



Stantec

**Phase II Site Assessment
Work Plan**

**South Canyon Field
Garfield County, Colorado**

Submitted to:

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1.0 Introduction

Stantec Consulting Corporation (Stantec), on behalf of Chevron Environmental Management Company (Chevron), is pleased to provide the Colorado Oil and Gas Conservation Commission (COGCC) and Bureau of Land Management (BLM) with this *Phase II Site Assessment Work Plan* for conducting additional site assessment in the vicinity of Federal 23-12 and Federal 27-11 (**Figure 1**) at the South Canyon Site (Site) in Garfield County, Colorado.

Remedial excavation activities were completed in 2008 in the large pits at both Federal 23-12 (Pit #111760) and 27-11 (Pit #111762) to a depth of 18 feet below ground surface (bgs); however, the vertical extent of soil with concentrations of hydrocarbons exceeding the COGCC Series 900 Allowable Concentrations in Table 910-1 (Allowable Concentrations) at these two locations had not been defined. Further assessment at Pit #111760 and Pit #111762 was broken up into two phases (Phase I and Phase II). The Phase I site assessment was conducted from May 10 through 27, 2010. The results from the Phase I site assessment indicate that soil impacts at Pit #111760 had been fully defined; however, since the groundwater flow direction and gradient parallel nearby West Salt Creek, groundwater may not be delineated down-gradient of the former pit center. At Pit #111762, impacts in soil and groundwater above Allowable Concentrations extend past the 50-foot radius explored and extents have not been fully defined.

1.1 OBJECTIVES

The objectives of the Phase II site assessment are to:

- Estimate the horizontal and vertical extent of constituents of concern (COCs) in soil at Pit #111762;
- Estimate the direction of groundwater flow and extent of COCs in groundwater at Pit #111762;
- Evaluate the potential for surface water impacts in the vicinity of Pit #111762;
- Collect additional soil data to define horizontal and vertical extent of COCs in soil at Pit #111760;
- Estimate the direction of groundwater flow and extent of COCs in groundwater at Pit #111760; and
- Estimate hydraulic conductivity at Pit #111760 and Pit #111762 to evaluate the following potential remedial approaches: no further action (NFA), monitored natural attenuation (MNA), or active remediation.

1.2 BACKGROUND

The South Canyon Gas Field is a coal bed methane gas field owned by the BLM. It was formerly leased and operated by Chevron USA, Mid-Continent Business Unit. The field and lease is currently operated by HRM Resources (HRM).

On August 28, 2008, Stantec submitted an *Interim Reclamation and Remedial Excavation Work Plan* (IR&REWP) to the BLM on behalf of CEMC. This IR&REWP was subsequently approved by BLM in September 2008, and included work at the following leases: Federal 6-13 (1 pit); Federal 12-16 (1 pit); Federal 23-12 (2 pits); Federal 27-11 (2 pits); and Lewis USA 36-1 (1 pit).

Remedial excavation activities have been completed at Federal 6-13; Federal 12-16; Lewis USA 36-1; and the small pits at both Federal 23-12 and 27-11. These activities are documented in the following reports:

- *Interim Reclamation and Remedial Excavation Documentation Report - Pit #111761*, dated December 15, 2008;
- *Interim Reclamation and Remedial Excavation Documentation Report - Pit #111763*, dated December 15, 2008;
- *Interim Reclamation and Remedial Excavation Documentation Report - Pit #111793*, dated December 15, 2008; and
- *Interim Reclamation and Remedial Excavation Documentation Report - Pit #112108*, dated December 15, 2008.

Activities conducted at Federal 12-16 were documented in a Sundry Notice (Form 4) to the COGCC submitted February 23, 2009.

Excavation activities at Pit #111760 have been completed to 18 feet bgs and a test pit within the larger excavation has extended sampling to 46 feet bgs. A soil sample collected at 46 feet bgs (111760-EF-B-46) exhibited a concentration for total petroleum hydrocarbons (TPH) of 19,550 milligrams per kilogram (mg/kg). Excavation activities at Pit #111762 have also been completed to 18 feet bgs and a test pit within the larger excavation has extended sampling to 40 feet bgs. A soil sample collected at 40 feet bgs (111762-EF-B-40) exhibited a concentration for TPH of 34,000 mg/kg. These activities are documented in the following reports:

- *Interim Reclamation and Remedial Excavation Documentation Report - Pit #111760*, dated December 15, 2008 and submitted February 23, 2009; and
- *Interim Reclamation and Remedial Excavation Documentation Report - Pit #111762*, dated December 15, 2008 and submitted February 23, 2009.

Further excavation without additional delineation was of concern at both pits due to the potential for collapse, the area needed to construct a 2:1 slope to get to depth, and the significant volume of soil that would need to be removed to reach these depths safely.

The remedial excavation activities completed in the large pits at both Federal 23-12 and 27-11 to a depth of 18 feet bgs eliminated the soil direct contact exposure pathway; however, the vertical extent of hydrocarbon concentrations at these two locations was not defined. Since the vertical extent of hydrocarbon concentrations in soil was not delineated, the BLM expressed concern that residual hydrocarbons could potentially affect groundwater and adjacent surface waters. Accordingly, assessment was proposed to evaluate the horizontal and vertical extents of potential hydrocarbon concentrations in soil and groundwater.

The *Site Assessment Work Plan*, dated March 31, 2010, was implemented from May 10 through 27, 2010 and included the Phase I site assessment activities. Four monitoring wells were installed at each pit; one was installed in the center of the former pit, and three additional wells were installed approximately 50 feet from the center of the former pit in up-gradient and down-gradient locations. Groundwater was encountered at approximately 41 to 43 feet bgs at Pit #111760, and at approximately 53 to 57 feet bgs at Pit #111762.

At Pit #111760, the groundwater flow direction was to the southwest at an average gradient of 0.012 feet per foot (ft/ft), and does not appear to be toward West Salt Creek. In soil, concentrations of TPH, benzene, toluene, and total xylenes above Allowable Concentrations were observed in 111760-MW-1 only (in the center of the former pit). In groundwater, concentrations of benzene and toluene were observed above Allowable Concentrations in 111760-MW-1, and a concentration of benzene equal to the Allowable Concentration of 5 micrograms per liter ($\mu\text{g/L}$) was observed in 111760-MW-3. These results indicate that impacts in soil are contained within the former pit footprint and impacts in groundwater above Allowable Concentrations extend approximately 50 feet southwest of Pit #111760, and do not extend to West Salt Creek (located approximately 250 feet southeast of the pit).

At Pit #111762, the groundwater flow direction was to the southeast at an average gradient of 0.003 ft/ft. In soil, concentrations of TPH, benzene, toluene, and total xylenes above Allowable Concentrations were observed in all four wells; however, elevated photoionization detector (PID) results (over 1,000 parts per million [ppm]) and BTEX concentrations above the Allowable Concentrations at 111762-MW-2, 111762-MW-3, and 111762-MW-4 were not encountered until 40 feet bgs. This may indicate that elevated soil concentrations are the result of groundwater fluctuations and represent the upper extent of the smear zone. In groundwater:

- Maximum concentrations were observed in well 111762-MW-3.
- Concentrations of benzene and toluene were observed above Allowable Concentrations in all four wells.
- A concentration of ethylbenzene above the Allowable Concentration was observed in 111762-MW-3.
- Total xylenes concentrations above Allowable Concentrations were observed in 111762-MW-1 through 111762-MW-3.

These results indicate that impacts in groundwater are above Allowable Concentrations and extend past the 50-foot radius explored during this investigation. The results also indicate that

while soil has been impacted at the extents of the investigation, it is unknown whether these soil impacts represent the upper smear zone or the extent of impacts in the vadose zone.

1.3 GEOLOGY AND HYDROGEOLOGY

1.3.1 Geology

The formations in the area of Pit #111760 and Pit #111762 consist of the relatively flat lying Cretaceous age Mesaverde group sandstones with interbedded shales and coals which cap the Book Cliffs and the underlying Mancos shale. The valley in which West Salt Creek is located appears to be a classic arid valley cut by historic alluvial processes and filled by mass wastage. These materials have subsequently been reworked by more recent alluvial processes resulting in the silts and fine sands observed on the surface and in both excavations. Grain sizes are expected to increase with depth resulting in the coarsest materials being just above bedrock.

During the Phase I site assessment activities, lithology consisted mainly of silt with varying percentages of sand and gravel to the maximum depth explored (57 feet bgs at Pit #111760 and 72 feet bgs at Pit #111762). Several gravel lenses were encountered at varying depths.

1.3.2 Hydrogeology

Pit #111760 and Pit #111762 are located in an Alluvial Aquifer adjacent to the West Salt Creek. Due to the arid climate in this part of the West Salt Creek drainage, groundwater is not present close to ground surface. Perched groundwater is present above the bedrock within the alluvial material, while regional groundwater may be present in the bedrock depending on the type of bedrock underlying the Site. During the Phase I site assessment, groundwater was encountered at approximately 41 to 43 feet bgs at Pit #111760, and at approximately 53 to 57 feet bgs at Pit #111762.

The West Salt Creek is the nearest surface body water to the pit locations. It is expected that West Salt Creek is an intermittent stream with peak flows occurring during spring runoff and the occasional localized precipitation event. During these times of year it may be a gaining stream, but most (if not all) other times of the year it is likely a losing stream where the presence or absence of groundwater is controlled by bedrock or impermeable materials.

2.0 Scope of Work

The proposed Phase II site assessment includes both soil and groundwater components. Final sampling locations and procedures will be dependent on conditions encountered in the field and obtaining access to the area adjacent to Federal 27-11. The proposed scope of work is presented below.

2.1 PERMITTING

At a minimum, permits will be required for the installation of the proposed monitor wells. Stantec and/or the licensed drilling contractor will submit a groundwater well installation application and coordinate with the State Engineer to receive the necessary permits prior to mobilization to the Site. Additionally, the Colorado Division of Water Resources (CDWR) will be notified 3 days prior to well installation.

2.2 LOCATION AND LINE CLEARANCE

As required by law, the Utility Notification Center of Colorado (UNCC) will be notified at least 48 hours before any intrusive activities. In addition to notifying the UNCC, Stantec will retain the service of a private utility locator to determine the location of underground utilities near the proposed soil borehole/monitor well locations. No borehole will be advanced within 10 feet of a known underground utility or within 20 feet of an aboveground utility.

After the locations of utilities are identified, the soil borehole and monitor well locations will be determined in the field based on the benchmarks and surveying grid set during previous activities. Each proposed soil borehole/monitor well location will be cleared for subsurface utilities from ground surface to a depth of 8 feet bgs using soft digging techniques. The cuttings will be logged by a geologist and soil samples may be collected from these depths. If an air knife or similar technology is used and it is determined that soil sample collection is needed, a hand auger will be used to collect non-disturbed soil samples.

2.3 SOIL AND GROUNDWATER ASSESSMENT

Soil and groundwater will be assessed at Pit #111760 by installing one down-gradient monitor well (111760-MW-5) using a truck-mounted hollow stem auger (HSA) drill rig. In addition, one soil borehole will be advanced approximately 25 feet down-gradient from the former pit center to estimate the vertical and horizontal extent of the soil impacts. Proposed soil borehole and monitor well locations for Pit #111760 are shown on **Figure 2**.

Soil and groundwater will be assessed at Pit #111762 by installing up to four monitor wells (111762-MW-5 through 111762-MW-8) using a truck-mounted HSA drill rig. Three monitor wells are proposed between the center of the former pit and West Salt Creek, and one monitor well is proposed between the center of the former pit and up-gradient Federal 27-12. In addition, a minimum of two soil boreholes will be advanced around the pit location to estimate the vertical and horizontal extent of the soil impacts. Up to two additional soil boreholes may be

installed at Pit #111762 based on field observations. Proposed soil borehole and monitor well locations for Pit #111762 are shown on **Figure 3**.

Monitor wells at Pit #111762 are contingent on obtaining access, and locations are dependent on existing surface disturbance permits. Stantec is working with HRM and Garfield County to gain approval to install monitor wells within areas that have existing surface disturbance permits. A Self Certification Form (or similar) for the prescribed activities on the existing surface disturbance permit will be executed by both HRM and Chevron and submitted to the BLM prior to the installation of the monitor well proposed within the lease road to Federal 27-12. Similarly, a Self Certification Form (or similar) will be executed between Garfield County and Chevron for the installation of monitor wells along the County Road 201 (Baxter Pass Road) right-of-way. If negotiations are not completed for an area, the proposed well will not be installed.

Following borehole clearance to 8 feet bgs, the drilling contractor will advance the soil borehole to depth. Completion depths are estimated based on conditions observed during the Phase I site assessment. Soil boreholes and monitor wells at Pit #111760 will be advanced to a total depth of approximately 55 feet bgs, and soil boreholes and monitor wells at Pit #111762 will be advanced to a total depth of approximately 70 feet bgs.

During soil borehole advancement, soil samples will be collected using a split spoon sampler at 5-foot intervals. The soil will be visually evaluated for evidence of hydrocarbons and soil stratigraphy will be classified using the Unified Soils Classification System (USCS) as a guide. A portion of soil will be retained from each sample interval and placed into a sealed plastic bag for field screening using a PID. Soil from each 5-foot interval will be stored on ice until it is determined which sample intervals will be sent for laboratory analysis. A minimum of three soil samples will be submitted to the laboratory from each borehole; one from immediately above the groundwater table, one exhibiting the highest PID reading; and one based on field screening and visual observation to ensure the soil is characterized through the full extent of the borehole.

A borehole/well construction log will be maintained during the advancement of each soil borehole and subsequent installation of each of the proposed monitor wells to record soil descriptions, PID readings, depth to first-encountered groundwater, well construction details, and other notable field observations.

Soil samples will be labeled and placed in an ice-filled cooler for preservation during shipment. The soil samples will be recorded onto a chain-of-custody document that will accompany the samples to the laboratory for analysis.

For soil boreholes converted to monitor wells, 2-inch diameter wells will be installed. The screen intervals will be constructed with flush-threaded, schedule 40, polyvinyl chloride (PVC) casing perforated with 0.010-inch slots. Each well should have a 20-foot screen interval. The annular space adjacent to the well screen will be filled with sand to 2 feet above the well screen interval. Medium bentonite chips will be placed above the sand filter pack to 2 feet bgs, and the bentonite will be hydrated and allowed to swell. The monitor well will be completed with an above-grade monument set in concrete. Prior to developing the new wells, the annular seals will be allowed to set for three days. A lockable, expanding well cap will be used to secure each well head.

Each soil borehole not converted to a monitor well will be properly decommissioned with bentonite chips following completion of soil sampling activities.

2.3.1 Surveying

Following installation and completion, the location of the soil boreholes and monitor wells will be surveyed horizontally to the nearest ± 0.1 -foot, the ground elevation will be surveyed to the nearest ± 0.01 -foot, and relative casing elevations (if completed as monitor wells) will be surveyed to the nearest ± 0.01 -foot.

2.3.2 Well Development

Following installation, monitor wells will be developed. Depth-to-groundwater and the total length of the casing will be measured to determine the quantity of water within the well casing. Well development activities will then be completed using a surge block, or similar method, and over purging to remove fines from the well screen.

2.3.3 Groundwater Sample Collection

All groundwater monitor wells, including those installed during Phase I site assessment activities, will be sampled. Prior to sampling activities, the depth to groundwater should be measured in each well using an oil-water interface probe, accurate to the nearest ± 0.01 -foot.

Three casing volumes should be removed by disposable polyethylene bailer. During well purging, depth to groundwater and indicator field parameters (pH, dissolved oxygen [DO], oxidation-reduction potential [ORP], conductivity, and temperature) will be measured and recorded on the Groundwater Sampling Field Data Sheet for each casing volume. If the well is dewatered prior to removal of three casing volumes, purging will be stopped and groundwater samples will be collected once sufficient groundwater is present.

Groundwater samples will be labeled and placed in an ice-filled cooler for preservation during shipment. The groundwater samples will be recorded onto a chain-of-custody document that will accompany the samples to the laboratory for analysis.

2.3.4 Hydraulic Conductivity Testing

Following groundwater monitoring, hydraulic conductivity will be determined by conducting slug tests on one well at Pit #111760 and two wells at Pit #111762. Rising head slug tests will be conducted at each well. The rising head slug test will be conducted by raising the slug out of the saturated portion of the well and monitoring resultant water level fluctuations. Water level fluctuations in the wells will be monitored with a pressure transducer.

2.3.5 Data-Logger Installation

Data-loggers are already present in wells 111760-MW-1 and 111762-MW-1 to continuously monitor for the presence of groundwater and groundwater elevations between sampling events. Data collected since the Phase I site assessment will be downloaded during this field event.

Two additional data-loggers will be installed at each pit so continuous data can be obtained to determine seasonal groundwater flow direction.

2.4 LABORATORY ANALYSIS

All soil and groundwater samples will be submitted to Merit Laboratories in East Lansing, Michigan for analysis.

All soil samples will be submitted for analysis of TPH and BTEX. In addition, four soil samples from each pit (three of which should be background samples and one from source area) will be submitted for analysis of polycyclic aromatic hydrocarbons (PAHs) and arsenic.

Additional soil COCs of electrical conductivity (EC), sodium absorption ratio (SAR), pH, and select metals (barium, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc) were eliminated from the analysis program as these COCs were analyzed during the 2008 interim reclamation and remedial excavation activities, and concentrations remaining in place are below the Allowable Concentrations in Table 910-1.

All groundwater samples will be submitted for analysis of TPH and BTEX. In addition, groundwater samples from two monitor wells at each pit will be submitted for analysis of natural attenuation indicator parameters (nitrate, sulfate, and ferrous iron). Additional natural attenuation indicator parameters (DO and ORP) will be measured in the field as described in Section 2.3.3. Also, groundwater samples from two monitor wells at each pit (one of which should be a background sample and one from the source area) will be submitted for analysis of total dissolved solids (TDS) and chloride.

Following assessment activities, soil and groundwater results will be evaluated and compared against both background and Allowable Concentrations in Table 910-1. The COC list will be modified for future assessment activities to only include those analytes that exceed background or the Allowable Concentrations in Table 910-1.

2.5 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Quality assurance/quality control (QA/QC) samples will be collected as follows:

- Equipment blanks – Equipment blanks will be collected to determine the potential for cross-contamination from drilling or sampling equipment. It is anticipated there will be two equipment blanks analyzed in conjunction with soil sampling, and one equipment blank analyzed in conjunction with groundwater sampling.
- Duplicates – Duplicate samples will be collected to evaluate the laboratory's performance by comparing the analytical results of two samples collected at the same location. It is anticipated there will be three soil duplicates and one groundwater duplicate.
- Trip blanks – Trip blanks will be submitted with samples to determine potential cross-contamination from the containers themselves or the atmosphere. Trip blanks will be

prepared by the analytical laboratory and shipped with the sample containers (two trip blank vials per cooler). It is anticipated there will be four trip blanks analyzed in conjunction with soil samples, and three trip blanks analyzed in conjunction with groundwater samples.

2.6 SAMPLE HANDLING

2.6.1 Sample Labeling

Before a particular sample is collected, all containers needed for the analytical parameters should be assembled and properly labeled. The sample label should be attached directly to the sample container. The information that should be included on the sample label includes the following:

- Project name;
- Sample ID (unique ID for each sample location; see Section 2.6.3);
- Date sampled;
- Time sampled (in military time);
- Initials of sampler(s); and
- Preservative in the sample container, if any.

2.6.2 Sample Custody

Possession of samples collected in the field will be traceable from the time of collection until they are analyzed by the laboratory or disposed. All samples will be held at 4°C in a cooler until delivery to the laboratory. Samples will be shipped to the laboratory via FedEx under chain-of-custody procedures. A project specific chain-of-custody record will be utilized by field personnel to document possession of all samples collected for chemical analysis. Chain-of-custody forms will accompany samples at all times. When transferring possession of the samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of transfer on the record. The chain-of-custody will be placed in a sealed plastic bag and taped to the inside of the sample chest. The sample chest will be securely sealed prior to presentation to the delivery service. A commercial delivery service (e.g., FedEx) will be identified by company name only; the delivery service is not required to sign the chain-of-custody. At the laboratory, the chain-of-custody will be compared with sample labels to ensure that the information is consistent. The chain-of-custody record will include, but is not limited to, the following information:

- Project name and number;
- Name(s) and signatures of samplers;
- Sample ID (unique ID for each sample location; see Section 2.6.3);

- Date and time of collection;
- Number and type of containers;
- Required analyses;
- Laboratory name and address; and
- Signatures documenting change of sample custody.

2.6.3 Sample Naming

Samples will be labeled in the following format:

Soil Samples (from monitor wells):

Pit #-Well ID, Depth (e.g., 111760-MW-5, 25'; 111762-MW-7, 40')

Soil Samples (from soil boreholes not converted to monitor wells):

Pit #-SB-#, Depth (e.g., 111760-SB-1, 40'; 111762-SB-3, 25')

Groundwater Samples:

Pit #-Well ID (e.g., 111760-MW-5, 111762-MW-7)

Equipment Blanks:

EB-# (e.g., EB-1, EB-2)

Duplicates:

DUP-# (e.g., DUP-1, DUP-2)

Trip Blanks:

TB-# (e.g., TB-1, TB-2)

2.7 DECONTAMINATION PROCEDURES

Any non-dedicated or non-disposable sampling equipment that comes into contact with soil or groundwater will be decontaminated before and after each use. The decontamination procedures are described below:

- Sampling implements, such as spatulas and trowels, will be washed with a Liquinox water solution and rinsed with distilled water before and after sample collection;
- The oil-water interface probe will be decontaminated following each measurement by spray-washing the probe and cable with a Liquinox water solution, wiping down the

probe and cable, followed by a final rinse with distilled water. Disposable bailers will be used at each monitor well to prevent cross-contamination during groundwater sampling;

- Auger sections are to be decontaminated by either steam cleaning or washing with a Liquinox water solution and rinsing with distilled water before and after drilling; and
- Analytical probes that come in contact with sample water should be cleaned by washing with a Liquinox water solution and thoroughly rinsing with distilled water.

2.8 WASTE MANAGEMENT

Soil cuttings and purge and decontamination water generated from the Phase II site assessment activities will be reclaimed at the Site instead of off-site disposal if approved by BLM and COGCC. If investigative-derived waste is not reclaimed on-site, it will be disposed of at Republic Waste's ECDC facility.

Reclaimed soils and water will be managed respective to the individual well site where it was derived (i.e., materials from different well sites will not intermingle). Any gross hydrocarbon materials (light non-aqueous phase liquid [LNAPL], tars, sludges, etc.) encountered during assessment will be disposed off-site and will not be reclaimed on-site.

2.8.1 Soil Cutting Reclamation

As provided by Rule 907.e.1.b, soil cuttings derived from investigation activities at each well site may be landfarmed within the perimeter of the respective well pad.

Soils will be mixed, tilled, and spread to a maximum depth of 12 inches during landfarming. Fresh water and nutrients (fertilizer, gypsum, manure, etc.) may be applied to soils as necessary to stimulate microbial activity. Temporary fencing (e.g., snow fence and T-posts) will be used to help restrict access by wildlife. Storm water run-off from the landfarms will be controlled with straw wattles, straw bales, silt fencing, or similar method. Landfarm location, footprint, and approximate soil depth will be documented in the assessment documentation report.

The landfarms will be sampled at least twice a year. One composite soil sample will be collected from each landfarm during each sampling event. The composite will be made from five discrete samples collected with a bias for locations that appear to be impacted based on qualitative observations (e.g., staining, odor, etc.). Soil samples will be submitted for analysis of appropriate COCs (COC list will be established as part of the Phase II site assessment).

Landfarming activities will continue until sample results indicate concentrations are below appropriate regulatory criteria (criteria will be refined as part of the Phase II site assessment). Laboratory data will be submitted via a sundry form.

Landfarmed soil will remain in place until surface reclamation plans for the well site are determined. Temporary fencing will be removed and revegetation with a BLM-approved seed

mix or barrier methods (e.g., straw wattles, straw bales, silt fencing, etc.) will be used to control storm water run-off until surface reclamation plans for the well site are determined.

2.8.2 Groundwater Reclamation

Purge water generated from well development or groundwater sampling activities may be managed on-site in two ways:

- Groundwater may be returned to the formation via the same well bore from which it was extracted; or,
- Groundwater may be solidified using soil from the respective landfarm and assimilated into that landfarm.

Decontamination water may be solidified using soil from the respective landfarm and assimilated into that landfarm.

3.0 Health and Safety

Stantec will update an existing site-specific health and safety plan (HASP) to cover the field activities described herein. The HASP will outline potential hazards to Stantec field personnel and subcontractors during the field activities. Permit to work documentation will be prepared when warranted, and job loss analyses (JLAs) will be created and continuously modified to cover any additional contingencies realized in the field. The HASP will also include required personal protective equipment (PPE) to be worn by all field personnel for each task. In addition, Stantec will produce a Journey Management Plan (JMP) in an attempt to prevent losses associated with motor vehicle incidents. A copy of Stantec's HASP and JMP will be available on-site during all field activities.

Health and safety tailgate meetings will be held twice daily (first thing in morning and after lunch prior to re-initiating work) throughout the duration of the project with Stantec personnel and all other subcontracted personnel on-site. These meetings will be utilized to promote awareness of health and safety concerns and to help ensure that a zero incident policy is stressed throughout the duration of the project.

4.0 Reporting and Documentation

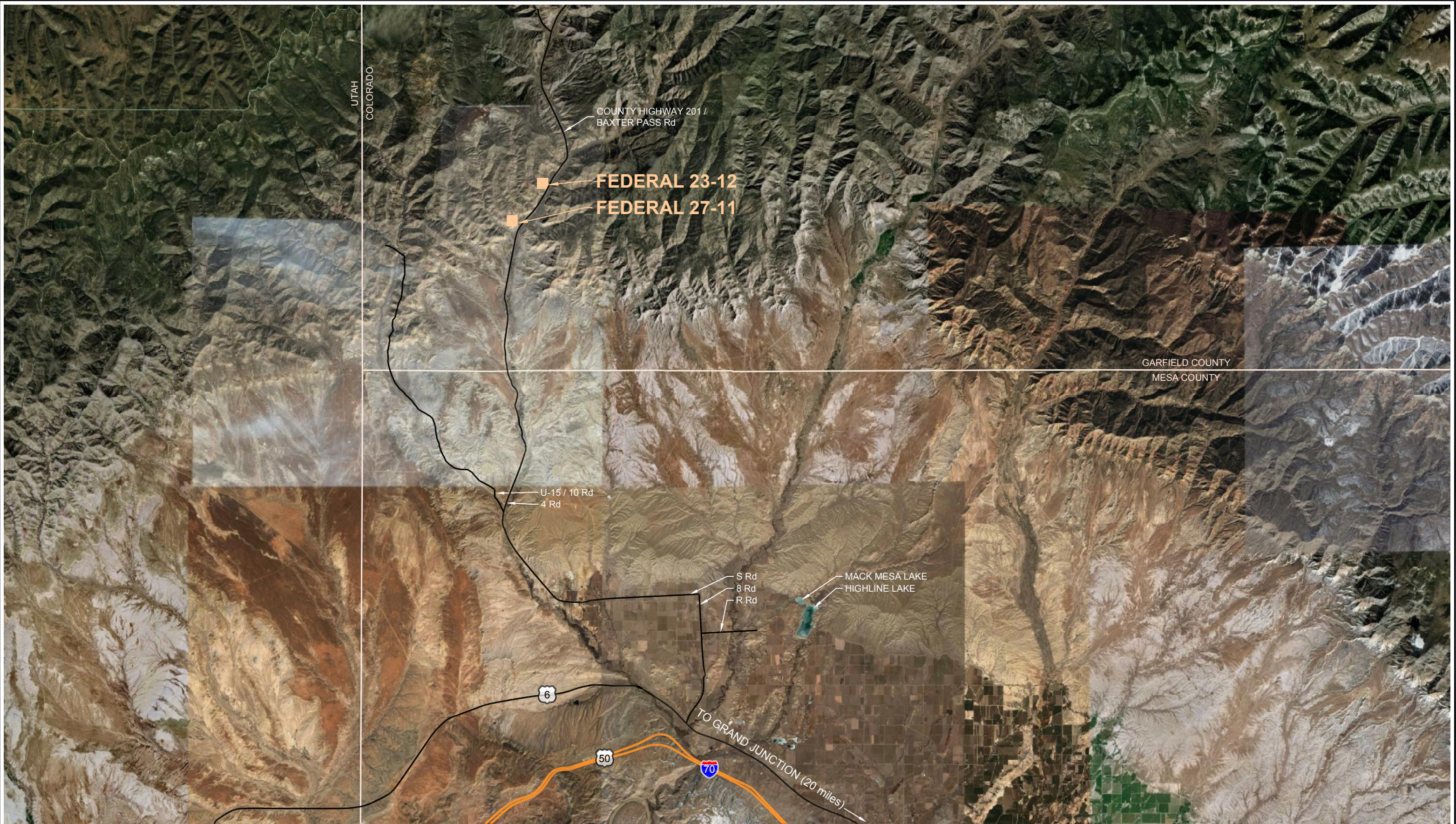
During the course of Phase II assessment activities at the Site, field activities will be documented using a field notebook, borehole/well construction logs, and Groundwater Sampling Field Data Sheets.

Following completion of the site assessment and groundwater monitoring detailed above, the results will be compiled and analyzed. A site assessment documentation report will be prepared and submitted following the Phase II site assessment, and will include a summary of Phase I and Phase II site assessment activities, tabulated Phase I and Phase II soil and groundwater analytical data, groundwater elevation maps, geologic cross-sections, and soil and groundwater isoconcentration maps.

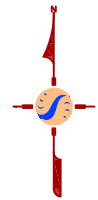
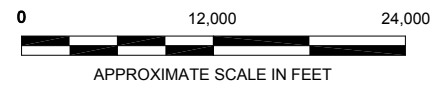
5.0 Limitations and Certification

This work plan was prepared in accordance with the scope of work outlined in Stantec's contract and with generally accepted professional engineering and environmental consulting practices existing at the time this work plan was prepared and applicable to the location of the site. It was prepared for the exclusive use of Chevron for the express purpose stated above. Any re-use of this work plan for a different purpose or by others not identified above shall be at the user's sole risk without liability to Stantec. To the extent that this work plan is based on information provided to Stantec by third parties, Stantec may have made efforts to verify this third party information, but Stantec cannot guarantee the completeness or accuracy of this information. The opinions expressed and data collected are based on the conditions of the site existing at the time of the field investigation. No other warranties, expressed or implied are made by Stantec.

Figures



LEGEND
FEDERAL 27-11 ■ PIT NAME AND LOCATION



2321 CLUB MERIDIAN DRIVE SUITE E
OKEMOS, MI 48864
PHONE: (517) 349-9499 FAX: (517) 349-6863

FOR:
CHEVRON
SOUTH CANYON GAS FIELD

JOB NUMBER: DRAWN BY: SW





SITE LOCATION MAP

CHECKED BY: BL APPROVED BY: SJ

FIGURE:
1
DATE: 3/2/10



LEGEND

-  MONITOR WELL LOCATION
-  PROPOSED SOIL BOREHOLE LOCATION
-  PROPOSED MONITOR WELL LOCATION
-  APPROXIMATE DIRECTION OF GROUNDWATER FLOW.
(DATE MEASURED JUNE 1, 2010)



Stantec
 2321 CLUB MERIDIAN DRIVE SUITE E
 OKEMOS, MI 48864
 PHONE: (517)349-9499 FAX: (517)349-6863

FOR:

CHEVRON
 SOUTH CANYON ROAD

JOB NUMBER:
 213201183

DRAWN BY:
 JRO

CHECKED BY:
 BAL

APPROVED BY:
 SAM





FIGURE:

2

DATE:
 8/24/10



LEGEND

-  MONITOR WELL LOCATION
-  PROPOSED SOIL BOREHOLE LOCATION
-  PROPOSED MONITOR WELL LOCATION
-  APPROXIMATE DIRECTION OF GROUNDWATER FLOW.
(MEASURED JUNE 1, 2010)



Stantec

2321 CLUB MERIDIAN DRIVE SUITE E
OKEMOS, MI 48864
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FOR:

CHEVRON
SOUTH CANYON ROAD

JOB NUMBER:
213201183

DRAWN BY:
JRO

CHECKED BY:
BAL

APPROVED BY:
SAM

FIGURE:

3

DATE:
8/24/10

PIT #111762 PROPOSED
SOIL BOREHOLE/
MONITOR WELL LOCATIONS