CHALLENGES OF MEDIUM CRUDE OIL SPILLS IN SPRING RUNOFF CONDITIONS

April 29, 2009

SWAT Consulting Inc.

Release Details

In early October, 2006 approximately 1250 cubic meters of medium crude oil was released into a small creek, with product movement of 2.2 kilometers and impacting three large diameter beaver dams.

Initial Containment and Recovery

- During the fall of 2006 approximately 1215 cubic meters of crude oil was recovered and accounted for using conventional recovery techniques, such as pumps, skimmers, vacuum units and absorbents, or remained at the break site.

Initial Containment

Bulk Product Recovery

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Winter Preparation

- A small volume (35m^3) of free product remained under the ice as the water froze. The site was secured for the winter utilizing six soil constructed inverted weirs within the creek system. Portions of the beaver dams were removed to confine the flow of the creek to a central channel.

Wier Installation

Weir Installatioin

Beaver Dam Removal

- Selected breaching of the beaver dam allowed us to direct the flow of the creek to a central channel. This also gave us the capacity regulate downstream water levels by plugging the breach points as required.

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Challenges

- To ensure sufficient flow rates, all of the weir discharges were built larger than the culverts within the engineered roads on the same creek.

Challenges

- As the native soils were too porous, so soil was brought in to insure the integrity of the weirs.
- Large retention ponds were built upstream to allow dissolved hydrocarbons time to settle out of the water column.

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Challenges

- Cold temperatures caused the weirs to freeze off. This allowed water levels to rise upstream of the weirs compromising the weirs capacity and integrity.

Weir House

- Insulated weir houses with catalytic heaters were constructed. This allowed us to regulate the temperature at the weir discharge.

Weir House

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Challenges

- With the creek confined to the central channel some free product was left stranded under the ice. Come spring, the thawing ground would allow product to impact soils.

Removal of Impacted Ice and Soils

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Spring Run Off

- Spring run off and heavy precipitation resulted in a one in ten year flood. During the flood the challenges of containing the residual hydrocarbons consisted of site safety, maintaining water levels, ensuring the structural integrity of the weirs and access roads, maintaining surface containment and managing woody debris.

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Challenges

- Spring runoff and heavy rains caused water levels to rise on average 30 cm per hour.

Management of Water Levels

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Utilization of High Flow Pumping Equipment

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Installation of Water Control Weirs at Beaver Dams

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Challenges

- Severe fluctuations in water level made weir containment unreliable.

Maintenance of surface Containment.

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Challenges

- Flood conditions brought large quantities of woody debris down stream threatening surface containment.

Management of Woody Debris

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Challenges

- Remote location and poor access made sending impacted equipment out to be decontaminated extremely difficult.

Decontamination

Decontamination

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Final Phase

- Post flood operations consisted of the treatment of shoreline impact, impacted soil removal and reclamation.

Shoreline Clean Up

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Shoreline Clean Up

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Impacted Soil Removal

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Reclamation

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Reclamation

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Results

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Results

Learnings

- Due to the narrow out flow on earthen weirs cold weather will cause them to freeze off.
  - Utilization of an insulated weir house prevents freeze up the weir

Learnings

- Due to trucking costs earthen weirs can be cost prohibitive.
- Earthen weirs are easily under cut in high flow situations
- Earthen weirs must be keyed into the banks causing significant impact to the creek.

Learnings

- SWAT has developed low impact prefabricated weirs to offset the difficulties associated with earthen weirs.

Learnings

- Removal of product frozen into the ice is cost prohibitive. Frozen product should be left in-situ until spring unless it will cause additional impact to soils or vegetation.

Learnings

- Water volumes in freshet can not be accurately predicted.
  - Pumping equipment and heavy machinery should be kept readily available to ensure quick response to rapidly rising water levels.

Learnings

- Fluctuating water levels decreases the effectiveness of earthen weirs.
  - Make sure surface containment is in place before freshet begins.

Learnings

- Increased amounts of woody debris due to flooding can negatively impact surface containment.
  - Prompt removal of woody debris is vital.
- Disposal costs for woody debris can be very high.
  - Utilize in-situ burning when ever permitted.

Learning

- Off site decontamination of equipment can be very expensive if not readily available.
- Impacted equipment sent off site can increase a spills foot print.
  - When ever possible set up a decontamination area on site.

Q & A

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