ATTACHMENT 4. LONG-TERM MONITORING PLAN FOR WATER RESOURCES

4. LONG-TERM MONITORING PLAN FOR WATER RESOURCES

4.1. INTRODUCTION

In response to public comments received on the Gasco Energy Inc. Uinta Basin Natural Gas Development Project Draft Environmental Impact Statement (EIS), the Bureau of Land Management (BLM) developed this long-term monitoring plan (monitoring plan) for water resources. This plan would be implemented as a joint effort between Gasco and BLM because some of the monitoring sites are already being monitored under the *West Tavaputs Plateau Natural Gas Full Field Development Plan EIS and Record of Decision* (BLM 2010a).

4.1.1. MONITORING OBJECTIVES

The overall objective of the monitoring plan is to document changes in water quality and quantity that could occur to Gasco project area streams (e.g., Nine Mile Creek, Pariette Draw), the Green River, groundwater, and springs over the life of the project (LOP). Monitoring data and reports will be shared with the Utah Division of Oil Gas and Mining (DOGM), the Utah Division of Water Quality (UDWQ) Groundwater Protection Section, and the UDWQ Watershed Management Section.

To account for uncertainty associated with data available for the Gasco EIS, this monitoring plan is designed to detect any unanticipated impacts to water resources associated with the Gasco project. These unanticipated impacts are as follow:

- Contamination of surface water and/or groundwater by accidental spills of fuels, lubricants, fluid used for hydraulic fracturing, produced petroleum products, evaporation pond fluid leakage to groundwater or surface water, downhole impacts to groundwater or surface water, and leakage from reserve pits
- 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
- Increased sedimentation and turbidity of surface waters, which could contribute to impairments of the beneficial use class 4 for agricultural uses and class 3B for warm water aquatic life in Pariette Draw associated with selenium, boron, and salinity
- Decreased flows from springs near development areas due to interception of groundwater by drilling operations
- Changes in groundwater level in water supply wells near development area due to interception of groundwater by drilling operations

It should be noted that, as disclosed in the Gasco EIS, none of these impacts are expected to occur. As disclosed in the Gasco EIS, the best management practices and applicant committee measures that were incorporated into the analysis should mitigate the potential for impacts to water resources.

4.1.2. QUALITY ASSURANCE AND SAMPLING ANALYSIS PLANNING

The first step in the implementation of this plan will be to develop a comprehensive quality assurance project plan (QAPP), including a comprehensive sampling analysis plan (SAP). Gasco will fund a qualified hydrologist (hereafter referred to as the hydrologist) to develop the QAPP and SAP. The QAPP will be developed using Environmental Protection Agency (EPA) guidance (EPA 2001) and

will document the planning, implementation, and assessment procedures for the project, including sampling methods, laboratory procedures, data management and analysis, and reporting. The QAPP will ensure data quality meets the required formats and standards that are required to be incorporated into the current UDWQ database. This step is necessary to ensure that data collected provide reliable detection of impacts to water resources in or downstream of the project area. The QAPP will be prepared prior to any sampling collection, including baseline sampling, prior to commencement of the project. Implementation of this plan will provide information for 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 response and mitigation measures in the unlikely event of impacts to water resources. The QAPP will be reviewed by the BLM, EPA, and the State of Utah before being approved by the BLM.

Prior to commencement of the Gasco project, baseline data will be collected in accordance with the QAPP and SAP for all parameters listed in Tables 4-2, 4-4, and 4-6 for surface water, springs, and groundwater, respectively. Data will be collected from appropriate monitoring sites, as described in sections 4.3.1, 4.3.2, and 4.3.3.

4.2. SUMMARY OF EXISTING WATER QUALITY DATA FOR THE GASCO PROJECT AREA

The Gasco FEIS includes available existing water quality data for surface water and shallow groundwater in the project area. Surface water quality data have been collected for some parameters at two locations on Nine Mile Creek and three locations on Pariette Draw. In addition, the U.S. Geological Survey (USGS) and the State of Utah provide regular monitoring of the Green River downstream from the project area. No data are available for ephemeral streams in the project area.

The surface water data collected consist of the following parameters:

- Physical: pH, temperature, specific conductance, dissolved oxygen (DO), DO saturation, turbidity, salinity, and hardness
- Nutrients: Inorganic nitrogen (nitrate plus nitrite), total phosphorus, orthophosphate, ammonia, and Kjeldahl nitrogen
- Metals: Aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc
- Other: Alkalinity, bicarbonate, boron, calcium, carbonate, chemical oxygen demand, chloride, hydroxide, magnesium, sodium, potassium, sulfate, total organic carbon, total dissolved solids [TDS], and total suspended solids [TSS]

Analyses of petroleum constituents (e.g., benzene, toluene, ethylbenzene, xylenes, methane, and hydrogen sulfide) have not been previously performed for either surface or groundwater, and therefore there are currently no existing data to compare to future water quality data. Because there is existing oil and gas development in the area, any anomalies identified in future samples could not be directly related to the Gasco EIS project without sufficient baseline samples.

Flow measurements were made at four USGS continuous flow gaging stations located on Pariette Draw in the late 1970s and early 1980s. These include USGS gages 09307200, 09307290, 09307295, and 09307300. More recently, flow was measured on several occasions in conjunction with water quality sampling at the two Utah Storage and Retrieval (STORET) monitoring stations located on Pariette Draw.

Groundwater quality data have been collected for one shallow groundwater well (Gasco Well) in the Gasco project area, located in the Eight Mile Flat area (Section 29, Township 9 South, Range 18 East). The well is approximately 300 feet deep with a depth to groundwater of approximately 75 feet. The data collected are limited to general water quality parameters, including TDS, pH, major cations (calcium, magnesium, sodium), major anions (bicarbonate, sulfate, chloride), several trace metals (iron and manganese), and dissolved gasses (carbon dioxide, hydrogen sulfide).

4.3. MONITORING SITE SELECTION, TYPES OF MONITORING AND PROTOCOLS, AND MONITORING FREQUENCY

4.3.1. SURFACE WATER MONITORING

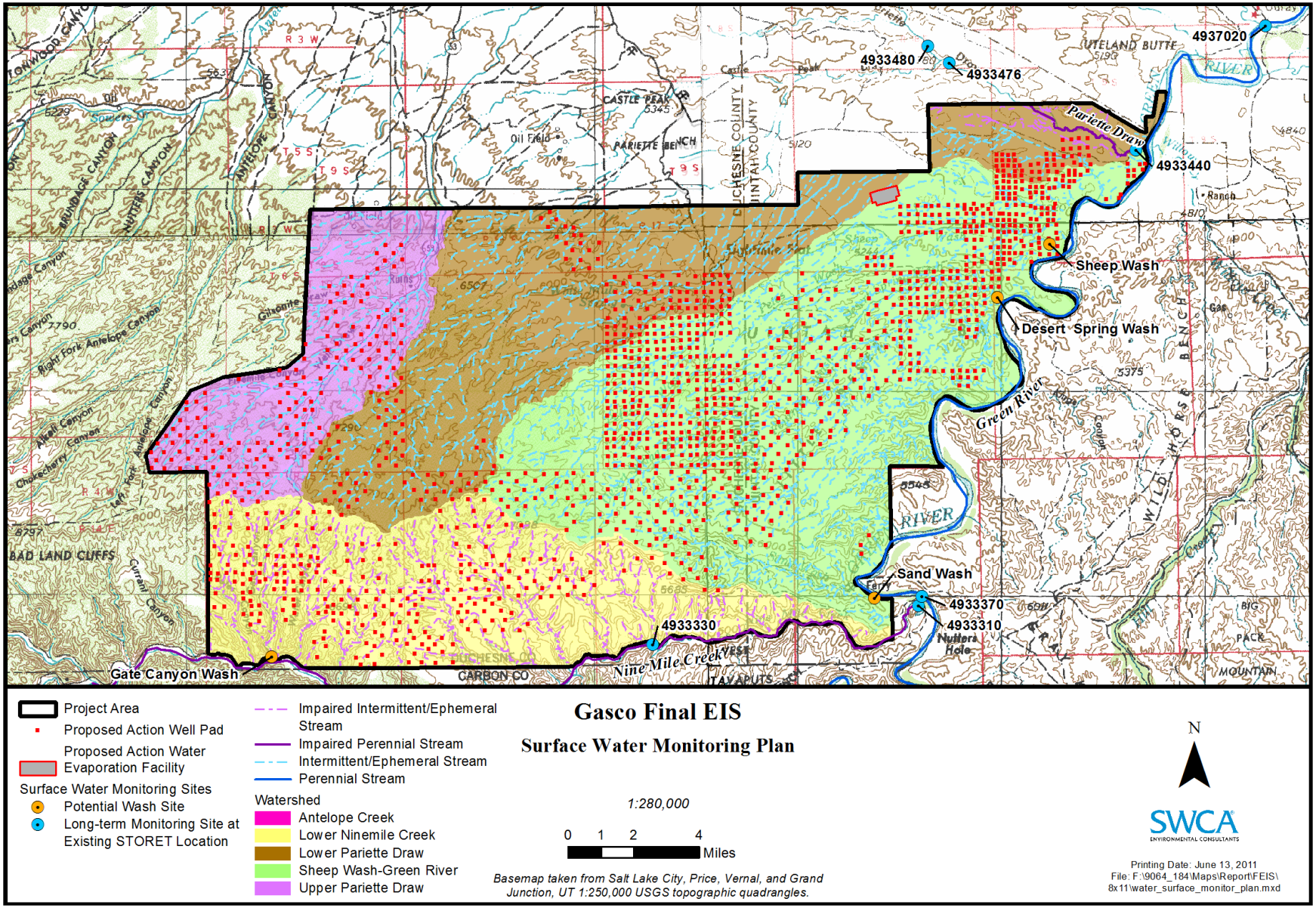
In addition to the existing data available for the project area, at least two but preferably three baseline surface water samples will be collected prior to commencement of the Gasco project. The baseline samples will include at least one sample collected under baseflow conditions, as defined in the QAPP. All surface water samples collected during the first year of sampling (including those collected after commencement of the Gasco project) will serve as the surface water quality baseline data against which potential impacts will be measured.

Long-term monitoring of surface water quality will be conducted at the five existing Utah STORET surface water quality locations listed in Table 4-1 and shown on Map 4-1. The two sites on Nine Mile Creek are already being monitored under Appendix Q in the FEIS West Tavaputs Plateau Natural Gas Full Field Development Plan (BLM 2010b). Data from those sites will be reviewed with additional data collected for this (Gasco) plan; however, no additional data beyond that collected for the West Tavaputs plan will be collected for the Gasco plan on Nine Mile Creek. Due to difficulties in testing the water quality of dry washes during storm events, a monitoring site on the Green River above (STORET 4937020) and below the project area (STORET 4933370) will be used to monitor any changes in water quality in the river below the project area. If possible, at least one storm event sample per year will be collected at four dry washes downstream of the project area: Sheep Wash, Desert Spring Wash, Sand Wash, and an unnamed wash draining to Nine Mile Creek from the project area (Map 4-1). If the BLM determines that monitoring dry washes is not feasible, the monitoring above and below the project area will be used to assess water quality contributions from the project.

Table 4-1. Long-term Surface Water Quality Monitoring Stations for the Gasco Long-term Water Resources Monitoring Plan

Water Body	STORET Number	Station Name
Pariette Draw	4933476	Below flood control (below Castle Peak Draw)
Pariette Draw	4933480	1/3 mile above flood control dam (P 1000)
Pariette Draw	4933440	1 mile above confluence with the Green River (P 2000)
Nine Mile Creek	4933330[1]	Below South Franks Canyon
Nine Mile Creek	4933310[1]	At mouth of Nine Mile Creek
Green River	4933370	Above confluence with Nine Mile Creek
Green River	4937020	Green River near Ouray

[1] These sites are already being monitored under the West Tavaputs Plateau EIS Long-Term Monitoring Plan for Water Resources (BLM 2010c). No new data will be collected under the Gasco monitoring plan; however, data will be shared between both plans for these two sites.



Map 4-1. Gasco FEIS map of sampling locations for surface water resources monitoring.

At each surface water monitoring site, field parameters will be measured, and a sample will be collected for analysis of the parameters listed in Table 4-2. For all parameters, the detection limit for each individual analysis will be reported in a database.

Table 4-2. Parameters for Long-term Surface Water Monitoring

Field and General Water Quality Parameters	Trace Metals	Other Inorganic Constituents	Organic Constituents
Total Alkalinity	Aluminum	Ammonia	Volatile organic compounds[1]
Temperature	Arsenic	Bicarbonate	Semi-volatile organic compounds[2]
Specific Conductance	Barium	Boron	Radionuclides
pH	Cadmium	Calcium	Total petroleum hydrocarbons[3]
DO	Chromium	Carbonate	–
Turbidity	Copper	Chloride	–
Dissolved Hardness	Iron	Magnesium	–
TDS	Lead	Nitrate + nitrite, total	–
TSS	Manganese	Phosphorus, total	–
Flow	Mercury	Potassium	–
–	Nickel	Sodium	–
–	Selenium	Sulfate	–
–	Silver	–	–
–	Zinc	–	–

[1] Volatile organic compounds will be analyzed using EPA Method 8260 or a fully equivalent standard method. Benzene will be analyzed at a detection limit of 1 microgram per liter or lower.

[2] Semi-volatile organic compounds will be analyzed using EPA Method 8270 or a fully equivalent standard method.

[3] Total petroleum hydrocarbons will include, at a minimum, analysis for diesel-range organics and gas-range organics.

Samples will be collected on a quarterly basis (one each in the winter, spring, summer, and fall), and one storm sample per year will be collected at each STORET site and the Green River site over the LOP. Storm events will be defined in the QAPP in terms of precipitation and/or flow. Flows at each site will be directly measured at the time each sample is collected. Depending on the magnitude of flow, measurements will be taken using the most appropriate method.

4.3.2. SPRING MONITORING

In addition to the existing data available for the project area, at least two but preferably three baseline spring water samples will be collected prior to commencement of the Gasco project. All spring water samples collected during the first year of sampling (including those collected after commencement of the Gasco project) will serve as the spring water quality baseline data against which potential impacts will be measured.

Long-term monitoring of water quality at selected springs will be conducted at the two springs listed in Table 4-3 and shown on Map 4-2. The springs selected are located in the project area and have water rights associated with stock watering.

Table 4-3. Long-term Spring Monitoring Locations

Spring Name and Number	Location	Water Rights Number
Deserts Spring	Section 18, Township 10 South, Range 18 East	47-1327
Unnamed Spring 1	Section 26, Township 11 South, Range 17 East	47-1119

At each spring monitoring location, field parameters will be measured, flows will be measured, and a sample will be collected for analysis of the parameters listed in Table 4-4. 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 (one each in the winter, spring, summer, and fall) at each spring over the LOP.

Flows at spring locations will be measured as near to the spring source as possible; measurement methods will be the same as those described under surface water. If flow is too low for these methods, alternative methods to measure or estimate flow may be considered.

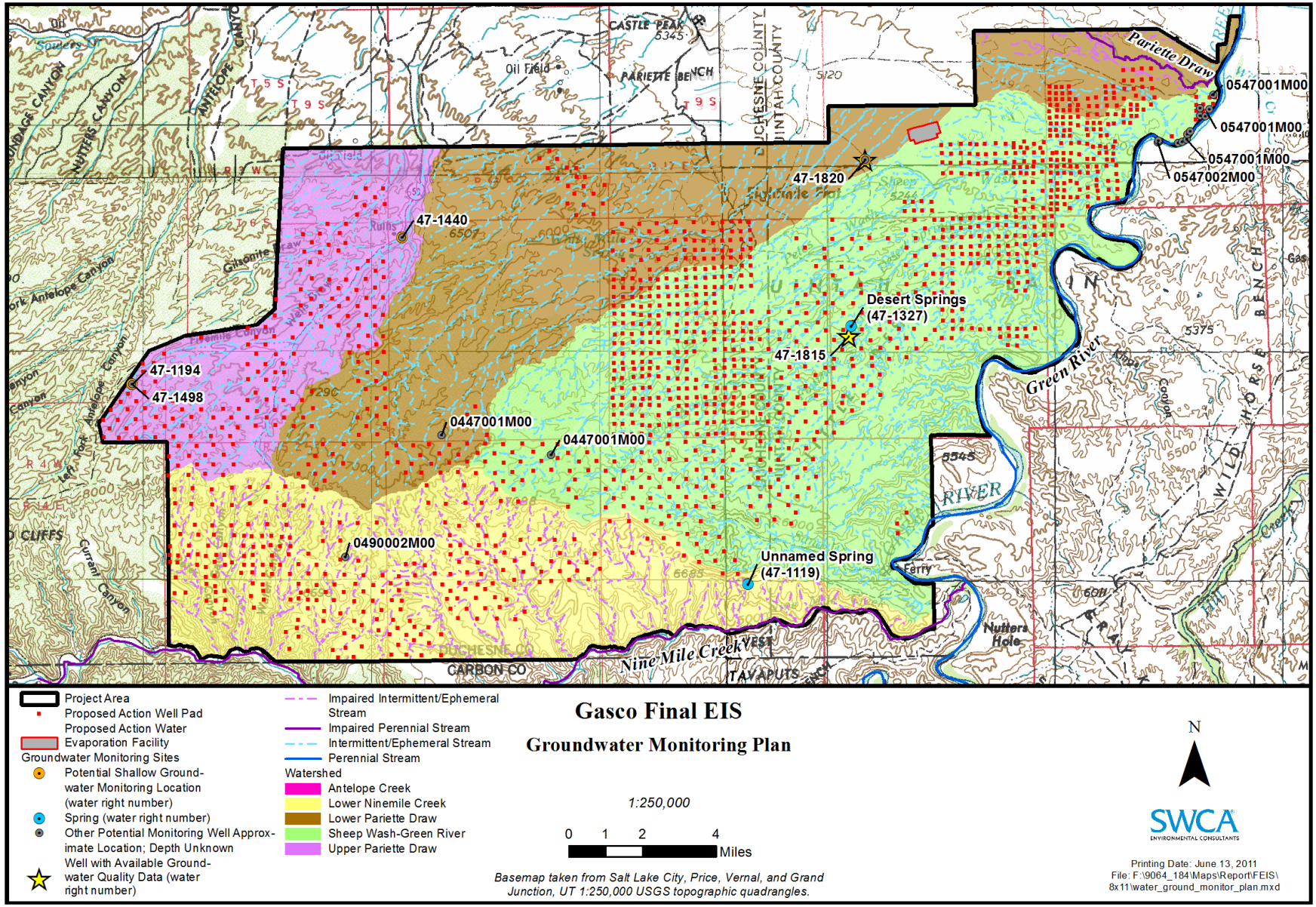
Table 4-4. Parameters for Long-term Spring Monitoring

Field and General Water Quality Parameters	Trace Metals	Other Inorganic Constituents	Organic Constituents
Total alkalinity	Aluminum	Ammonia	Volatile organic compounds[1]
Temperature	Arsenic	Bicarbonate	Semi-volatile organic compounds[2]
Specific conductance	Barium	Boron	Radionuclides
pH	Cadmium	Calcium	Total petroleum hydrocarbons[3]
DO	Chromium	Carbonate	–
TDS	Copper	Chloride	–
Dissolved hardness	Iron	Magnesium	–
Flow	Lead	Nitrate+Nitrite, total	–
–	Manganese	Phosphorus, total	–
–	Mercury	Potassium	–
–	Nickel	Sodium	–
–	Selenium	Sulfate	–
–	Silver	–	–
–	Zinc	–	–

[1] Volatile organic compounds will be analyzed using EPA Method 8260 or a fully equivalent standard method. Benzene will be analyzed at a detection limit of 1 microgram per liter or lower.

[2] Semi-volatile organic compounds will be analyzed using EPA Method 8270 or a fully equivalent standard method.

[3] Total petroleum hydrocarbons will include, at a minimum, analysis for diesel-range organics and gas-range organics.



Map 4-2. Gasco FEIS map of sampling locations for groundwater resources monitoring.

4.3.3. GROUNDWATER MONITORING

In addition to the one existing groundwater sample available for the project area, at least two but preferably three baseline groundwater water samples will be collected prior to commencement of the Gasco project. A monitoring network of wells with adequate spatial coverage will be selected by the hydrologist to establish baseline groundwater quality and to monitor future changes. Detailed monitoring protocols and final well selection will be identified in the QAPP and SAP prior to any drilling or construction of evaporation ponds.

The purpose of the baseline monitoring network will be to 1) establish baseline groundwater quality for the major known aquifers in the area that could be impacted by drilling, 2) establish baseline groundwater quality for any freshwater aquifers and known drinking water sources in the area, and 3) establish monitoring points likely to be down-gradient of major project activities. All groundwater samples collected during the first year of sampling (including those collected after commencement of the Gasco project) will serve as the groundwater quality baseline data against which potential impacts will be measured. The following three types of monitoring wells will be considered for selection:

1. *Drinking water or stock use wells.* The hydrologist will conduct a search of water rights within the area (via the Utah Division of Water Rights) for any water rights that are used for either drinking water or stock water. These could be wells, springs, or other diversion types. Following the database search, the hydrologist will conduct site visits of the potential monitoring points to verify that there is sufficient access and infrastructure to use the wells for semi-permanent monitoring. If monitoring points appear to be constructed in a manner that will allow for periodic sampling, the landowner will be contacted for permission to sample and for additional details regarding well construction (e.g., depth, screened interval, drilling logs).

2. *Existing monitoring well networks.* The hydrologist will conduct a search of water rights in the area to identify any existing monitoring well networks. Following the database search, the hydrologist will contact owners and determine if these wells are accessible, determine the possibility of obtaining permission for sampling, and obtain additional construction details.

3. *Other non-potable wells.* The hydrologist will identify additional non-potable wells in the area, likely through companies currently conducting oil and gas exploration, by directly contacting other oil and gas operators in the area.

Long-term monitoring of groundwater quality will be conducted at three or four of the existing wells listed in Table 4-5 and shown on Map 4-2. These sites will be selected based on their feasibility for monitoring, distance from one another (sites will represent the subsurface resources throughout the project area) and their utility in providing information about freshwater resources in the project area.

If access to a sufficient number of wells with good spatial distribution proves infeasible, shallow monitoring wells may be drilled in some areas to monitor potential freshwater resources.

Given the programmatic nature of the Proposed Action, it is not possible to know at this time which of the wells listed in Table 4-5 will be hydraulically down-gradient from individual gas production wells or evaporation ponds. During the permitting process for individual project elements, additional

site-specific monitoring may be required following selection of specific drilling or evaporation pond locations, or in response to conditions encountered during drilling activities.

There are no delineated freshwater aquifers in the project area; however, identification of shallow freshwater aquifers could occur during site-specific drilling or construction of evaporation ponds. Additional monitoring points would be added to the monitoring network on a site-specific basis if freshwater aquifers are discovered during the drilling process. If a freshwater aquifer is encountered during drilling, a search of the nearby area will be conducted to determine if any springs or wells access the same aquifer. If so, these monitoring points will be investigated for accessibility, and permission will be sought to add them to the monitoring network.

During the BLM and UDOGM site-specific permitting processes for evaporation basins, the BLM and UDOGM will require site-specific hydrogeologic information regarding the aquifers present at the site, and they will use this information to determine the appropriate location and depth for monitoring potential impacts. If monitoring wells are required to obtain this information, they will be added to the groundwater monitoring network.

Table 4-5. Existing Long-term Shallow Groundwater Monitoring Locations

Well	Location	Water Rights Number
Maxine Burdick (well)	N220 E1890 W4 06 10S 16E SL	47-1440
Gasco (well)	N170 E170 W4 29 9S 18E SL	47-1820
Michael M. Carlson (underground water tunnel)	S1657 W13 NE 26 10S 14E SL	47-1494; 47-1498
Utah School & Institutional Trust Lands Adm.	S2050 W1900 NE 02 11S 16E SL	0447001M00
Utah School & Institutional Trust Lands Adm.	N820 W2050 SE 32 10S 16E SL	0447001M00
Total Corrosion Solutions Inc.	S948 W770 N4 23 11S 15E SL	0490002M00
Duchesne Co. Water Conservancy District	S750 W1750 NE 27 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	S450 W1300 NE 27 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	S200 W600 NE 27 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	N350 W1150 SE 22 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	N800 W675 SE 22 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	S2100 E900 NW 23 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	S1000 E900 NW 23 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	S900 W700 N4 23 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	N100 W100 N4 23 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	N750 W1000 SE 14 9S 19E SL	0547001M00
Duchesne Co. Water Conservancy District	S526 E1103 N4 27 9S 19E SL	0547002M00
Duchesne Co. Water Conservancy District	S434 E1226 N4 27 9S 19E SL	0547002M00
Duchesne Co. Water Conservancy District	S403 E1264 N4 27 9S 19E SL	0547002M00
Duchesne Co. Water Conservancy District	S283 E1169 N4 27 9S 19E SL	0547002M00

At each groundwater monitoring location, field parameters will be measured, and a sample will be collected for analysis of the parameters listed in Table 4-6. 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; detection limits are required to be below applicable regulatory water quality standards, or as specifically noted in Table 4-6. Samples will be collected on a quarterly basis (one each in the winter, spring, summer, and fall) at each groundwater monitoring location over the LOP. Because baseline water quality data are limited, sample collection will include at least two rounds of baseline sampling prior to any drilling in the project area.

Table 4-6. Parameters for Long-term Shallow Groundwater Monitoring

Field and General Water Quality Parameters	Other Inorganic Constituents	Trace Metals	Organic Constituents and Other
Total Alkalinity	Ammonia	Aluminum	Methane and isotopes of methane[1]
Temperature	Bicarbonate	Arsenic	Hydrogen sulfide
Specific conductance	Calcium	Barium	Volatile organic compounds[2]
pH	Carbonate	Boron	Full gas chemistry (ethane, propane, butane, pentane, etc.)[1]
DO	Chloride	Cadmium	Semi-volatile organic compounds[3]
TDS	Magnesium	Chromium	Radionuclides
Dissolved hardness	Nitrate + nitrite, total	Copper	Total petroleum hydrocarbons[4]
–	Phosphorus, total	Iron	–
–	Potassium	Lead	–
–	Sodium	Manganese	–
–	Sulfate	Mercury	–
–	–	Nickel	–
–	–	Selenium	–
–	–	Silver	–
–	–	Zinc	–

[1] Methane will be analyzed at a detection limit of 10 micrograms per liter or lower If methane is detected above laboratory detection limits; isotopes of methane and full gas chemistry (e.g., methane, ethane, propane, butane, and pentane) will be analyzed.

[2] Volatile organic compounds will be analyzed using EPA Method 8260 or a fully equivalent standard method. Benzene will be analyzed at a detection limit of 1 microgram per liter or lower.

[3] Semi-volatile organic compounds will be analyzed using EPA Method 8270 or a fully equivalent standard method.

[4] Total petroleum hydrocarbons will include at a minimum analysis for diesel-range organics and gas-range organics.

Static groundwater levels will also be measured at the time of sample collection, prior to any pumping disturbance. Sampling techniques will be specified in the project-specific QAPP prior to data collection.

4.4. 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 and summarized quarterly. Data and quarterly summaries will be delivered to the BLM Vernal Field Office, the UDWQ, and the DOGM Roosevelt Office. In addition, an annual monitoring report will be prepared by the hydrologists 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 potential impacts to water quality, flow conditions, changes in depth to groundwater, recommendations for changes in the long-term monitoring program, and recommendations for mitigation measures to reduce any impacts observed.

The BLM will review the monitoring plan every two years to determine 1) if the plan needs to be changed to adapt to data results, 2) the locations of active project construction, and 3) other project variables. However, these changes should meet the monitoring objectives described in Section 4.1 and defined in the project-specific QAPP. These changes could include relocation, addition, subtraction, or substitutions of monitoring locations or addition or subtraction of monitoring parameters, and an increase or decrease of monitoring frequency if evidence suggests this is appropriate. All recommended changes, with an explanation for the requested change, will be submitted to the BLM and approved 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 will summarize the entire monitoring program and include a final assessment of all sites monitored throughout the LOP. All monitoring reports will be submitted to the BLM, UDWQ, and DOGM, and they will be made available to the public upon request.

4.4.1. SOURCE IDENTIFICATION AND MITIGATION

Monitoring serves to identify the range, intensity, and effects of impacts directly or indirectly related to development. When and if a water resources concern is identified at an established monitoring point, BLM will work with Gasco (and potentially other operators in the area) to conduct an investigation that may include additional monitoring to identify the source of the problem. Water resources concerns associated with the project would include any of the impacts described in Section 4.1, including the presence of contaminants associated with oil and gas development, changes in water quality associated with surface disturbance, or changes in groundwater levels or stream flows. The QAPP will quantify monitoring "triggers" that will indicate the possible need for more intensive monitoring to identify the source (point or nonpoint) of the concern. At a minimum, these triggers will include drinking water quality standards, where applicable, and/or an established percentage above baseline data. If any of the parameters listed in Table 4-2, 4-4, or 4-6 are found to be above established levels, the BLM, UDWQ, and DOGM will be immediately notified, and source identification and mitigation measures will be considered by these agencies. The following are additional monitoring and/or mitigation measures that would be considered in the event of an identified impact:

- Increased Sedimentation
    - Review best management practices used for road, well pad, and pipeline construction to reduce sediment delivery to area streams.

  - Use additional sediment and erosion controls at well pads and along access roads.
  - Identify and increase treatment (paving, stabilizing, or surface treating) to critical portions of roads.
  - Relocate proposed well pads, roads, and/or pipelines to avoid erosion-prone areas.
- Increased Concentrations of Inorganic Constituents, including Metals
  - Review dust suppression program, including the types of chemical agents used, and modify if necessary.
  - Review best management practices used for road, well pad, and pipeline construction to reduce sediment delivery to area streams and increase implementation levels if necessary.
  - Use additional sediment and erosion controls at well pads and along access roads.
  - Identify and increase treatment (paving, stabilizing, or surface treating) to critical portions of roads.
  - Relocate proposed well pads, roads, and/or pipelines to avoid erosion-prone areas.
  - In cases of increased concentrations of selenium, boron, or TDS, collaborate with UDWQ to determine the source of the increase and whether oil and gas development has contributed to the increase. Implement appropriate best management practices to mitigate the identified source and/or pathway.
- Contamination with Petroleum and other Organic Constituents
  - Review 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 reserve pits, storage tanks, evaporation ponds, aboveground 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 compensation to the well owner/water user and disclose the contamination of the impacted well, spring, or surface water to the EPA, Bureau of Indian Affairs, and Utah Department of Environmental Quality.
  - Identify and consider potential alternate sources of water (drill new well, haul water from offsite, etc.).
- Reduction of Spring Flows
  - Assess whether reduction in spring flow is seasonal fluctuation, due to drought, or the possible result of drilling activities.
  - Identify source area of spring using appropriate methods (e.g., tracer study), when feasible.
  - Review the cementing program for well completion, including review of cement bond logs for wells drilled near the impacted springs.
  - Collect all available historic records concerning pumping history and water levels in nearby water supply wells on spring flows. If feasible, implement continued measurements of pumping rates and water levels in water supply wells.
  - Require compensation be made to users of impacted springs.

  - Implement conservation or water re-use procedures to reduce withdrawals from water supply wells near, or hydrologically connected to impacted springs.
  - Identify and consider potential, alternate sources of water (drill new well, haul water from offsite, etc.).
- Reduction of Water Levels in Wells
  - Identify whether the reduced water levels are substantial and affect the availability of water (i.e., below pump intake).
  - Review the cementing program for well completion, including review of cement bond logs for wells drilled near the impacted water sources.
  - Evaluate the effects of water supply wells on existing water sources.
  - Require that compensation be made to users of impacted wells.
  - Implement conservation or water re-use procedures to reduce withdrawals from water supply wells near, or hydrologically connected to impacted wells.
  - Identify and consider potential alternate sources of water (drill new well, haul water from offsite, etc.).

4.5. REFERENCES

BLM. 2010a. *West Tavaputs Plateau Natural Gas Full Field Development Plan Final Environmental Impact Statement and Record of Decision*. Available at: http://www.blm.gov/ut/st/en/fo/price/energy/Oil_Gas.html. Accessed May 15, 2011.

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EPA. 2001. *EPA Requirements for Quality Assurance Project Plans*. Available at: http://www.epa.gov/quality/qs-docs/r5-final.pdf. Accessed May 15, 2011.