

## **Revised Remediation Work Plan**

### *Attachment 1*

#### **1.0 Introduction**

Three produced water pits are located at the Schwake Well A-2 Tank Battery in Peetz, Colorado. Investigation and remediation activities are being conducted for these pits pursuant to Notice of Alleged Violation to Schneider Energy Services Inc. dated March 31, 2009 from the Colorado Oil & Gas Conservation Commission (COGCC) and subsequent correspondence regarding this matter. On January 7, 2010, Form 27 was submitted to COGCC describing the results of the pit investigation and proposing a remedy to address elevated concentrations of Total Petroleum Hydrocarbons (TPH), electrical conductivity (EC), and sodium absorption ratio (SAR) in the pit materials. COGCC conditionally approved the remediation work plan in a letter dated February 2, 2010.

The location and layout of the three production water pits are shown on Figures 1 and 2. These pits include:

- a main pit, measuring approximately 175 feet (ft) long by 80 ft wide by eight ft below grade;
- an overflow or reserve pit measuring approximately 145 ft long, by 50 ft wide, by 12 ft below grade; and
- a circular crude skimmer pit with a diameter of 25 ft.

The pits are surrounded by berms that rise to about four ft above grade.

The main pit contains layers of tarry crude residues and crude-impacted soil to a maximum depth of about 17 ft. Constituents that were reported to have elevated concentrations in excess of Table 910-1 limits include TPH, EC, and SAR. The overflow pit has no visible staining in the subsoil and is affected by EC and SAR above limits. The skimmer pit contains fluids and presumably solids with elevated concentrations of TPH, EC, and SAR to a presumed depth of 10 to 15 feet. The approved remedy included excavation of the TPH-affected materials for off-site disposal and covering the remaining materials with a soil cap. Attachment 2 of the February 2, 2010 Form 27 submittal contains additional site investigation detail and analytical results.

After further evaluation, it was determined that the materials were too wet to implement the excavation portion of the remedy for a reasonable cost and within the timeframes envisioned by the COGCC. On April 14, 2010, COGCC and Merchant Energy Partners LLC discussed alternatives to excavation. It was agreed that the remedial approach be revised to include on-site landfarm treatment as the appropriate remedy for the TPH-affected soil. A copy of the correspondence regarding this change is provided in Appendix A.

The purpose of this document is to present a revised remediation work plan consistent with the requirements of COGCC Rule 907.e.2 to address TPH-affected materials in the Main Pit and Skimmer Pit.

## **2.0 Scope of Work**

The proposed pit closure remedy will reduce TPH concentrations to levels below the Table 910-1 limits and encapsulate soil with EC and SAR impacts from surface water infiltration and leaching to ground water. The following discussion presents the remedial approach for each pit:

### **2.1 Main Pit**

The proposed pit remediation includes the following steps:

- Excavate stained soil to the maximum depth of impact;
- Transport soil to the on-site landfarm treatment area;
- Manage soil in landfarm in accordance with procedures described below under Landfarm Bioremediation Management;
- Once the treatment has been deemed effective, backfill the pit in lifts with treated soil from landfarm, compact, and slope to drain at surface;
- Cover pit with graded topsoil to direct surface water runoff away from the backfilled pit; and
- Seed the graded area with native grasses using hydromulch in order to stabilize the soil and restore it for suitable agricultural or recreational use.

### **2.2 Overflow Pit**

- No excavation is contemplated for the overfill pit, owing to the lack of hydrocarbon impacts. EC and SAR impacts will be addressed by capping with a soil cover;
- Backfill the pit in lifts with treated soil from landfarm, compact, and slope to drain at surface;
- Cover main and overflow pits with graded topsoil to direct surface water runoff away from the backfilled pit; and
- Seed the graded area with native grasses using hydromulch in order to stabilize the soil and restore it for suitable agricultural or recreational use.

### **2.3 Skimmer Pit**

- Pump out liquids by vacuum truck as necessary and dispose at a permitted oilfield waste management facility;
- Excavate affected materials to the depth of exceedances of Table 910-1;
- Manage soil in landfarm in accordance with procedures described below under Landfarm Bioremediation Management;
- Collect samples of mixed soil, obtain laboratory analyses, and confirm soil concentrations are within limits prior to backfilling;
- Backfill pit in lifts, with treated soil from landfarm after bioremediation is completed, compact to, and slope grade to drain;

- Cover pit with graded topsoil to direct surface water runoff away from the backfilled pit; and
- Seed the graded area with native grasses using hydromulch in order to stabilize the soil and restore it for suitable agricultural or recreational use.

### 3.0 Ground Water

COGCC has confirmed that no ground water remediation is necessary because replacement water well was installed on October 19, 2009 on the Nelson residence to address the potential for contact with affected ground water from the pits. The well is completed in the Pierre Shale from 820-1020 ft and the screened zone is isolated by 570 ft of clay and shale from the High Plains (Ogallala) Aquifer in which the old Nelson well (total depth of 250 ft) was completed.

### 4.0 Landfarm Soil Treatment

The landfarm facility will be located adjacent to the pits at Schwake Well A-1. The final location will depend upon concurrence of the property owner. The size of the facility is expected to be approximately 4 acres. Figure 3 is a map showing the general relationship of the landfarm to the pits.

#### 4.1 Proposed Landfarm Construction Details

The conceptual design of the landfarm treatment area is to construct treatment cells that will be suitable for promoting the degradation of TPH-affected soil, while being protective of human health and the environment. An estimated volume of 5,200 bulk cubic yards (BCY) of material will be treated in the landfarm based on the following calculations:

<i>Volumetric Estimates for Landfarm</i>		
Item	Units	Value
Schwake's Pits Volume of TPH-Affected Material	BCY	3,900
Contingency Volume @30% (to be treated in Cell 3 as needed)	BCY	1,300
Total Landfarm Volume	BCY	5,200

The landfarm will be divided into three cells. Figure 4 shows a generalized plan and detail of the proposed landfarm. Cells 1 and 2 will be constructed to provide a volume of about 4,000 BCY. Cell 3 will be constructed, if needed, to provide additional treatment capacity should soil volumes approach the estimated volumes. The final dimensions of Cell 3 may vary from those described for Cells 1 and 2, pending determination of the final volume of soil to be treated. Alternatively, soil treatment may occur at such a rate as to afford additional soil treatment opportunities in Cells 1 and 2 within a reasonable length of time.

The landfarm will be surrounded by an external berm with an interior berm provided for ease of access and operational flexibility. Natural drainage at the site is generally to the north/northwest at a slope of less than approximately 0.5%.

The landfarm will be constructed in cells with each cell consisting of three layers:

1. The top layer will be a 12-inch thick layer of hydrocarbon-affected soil excavated from the pit area;
2. Beneath the top layer will be a 6-inch layer of sand to provide drainage;
3. The third layer down will be an approximately 12-inch thick, compacted, low permeability clay liner placed on natural grade.

Site preparation will include stripping the top 6-inches of existing soil then proof-rolling the subgrade. The liner will be sufficiently deep, beneath the sand, that it will not be damaged by the tilling equipment used at the landfarm during routine operations.

The sand drainage layer will incorporate a French drain system for leachate collection. At various points along the surrounding berms, clay-lined, earthen leachate sumps will be provided. Earthen ramps will be provided at the berms for equipment access to the landfarm interior.

Stormwater run-on and run-off will be controlled at this facility by the use of earthen berms and ditches. Ditches will be sized for a 25-year, two-hour storm (2.5-inches rainfall). On average, the area within the landfarm will be relatively flat. Drainage ditches will use channel drops to maintain a velocity low enough to limit erosion but fast enough to reduce the potential for silting. Accumulated storm water will be applied back into the cells to provide moisture for biological treatment. Excess storm water, if any, will be collected using a vacuum truck for disposal.

Perimeter drainage ditches for non-contact stormwater will join at a single point. From that confluence, it is proposed that a drainage ditch will be extended northward to the roadside ditch along County Road 74.

#### **4.2 Landfarm Bioremediation Management Plan**

The most significant treatment in the landfarm is expected to occur during the relatively warm months of April through October of each year of operation. The landfarm will be divided into multiple cells with each cell being scheduled on a regular, rotating basis to be aerated and watered during the treatment season.

When the material is aerated, it will be turned over with a tractor-pulled disc harrow. The windrowing effect of the disc will turn over the entire depth of the affected material, thus periodically exposing all the affected material to sunlight, oxygen, and water. During this operation, the cultivation will be controlled such that the material thickness will be uniform during the treatment period.

Fertilizers and other nutrients will be added as needed, to achieve a decay rate suitable for up to two years of landfarm operations. At a minimum, fertilizers and other nutrients will be added annually, unless sampling precludes the need for supplements. The target concentration is less than 500 mg/kg and the material will be cultivated until these levels are reached, pursuant to 907(e)(2)(E).

The landfarm is in a relatively dry area; therefore water will likely have to be added to maintain a moisture content of around 40% in the soil. Based on interim sample results, this amount may have to be adjusted from time to time.

#### **4.3 Sampling and Analysis Plan**

Samples will be collected from the material within the landfarm according to the schedule outlined below. Unless otherwise noted, samples will be collected and analyzed for TPH.

- *Prior to Construction*

To establish a baseline of existing soil conditions, samples will be collected from the area where the landfarm is to be constructed. Sample locations and results will be noted on a pre-construction site map.

- *Prior to Beginning Treatment*

Once the affected material is placed, spread, and initially tilled, a second round of sampling will occur to establish a baseline condition of the affected soil at the beginning of treatment. Samples should be collected and evaluated for moisture content. This will indicate whether supplemental moisture needs to be added to one or more areas of the landfarm.

- *During Treatment*

Over the anticipated seven month treatment season, samples will be collected at the beginning of the treatment season (April), in June and August, and in October when a sample set is collected at the end of the treatment season. Samples should be collected and evaluated for moisture content on a weekly basis. This will indicate whether supplemental moisture needs to be added to one or more areas of the landfarm.

- *Confirmation Samples*

To verify completion of the required treatment program and compliance with Rule 907(e)(2), a final set of confirmation samples will be taken from the landfarm. A set of samples of the underlying soils will be taken at the closure of the cells to confirm no significant releases have occurred from the landfarm.

#### **4.4 Closure Criterion**

Treatment in a cell will be considered complete when the TPH concentration in the samples is less than the 500 mg/kg criterion for TPH specified in Table 910-1. At that point, the treated landfarm material and the drainage layer will be removed and placed back into the pit from which it originally came. PVC and other similar materials will be disposed off site in an appropriate landfill facility.

#### **4.5 Surface Owner Approval**

A copy of the written approval from the surface owner is provided in Appendix B.

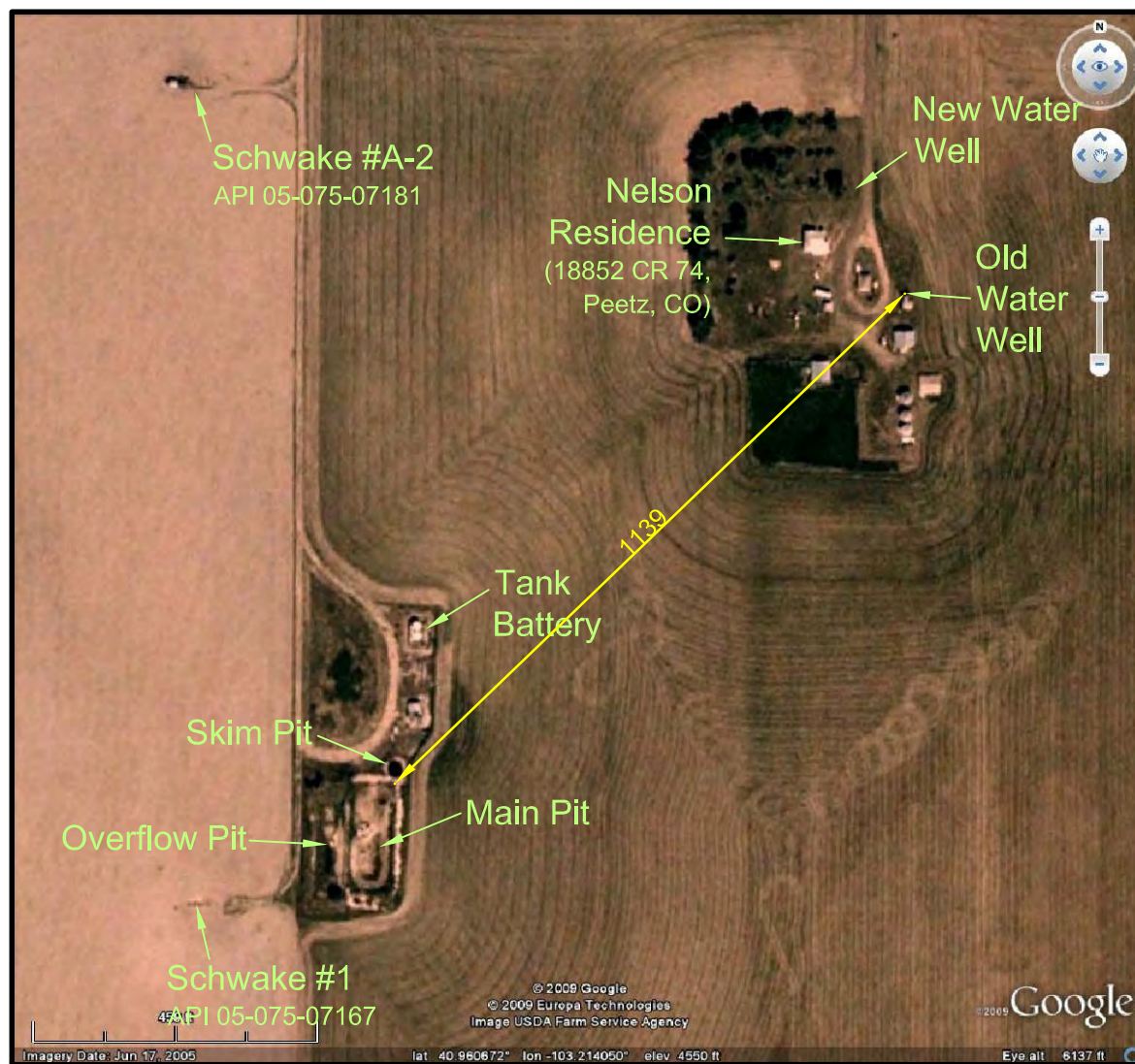
## **Figures**

*April 29, 2010*  
*Project No. 0104362*

**Environmental Resources Management Southwest, Inc.**  
15810 Park Ten Place, Suite 300  
Houston, Texas 77084-5140  
(281) 600-1000

# LEGEND

DIMENSION DISTANCE  
FROM PITS TO WATER  
WELL



## Environmental Resources Management

DESIGN: JLB	DRAWN:	CHKD.: PAS
DATE: 12/8/2009	SCALE: AS SHOWN	REV.:

W.O. NO.: H:\DWG\L09\0104862a001.dwg, 12/8/2009 2:33:22 PM

FIGURE 1  
SITE LOCATION MAP  
FACILITY ID 100305  
PEETZ WEST (68300)  
LOGAN COUNTY, CO





# LEGEND

- OUTLINES OF PIT MARGINS USED FOR VOLUME ESTIMATION
- S1 TRACK LOADER SAMPLE PITS INSTALLED ON 10/8/09



## Environmental Resources Management

DESIGN: JLB	DRAWN:	CHKD.: PAS
DATE: 12/8/2009	SCALE: AS SHOWN	REV.:
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FIGURE 2  
PIT SAMPLE LOCATION MAP  
FACILITY ID 100305  
PEETZ WEST (68300)  
LOGAN COUNTY, CO







NOTE: THE EXACT LOCATION OF THE LANDFARM WILL BE ADJUSTED IN THE FIELD TO ACCOMMODATE THE LANDOWNERS REQUIREMENTS.



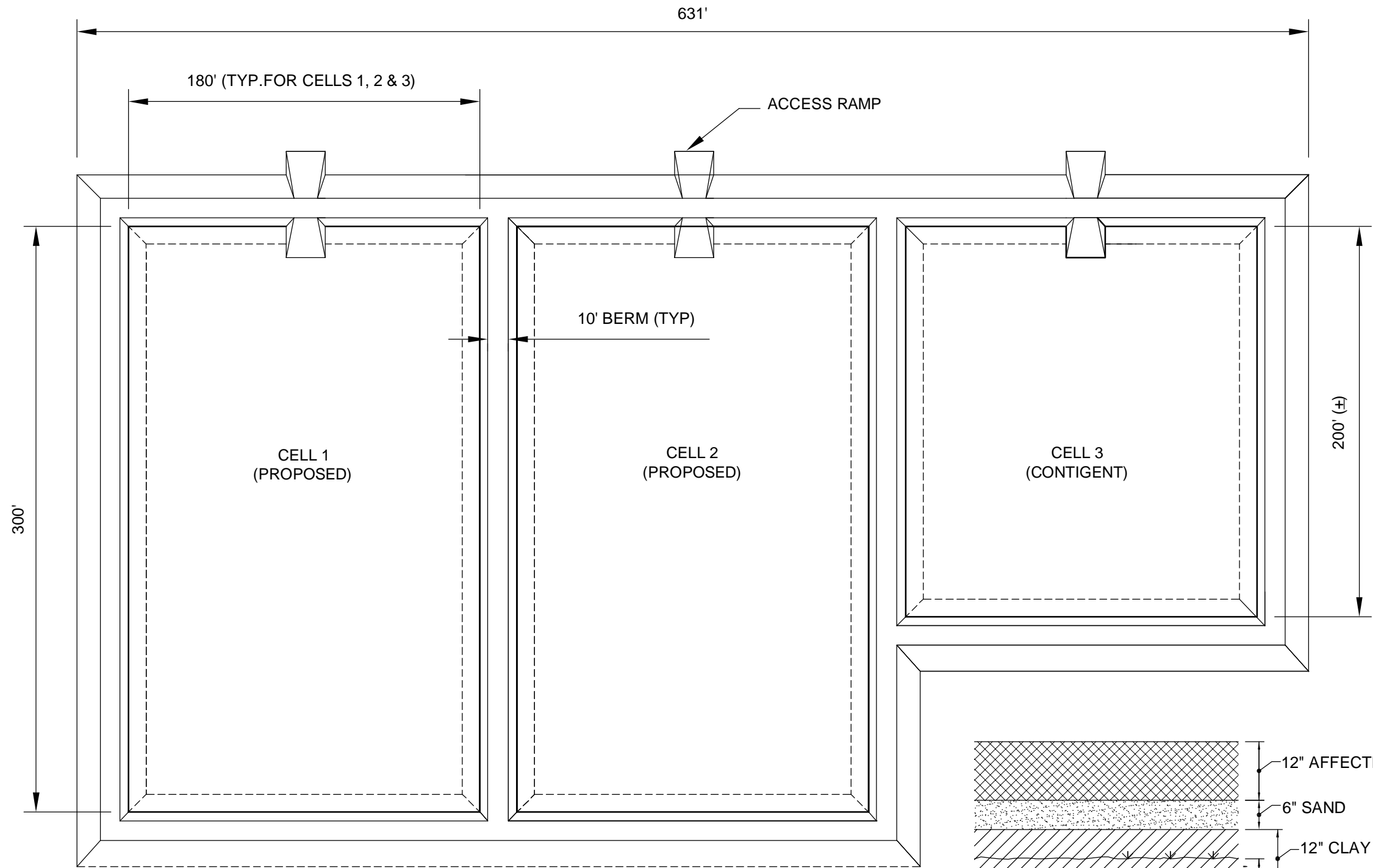
## Environmental Resources Management

FIGURE 3  
PROPOSED LANDFARM LOCATION  
FACILITY ID 100305  
PEETZ WEST (68300)  
LOGAN COUNTY, CO



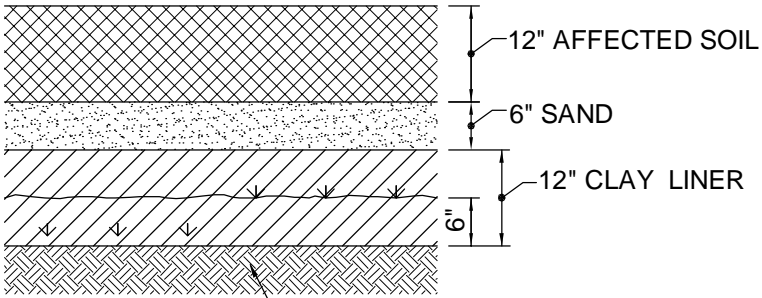
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ERM-Southwest, Inc. TX PE Firm No. 2393



- NOTES:
1. PROVIDE PERIMETER SWALES AND DITCHES.
  2. PROVIDE EARTHEN LEACHATE COLLECTION SUMP IN EACH CELL.
  3. SEE WORK PLAN FOR ADDITIONAL INFORMATION.

**PLAN VIEW**  
SCALE: 1" = 60'



STRIP 6" EXISTING  
GRADE; PROOF-ROLL  
**DETAIL**  
SCALE: 1/2" = 1'-0"

**Environmental Resources Management**

FIGURE 4  
PROPOSED LANDFARM PLAN AND SECTION  
FACILITY ID 1000305  
PEETZ WEST (68300)  
LOGAN COUNTY, CO

DESIGN: RTG	DRAWN: RTG/RLM	CHKD: _____
DATE: 4/29/2010	SCALE: AS SHOWN	REV: _____
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**Relevant Correspondence**  
*Appendix A*

*April 29, 2010*  
*Project No. 0104362*

**Environmental Resources Management Southwest, Inc.**  
15810 Park Ten Place, Suite 300  
Houston, Texas 77084-5140  
(281) 600-1000

**From:** Axelson, John [John.Axelson@state.co.us]

**Sent:** Wednesday, April 14, 2010 9:43 AM

**To:** Scott Stapp

**Cc:** Gottsegen, Thomas E; Paul Stefan; James Weber; David Hooker; Baldwin, Debbie; Lindblom, Steven

**Subject:** RE: change in procedure  
Scott,

Thank you for the update. COGCC concurs with your request for an extension to complete remediation. Because you have already submitted a Site Investigation and Remediation Workplan (Form 27) that was approved, I will need a revised remediation plan. It is not necessary to fill out another Form 27, but a detailed plan for land farming is required. At a minimum, it should include the following information - Reference COGCC Rule 907.e.(2):

- Site diagram depicting the area where the material will be treated.
- Diagram and discussion of treatment area including liner and stormwater controls. If liner is not going to be used under the treatment area, confirmation samples of underlying native soil will be required at the termination of the landfarm.
- Discussion of bioremediation including volume of material, a schedule for aerating and moisturizing as well as quantities and types of nutrients that will be added to enhance biodegradation. Also, include information regarding the thickness of the material = no deeper than equipment can sufficiently till for aeration.
- Sampling and analysis plan – once the waste has been excavated and placed, a sufficient number of representative soil samples need to be collected to characterize contaminant levels at the start of landfarming. A suggestion would be one composite sample to represent each 50 cubic yards of material. Each sample should be analyzed for TPH, BTEX, PAHs, inorganics and metals.
- Samples shall be collected again at the end of the first season to establish the rate of biodegradation. Final confirmation samples will also be required verifying that Table 910-1 standards have been met prior to re-use of the treated material.
- Provide written surface owner approval for the land treatment.

Because most progress in landfarming is made in the warmer months in Colorado – time is of the essence. Please submit the revised remediation plan by the original due date set to complete remediation - April 30, 2010. Also provide a schedule to begin excavation and placement of material beginning in May 2010.

If you have any questions please give me a call.  
Thank you,

John Axelson, P.G.  
Environmental Protection Specialist, Northeast Region  
Colorado Oil & Gas Conservation Commission  
Phone: 303-637-7178  
Cell: 303-877-9964  
Fax: 303-637-7179



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**From:** Scott Stapp [mailto:[ssapp@mepco.us.com](mailto:ssapp@mepco.us.com)]  
**Sent:** Wednesday, April 14, 2010 6:07 AM  
**To:** Axelson, John  
**Cc:** 'Gottsegen, Thomas E'; Paul Stefan; James Weber; David Hooker  
**Subject:** change in procedure

John,

This email is a follow-up to our phone conversation last week which we discussed the change in our procedure in cleaning up the Schwake pit in Section 6-11N-52W Logan co., CO. We have received several bids on hauling the contaminated soil and disposal, which have proven to be cost prohibitive. We are now pursuing the option of land farming. Due to the change in the clean up procedure meeting the completion deadline of April 30<sup>th</sup> is not possible, I request an extension in order to start the land farming.

Thank you,

Scott Stapp

*Merchant Energy Partners, LLC*  
D. Scott Stapp  
10901 W. Toller Dr., Suite 200  
Littleton, CO 80127  
[ssapp@mepco.us.com](mailto:ssapp@mepco.us.com)  
o. (720) 351 -4006  
c. (303) 204-0446

**Approval from Surface Owners**  
*Appendix B*

*April 29, 2010*  
*Project No. 0104362*

**Environmental Resources Management Southwest, Inc.**  
15810 Park Ten Place, Suite 300  
Houston, Texas 77084-5140  
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