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June 13, 2012

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NMED Hazardous Waste Bureau

Mr. David Cobrain
Manager, Santa Fe Group
Permits Management Program
Hazardous Waste Bureau
2905 Redeo Park Drive East, Building 1
Santa Fe, New Mexico 87505

RE: Report of 2011 Groundwater Remediation Activities
Roswell Station Remediation Site
Transwestern Pipeline Company, LLC
Chavez County, New Mexico
Case # GW-052

On behalf of Transwestern, enclosed is a copy of the annual Report of 2011 Groundwater Remediation Activities for the Roswell Station Remediation Site. This report includes the results of groundwater assessment and remediation work completed at the site during 2011. The original report has been submitted to the NMOCD Environmental Bureau.

If you have any questions or comments regarding the report, please contact Richard Spell at (832) 668-1392.

Sincerely,

George Robinson

George Robinson
President/Principal Engineer

xc w/attachment: Richard Spell — Transwestern Pipeline Company (Houston, TX)
Larry Campbell — Transwestern Pipeline Company (Roswell, NM)

Report of 2011 Groundwater Remediation Activities

Transwestern Pipeline Company, LLC
Roswell Station Remediation Site
Chaves County, New Mexico

CASE # GW-052

Submitted to:
New Mexico Oil Conservation Division

June 6, 2012

Prepared For:
Transwestern Pipeline Company
6381 North Main Street
Roswell, NM 88201

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1. Introduction

The last report of groundwater remediation activities covered activities completed through December 2010. This report presents a summary of monitoring and remediation activities completed during calendar year 2011 (including the January 2-3, 2012 groundwater sampling event).

2. Groundwater Monitoring Activities

2.1 Semiannual Groundwater Sampling Events

Two semi-annual groundwater sampling events were completed during the reporting period. These events were completed in April 2011 and January 2012.

Prior to sampling, the depth to water, and the depth to hydrocarbon where phase separated hydrocarbon (PSH) was present, was determined for each monitor well and recovery well. The measured depths and the corresponding water table elevation for each monitor well and recovery well is presented in Tables 1 and 2.

In the course of each sample event, groundwater samples were collected from selected monitor wells at the site in accordance with the site sampling analysis plan. As a matter of standard operating procedure, samples were not collected from monitor wells with accumulated PSH in the well casing. Groundwater samples were delivered to a laboratory for analysis for benzene, toluene, ethylbenzene, and xylene (BTEX) by EPA Method 8021B. Samples from three wells located at the north end of the site were submitted for analysis for volatile organic compounds (VOCs) by EPA Method 8260B.

A summary of field measured groundwater quality parameters (pH, temperature, electrical conductivity and dissolved oxygen) obtained in the course of sampling is presented in Table 3. An updated summary of laboratory results for organic compounds (BTEX and other VOCs) is presented in Table 4. Analyses for inorganic constituents were discontinued in 2003, however, for reference, a summary of laboratory results for inorganic constituents measured during prior sampling events is presented in Table 5.

A copy of the laboratory reports for the two semiannual groundwater sampling events are included in Appendix D.

2.2 Results/Conclusions from Groundwater Sampling Events

2.2.1 Occurrence and Direction of Groundwater Flow

A water table elevation map based on measurements obtained in December 2011 is included as Figure 2. The information presented in Figure 2 appears to define a complex groundwater system with some areas of low flow and other areas of preferential flow. Furthermore, there is an apparent divide in the groundwater flow direction beneath the site. At the northern end of the affected area, groundwater flow is toward the North; while in the central and southern portions of the site, groundwater flow is toward the South-Southeast. The apparent direction of groundwater flow is consistent with water table elevation maps previously developed for this site and is also consistent with the distribution of contaminants in the uppermost aquifer.

Hydrographs for selected monitoring wells with no accumulated PSH are included in Appendix A. The hydrographs show a history of water table elevation change since depth to water measurements were first recorded at the site in 1996. There is a sharp decline in the water table elevation following startup of the groundwater recovery and treatment system in April 2004. The hydrographs indicate about a three to four foot decline in the water table during the 7 ½ year period between April 2004 and December 2011. A continued decline in the water table is anticipated and is beneficial to the remediation effort.

2.2.2 Lateral Extent of Phase Separated Hydrocarbon

Within the "uppermost aquifer", the lateral extent of PSH is currently defined by the occurrence of PSH at the water table in 11 wells and the absence of PSH in all other wells. The thickness of accumulated PSH in monitor wells and multi-phase extraction (MPE) wells is presented in Tables 1 and 2. A figure indicating the estimated area with PSH present at the water table is included as Figure 3. Also indicated in Figure 3 is the estimated maximum extent of PSH measured at the site in March 2005.

In March 2005, accumulated PSH was measured in 23 wells within the "uppermost aquifer"; in December 2011, this number had been reduced to 11 wells. The current lateral extent of PSH covers an area about 53% the size of the estimated maximum extent indicating that the remediation system is effectively reducing the size of the impacted area. In most wells where accumulated PSH has persisted, the measured thickness of PSH has decreased significantly since active remediation efforts began. This can be seen graphically in the hydrographs presented in Appendix B.

It was suspected that the continued presence of PSH in some MPE wells was more likely associated with the preferential accumulation of PSH in low pressure areas, such as soil vapor extraction wells, and was not likely indicative of PSH present at the water table outside of the immediate vicinity of the well screen. In light of this, a program was initiated in June 2010 to evaluate the re-accumulation rate of PSH in MPE wells. In June 2010, accumulated PSH was removed from eight MPE wells containing PSH using a bailer. Ten months later, in April 2011, the re-accumulation of PSH was measured in the course of the April 2011 groundwater sampling event. A summary of the data obtained during this evaluation is provided in Table 2b. Results indicate that the accumulation of PSH was reduced in six of the eight MPE wells; two of the eight MPE wells had no measurable re-accumulation of PSH after ten months.

A shallow perched zone was identified during the initial site investigation activities. The perched zone is very limited in lateral extent and occurs at a depth of about 30-35 feet, which is about 30 feet above the depth of the "uppermost aquifer". There are 9 SVE wells completed within the perched zone. In December 2011, depth to water measurements indicated that two of the 9 shallow SVE wells were dry; the remaining shallow SVE wells contained less than five feet of water column. In addition, one of the shallow SVE wells contained a measurable accumulation of PSH. The estimated lateral extent of PSH in the shallow perched zone is indicated in Figure 4.

2.2.3 Condition of Affected Groundwater

The primary constituent of concern is benzene. Additional constituents of concern are 111-trichloroethane, 11-dichloroethane, and 11-dichloroethene (11-DCE). In January 2012, laboratory results for groundwater samples indicated that only benzene and 11-DCE were measured at concentrations above NMWQCC standards.

A site diagram indicating the distribution of benzene in groundwater is included as Figure 5. The present lateral extent of dissolved phase benzene is contained within an area just slightly greater than the lateral extent of PSH. The maximum historic extent of benzene in groundwater is also indicated in Figure 5. It is apparent that the present lateral extent of benzene is considerably smaller than the maximum historic extent of benzene.

A site diagram indicating the distribution of 11-DCE in groundwater is included as Figure 6. The small plume of dissolved-phase 11-DCE does not appear to be closely associated with the presence of accumulated PSH.

Startup of the groundwater recovery system appears to have accelerated natural attenuation processes and has resulted in a decrease in contaminant concentrations at most sampling locations. It is anticipated that contaminant concentrations in groundwater will continue to decline with continued operation of the groundwater remediation system.

3. Status of Remediation Activities

3.1 Remediation Activities Completed through December 2011

The following remediation activities were completed during the reporting period:

1) Two routine semiannual groundwater sampling events were completed.
2) The SVE system operated continuously during the year except for temporary shut-downs for maintenance.
3) Soil vapor samples were collected from the remediation system on August 10, 2011 and delivered to a laboratory for analysis for TPH by method 8015mod (GRO). The concentrations of TPH found in each circuit correspond well with the distribution of PSH measured in wells. The results from laboratory analyses are presented in Table 8 and Table 8b. As indicated in Table 8b, the SVE system is recovering total non-methane hydrocarbons at a rate of about 4,100 gallons equivalent per year. A copy of the laboratory report is included in Appendix D.
4) The groundwater recovery, treatment, and irrigation system operated from late-June through November 2011.
5) Three water treatment and irrigation system sampling events were completed during the period that the groundwater recovery and irrigation system was in operation. Laboratory results are presented in Table 10. Copies of the laboratory reports are included in Appendix D.

4. Proposed Modifications

4.1 Anticipated Changes to the Groundwater Monitoring and Remediation Well Network

An evaluation of contaminant plume stability was recently completed utilizing the Ricker Plume Stability Analysis method. Findings from this evaluation provided an overall understanding of the stability of the constituent plumes in terms of their area, average concentration, mass indicator, and center of mass. Results further indicate that the constituent plumes are stable and/or decreasing. Changes to the existing network of groundwater monitoring and remediation wells is anticipated based on the results of this evaluation.

Upon review of the plume stability evaluation it was noted that the existing monitoring well network will require to be expanded in the northern portion of the site. Specifically, further delineation of the contaminant plume in the area north (downgradient) of monitoring well MW-26 will be necessary. This will be accomplished with the addition of one or more monitoring wells downgradient of well MW-26. A separate work plan will be prepared for this activity and submitted to NMOCD for approval after completion of further evaluation of the existing data.

The plume stability evaluation also identified several groundwater monitoring and remediation wells that are no longer necessary for continued monitoring and/or remediation activities at the site. Generally, this includes monitoring wells that have been documented to be "clean" for a number of previous sampling events and remediation wells that are outside the affected area. A separate work plan to plug and abandon wells no longer needed will be prepared and submitted to NMOCD for approval after completion of further evaluation of the existing data.

4.2 Modifications to the Routine Groundwater Sampling Plan

Sampling location, frequency and the sampling analysis plan (SAP) will continue on a semi-annual basis. A summary of the sample analysis plan is presented in Table 7.

In addition to the routine sampling activities outlined in the SAP, one or more samples of PSH will be collected from wells with accumulated PSH in an effort to better define current physical properties and chemical composition. PSH samples will be delivered to a laboratory for analysis to determine specific gravity and viscosity. Analysis may also include hydrocarbon fingerprinting and/or chemical speciation. This effort will also include collecting groundwater samples from selected wells with accumulated PSH in an effort to evaluate the partitioning of BTEX compounds between remaining PSH and groundwater.

4.3 Modifications to the Remediation System

In coordination with the plume stability analysis, a Remediation System Benefit Analysis (RBSA) was completed in an effort to evaluate the effectiveness of the current remediation system. This evaluation was based on graphical data outputs generated from the Ricker Plume Stability Analysis, as well as trends associated with contaminant removal rates and relative cost/benefit indicators. This analysis utilized Benzene as the primary indicator parameter. The results from the evaluation indicate that the remediation system continues to be an "Effective Remediation System". This classification tends to indicate that, though the system continues to be effective, additional measures may be necessary to address a contributing source of contamination that is adding contaminant mass to the groundwater plume. Remaining PSH has been identified as the contributing source. If any significant modifications (such as installing

additional remediation wells) are needed to further address remaining PSH, then a separate work plan will be prepared for this activity and submitted to NMOCD for review.

4.4 Reporting

Reporting of groundwater monitoring and remediation activities will continue on an annual basis. Future reporting will incorporate any additional requirements specified in the facility's Discharge Plan Renewal issued January 11, 2012.

5. Progress Toward Project Completion

The Phase I and Phase II components of the remediation system have been installed and are in operation as described in the "Conceptual Remedial Design and Discharge Plan Modification" document dated September 10, 2002. The SVE component of the system has been in operation since March 2003 and the groundwater recovery system has been in operation since April 2004.

Based upon a review of groundwater sample results, operation of the groundwater remediation system appears to have accelerated natural attenuation processes and has resulted in a decrease in contaminant concentrations at most sampling locations. Furthermore, an evaluation of contaminant plume stability indicates that the contaminant plumes are stable and/or decreasing in area, concentration, and mass. In addition, the anticipated delineation is also intended to confirm contaminant plume stability.

FIGURES

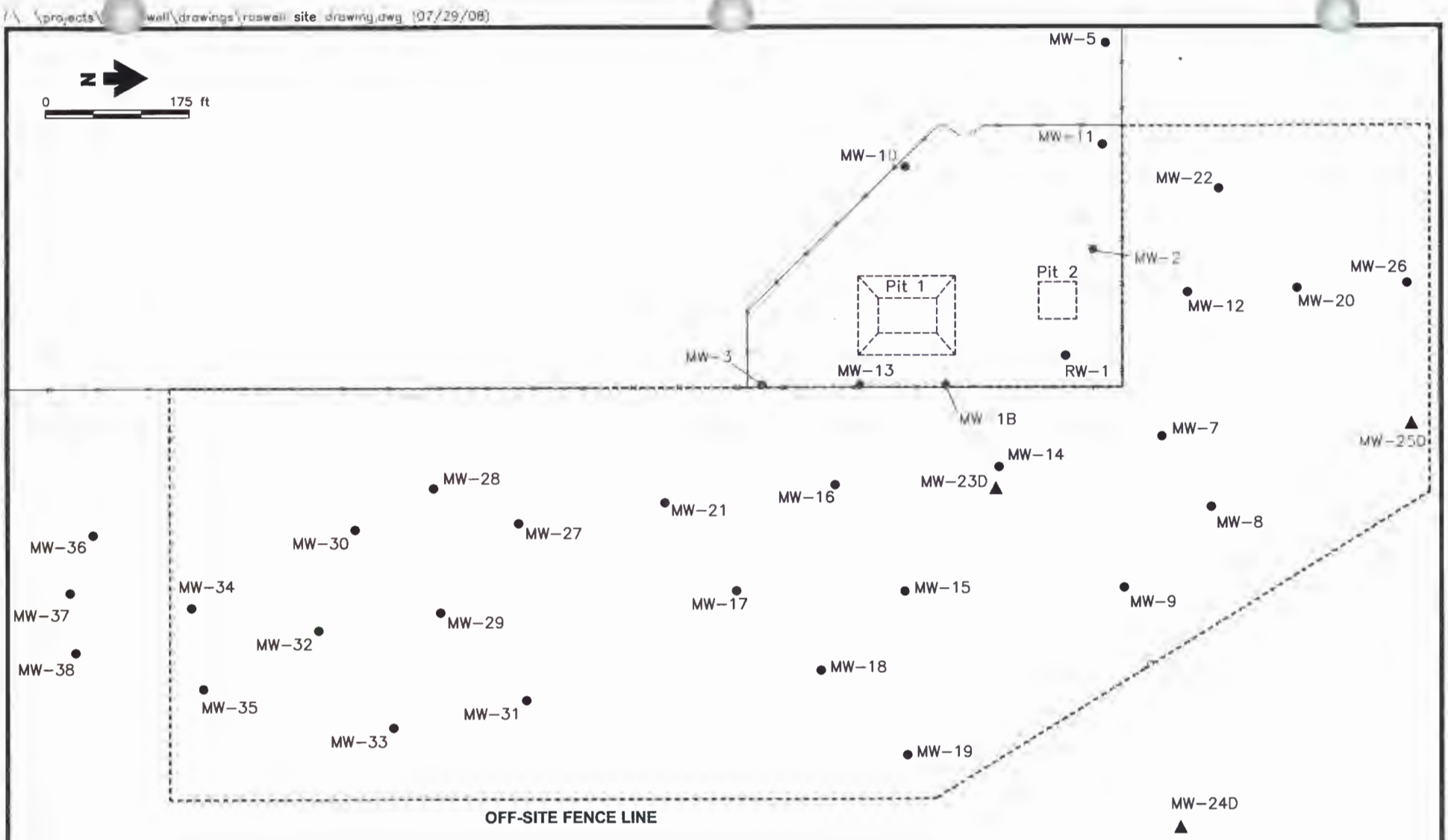
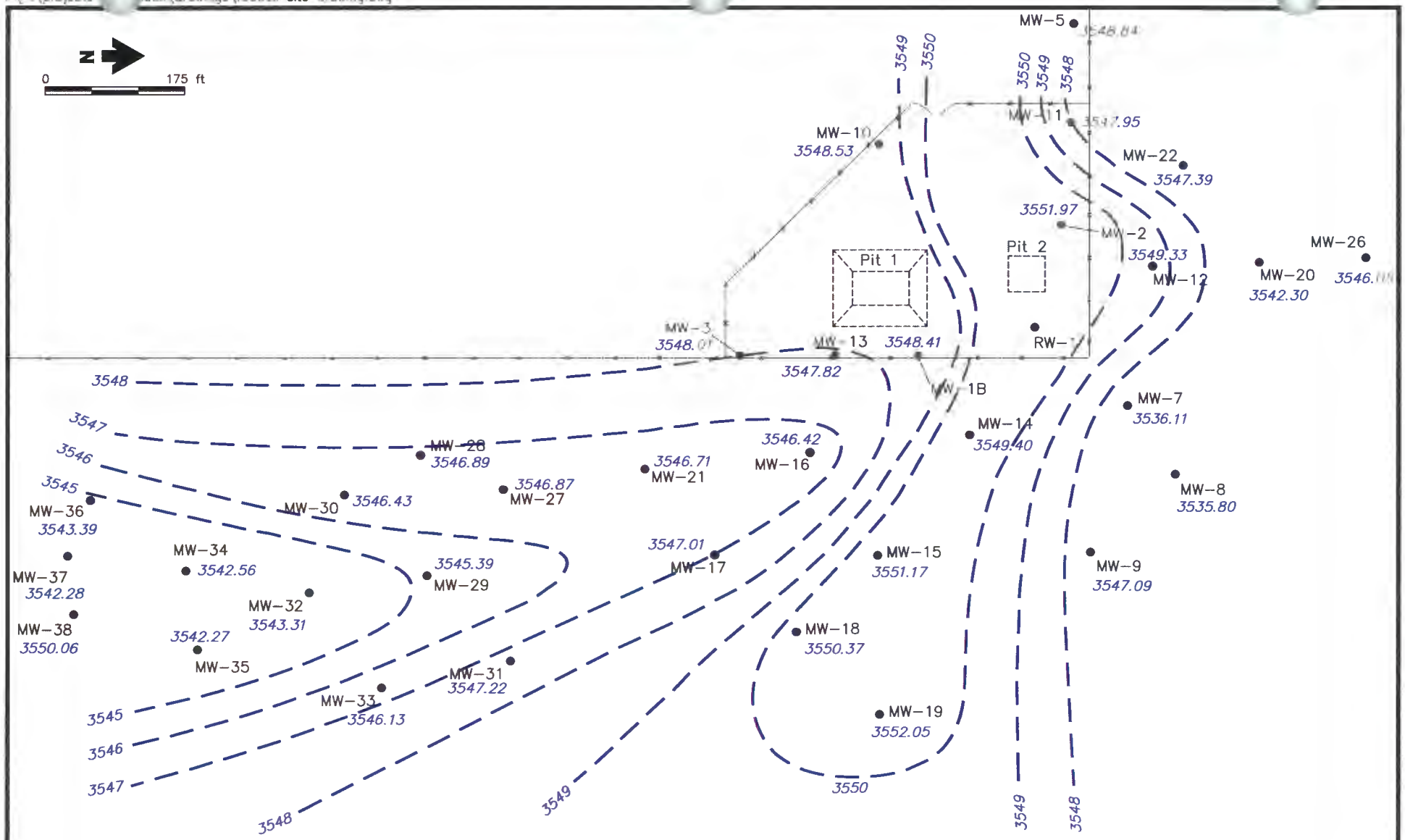

\projects\ well\drawings\roswell site drawing.dwg (07/29/08)
N
0
175 ft
MW-5
MW-11
MW-10
MW-22
MW-2
Pit 2
Pit 1
MW-26
MW-12
MW-20
MW-3
MW-13
RW-1
MW 1B
MW-7
MW-25D
MW-14
MW-28
MW-23D
MW-16
MW-21
MW-27
MW-8
MW-36
MW-30
MW-34
MW-15
MW-37
MW-17
MW-9
MW-29
MW-32
MW-38
MW-18
MW-35
MW-31
MW-33
MW-19
MW-24D
OFF-SITE FENCE LINE
LEGEND
Monitor well
Deep monitor well
Multiphase Extraction Well
MPE & Soil Vaper Extraction Well Cluster
ROSWELL STATION REMEDIATION SITE
Monitor Well Locations
CYPRESS ENGINEERING SERVICES, INC.

Figure 1



ROSWELL STATION REMEDIATION SITE

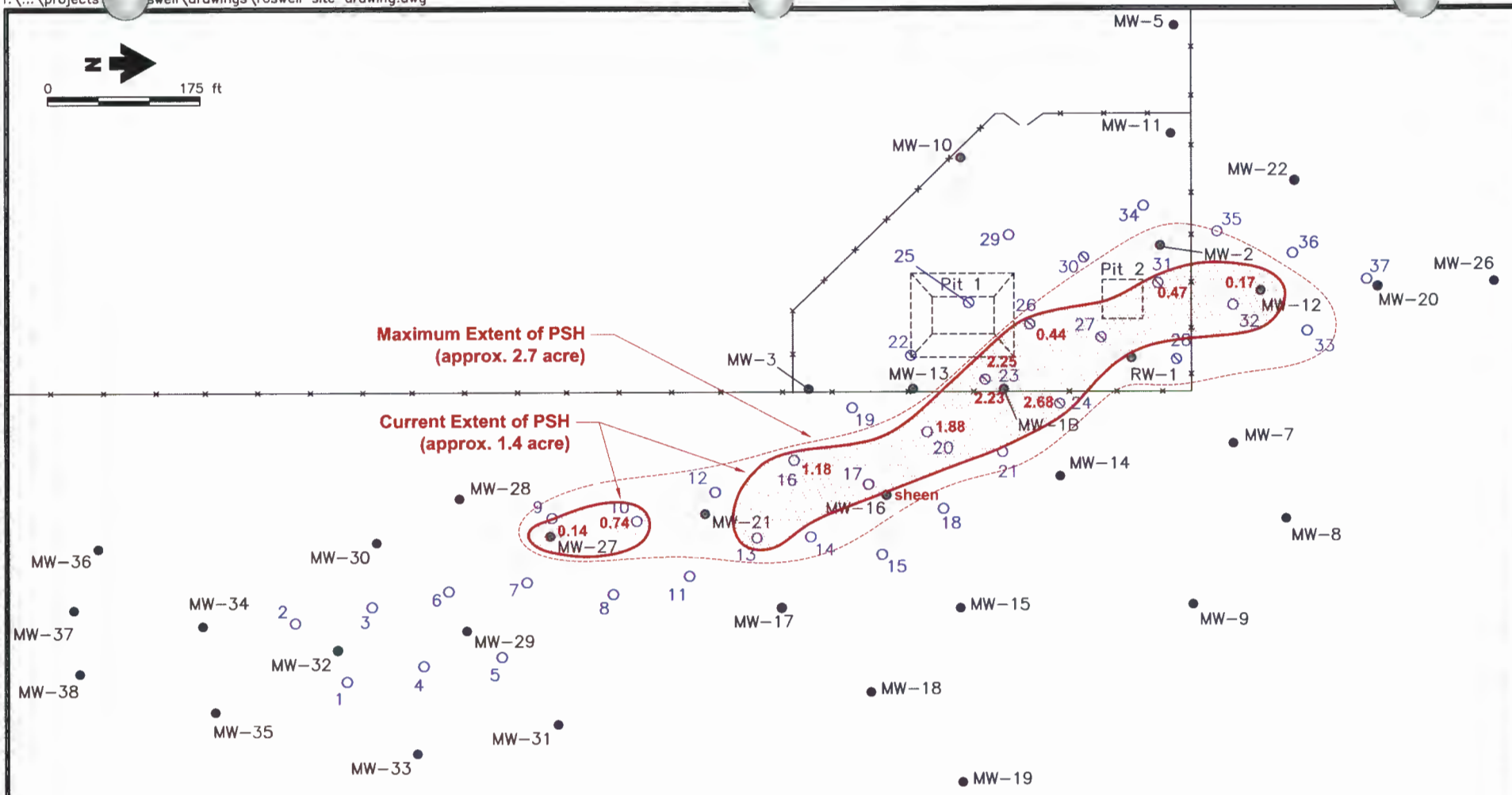
Groundwater Surface Elevations in the Uppermost Aquifer

December 22, 2011

CYPRESS ENGINEERING SERVICES, INC.

Figure 2

f:\...\projects\...swell\drawings\roswell site drawing.dwg



LEGEND

- Monitor well
- Deep monitor well
- Multiphase Extraction Well
- MPE & Soil Vaper Extraction Well Cluster
- Estimated Area of PSH Dec '11 (Phase Separated Hydrocarbon)
- Estimated Area of PSH Mar '05

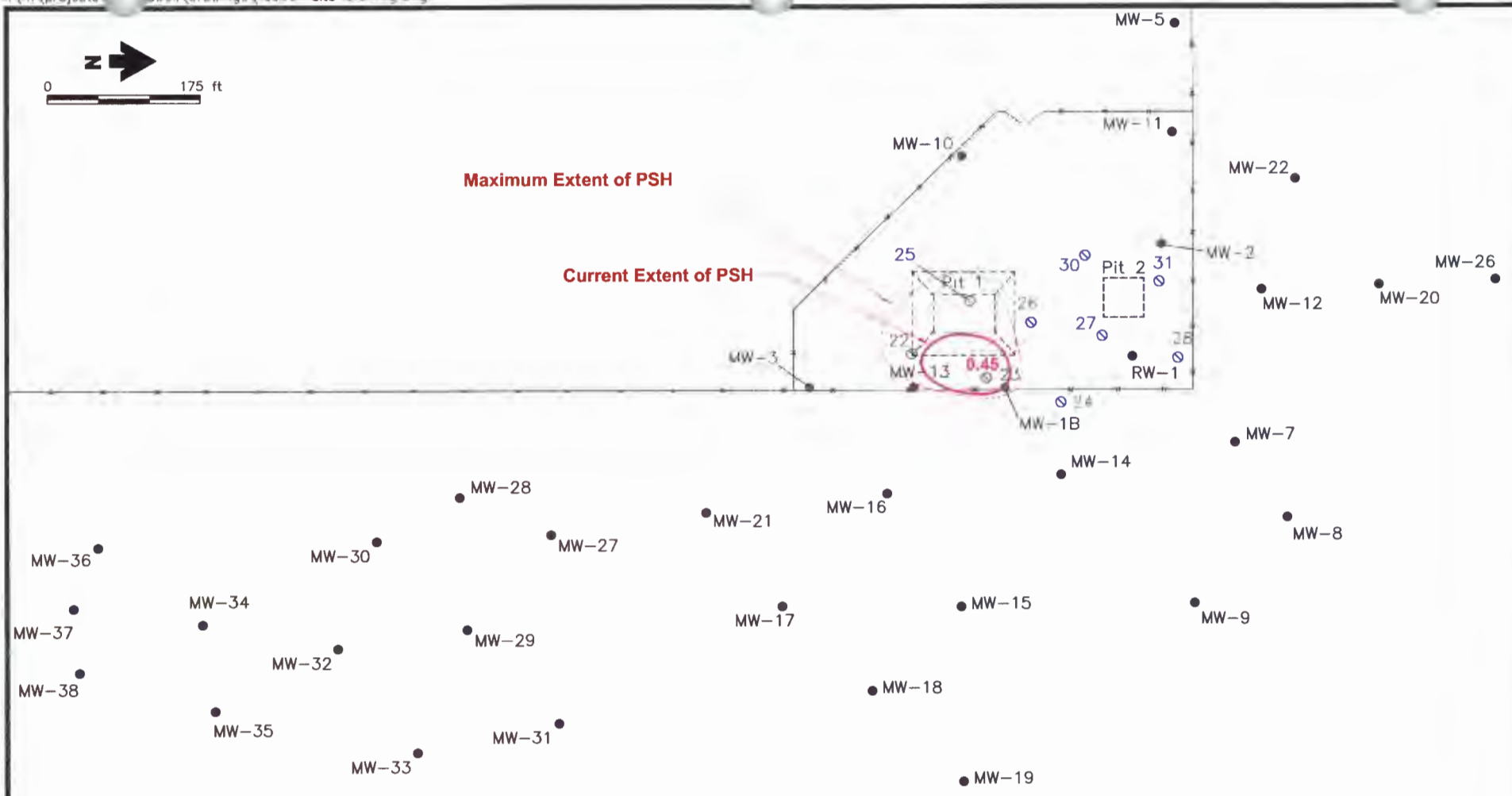
ROSWELL STATION REMEDIATION SITE

Distribution of PSH on Groundwater in the Uppermost Aquifer

December 22, 2011

CYPRESS ENGINEERING SERVICES, INC.

Figure 3



LEGEND

- Monitor well
- Deep monitor well
- Multiphase Extraction Well
- MPE & Soil Vaper Extraction Well Cluster
- Estimated Area of PSH Dec '11 (Phase Separated Hydrocarbon)
- Estimated Area of PSH Mar '04

ROSWELL STATION REMEDIATION SITE

Distribution of PSH on Groundwater in the Perched Zone

December 22, 2011

CYPRESS ENGINEERING SERVICES, INC.

Figure 4

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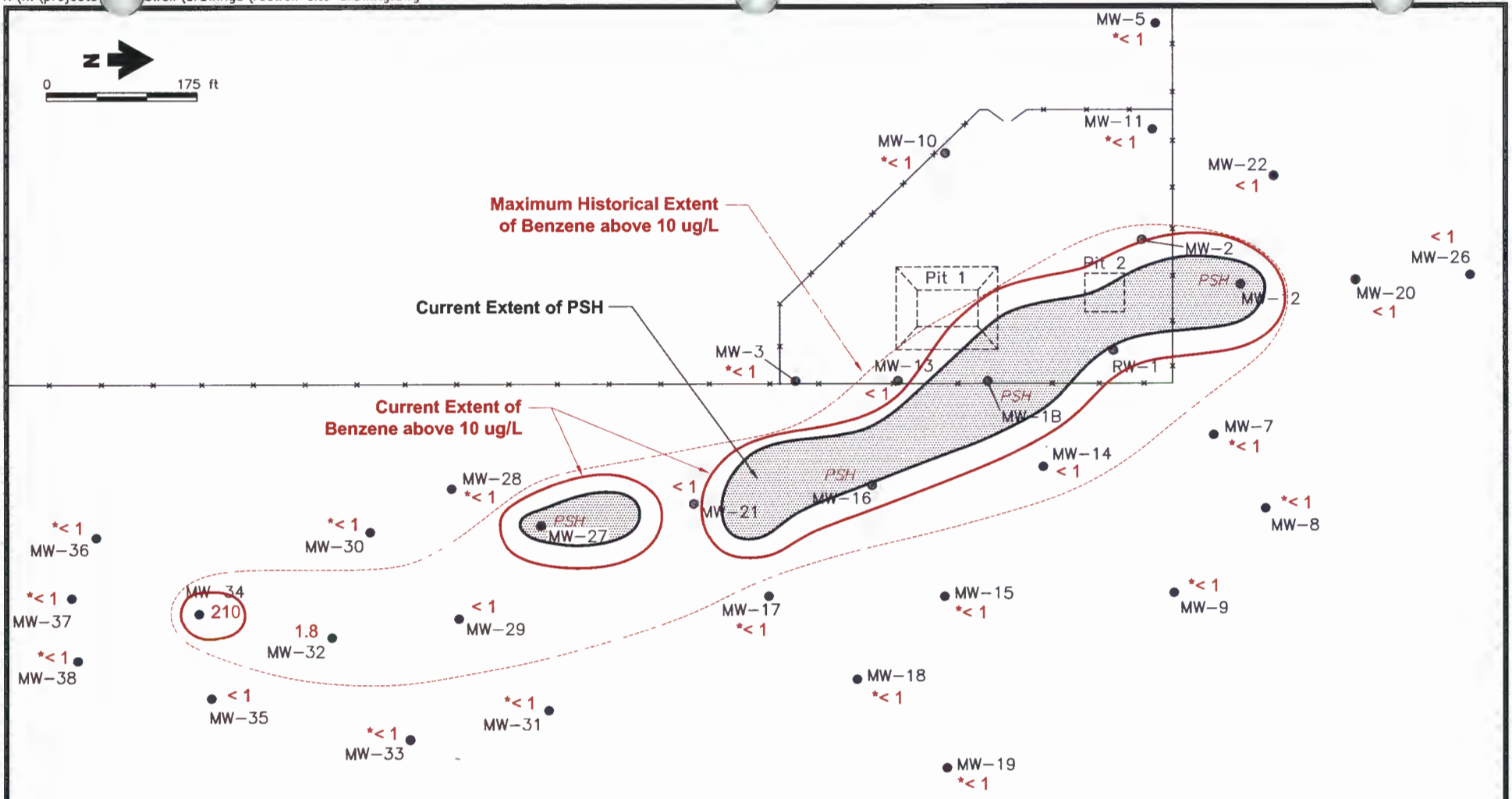

LEGEND

- Monitor well
- Deep monitor well
- Multiphase Extraction Well
- MPE & Soil Vaper Extraction Well Cluster
- < 1 — Benzene concentration in groundwater (ppb) (* indicates results from a previous sample event)
- Estimated Area with PSH in Dec '11
- Estimated Area with Benzene above 10 ug/L

ROSWELL STATION REMEDIATION SITE

Distribution of Dissolved Benzene in the Uppermost Aquifer

January 2, 2012

CYPRESS ENGINEERING SERVICES, INC.

Figure 5

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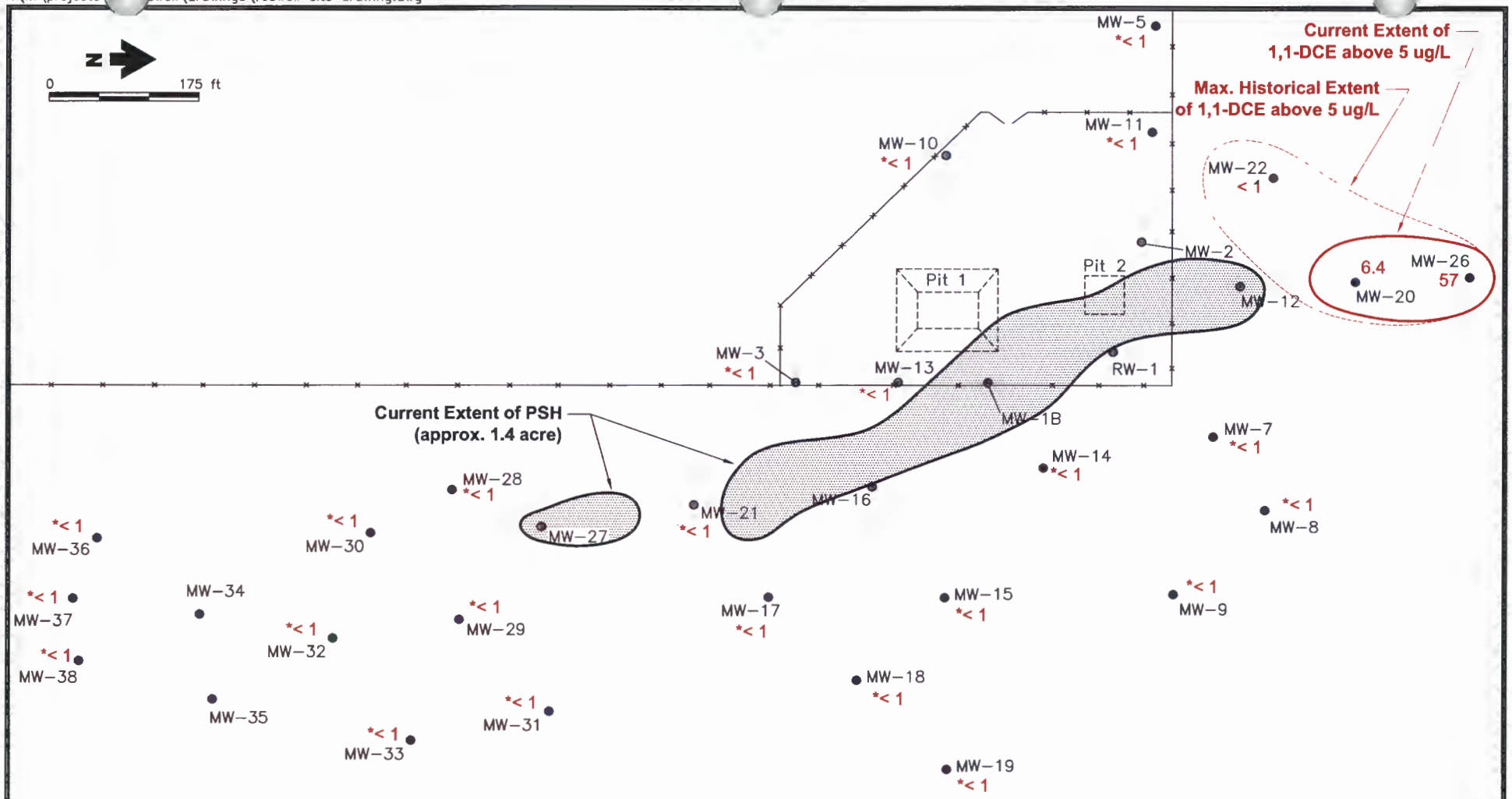


LEGEND

- ● Monitor well
- ▲ Deep monitor well
- ○ Multiphase Extraction Well
- ⊘ MPE & Soil Vaper Extraction Well Cluster
- < 1 1,1-DCE concentration in groundwater (ppb) (* indicates result from a previous sample event)
- ⬭ Estimated Area with PSH in Dec '11

ROSWELL STATION REMEDIATION SITE

Distribution of Dissolved 1,1-DCE in the Uppermost Aquifer

January 2, 2012

CYPRESS ENGINEERING SERVICES, INC.

Figure 6

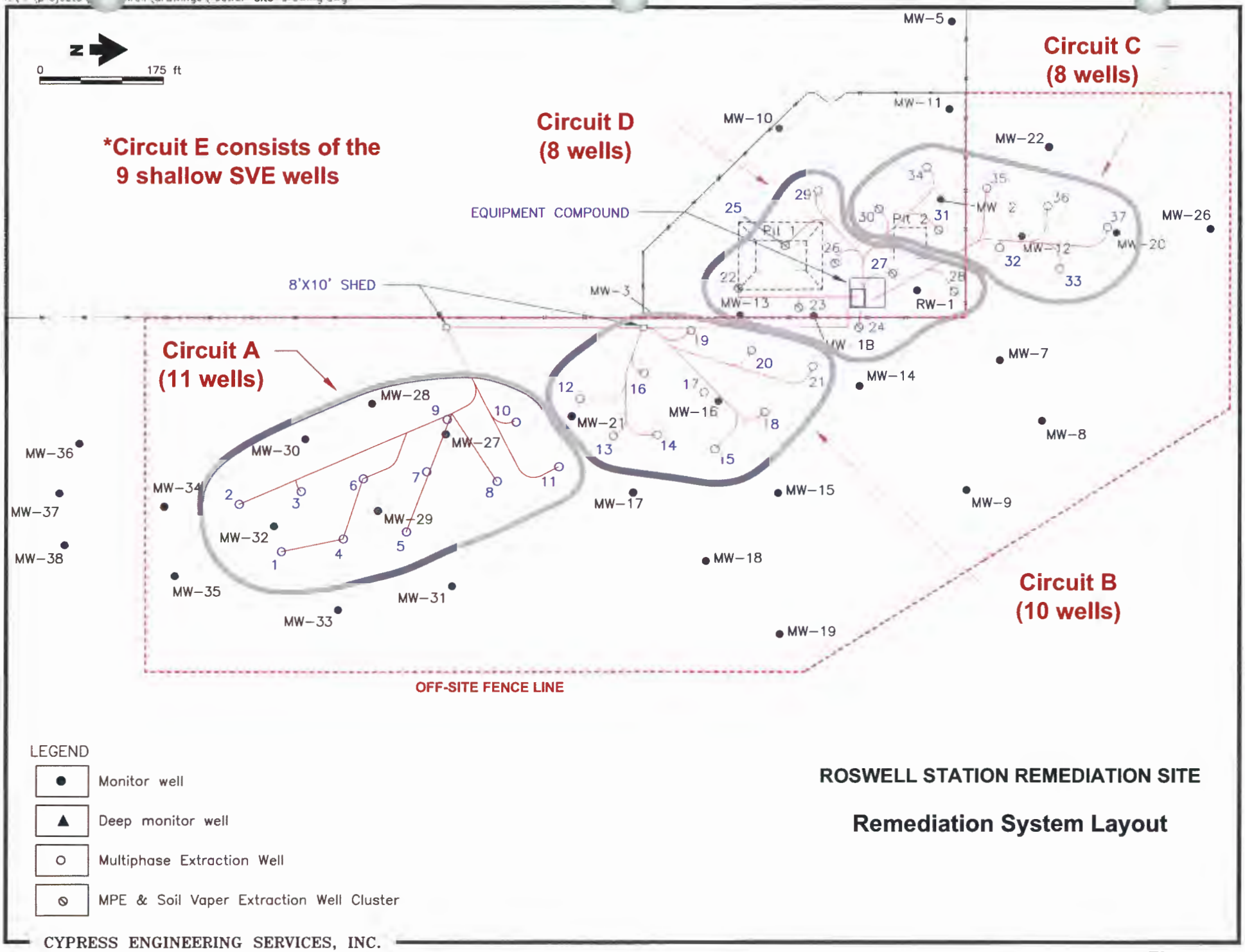

N
0
175 ft
*Circuit E consists of the 9 shallow SVE wells
Circuit A (11 wells)
Circuit B (10 wells)
Circuit C (8 wells)
Circuit D (8 wells)
EQUIPMENT COMPOUND
8'X10' SHED
OFF-SITE FENCE LINE
MW-1
MW-2
MW-3
MW-5
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
MW-13
MW-14
MW-15
MW-16
MW-17
MW-18
MW-19
MW-20
MW-21
MW-22
MW-26
MW-27
MW-28
MW-29
MW-30
MW-31
MW-32
MW-33
MW-34
MW-35
MW-36
MW-37
MW-38
RW-1
Pit 1
Pit 2
LEGEND
Monitor well
Deep monitor well
Multiphase Extraction Well
MPE & Soil Vaper Extraction Well Cluster
ROSWELL STATION REMEDIATION SITE
Remediation System Layout
CYPRESS ENGINEERING SERVICES, INC.

Figure 7

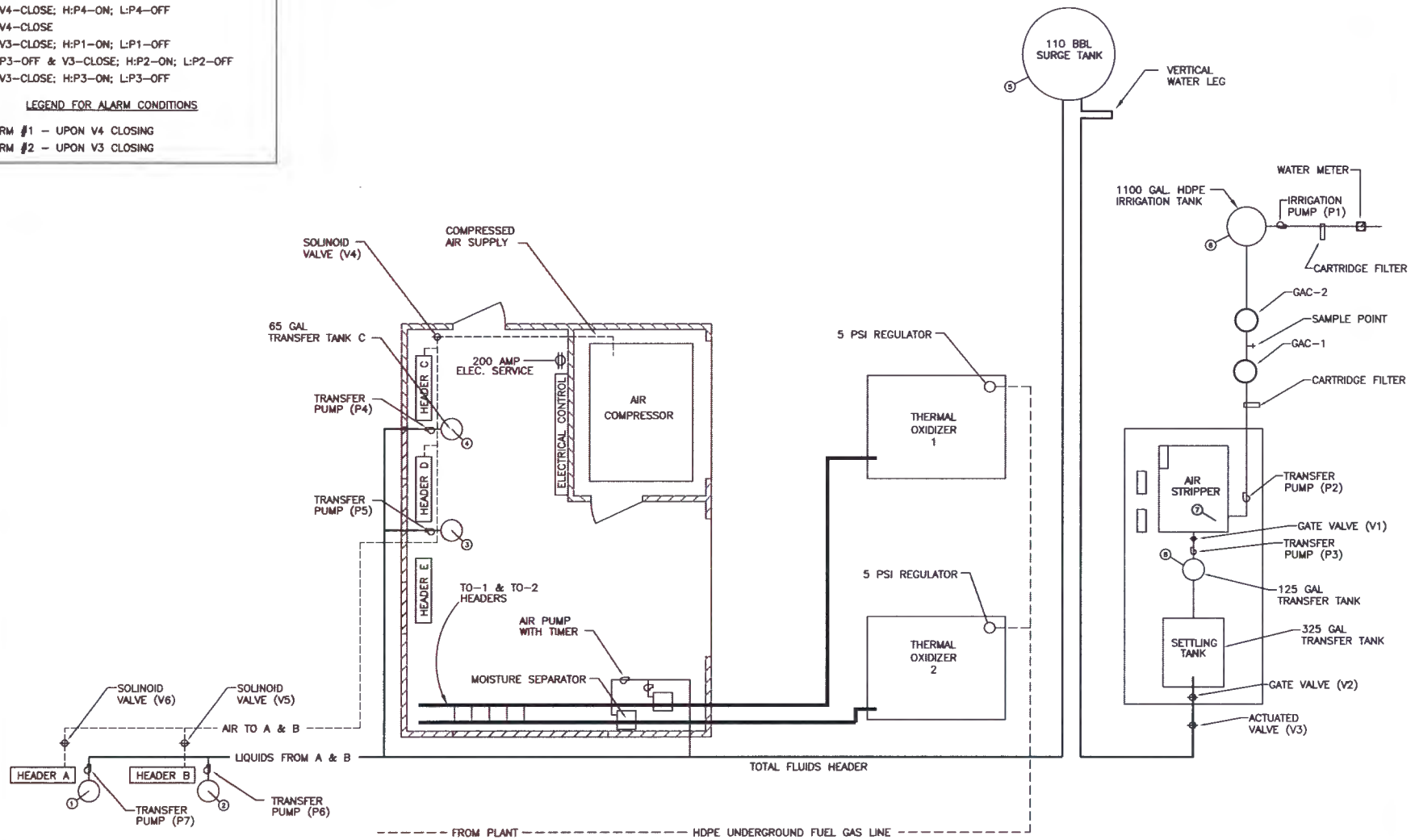
g:\...\tw\roswe...wings\roswell equipment layout (rev100806).dwg

LEGEND FOR CONTROLS

① HH:V6–CLOSE; H:P7–ON; L:P7–OFF
② HH:V5–CLOSE; H:P6–ON; L:P6–OFF
③ HH:V4–CLOSE; H:P5–ON; L:P5–OFF
④ HH:V4–CLOSE; H:P4–ON; L:P4–OFF
⑤ HH:V4–CLOSE
⑥ HH:V3–CLOSE; H:P1–ON; L:P1–OFF
⑦ HH:P3–OFF & V3–CLOSE; H:P2–ON; L:P2–OFF
⑧ HH:V3–CLOSE; H:P3–ON; L:P3–OFF

LEGEND FOR ALARM CONDITIONS

ALARM #1 – UPON V4 CLOSING
ALARM #2 – UPON V3 CLOSING



0 Not to Scale

ROSWELL STATION REMEDIATION SITE

Water and Vapor Treatment Equipment, Controls, and Process Details

TABLES