTAs on a daily basis during spring through fall when the bird migration and breeding period is underway. Field personnel check on any potential wildlife issues on the surface of the ETDA, in addition to checking and maintaining the performance of the BirdAvert™ bird deterrent system (as discussed in PRM SIR Round 2 Response SIR 72, and JPME SIR Round 2 Response SIR 37).
The same bird deterrent system and field monitoring is planned for the approved Jackpine Mine South ETDA (the first in operation for the Jackpine Mine) and performance data and best practices will be applied to the proposed JPME North ETDA and PRM North ETDA.

If floating muskeg mats are identified, tailings field personnel remove the deep-water mats by hauling them to shore by boat or, if in a shallow area, by dragging them out using a backhoe. Mats that cannot be removed may be covered with tarpaulins to discourage any potential nesting birds.

Request

7d  Provide evidence, with examples, to demonstrate that covering peat with coarse sand tailings and/or tarpaulins will be successful?

Response:

7d  As described in the response to SIR 7c, Shell has designed the filling activities to minimize the possibility of floating muskeg. While direct evidence is not available, birds may be attracted to the muskeg mats as nesting areas due to the vegetation characteristics. By fundamentally altering those characteristics through either rapid covering with CST and/or employing tarpaulin covers, Shell is confident the mats inherent attractiveness will be removed, thereby minimizing the risk that they would be used as a nesting area.

Request

7e  How will Shell monitor the ETDA to detect floating muskeg and ensure that a rapid mitigative response is applied?

Response:

7e  See response to SIR 7(c).
Section 3 – Health

Question No. 8

8.  PRM SIR Round 2 Response, SIR 85, Page 14-22; JME SIR Round 2 Response, SIR 50, Page 13-17

Request

8a Provide the tonnes per year emissions, not using a total carbon dioxide equivalent basis, associated with construction for SO₂, NO₂, PM₂.₅, CO and VOCs.

Response:

8a The maximum annual construction emissions expected at Pierre River Mine (PRM) and Jackpine Mine Expansion (JPME) are presented in Table 7-1.

Table 8-1 Pierre River Mine and Jackpine Mine Expansion Maximum Construction Emissions

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<td>Construction Emissions [tonnes/day]</td>
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Note: Values have been rounded for presentation purposes.

A comparison of the maximum construction emissions and the maximum operation emissions at Pierre River Mine and Jackpine Mine Expansion is provided in Table 8-2. The table shows that the construction emissions are lower than the maximum operation emissions as stated in Volume 3, Appendix 3-8, Section 3.2 of the EIA.
### Table 8-2  Comparison of the Construction Emissions and the Maximum Operation Emissions

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(a) Source: EIA Volume 3, Section 3.4, Table 3.4-2.
(b) Note that to avoid negative operation emissions, the JPME maximum operation emissions do not include the changes to Jackpine Mine - Phase 1.
Section 4 – Approvals

The responses to questions in this Approvals section will not be considered as part of the EIA completeness decision made by Alberta Environment.

Section 4.1 – Environmental Protection and Enhancement Act

Question No. 9

9.  JME SIR Round 2 Response, SIR 11a, Page 11-20

Shell states No action is planned to protect the integrity of the Pleistocene Channel Aquifer (PCA) because when the project is closed, the PCA will continue to be part of a functional hydrogeological system. Additional information provided does indicate that portions of the PCA will remain and continue to provide groundwater storage and a permeable media for facilitating the lateral flow of groundwater.

Request

9a Clarify what actions, if any, (placement of overburden and/or interburden material) will be taken at the pit limits with the PCA, during mine closure and reclamation, that may impede the migration of in-pit waters into the PCA.

Response:

9a Where the pit limits intersect the PCA, the PCA will be isolated from tailings deposits through the placement of a low-permeability barrier (e.g., low-permeability overburden), if tailings need to be placed above the top of the McMurray Formation. Otherwise, the PCA will be in direct contact with backfilled overburden materials.

The isolation of Quaternary sand and gravel deposits from backfilled tailings was described in the EIA, Vol. 4A, Section 6.3.2, page 6-64; Section 6.3.5, page 6-145; and Section 6.4.1, page 6-250.