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STATEMENT OF BASIS

GROUND WATER DISCHARGE PERMIT NO. UGW 470004

MCW Energy Group
Bitumen Extraction Processing and Tailings Disposal
Uintah County, Utah

Description of Facilities

The MCW Energy Group facilities in Uintah County consist of two sites (Figure 1):

1) Near Maeser, a tar sands processing facility located in the Northwest Asphalt Ridge area of Uintah County, Utah. The Maeser site is located in the NW ¼ of Section 24, Township 4 South, Range 20 East, Salt Lake Base and Meridian (SLB&M); and
2) The Temple Mountain mine site is located in the SW1/4 and the W1/2 of the SE1/4, Section 31, Township 5 S, Range 22 E, SLB&M, and in the E1/2 of the SE1/4, Section 36, Township 5 S, Range 21 E, SLB&M.

MCW Energy plans to truck tar sands from stockpiles of previously mined ore at the Temple Mountain Energy mine site for processing at the facility near Maeser. Processing at the Maeser facility will remove hydrocarbons using a solvent where bitumen will be extracted from the oil sands ore using combinations of hydrocarbon-based solvents with high vapor pressures and low specific gravities. Because these solvents are less dense than water, they would act as light non-aqueous phase liquids if released into aquifers or surface water. The solvents are proprietary at this time and will not be identified in public documents, but have been disclosed to the Division of Water Quality (DWQ). Tailings from the process will be trucked back to the Temple Mountain Energy mine site for disposal in the lined, monitored and permitted facility covered under Permit No. UGW 470004. In the future, processing may be moved to the Temple Mountain mine site, however in this event the Maeser site will continue to be used for further process testing and development.

Maeser Processing Facility

Permitting

The Maeser processing facility has previously been reviewed for permitting in accordance with R317-6. DWQ received a permit application on October 12, 2011 from the MCW group and on January 26, 2012, following a 30 day public comment period, DWQ issued a Permit-by-Rule (PBR) and *de mininmis* determination for this site. Although additional construction of containment pads is occurring at the Maeser facility and DWQ is concurrently issuing a construction permit for these pads, the site still qualifies for and is covered under the previously issued PBR.

Approved construction for the Maeser site, as specified in the construction permit contained in Part I of the ground water discharge permit (No. UGW470004), consists of two separate pads: 1) An Ore Stockpile Pad and 2) A Tailings Holding Pad for the processed tar sands. Both pads will be constructed with a liner that is 1 foot of clay with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec and six inches of native asphalt over the compacted clay. The pads are 65'x 65' and are designed for temporary storage. As described previously, ore will be trucked from the mine site to the processing facility and placed on the Ore Stockpile Pad. The ore is then processed and the sands placed onto the Tailings Holding Pad. The processed sands will then be hauled back to the mine site for permanent storage and mine reclamation.

Processing Description

During the first stage of the bitumen extraction process, crushed oil sands ore is premixed with MCW's solvent in a mixing vessel located at the top of the facility tower. The resultant slurry then passes vertically downward through a pug mill that further crushes any clumps of oil sands ore allowing greater contact area between the solvent and the oil sands which helps make the recovery operation more efficient. The slurry is then fed into the primary oil recovery vessel at the base of the facility tower, where more solvent is added to the slurry and the majority of the bitumen is recovered from the oil sands. The slurry is then pumped into a pseudo-boiling layer fluidized bed extraction column. The solids (mainly sand and clay) settle to the bottom of the extraction column while the solvent/bitumen mixture leaves the top of the extraction column and is deposited into a surge tank. The solvent/bitumen mixture is then pumped from the surge tank back into the mixing vessel, where it recovers more bitumen from the oil sands that are continuously being fed into it. This process of pumping the solvent/bitumen mixture from the surge tank to the mixing tank, then to the extraction column and finally back to the surge tank is repeated multiple times until the API of the solvent/bitumen mixture is lowered to meets the product's desired specification. This process produces oil with a "light-sweet" API classification that is composed of a mixture of the heavy oils found in the oil sands and the light hydrocarbons found in the solvent.

If further reduction of the API of this oil product is required, the solvent/bitumen mixture is pumped from the surge tank to the distillation column. The solvent/bitumen mixture is heated and the light hydrocarbon and alcohol solvent is separated from the bitumen by distillation. The distillation process is designed to allow some of the lighter hydrocarbons in the solvent to remain in the solvent/bitumen mixture in order to give the customer oil with the specific API to meet their needs. This can range from light API oil ($>31.1^o$) medium API oil (22.3^o – 31.1^o), to heavy API oil ($<22.3^o$), depending upon the needs of the end user (purchaser). After separating the solvents from the oil, the oil is pumped into the onsite storage tanks and/or delivery trucks and shipped to the customer. All the solvent vapors produced by the distillation process are collected and then condensed in a chiller and returned to the closed-loop system where they are used to recover more bitumen from incoming oil sands ore. No water will be used in the bitumen extraction process.

During the final stage of the operation, the processed sand is transferred from the extraction column into the drying vessel to begin the drying process. The sand is heated by steam lines within the drying vessel in order to vaporize any remaining solvent in the sand. The vaporized solvent is recovered from the drying vessel, condensed in the chiller and recycled in the closed loop system. Over 99% of the solvent is recovered and recycled from the processed sand. Any water that was originally contained in the ore is removed at this point and used for steam generation. The processed sand can then be sold as a construction aggregate or used in mine remediation.

Dry analysis of processed sand from MCW's pilot project showed detectable levels of Total Petroleum Hydrocarbons Diesel Range Organics (TPH-DRO), TPH Gasoline Range Organics (TPH-GRO), C9 & C10 Alkyl Benzenes and Toluene. (Table 7, Processed Sand Storage and Monitoring Program for the Temple Mountain Mine Site, MCW Energy Ground Water Discharge Permit Application) Of these parameters, TPH-GRO and Toluene are significantly below the risk-based Initial Screening Levels (ISLs) used by the DEQ Division of Response and Remediation (DERR), TPH-DRO is higher than the ISLs, and there is no standard for C9 & C10 Alkyl Benzenes. All three parameters are lower than DERR's Tier 1 Screening Criteria.

Containment Technology

In addition to the *de minimis* determination for the previously issued PBR at the Maeser facility, further minimization of any potential for contamination is based on total containment of potential ground water contaminants and therefore any discharge to waters of the state. These additional control and containment features include:

1) Solvents will be trucked to the site and stored in aboveground tanks with secondary containment;
2) Any spills will be managed under a Spill Prevention, Control, and Countermeasure Plan;
3) Oil sands ore will arrive at the site after being trucked from the mine site, and should not be free-draining;
4) Process solvents and bitumen will be removed from processed sand by a centrifuge and the processed sand should not contain levels of any liquids that will be free-draining; under these conditions, contaminants could only be mobilized by addition of moisture from precipitation;
5) Both unprocessed oil sands ore and process sand tailings will be temporarily stored on lined storage pads constructed in accordance with this permit, in order to prevent discharge of contaminants to the subsurface;
6) The pads will be built with berms to prevent discharge of contaminants to surface water;
7) Because ore and tailings will be continuously placed on and removed from the pads, inspection and maintenance to insure liner integrity will be possible, and a program for inspection and maintenance will be required;
8) In the dry climate at the Maeser site, there should be little or no hydraulic head on the pad liners to drive water and dissolved contaminants through them.

There are no perennial streams near the Maeser site.

Temple Mountain Mine Site

<u>Hydrogeology</u>

Climate at the Temple Mountain mine site is dry and is representative of a true desert, i.e. less than 10 inches of precipitation annually; average annual precipitation at nearby Vernal, at a slightly higher elevation, was 8.42 inches for the period from 1894 to 2010 (Page 14-Project Background, Geology, Hydrology and Project Description; Temple Mountain Mine GW Permit Application).

Asphalt Ridge is a northwest-trending escarpment of the Oligocene Duchesne River Formation which overlies older strata in an angular unconformity. The Duchesne River and older formations dip to the southwest. At the Temple Mountain Energy mine site, the Duchesne River lies on top of the Cretaceous Mesaverde Group. The Duchesne River Formation is a fluvial facies which consists of fine to medium-grained sandstone and siltstone with minor amounts of mudstone and conglomerate. The underlying upper unit of the Mesaverde Group consists of fine-grained sandstone with carbonaceous shale and coal. The upper member of the Mesaverde Group dips 16 to 22 degrees to the southwest in the project area; the Duchesne River Formation also dips to the southwest but at a lower angle because it was deposited on an erosional surface developed on the already-dipping underlying strata. Many sandstones and conglomerates in both formations are impregnated with bitumen, which is heavy hydrocarbon compounds remaining from an ancient oil reservoir that was unroofed by erosion, allowing lighter, more volatile hydrocarbons to escape or oxidize.

Two series of core holes were drilled in the mine area in 1957 and 1975. The 1957 cores ranged in depth from 210 feet to 441 feet below ground surface (bgs). The maximum depth of the 1975 cores was 173 feet bgs. Of these 17 drill holes, only four encountered intervals that were described as "water wet" in the logs. (Table 3, Appendix D of MCW Energy ground water discharge permit application). Hole CF-1, drilled in 1957, encountered 9 intervals described as "water wet". The maximum thickness of continuous saturated intervals, with less than 10 feet separating the saturated intervals, was 58 feet, beginning below 215 feet bgs, the greatest of the 17 holes drilled in 1957 and 1975. This hole is located approximately ¼ mile south of present and planned mine workings. To further evaluate ground water conditions, in October 2015 a new hole was drilled using air rotary at a location approximately 100 feet east of CF-1, to a total depth of 275 feet bgs. No "water wet" intervals were observed in this hole, though they would have been readily apparent because of the air rotary drilling method. These drill holes encountered conglomerate, sandstone and shale strata, and many of the conglomerate and sandstone strata contained bitumen. All these drill holes were completed in the Duchesne River Formation, except for hole CG-1, located approximately ¼ mile east and up-dip from the mine site, which penetrated the Mesaverde Group at 214 feet bgs.

A stream that is perennial or almost perennial (containing water most of the year) is located immediately east of the past and planned mine operations. The mine pit has been excavated to within 20 linear feet of the stream bed and 40 feet below the stream channel elevation. During mining no seepage of water from the stream was observed in the pit high wall. This illustrates the low permeability of the bedrock (shales and oil sands) at the mine site. In addition, water in the stream is of natural poor quality with low pH, which was measured by DWQ in 2008 at 3.13 (TME mine stream pH report), and with cadmium levels above ground water standards. If any saturated zones exist that are recharged by this stream, they would have Class III ground water at best.

Ground Water Quality

No ground water was encountered in the October, 2015 drill hole within 275 feet of the ground surface, despite "water wet" intervals described in the log of a hole drilled 100 feet to the west in 1957. This location had the best known probability of encountering ground water on the Temple Mountain mine site. Accordingly, this permit will not formally define ground water quality or ground water class. Protection of ground water quality will be assured by a combination of site characteristics, waste characteristics and engineered control structures, and monitoring for leachate discharge to the subsurface.

Best Available Technology (BAT)

Ground water quality will be protected by engineered containment structures appropriate for the nature of the waste and the site conditions, constructed according to the plans and specifications approved in Part I of this permit. The sand tailings will have very low moisture content with trace levels of residual solvents and hydrocarbons. Under these conditions, Best Available Technology for this permit will include:

- Berm just west of the stream. Construction of a berm between the mine and the stream that is to the east of the mine. On the northern portion of the property the stream is at a higher elevation than the mine so in this area the berm will protect the mine from receiving water from the stream during major storm events. In the southern portion of the property where the stream is at a lower elevation than the mine, the berm will protect the stream from receiving any sediment that may be washed in that direction.
- Construction of a Staging Area Pad. This is the same design as the Stock Pile Retention Pad at the Maeser Facility. This pad is located at the top of the hill just directly east of the mine and the processed tar sands will then be pushed into the mine for reclamation.
- Additional processed sands storage. There is a flat area directly north of the Former Work Facility that may be used for temporary storage of processed sands. This area currently has approximately 15 feet of oil sands ore. The processed sands will ultimately be placed back into the mine for reclamation and the underlying ore will be processed.
- Collection Lysimeter. Before placement of the reclamation liner a concrete collection lysimeter will be constructed for long term water/leachate monitoring.

- Reclamation Liner. Before placement of processed sands a reclamation liner shall be constructed identical to the liner constructed over the lysimeter. This includes a 1 foot clay liner with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec and six inches of native asphalt over the compacted clay. The portion of this liner that overlies the collection lysimeter shall be identical in construction to the rest of the liner at the site.
- Reclamation Cap. An evapotranspiration cap will be placed over the processed sands during mine reclamation. This cap is designed with various layers including a gas vent layer, an hydraulic barrier layer with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec, a 40 mil HDPE flexible membrane liner, and a vegetative soil layer. The gas vent layer will have horizontal perforated pipe placed into the aggregate that will collect any volatile hydrocarbons and conduct that to a vertical pipe that carries the gas through the other layers for venting of the waste sands.

<u>Residual Contaminant Evaluation</u>

To evaluate the potential for contaminants to leach from the processed sand into precipitation that may come into contact with it, samples were subjected to a Synthetic Precipitation Leaching Procedure (SPLP) extraction and the resulting water analyzed for dissolved contaminants. Results are reported in Table 5 of Processed Sand Storage and Monitoring Program for the Temple Mountain Mine Site from the MCW Energy Ground Water Discharge Permit Application. This is a laboratory method where 200 g of a sample is stirred in 1 liter of deionized water with pH adjusted to simulate precipitation at the site's location. While this method cannot predict the exact concentrations of leachate generated under actual field conditions, it does identify leachable contaminants in the sample and gives a standardized measure of their abundance in the sample.

The SPLP extract sample showed detectable levels of Total Organic Carbon, TPH-DRO, TPH-GRO, C5 & C6 aliphatic hydrocarbons, C9 & C10 alkyl benzenes, ethylbenzene, naphthalene, toluene and total xylenes. With the exception of Total Organic Carbon, these contaminants were present at only trace levels (below 1 mg/l) in the SPLP extract.

In a cleanup of spilled petroleum products, soil contaminated with petroleum compounds at levels below the two sets of standards may be left in place with little or no risk to human health and the environment. The Tier 1 criteria may be used in situations where there are fewer exposure pathways; the only reason they would not apply to the Temple Mountain site is because parts of the planned tailings disposal area may be closer than 500 feet to a stream that runs through the property; water quality in this stream, and any ground water that may be recharged from it, is discussed with the hydrogeology of the Temple Mountain site.

<u>Potential Impacts to Ground Water</u>

Potential impacts to ground water have been minimized primarily by the site conditions, which include a dry climate, bedrock consisting mainly of low-permeability shales and bitumen-impregnated sandstone, and lack of evidence for zones of ground water saturation in the upper subsurface. In addition, the sand tailings will be stored on a lined pad before their final disposal in a lined and capped landfill structure that allows for venting of volatile compounds. If a tar sands processing operation is started at the Temple Mountain mine site, the permittee shall notify DWQ so that the operation can be evaluated for potential impact to waters of the state, and appropriate regulatory measures taken.

References

1. 2016 MCW Energy Ground Water Discharge Permit Application for Maeser and Temple Mountain Mine Facility: DWQ-2016-009342 and DWQ-2016-009343.
2. DWQ Monitoring Section Temple Mountain 2008 Mine Stream Report: DWQ-2016-009161.
3. January 26, 2012 Permit-by-Rule Determination for tar sands processing facility near Maeser:

DWQ-2012-006241.

4. Public Notice of PBR for MCW Group processing facility: DWQ-2011-010641.
5. 2011 MCW GW Permit Application for Maser Facility: DWQ-2011-010642.

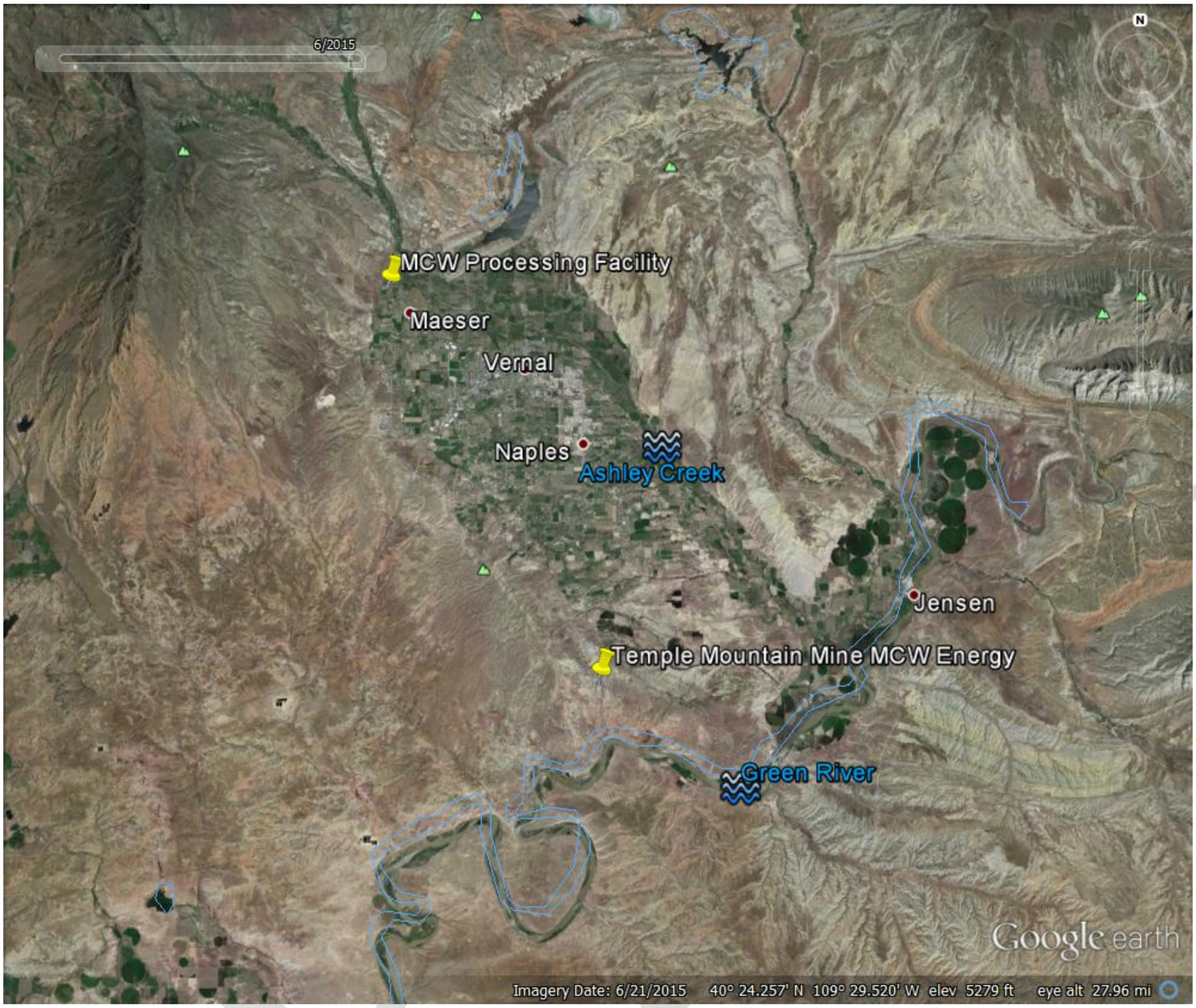

Figure 1. MCW Group Facility Location Map Uintah County, Utah.