GROUND WATER DISCHARGE PERMIT-BY-RULE
STATEMENT OF BASIS

Crown Asphalt Ridge LLC
Oil Sands Mine and Hot Water Extraction Plant
Asphalt Ridge near Vernal, Utah

May 8, 2012

Location

Crown Asphalt Ridge (CAR) operates an oil sands mine located southeast of Vernal, Utah in portions of Sections 30, 31 and 32 of Township 4 South, Range 21 East; and Section 24 of Township 4 South, Range 20 East, SLBM. The site location is shown on Figure 1 of the CAR Ground Water Discharge Permit Application.

Background

The CAR mine and processing site has a history dating back to 1996 when it was called the Buenaventura Resources Corporation. At that time, Permit-By-Rule status was issued for a bitumen extraction process that used a modified hot water extraction process until 2001, when operations were suspended for economic reasons. In 2008, CAR applied for and received a Permit-By-Rule for a pilot plant to test a new two-step bitumen extraction process. The first step was intended to separate the sand fraction of the matrix holding the bitumen, leaving a bitumen froth consisting of 50-60% bitumen, 10-20% fines (clay), and water. The second step was intended to separate the clay particles from the bitumen using a solvent extraction process. The proposed 2008 CAR pilot was never conducted.

Proposed Process

CAR proposes to process the oil sands at the site with hot water to produce a dry froth product which is used as an amendment to asphalt. A process flow diagram is provided in Figure 3 of the CAR Ground Water Discharge Permit Application. Hot water will be used to separate out the sand fraction of the matrix, leaving a froth consisting of bitumen and fines (mainly clay). Process water used for the extraction will be reclaimed from a secondary separation tank used in the process, and also from dewatering the froth and from tailings drainage. The process water will not be contained in ponds, lagoons or other facilities which would require a ground water discharge permit.

Approximate composition of the tailings from the process will be: 10% water, 10% clay, 0.5% bitumen, 80% sand, and 5 to 10 grams of flocculent per metric ton of solids. To comply with the ground water quality standards of UAC R317-6-2.1, the pH of the tailings will be adjusted, if necessary, to the range of 6.5-8.0 using sodium hydroxide.

Initially the processed oil sand tailings will be placed in an asphalt-lined repository. Once tailings have been produced, samples will be analyzed for the potential to leach contaminants. If the content of potential ground water contaminants is insignificant and storage of tailings off the liner would result in de minimis potential for harm to ground water resources at this site, the Division of Water Quality (DWQ) will approve disposal of the tailings along with mined overburden in the mine pit.

Hydrogeology

The mine site is located southeast of Vernal on Asphalt Ridge. Exposed strata consist of the Asphalt Ridge Sandstone and overlying Rim Rock Sandstone of the Cretaceous Mesaverde Group. These two sandstones are separated by a thin tongue of the Mancos Shale. The Rim Rock Sandstone is overlain unconformably by the Tertiary Duchesne River Formation, which contains interbedded fluvial sandstones, conglomerates, and shales. These formations dip southwestward toward Asphalt Ridge, away from fluvial aquifers in Ashley Valley, which is located northeast and downslope from the mine site.

Sandstones at the mine site are impregnated with bitumen, which represents an ancient oil reservoir that was unroofed by erosion. The crude oil in the reservoir was subject to dissolution by meteoric water and biodegradation, which removed light and water-soluble hydrocarbons, paraffins and isoprenoids. The remaining bitumen has high viscosity and low water solubility.

A small seep with a flow of less than 1 gallon per minute is located within the mine pit as shown in Figure 2 of CAR's Ground Water Discharge Permit Application. Flow from this seep is directed to a sump area in the southeast portion of the mine pit. The sump area is bermed to insure that no stormwater or water from other sources is mixed with water from the seep. Water in the sump area will either evaporate or infiltrate the subsurface immediately underneath the sump. This discharge qualifies for permit-by-rule under UAC R317-6-6.2A(6) as "natural ground water seeping or flowing into conventional mine workings which re-enters the ground by natural gravity flow prior to pumping or transporting out of the mine and without being used in any mining or metallurgical process".

Ground Water Quality

Three monitoring wells were installed at the mine site in 2005 as part of a due diligence investigation. These well locations are shown in Figure 2 of CAR's Ground Water Discharge Permit Application. Ground water analytical results from 2005, 2008, 2009, and 2012 indicate heavier, less mobile hydrocarbons that would be expected in naturally occurring oil sands, but low or non-detect concentrations of the lighter fractions that would be used for solvents or remain as residual in tailings from a solvent extraction process. The highest hydrocarbon concentrations were in well MW-1, which had 27.0 mg/l total petroleum hydrocarbons diesel range organics, and 15.1 mg/l oil & grease. Total dissolved solids concentrations ranges from 3,700 to 6,000 mg/l. Based on this information, ground water at the mine site is Class III Limited Use Ground Water.

Ground water conditions are variable across the mine site. Monitoring well MW-3, which is located at the highest topographic elevation, has a static water level at 2.2 feet below ground surface. Monitoring well MW-2, which is located at an intermediate elevation, was drilled to a total depth of 31.6 feet and has been dry since at least 2008. Monitoring well MW-1, which is located at the lowest elevation of the three wells, is a flowing well.

CAR will continue to monitor ground water semi-annually as long as the monitoring wells are not overtaken by mining. Analytical results will be submitted to DWQ for review.

Discharge Control

The only potential discharges to ground water would be draindown of pore water from the tailings or leachate from precipitation falling on the tailings. No organic solvents will be used to process the oil sands; only hot water will be used in the process. The tailings will contain an estimated 0.5% of asphaltine components that did not separate out during the extraction process. These represent the least soluble and mobile hydrocarbons that were contained in the unprocessed oil sands. The only additives to the tailings would be five to ten grams of flocculent per metric ton of solids, and if necessary, sodium hydroxide to neutralize pH. Therefore, no potential ground water contaminants will be introduced during the processing other than insignificant quantities of flocculent and sodium hydroxide. Potential ground water contaminants in the tailings will be limited to contaminants that were naturally present in the oil sands to begin with, and ground water at the site has apparently been affected by contact with the oil sands already.

Processed oil sand tailings will contain approximately 23% water by volume coming out of the plant. The tailings will drain down to 5 to 7% water on the conveyors between the plant and the locations where they will be deposited. The drain down water will be collected in sumps on the conveyors and recycled back into the process. Excess water in the process system will be stored in the water treatment plant which has a 60-foot diameter thickener tank and a 40-foot diameter clarifier tank. No ponds or lagoons will be used to store process water.

Tailings Analysis

After processed oil sand tailings have been produced by the pilot project, CAR will sample them and perform the following analyses on a Synthetic Precipitation Leaching Procedure (SPLP; EPA Method 1312) extract:

- Benzene, toluene, ethylbenzene, xylenes, and naphthalene (BTEXN; EPA Method 8021B/8260B),
- Total petroleum hydrocarbons diesel range organics; (TPH-DRO; EPA Method 8015B/3545),
- Total recoverable petroleum hydrocarbons (TRPH; EPA Method1664-SGT),
- Volatile organic compounds (VOCs; EPA GC/MS Method 8260B),

- Semi-VOCs (EPA Method 8270C/3510C) including polycyclic aromatic hydrocarbons,
- Oil & Grease (EPA Method 1664A), and
- Total dissolved solids (TDS; EPA Method 160.1).

Laboratory minimum detection limits must be equal to or less than Utah Ground Water Quality Standards or other applicable standards to enable meaningful comparisons with the laboratory analytical results. Analytical results will be reported to DWQ, and upon review and approval, tailings may be placed back in the mine excavation. Proposals for any other use of tailings will require review and approval from DWQ.

Permit-By-Rule Determination

Below are relevant factors for determining whether the proposed project will have a de minimis effect on ground water quality:

1. Based on site-specific data, ground water quality at the site is classified as Class III Limited Use Ground Water.
2. The only potential discharges to ground water will be pore water from the processed oil sand tailings.
3. The bitumen extraction process will only use hot water and no organic solvents.
4. Tailings will drain down to 5 to 7% water on the conveyors between the plant and the locations where they will be deposited.
5. Initially, tailings will be stored in an asphalt-lined repository.
6. Once the process has been optimized, tailings will be analyzed by SPLP to determine if tailings can be mixed with overburden and returned to the mine pit.
7. The tailings will have less hydrocarbons than the naturally occurring oil sands prior to processing.
8. The tailings will contain an estimated 0.5% of asphaltine components, which are the least soluble and least mobile hydrocarbons in the oil sands.

Considering the factors described above, the proposed oil sands mining, processing, and tailings disposal should have a *de minimis* potential effect on ground water quality and qualifies for ground water discharge permit-by-rule under UAC R317-6-6.2.A(25). If any of these factors change because of changes to the operation, from additional knowledge of site conditions, or in scaling up from the pilot phase to the production phase of the operation, CAR must inform DWQ of the changes. If future project knowledge or experience indicates that ground water quality is threatened by this operation, the Director may require CAR to obtain a ground water permit in accordance with UAC R317-6-6.2.C. In this case, CAR may be required to supply additional information to supplement the current ground water discharge permit application.