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Project No. SC11-650

**Attention: Mark Pickering, AENV Regional Inspector
Jeff Gonek, DFO Field Supervisor**

Remediation and Reclamation Proposal Moosehorn 8" Line Break, Swan Hill, AB

As requested by Alberta Environment (AENV) and the Department of Fisheries and Oceans (DFO), SWAT Consulting Inc. (SWAT), on behalf of Pembina Pipeline Corporation (Pembina), has completed a Remediation and Reclamation Proposal for the Point of Entry into an un-named creek (POE).

This remediation and reclamation proposal is developed for the POE and the upper section of the creek where flushing operations are not effective. This may also be used in areas along the un-named creek pending a review of the Shoreline/Bank Assessment that will be completed as crews complete the secondary flush of the creek system.

BACKGROUND

The release was a result of an 8" pipeline break on July 19, 2011. The estimate of lost product was 800-1,000 barrels of a light crude oil. The product migrated off the Right Of Way (ROW) and down a swale with an 8-10% slope; continued for approximately 120m through a mixed forest with heavy blow down and into an un-named creek.

The first response operations undertaken by Pembina personnel were to shut in the line, gain site access, isolate the source, complete a pull back on the remaining line fluids and construct a berm system along the ROW to prevent further surface migration of product. Additional control points were then installed at preselected locations along approximately 4km of creek system. As further site access was gained, the POE was stripped of timber and salvaged for later use, the impacted organics stockpiled and sampled. Due to a small spring feeding the swale of the POE, a trench and weir system was installed at the visible point of entry into the un-named creek. Additional trenches were installed down gradient of the trench system to determine if full containment had been achieved.

A fish habitat evaluation is currently being conducted to determine if the known product in the soils and sediment and/or water column is detrimental for fish.



To date, the bulk of the free product has been removed from the creek system; only heavy hydrocarbon sheen remains. This remaining sheen is being directed into the control points and recovered.

Through further delineation and visible indicators within the down gradient trenches of the POE, it was identified that product had migrated within a cobble lens under the organic layer (15cm organic, 5cm silt B horizon and then a siltyclay with heavy cobble C horizon) prior to the trench and weir system being installed.

This area was then cleared of timber and salvaged; the organics stripped up to the creek banks and stockpiled. Silt fence was installed along the creek banks and the area was flushed to bring the remaining residuals to surface for collection. The result of the flushing operations indicated that small pockets of oil still remained within the cobble. Peat moss was then applied to the area to control any further run-off.

REMEDIATION AND RECLAMATION PROPOSAL

The following Remediation and Reclamation Proposal is based on specific site conditions and parameters of concern:

- Continue to recover any free product from the point of release;
- Excavate known impacted soil from within the creek and upslope within the swale area, up to the ROW;
- Prior to initiating the excavation, silt fence will be installed along the creek banks and downstream of work activities to reduce potential sediment movement during days of heavy precipitation;
- Construct a bell hole upstream of the excavation area and complete a pump around of the spring fed un-named creek. Current flow rate of the spring fed creek is approximately 60 gpm;
- Divert the clean spring water from within the swale of the POE downstream;
- Remove the existing stockpiles and place within a temporary storage area, and then transfer to an approved waste disposal facility;
- Excavation will start from within the creek and continue up the swale back to the ROW. As the creek is excavated, an inverted weir will be installed to address any water within the excavation as a result of precipitation;
- Water samples from the immediate area of the excavation during days of precipitation will be obtained in conjunction with the excavation, and;
- Pending laboratory analyses the water will be either released back down stream through the weir or a Granular Activated Carbon (GAC) unit will be utilized;
- The excavation will be guided by visual indicators along with the use of a Gastech to obtain hydrocarbon vapour concentrations from soil and sediment samples;



- The final limits of the excavation will be assessed utilizing a grid sampling method. Based on information known at the site the final excavation grid will likely be a 2m by 5m grid;
- Confirmatory samples from the excavation will be obtained and based on field screening hydrocarbon vapour concentrations and/or field observations, a soil sample from each wall and base will be submitted to the laboratory for analyses consisting of some or all of: PAHs, BTEX, F1-4G, and particle size analyses (>75um sieve);
- All soil and water samples will be obtained following industry standards. Samples will be placed in a cooler for transport to the laboratory, and a chain of custody will be filled out;
- Once certificate of analyses is received the excavated area of the creek and its banks will be backfilled utilizing pit run and re-contoured;
- The area of the swale will be backfilled with like materials and re-contoured;
- Erosion barriers will be installed along the POE, coconut matting laid and staked in. An approved seed mixture will be added to a polymer and the mixture will be adhered to the matting;
- Utilizing the salvaged timber, timber placement will be conducted to further aid in potential erosion issues and provide ground cover to establish eco climes;
- Document the activities on site, map out the impacted area in relation to physical features and obtain photographs throughout the time onsite; and,
- Preparation of a report summarizing the activities.

CONCLUSION

SWAT is available at any time to answer any questions\or concerns with this location.



CLOSURE

SWAT Consulting Inc., on behalf of Pembina Pipeline Corporation, has prepared this remediation and reclamation proposal of the POE for Alberta Environment and the Department of Fisheries and Oceans. Information was obtained while conducting product recovery and the site assessment at the POE.

The material contained in this report reflects SWAT's best judgement in light of the information available at the time of preparation.

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