WATER QUALITY AND GROUNDWATER MOUNDING/SHADOWING PLAN TURNPIKE MINING RESOURCE M-2004-009-AM-2

Prepared by:

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December 7, 2012

Figures

Appendices

1.0 WATER QUALITY

1.1 BACKGROUND

The reclamation plan calls for the placement of shale backfill material into Cell 2. The shale backfill material was previously excavated from the pit floor of Cell 1. Due to the low permeability of the shale backfill material, it is possible that up-gradient groundwater levels could increase (mounding) and down-gradient groundwater levels could decrease (shadow). For the purpose of evaluating the extent of mounding/shadowing, installation of observation and monitoring wells shall be completed as discussed below.

The DRMS had commented that there is the possibility of impacts to groundwater quality due to the backfilling of shale material within the alluvial aquifer. Impacts to groundwater are predicted to be unlikely due to the very low permeability of the backfilled shale material. The shale backfill material is classified as lean clay with a plasticity index of 22 as determined by a geotechnical analysis of the same shale bedrock material which was used to construct the reservoir liner in Cell 1 (see Appendix A). The backfilling process will likely result in compaction to 80-90% of maximum dry density, which combined with the high clay content, will yield very low permeability as achieved by the weight of and compaction by heavy equipment placing the material. This plan will however, gather ambient water quality data and, in the event that water is in fact observed to flow through the backfilled shale, a water quality sampling program has been specified. In order to determine if any groundwater flow occurs through the backfilled shale material, observation wells shall be constructed within the backfilled shale area.

In accordance with Section 3.1.7(b) of the Construction Materials Rule, the following information is provided concerning groundwater monitoring:

1.2 MAP

The map given in Figure 1 accurately locates all proposed groundwater sample points (monitor wells) and observation wells.

1.3 METHOD OF MONITORING WELL COMPLETION

Monitor wells (MW-1, MW-2) shall be completed at the locations shown in Figure 1. Wells shall be completed to the depth of bedrock and screened within the sand and gravel layer. A typical well completion diagram is given in Figure 2. Observation wells shall be completed within 2ft of the bottom of the shale backfill area at locations shown in Figure 1. Observation wells may be constructed of plain PVC pipe with a 5 ft screen interval at the bottom of the string. The annulus may be backfilled with onsite sand and followed by 2ft of shale for a surface plug. Observation wells are designed for water level measurement and not water quality sampling.

1.4 METHOD OF SAMPLING, FREQUENCY OF SAMPLING AND REPORTING TO THE OFFICE;

Rule 3.1.7 (4) b states “If there is a reasonable potential to exceed groundwater quality standards promulgated by the WQCC, the Operator shall modify the

permit as necessary to implement such standards in compliance with this Subsection, 3.1.7". For the purpose of determining if a "reasonable potential" exists for the backfilled shale material to impact water quality through leaching of inorganic minerals to groundwater, analysis of groundwater flow through the backfilled shale shall be performed. Observation wells OW-3 through OW-5 are designed to determine if groundwater occurs and or is flowing through the backfilled area.

Water levels in observation wells OW-3 through OW-5 shall be measured, recorded and be reported bi-monthly for 90 days following the completion of the reclamation backfilling of Cell 2 (A,B,C).

If no water is found in observation wells OW-3 through OW-5, then no water is flowing through the backfilled material and therefore there would be no reasonable potential for the backfilled material to cause impacts to water quality. If observation wells OW-3 through OW-5 yield a saturated layer within the backfilled shale, then water sampling from MW-1 and MW-2 shall be performed and reported quarterly for a period of 1 year. The water sampling parameters are given in Appendix B, which are based on Colorado Regulation No. 41: *The Basic Standards for Groundwater* (5 CCR 1002-41) (WQCC 2009).

1.5 PARAMETERS ANALYZED, WATER QUALITY ANALYSIS METHODS, AND QUALITY CONTROL/QUALITY ASSURANCE METHODS;

Groundwater samples shall be analyzed for the parameters given in Appendix B, which is taken from the Colorado Regulation No. 41: *The Basic Standards for Groundwater,* Table 2 – Inorganic parameters for domestic water supply.

1.6 FORMATIONS, AQUIFERS OR STRATA TO BE SAMPLED;

The aquifer to be sampled is the tributary alluvial aquifer composed of sand and gravel.

1.7 POTENTIAL SOURCES OF GROUNDWATER CONTAMINATION THAT WILL BE MONITORED BY EACH POINT OF COMPLIANCE MONITORING POINT;

The potential source of groundwater contamination is the backfilled shale material. MW-2 will be constructed just down-gradient of any groundwater flow that may be transmitted through the backfilled shale.

1.8 TIME-SCHEDULE FOR IMPLEMENTATION

Monitor wells 1-2 shall be constructed and ambient water quality will be sampled before the end of 2012 or early 2013. If necessary, MW-2 will be sampled quarterly for one year following the backfilling of Cell 2. Observation wells OW-1 and OW-2 shall be constructed before the end of 2012 or early 2013 and observation wells OW-3 through OW-5 shall be constructed following the completion of backfilling Cell 2.

1.9 AMBIENT GROUNDWATER QUALITY DATA SUFFICIENT TO CHARACTERIZE POTENTIALLY IMPACTED GROUNDWATER QUALITY.

As indicated above, ambient groundwater data will be gathered following completion of the monitor wells.

2.0 GROUNDWATER MOUNDING / SHADOWING

2.1 BACKGROUND

Due to the low permeability of the backfilled shale material, it is possible that up-gradient groundwater levels may rise to levels that could impact adjoining property owners to the east. The Schell house occurs approximately 250ft up-gradient of the backfill boundary and the Timmreck house occurs approximately 183ft up-gradient of the backfill boundary. The Andreason domestic well occurs west of the Cell 2C backfill area, however is unlikely to be affected by a groundwater shadow since the groundwater flow vector is northwest (See Figure 1). Currently, pumping is occurring in Cell 2A and therefore establishment of baseline water levels cannot be achieved by measuring the monitoring well presently or in the near future at this location. Instead, this plan will piece together some historic and published data to approximate baseline water levels.

2.2 HISTORIC/BASELINE GROUNDWATER LEVELS / MOUNDING ANALYSIS

Previously, a portion of Cell 2 A had been allowed to fill with groundwater due to shutdown of the pumps. On July 14, 2012 the water level of the pond in Cell 2 A was surveyed at 4938.32ft. July would normally be considered a time when the seasonal groundwater levels would be expected to be near their maximum. This is due to the fact that the local groundwater levels are strongly influenced by regional irrigation and stages of the local ditches. Irrigation ditch diversions in the area typically peak in July and tail off in August-Oct. It should be noted however, that the summer of 2012 was considered a drought year. Additional baseline groundwater levels were measured during a subsurface investigation that was conducted by Rocky Mountain Consultants (RMC) in October 1999. Elevations are given in Table 1.

For the purpose of estimating historic seasonal high groundwater levels, the July 2012 pond water level in Cell 2 A (“July Pond”) is used to back calculate up-gradient water levels based on the published regional water table gradient given in the USGS Open File Report 02-338. The eastern edge of the July Pond in Cell 2 A occurred 675 ft down-gradient from the observation well on Schell’s property (108A). Multiplying that distance by a gradient of 0.0031 ft/ft (USGS OFR 02-338) and adding to the July Pond elevation, yields a water level of 4940.41ft. This elevation compares reasonably well with the observed October 2011 water level of 4938.51 ft. at well 108A considering that October groundwater levels would be expected to be a few feet lower than July. The October 1999 RMC test hole TH-39 occurs 202.55 ft up-gradient of the July Pond. Multiplying that distance by a gradient of 0.0031 ft/ft (USGS OFR 02-338) and adding to the July Pond elevation yields a water level of 4938.95 ft. This elevation compares reasonably well with the observed October 1999 water level of 4937.5 ft (+1.44 ft difference) of TH-39 considering that October groundwater levels would be expected to be a few feet lower than July.

The observation well at 108A occurs at approximately the same up-gradient distance from the Schell house and therefore will serve as a good well to observe the influence of the clay backfill material on groundwater levels. It is estimated that the elevation of the lower footing at the Schell house is at 4944.0 ft. The threshold not to exceed groundwater elevation value at well 108A is therefore set at ***4944.0 ft***. The value of 4944.0 ft is 3.6 ft above the predicted seasonal high water table elevation at 108A. At a minimum, water levels at MW-1 and 108A shall be observed and recorded monthly for one year following the backfilling of Cell 1. A more detailed water level measurement schedule will be prepared and submitted to the DRMS before any more significant backfilling of Cell 2 occurs. If water levels are observed to exceed 4944.0 ft at 108A, then ASCI shall be required to design and build an engineered groundwater level mitigation system that will alleviate high groundwater levels on the Schell property to levels below 4944.0 ft at observation well 108A. Alternatively, ASCI will reserve the right to cause groundwater levels higher than 4944.0 ft on the condition that a signed notarized agreement between ASCI and Schell or Schell's successors that would allow them to do so.

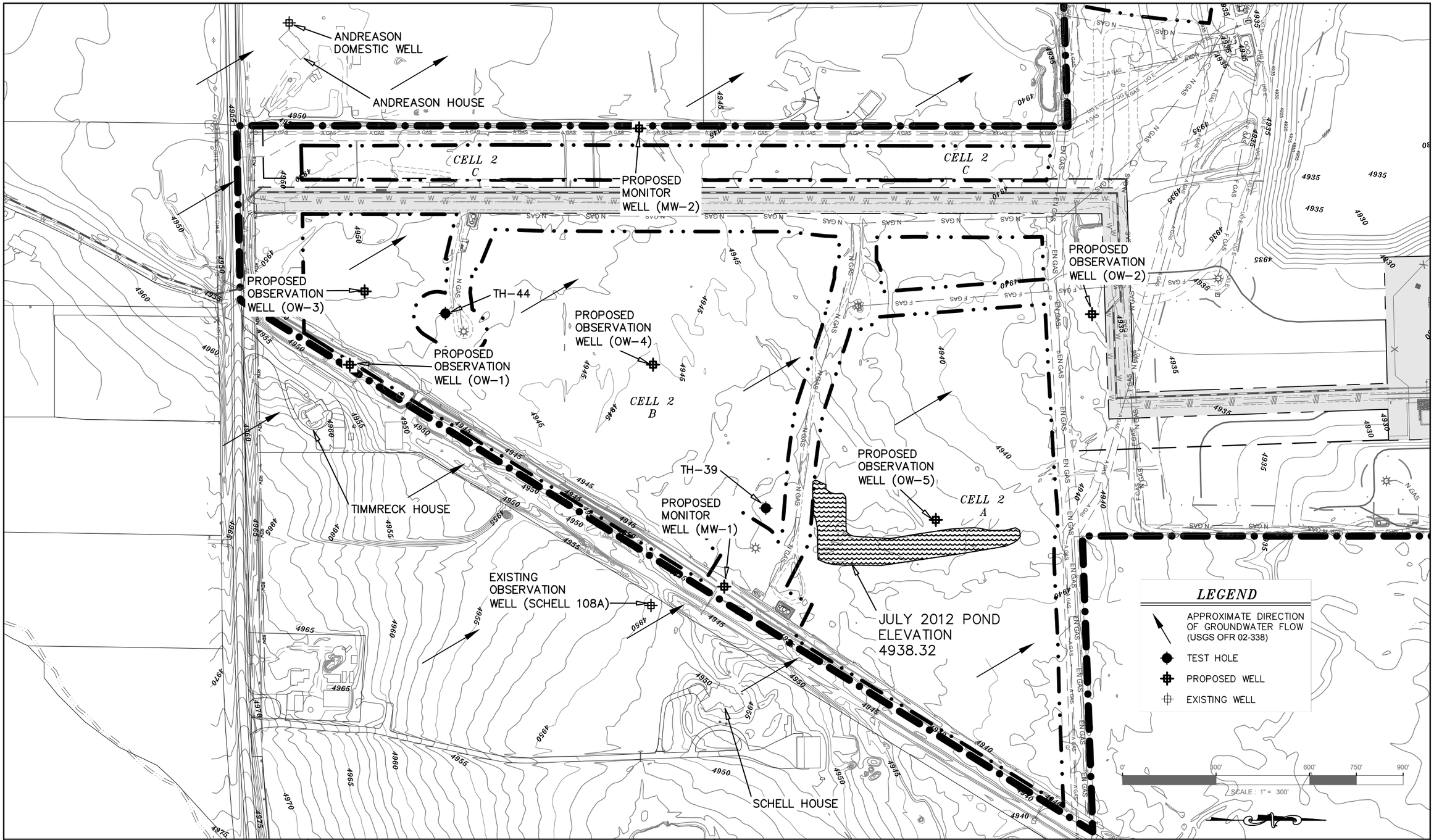
Table 1. Observed Groundwater Elevations

Site	**Date**	**Elevation**	
Cell 2 A July Pond	July 2012	4938.32	
TH-39	Oct 1999	4937.5	
Schell 108a	Oct 2011	4938.51	
TH-44	Oct 1999	4942.0	

In order to estimate the seasonal high groundwater elevation in the vicinity of the Timmreck house, the October 1999 observed water level at TH-44 is adjusted by 1.44 ft from 4942.0 ft to 4943.44. This adjustment is based on the predicted July elevation for TH-39 based on the discussion above. The distance from TH-44 to the Timmreck house is 493.52 ft. Multiplying that distance by a gradient of 0.0031 ft/ft (USGS OFR 02-338) and adding to the adjusted TH-44 elevation yields a water level of 4944.96 ft. The finished floor elevation of the Timmreck house appears to be 4956.2 ft, which would put the bottom of the footing at approximately 4954.0 ft.

The proposed observation well OW-1 occurs 146 ft down-gradient from the Timmreck house. Multiplying that distance by a gradient of 0.0031 ft/ft (USGS OFR 02-338) and subtracting from 4954.0 ft elevation yields a water level of 4953.54 ft. The threshold not to exceed groundwater elevation value at well OW-1 is therefore set at ***4953.5 ft***. This is approximately 8.5 ft above the predicted seasonal high groundwater elevation described above. At a minimum, water levels at OW-1 shall be observed and recorded monthly for one year following the backfilling of Cell 1. A more detailed water level measurement schedule will be prepared and submitted to the DRMS before any more significant backfilling

of Cell 2 occurs. If water levels are observed to exceed 4953.5 ft at OW-1, then ASCI shall be required to design and build an engineered groundwater level mitigation system that will alleviate high groundwater levels on the Timmreck property to levels below 4954 ft or 4953.5 at OW-1. Alternatively, ASCI will reserve the right to cause groundwater levels higher than 4953.5 ft on the condition that a signed notarized agreement between ASCI and Timmreck or Timmreck's successors that would allow them to do so.



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

Weiland, Inc.
Environmental & Engineering
PO BOX 18087
BOULDER, CO. 80308
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TURNPIKE MINING RESOURCE

REGULAR 112 PERMIT M-2004-009-AM-2

WELD COUNTY, CO

PREPARED FOR: ASPHALT SPECIALTIES CO., INC.

FIGURE 1

SITE PLAN - GROUNDWATER

SCALE	DWG NO.	REV.
1"=300'	GW.DWG	REV

DRAWN BY:	CHECKED BY:	DATE:	SHEET
CTW	PFW	12/07/12	SHEET#

HOLE NUMBER	DATE	LOGGED BY	DRILLER	NOTES

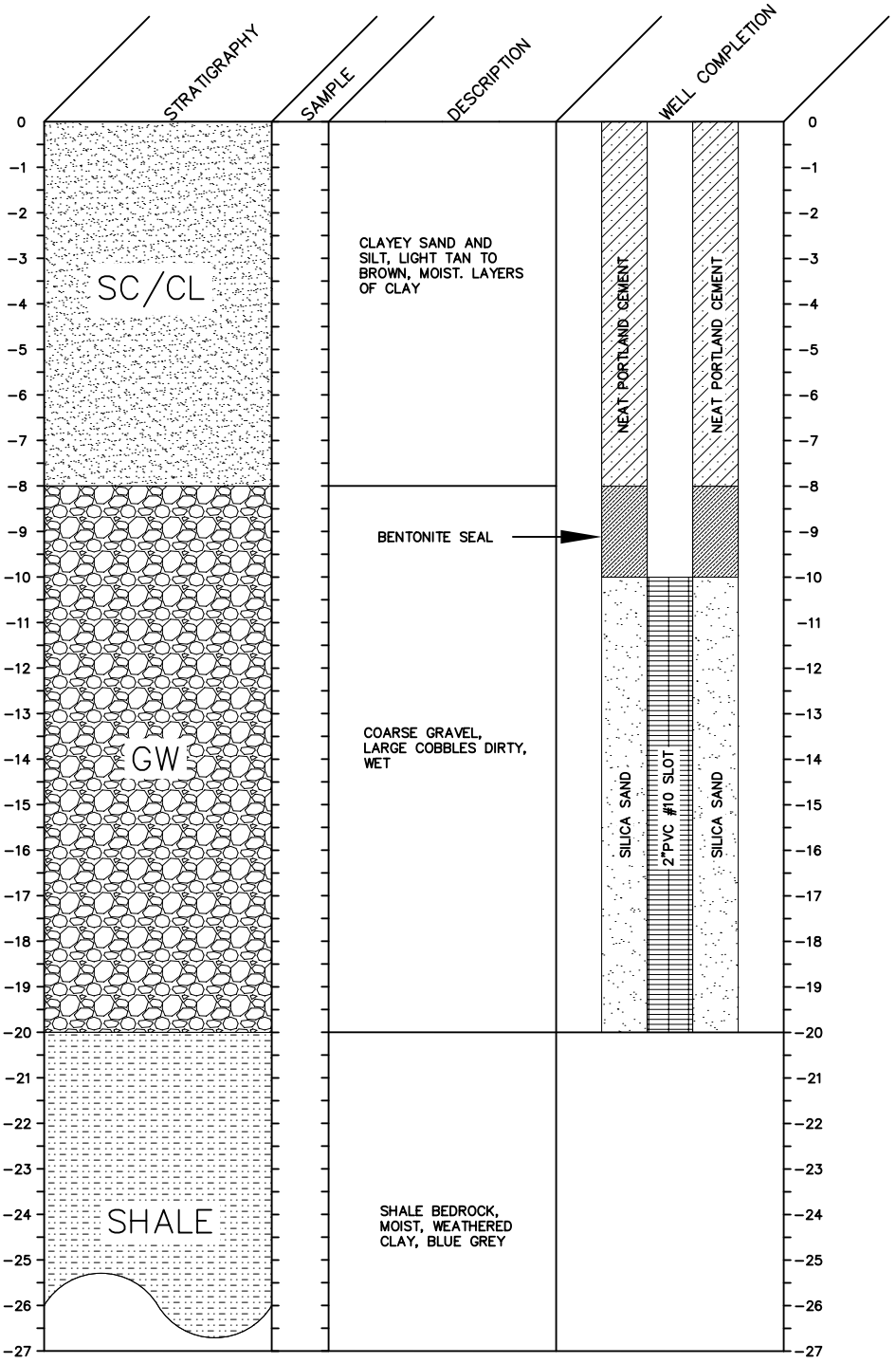


FIGURE 2

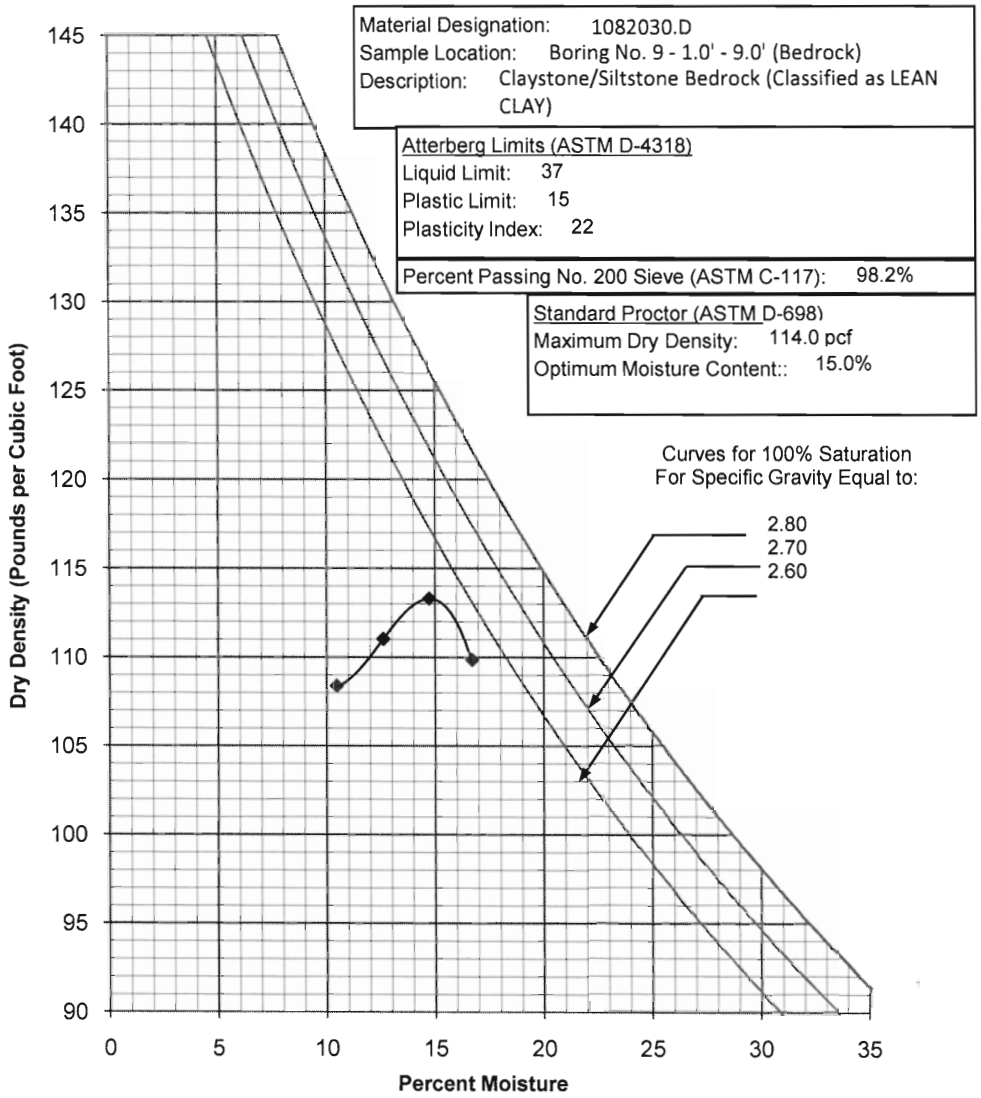
Weiland, Inc.
Environmental & Engineering

TYPICAL MONITOR WELL COMPLETION

APPENDIX A

Earth Engineering Consultants, Inc.

Summary of Laboratory Classification/ Moisture-Density Relationship



Project: Turnpike Reservoir
Erie, Colorado
Project No: 1082030
Date Apr-08

APPENDIX B

Water Quality Sampling Parameters (Rule 41 for Domestic Water Supply)

Inorganic Water Quality Parameters	. ***Standard***
Antimony (Sb) [d, M]	0.006 mg/l
Asbestos [M]	7,000,000 fibers/Liter
Arsenic (As) [d, M]	0.01 mg/l
Barium (Ba) [d, M]	2.0 mg/l
Beryllium (Be) [d, M]	0.004 mg/l
Cadmium (Cd) [d, M]	0.005 mg/l
Chromium (Cr) [c, d, M]	0.1 mg/l
Cyanide [Free] (CN) [M]	0.2 mg/l
Fluoride (F) [d, M]	4.0 mg/l
Lead (Pb) [d]	0.05 mg/l
Mercury (inorganic) (Hg) [d,M]	0.002 mg/l
Molybdenum (Mo) [d]	0.035 mg/l
Nickel (Ni) [d]	0.1 mg/l
Nitrate (NO_3) [d, M]	10.0 mg/l as N
Nitrite (NO_2) [d, M]	1.0 mg/l as N
Total Nitrate+Nitrite (NO_2 +NO_3 -N) [d, f]	10.0 mg/l as N
Selenium (Se) [d, M]	0.05 mg/l
Silver (Ag) [d]	0.05 mg/l

Thallium (Tl) [d, M]	0.002 mg/l
Uranium (U) [d, M]	0.03 mg/l