ATTACHMENT 7

LONG-TERM MONITORING PLAN FOR WATER RESOURCES

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Long-Term Monitoring Plan for Water Resources

Introduction

In response to public comments received on the WTP DEIS, the BLM developed a long-term monitoring plan (monitoring plan) for water resources.

The overall objective of the monitoring plan is to document changes in water quality and quantity that could potentially occur to WTP Project Area streams, (e.g., Nine Mile Creek, Jack Creek), the Green River, groundwater, and springs over the life of the project (LOP). Potential impacts to water quality include:

- contamination of surface water and groundwater by accidental spills of fuels, lubricants, frac fluid, and produced petroleum products;
- increased sedimentation and turbidity of surface waters, which could lead to increased temperatures in Nine Mile Creek and further impairment of the beneficial use class 3A for cold water aquatic life; and
- decreased flows from springs near and hydraulically downgradient from development areas due to interception of groundwater by drilling operations.

Implementation of this plan will provide information which will allow the BLM to identify, evaluate, document, and monitor direct, indirect, and cumulative impacts to water resources. This plan will also provide the BLM with the tools necessary to determine appropriate mitigation measures. The plan will be funded by the project operators and implemented by a third-party contractor approved by the BLM.

Summary of Baseline Water Quality Data for the WTP Project Area

The WTP FEIS includes available baseline water quality data for surface water, shallow groundwater, and springs in the WTP Project Area. Baseline surface water quality data has been collected at four locations on Nine Mile Creek, two locations in Cottonwood Canyon, and one location on Jack Creek at the confluence with the Green River. In addition, the USGS and the State of Utah provide regular monitoring of the Green River downstream from the WTP Project Area. No baseline data is available for streams in Harmon Canyon, Dry Canyon, or Prickly Pear Canyon.

The baseline data collected are limited to general water quality parameters (e.g., pH, temperature, conductivity, alkalinity, hardness, total dissolved solids [TDS], dissolved oxygen [DO], turbidity, and total suspended solids [TSS]); major anions (e.g., bicarbonate, chloride, sulfate, nitrate plus nitrite, total phosphorus, ammonia; major cations (e.g., calcium, magnesium, sodium, and potassium); and trace metals (e.g., aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver, and zinc). Analyses of petroleum constituents (e.g., benzene, toluene, ethylbenzene, xylenes, methane, and hydrogen sulfide) have not been performed. Small amounts of these parameters, especially methane and hydrogen sulfide, may be naturally present in surface waters of the area.

Flow measurements were made at one USGS gauging station located on Nine Mile Creek at Nutters Ranch during the period July 1947 to September 1955. Flow was also estimated on

several occasions in conjunction with water quality sampling at the four Utah STORET monitoring stations located on Nine Mile Creek, Jack Creek, Trail Creek, and Cottonwood Canyon.

Baseline water quality data for shallow groundwater in the WTP Project Area is limited to a few samples collected from alluvial wells along Nine Mile Creek. These samples were generally analyzed for the parameters listed above for surface water. Analyses of petroleum constituents were not conducted.

Baseline water quality data for springs in the area are limited to a few measurements of pH, temperature, conductivity, and discharge made in conjunction with the spring and seep survey conducted in August 2008.

Monitoring Site Selection, Types of Monitoring and Protocols, and Monitoring Frequency

Surface Water Monitoring

Long-term monitoring of surface water quality would be conducted at the five existing Utah STORET surface water quality locations listed in **Table 1**.

Table 1. Long-Term Surface Water Quality Monitoring Stations at Existing STORET Sites

STORET Name and Number	Location
Cottonwood Canyon, Utah STORET 4933280	Main stem of Cottonwood Canyon
Jack Creek, Utah STORET 4933250	At mouth of Jack Creek
Nine Mile Creek, Utah STORET 4933330	Below South Franks Canyon
Nine Mile Creek, Utah STORET 4933288	Below Dry Canyon
Nine Mile Creek, Utah STORET 4933310	At mouth of Nine Mile Creek

In addition to the five existing stations, five new surface water quality monitoring stations will be established. The five new stations are:

- In lower Harmon Canyon above the confluence with Nine Mile Creek
- In lower Dry Canyon above the confluence with Nine Mile Creek
- In lower Prickly Pear Canyon above the confluence with Nine Mile Creek
- In lower Cottonwood Canyon above the confluence with Nine Mile Creek
- On Jack Creek below Indian Spring

The proposed sites on Harmon, Dry, Prickly Pear, and Cottonwood Canyons would be located just above the confluence with Nine Mile Creek. The proposed site on Jack Creek would be located near the top of the drainage. These additional monitoring sites will provide more complete coverage of the streams that drain development areas within the WTP Project Area.

At each surface water monitoring site, field parameters would be measured, and a sample collected for analysis of the parameters listed in **Table 2**. For all parameters, the detection limit for each individual analysis will be reported in a database. The inclusion of detection

limits will allow for the accurate calculation of mean concentrations for parameters with large numbers of non-detect values.

Table 2. Parameters for Long-Term Surface Water Monitoring			
Field and General Water Quality Parameters	**Major Cations and Anions**	**Trace Metals**	**Organic Constituents**
Total Alkalinity	Ammonia	Aluminum	Benzene
Temperature	Bicarbonate	Arsenic	Toluene
Specific Conductance	Calcium	Barium	Ethylbenzene
pH	Carbonate	Boron	Xylenes
Dissolved Oxygen	Chloride	Cadmium	Methane and isotopes of methane[1]
Turbidity	Magnesium	Chromium	Hydrogen Sulfide
Dissolved Hardness	Nitrate + Nitrite, total	Copper	Volatile Organic Compounds
Total Dissolved Solids	Phosphorus, total	Iron	Total petroleum hydrocarbons – diesel range
Total Suspended Solids	Potassium	Lead	
	Sodium	Manganese	
	Sulfate	Mercury	
		Nickel	
		Selenium	
		Silver	
		Zinc	

[1]Isotopes of methane will be analyzed if methane is detected

Samples would be collected on a quarterly basis (4 times per year) at each site over the LOP. Flows at each site will be directly measured (not estimated) using one of the following methods:

- Container and stopwatch
- Price AA or Pygmy meter
- Portable cutthroat flume
- Permanent Parshall flume

Direct measurement of flows at each site will improve the understanding of hydrologic conditions in the WTP Project Area and allow for the development of loading calculations.

Spring Monitoring

Long-term monitoring of the water quality at selected springs will be conducted at the six springs listed in **Table 3**.

The springs selected showed significant flow during the August 2008 spring survey and are located downgradient of proposed development areas.

Table 3. Long-Term Spring Monitoring Locations	
Spring Name and Number	**Location**
Unnamed Spring 1	Prickly Pear Mesa below Compressor station
Unnamed Spring 2	Cottonwood Canyon
Unnamed Spring 7	Harmon Canyon
Unnamed Spring 8	Prickly Pear Mesa
Unnamed Spring 11	Head of Jack Creek
Indian Spring	Head of Jack Creek

At each spring monitoring location, field parameters will be measured, flows would be measured or estimated, and a sample collected for analysis of the parameters listed in **Table 4**. For all parameters, the detection limit for each individual analysis will be reported in a database. The inclusion of detection limits will allow for the accurate calculation of mean concentrations for parameters with large numbers of non-detect values. Samples will be collected on a quarterly basis (4 times per year) at each spring over the LOP.

Table 4. Parameters for Long-Term Spring Monitoring			
Field and General Water Quality Parameters	**Major Cations and Anions**	**Trace Metals**	**Organic Constituents**
Total Alkalinity	Ammonia	Aluminum	Benzene
Temperature	Bicarbonate	Arsenic	Toluene
Specific Conductance	Calcium	Barium	Ethylbenzene
pH	Carbonate	Boron	Xylenes
Dissolved Oxygen	Chloride	Cadmium	Methane and isotopes of methane[1]
Total Dissolved Solids	Magnesium	Chromium	Hydrogen Sulfide
Dissolved Hardness	Nitrate + Nitrite, total	Copper	Volatile Organic Compounds
	Phosphorus, total	Iron	Total petroleum hydrocarbons – diesel range
	Potassium	Lead	
	Sodium	Manganese	
	Sulfate	Mercury	
		Nickel	
		Selenium	
		Silver	
		Zinc	

[1]Isotopes of methane will be analyzed if methane is detected

Flows at spring locations would be measured using the above-mentioned methods.

Groundwater Monitoring

Long-term monitoring of groundwater quality will be conducted at the existing bedrock wells listed in **Table 5**.

Three existing water supply wells will be monitored to provide water quality information for bedrock aquifers in the proposed development areas. In addition, wells completed in the alluvium along Nine Mile Creek will be monitored to provide early detection of adverse changes to the shallow groundwater that could potentially be caused by spills or infiltration of chemicals used for dust suppression. The wells to be monitored will be selected by the BLM in consultation with landowners along Nine Mile Creek.

Table 5. Long-Term Deep Groundwater Monitoring Locations	
	Location
Water supply well 1	Prickly Pear Mesa
Water supply well 2	Flat Iron Mesa
Water supply well 3	Cottonwood Canyon

At each groundwater monitoring location, field parameters would be measured, and a sample collected for analysis of the parameters listed in **Table 6**. For all parameters, the detection limit for each individual analysis will be reported in the database. The inclusion of detection limits will allow for the accurate calculation of mean concentrations for parameters with large numbers of non-detect values. Samples would be collected on a quarterly basis (4 times per year) at each groundwater monitoring location over the LOP.

Table 6. Parameters for Long-Term Shallow Groundwater Monitoring			
Field and General Water Quality Parameters	**Major Cations and Anions**	**Trace Metals**	**Organic Constituents**
Total Alkalinity	Ammonia	Aluminum	Benzene
Temperature	Bicarbonate	Arsenic	Toluene
Specific Conductance	Calcium	Barium	Ethylbenzene
pH	Carbonate	Boron	Xylenes
Dissolved Oxygen	Chloride	Cadmium	Methane and isotopes of methane[1]
Total Dissolved Solids	Magnesium	Chromium	Hydrogen Sulfide
Dissolved Hardness	Nitrate + Nitrite, total	Copper	Volatile Organic Compounds
	Phosphorus, total	Iron	Total petroleum hydrocarbons – diesel range
	Potassium	Lead	
	Sodium	Manganese	
	Sulfate	Mercury	
		Nickel	
		Selenium	
		Silver	
		Zinc	

[1]Isotopes of methane will be analyzed if methane is detected

Reporting Obligations and Plan Review

All water resources monitoring will be conducted under the supervision of a qualified hydrologist. Quarterly monitoring results will be entered into a database that is delivered to

the BLM Price Field Office and also sent to the State of Utah for inclusion in the EPA STORET system. In addition, an annual monitoring report will be prepared by the contractor responsible for monitoring activities. At a minimum this report will contain a description of the monitoring results that identifies, by location, observed trends in water quality, any identified impacts to water quality or flow conditions, recommendations for changes in the long-term monitoring program, and recommendations for mitigation measures to reduce any impacts observed.

The contractor responsible for implementation of the plan may recommend changes to the plan based on the data collected, the locations of active project construction, and other project variables. These changes could include relocation, addition, or elimination of monitoring locations, addition or elimination of monitoring parameters, and reduction of monitoring frequency. All recommended changes with an explanation for the requested change will be submitted to and approved by the BLM prior to implementation.

In addition to the annual reports, every five years a cumulative assessment of the previous five years of monitoring results will be compiled. A final report will also be completed at the conclusion of the project which summarizes the entire monitoring program and includes a final assessment of all sites monitored throughout the LOP. All monitoring reports will be submitted to the BLM and would be made available to the public.

Mitigation

Monitoring serves to identify the range, intensity, and effects of impacts directly or indirectly related to development, but in itself does nothing to alleviate or mitigate potential impacts. Where the monitoring results in the identification of impacts, the following options will be considered for each type of impact:

Increased Sedimentation

- Review of the best management practices used for road, well pad, and pipeline construction to reduce sediment delivery to area streams
- The use of additional sediment and erosion controls at well pads and along access roads
- Paving of critical portions of roads
- Relocation of proposed well pads, roads, and pipelines to avoid erosion-prone areas including canyon rims and at least 330 feet of ephemeral stream channels

Increased Anion and Metals Concentrations

- Review of the dust suppression program, including the types of chemical agents used
- Review of the best management practices used for road, well pad, and pipeline construction to reduce sediment delivery to area streams
- The use of additional sediment and erosion controls at well pads and along access roads
- Paving of critical portions of roads
- Relocation of proposed well pads, roads, and pipelines to avoid erosion-prone areas including canyon rims and at least 330 feet of ephemeral stream channels

Contamination with Petroleum Constituents

- Review of the cementing program for well completion, including audits of cement bond records for wells near the impacted streams
- Conduct inspections of well pad facilities that may be leaking, including storage tanks, above-ground piping, and process units
- Require complete remediation of any observed spills or leaks encountered during the well inspections
- Review truck loading procedures for produced water and petroleum products
- Require that all storage tank batteries be lined with impermeable plastic

Reduction of Spring Flows

- Review of the cementing program for well completion, including review of cement bond logs for wells drilled near the impacted springs
- Evaluate the effects of water supply wells on spring flows
- Require mitigation be made to users of impacted springs