Appendix B

Groundwater Capture Evaluation

Prepared for:
Tronox LLC
Henderson, Nevada

Groundwater Capture Evaluation at Tronox Extraction Systems, Tronox LLC, Henderson, Nevada

ENSR Corporation
August 2008
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Responsible CEM for this project

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and, to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.

8-25-08

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List of Acronyms and Abbreviations

bgs	below ground surface
cm/s	centimeters per second
FBR	Fluidized Bed Reactors
ft	feet
ft/ft	feet per foot
gpm	gallons per minutes
GWTP	Groundwater Treatment Plant
lbs/day	pounds per day
MCf	Muddy Creek Formation – fine grain unit
mg/L	milligrams per liter
NDEP	Nevada Division of Environmental Protection
NPDES	National Pollutant Discharge Elimination System
Qal	Quaternary alluvium
RTC	Response to Comment
SNWA	Southern Nevada Water Authority
TDS	total dissolved solids
TMCF	Tertiary Muddy Creek formation
Tronox	Tronox LLC
µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency

1.0 Introduction

In commenting on the Tronox LLC (Tronox) *Semi-Annual Performance Report, for Chromium and Perchlorate* (February 28, 2007), the Nevada Division of Environmental Protection (NDEP)(2007a) requested that Tronox evaluate the effectiveness of its groundwater capture systems by considering at least three of six United States Environmental Protection Agency (USEPA) "lines of evidence" (USEPA 2002, 2005). In response to that request, a draft work plan was provided to NDEP on May 30, 2007. On June 26, 2007, NDEP provided comments on the Draft Work Plan to Evaluate Effective Groundwater Capture at Tronox Extraction Systems (ENSR 2007a). Additionally, McGinley and Associates (McGinley 2007) also provided a report dated June 30, 2007 describing the results of capture analysis using both an analog approach and a numerical groundwater model constructed for the Athens Road well field. In their report, McGinley evaluated well field capture efficiency and provided recommendations to further evaluate the capture zone at Athens Road. Following discussions with NDEP, and in response to their June 2007 comments, and in consideration of the recommendations provided by McGinley (2007), a revised work plan (ENSR 2007c) was prepared and submitted on August 29, 2007. Subsequently, NDEP provided additional comments on October 3, 2007. On November 28, 2007, Tronox provided a letter responding to the NDEP comments. On December 11, 2007 NDEP approved the revised work plan with a few exceptions noted for the administrative record. **Attachment A** contains copies of the NDEP and Tronox correspondence.

This report evaluates the hydraulic data in support of converging lines of evidence that hydraulic capture is occurring at each extraction system and offers recommendations to improve and strengthen the effectiveness of the systems.

Field work, consisting of borehole drilling, lithologic sample description, geotechnical sampling, well completion, well development, and well testing began on November 26, 2007 and continued intermittently until March 19, 2008. Borehole lithology logs and well completion diagrams are located in **Attachment B** of this report, and well/piezometer development records are presented in **Attachment C**. The scope of work for the on-site barrier wall, Interceptor well field, and Athens Road well field was completed as proposed (ENSR 2007c). However, access agreement issues for the Seep well field prevented the installation of the proposed groundwater monitor wells in this area. These issues have been resolved and drilling and well completion will commence by the 4th quarter 2008.

1.1 Operational History

Tronox operates three primary groundwater containment and extraction systems associated with its facility in Henderson, Nevada **(Figure 1)**:

- <u>On-Site Barrier Wall and Interceptor Well Field</u> – A bentonite-slurry wall constructed as a physical barrier across the higher concentration portion of the perchlorate plume on the Tronox site. The barrier wall is 1,600 feet in length, is about 60 feet in depth, and is combined with an upgradient series of 23 groundwater extraction wells that are situated due south of the barrier wall. The upgradient well field pumps about 61 gallons per minute (gpm), effectively dewatering the alluvial aquifer and upper portion of the Muddy Creek Formation in the vicinity of the barrier wall. Most of the wells comprising the Interceptor well field are completed in the alluvial aquifer and upper and unconfined portion of the Muddy Creek Formation (see Figure 2 of the accompanying *2008 Annual Remedial Performance Report for Chromium and Perchlorate* [ENSR 2008d]).

- Athens Road Well Field – Located approximately 8,200 feet north of the barrier wall and interceptor well field, the Athens Road well field includes a series of 14 groundwater extraction wells at seven paired well locations (see Figure 3 of the accompanying *2008 Annual Remedial Performance Report for Chromium and Perchlorate* [ENSR 2008d]). The wells span roughly 1,200 feet of the alluvial paleochannel and pump at a combined rate of about 266 gpm.

- Seep Area Collection System – Located near Las Vegas Wash, approximately 4,500 feet north of the Athens Road well field, the system includes a surface capture pump for the intermittent surface stream (Seep) flow and 10 groundwater extraction wells in the Seep well field to capture subsurface flow (see Figure 4 of the of the accompanying *2008 Annual Remedial Performance Report for Chromium and Perchlorate* [ENSR 2008d]). The Seep area collection system pumps at a combined rate of about 630 gpm.

All groundwater from the hydraulic containment systems is routed for treatment to the Tronox facility and is discharged to the Las Vegas Wash under a National Pollutant Discharge Elimination System (NPDES) permit.

1.2 NDEP Guidance Concerning Evaluation of Groundwater Capture

NDEP (2007a) requires verification that the Tronox systems are effectively removing contaminants passing through the capture zones. The evaluation of the containment must consider three-dimensional capture including flow contributions from both the alluvium in the paleochannels and the upper portion of the Muddy Creek Formation (NDEP 2007a).

At least three of six possible lines of evidence are required by the USEPA (2002, 2005) to demonstrate adequate capture. The possible lines of evidence include the following:

1. Estimation of capture zone through calculations of flow-budget or analytical modeling

2. Demonstration of overlapping cones of depression via flow nets both in plan view and vertical cross section

3. Demonstration of inward flow from a compliance boundary using groundwater elevations at two or more locations perpendicular to the boundary

4. Concentration trends over time at sentinel wells located downgradient of the containment

5. Particle tracking using a calibrated numerical model

6. Tracer testing

2.0 EVALUATION OF GROUNDWATER CAPTURE

Section 2 discusses each of the three groundwater capture systems and the results of recent capture-related field work and provides a performance evaluation based on recent data in the *Annual Remedial Performance Report for Chromium and Perchlorate, July 2007-June 2008* (ENSR 2008d). Data gaps in demonstrating effective capture are identified, and a scope of work to address those gaps is presented. **Figures 2, 4,** and **6** show the locations of the recently installed groundwater monitor and extraction wells, and the proposed additional monitor wells. **Table 1** presents the well completion and geotechnical information for the recently installed wells. Survey data for the newly installed wells is provided in **Attachment D**.

A total of 16 wells were installed between November 2007 and March 2008 using sonic drilling equipment. Lithology logs and well completion diagrams for these new wells are located in **Attachment B** of this report and chemical data and groundwater elevation information are presented **Table 1** and in Appendices A and D of the accompanying *2008 Annual Remedial Performance Report for Chromium and Perchlorate* (ENSR 2008d). Six soil samples were collected for physical properties measurements consisting of pore fluid saturation, porosity, density, moisture content, effective permeability, and vertical hydraulic conductivity (see **Table 1**).

As part of the capture-related field work, 22 of 23 Interceptor wells were redeveloped. Well development records for the new wells and Interceptor wells are presented in **Attachment C.** A summary of well development data for the Interceptor well field is shown in **Table 2**.

2.1 On-Site Barrier Wall and Interceptor Well Field

There is significant interaction between the perchlorate and chromium plume and the total dissolved solids (TDS) plume, which affects plume geometry at the groundwater capture systems on- and off-site. The location and extent of the perchlorate, chromium, and TDS plumes interpreted from groundwater samples collected in May 2008 are shown on Plates 3, 4, and 5, respectively, of the accompanying *2008 Annual Remedial Performance Report for Chromium and Perchlorate* (ENSR 2008d). Plate 5 shows that a very high level of TDS, up to 54,000 milligrams per liter (mg/L), exists west of the Tronox facility and that this plume of high TDS enters the Main Channel beneath the northwestern corner of the Tronox property. Likewise, east of the Tronox facility a high TDS area, up to 19,000 mg/L, exists beneath the northern portion of the Timet property.

On the site, the highest TDS concentration (18,000 mg/L) is found due south of the interceptor well field and barrier wall. TDS concentrations above 10,000 mg/L are present upgradient of the barrier wall and trend about 1,800 feet south to an area around the Chemstar property. TDS concentrations below the unit buildings further to the south are generally below 5,000 mg/L, indicating that the area beneath the process plants is clearing up over time. North of the slurry wall TDS concentrations are in the 2,800 to 8,000 mg/L range due to the effective groundwater capture at the interceptor well field and barrier wall and the recharge of low-TDS Lake Mead water.

Plates 3 and 4 of the *2008 Annual Remedial Performance Report for Chromium and Perchlorate* (ENSR 2008d) show the configuration of the chromium and perchlorate plumes, respectively, from the site to the Las Vegas Wash. As mapped, both plumes occupy the inter-fluvial area east of the Main Channel from south of Warm Springs Road to Sunset Road where they begin to enter the channel. This is due to the higher density, high TDS-bearing groundwater in the channel prohibiting the chromium and perchlorate plumes from entering

the channel until the density difference dissipates downgradient. Both chromium and perchlorate behave as soluble ions and perchlorate is assumed to migrate at the rate of groundwater flow.

2.1.1 Previously Identified Data Gaps and Discussion of Results

In order to strengthen the lines of evidence for capture, Tronox identified the following data gaps and proposed methods to address them in the *Revised Work Plan to Evaluate Effective Groundwater Capture at Tronox Extraction Systems* (ENSR, 2007c):

1. **Data Gap**: Demonstrate the barrier wall is continuous and does not leak significantly along its length.

   Proposal: Pump wells M-70 and M-71 on the downgradient side of the barrier wall and monitor the perchlorate concentrations over time. Concentrations of perchlorate are expected to decrease over time indicating that the barrier wall is functioning as designed. Tronox proposed to pump these two wells north of the barrier wall at a rate of about one gpm each or as formation transmissivity permits. Capacity to handle the water in the Groundwater Treatment Plant (GWTP) will be made available by routing the discharge from selected wells connected to the west header, directly to the GW-11 pond.

   Results: In anticipation of pumping these wells, M-70, M-71, and M-72 were redeveloped. During this time they were found to be very poor producers – with M-71 yielding the most water at 0.75 gpm (see **Table 2**). It appears that with the recharge trenches clogging up with salt cedar roots, the wells were unable to infiltrate the usual amount of water; therefore, the groundwater mound to the south in the area of these wells had dissipated. With the recent completion of the rehabilitation of the trenches, water levels are rising in these wells and pumping activities will start by the 4th quarter 2008.

   This data gap has been partially addressed, since with reduced mounding from the injection trenches the water elevation downgradient of the barrier wall has decreased, indicating that the barrier wall has negligible leakage.

2. **Data Gap:** Demonstrate the upward gradient from the Muddy Creek to the alluvium.

   Proposal: Install nested monitor wells at the west and east end of the barrier wall. Complete these wells in the alluvium and at different depths within the Muddy Creek and compare their respective static water levels to determine vertical groundwater gradient. The proposed nested wells consisted of two wells each completed in the Muddy Creek at depths of between 60 and 70 feet below the ground surface (bgs) and 80 and 90 feet bgs adjacent to shallow wells that were completed in the shallow saturated portion of the Muddy Creek (i.e., depths of about 20 to 40 feet bgs) and used to evaluate horizontal flow around the west and east end of the barrier wall.

   Results: Wells M-132 and M-133 were completed in close proximity to M-74 on the east end of the barrier wall (see **Figure 2**). **Table 1** provides the well completion data and shows that the May 2008 water elevation in the deepest well (M-132, 90 feet total depth) is higher than the adjacent shallower well M-133; thus indicating an upward vertical gradient. Further, the water level data for the second quarter 2008, provided in **Appendix A** of the accompanying *2008 Annual Remedial Performance Report for Chromium and Perchlorate*, shows that the water

elevation for well M-74, completed in the uppermost portion of the Muddy Creek, is lower than the water level measured in wells M-132 and M-133. This also indicates that there is an upward vertical gradient into the shallowest saturated portion of the Muddy Creek. Likewise, on the western end of the barrier, wells M-134, M-135, and M-136 were drilled and screened at different depths to a maximum of 90 feet (M-136). The May 2008 water elevations from these wells also show an upward vertical gradient (**Table 1**).

Core samples of the Muddy Creek formation were taken from three borings on the east end of the barrier (M-129, M-130, and M-132) and one from the west end (M-136) and tested for physical property measurements which showed all samples to have hydraulic conductivities in the 10^{-6} to 10^{-7} centimeters per second (cm/s) range (see **Table 1**).

Calculations of vertical gradient for these nested well sets utilized an USEPA tool found at www.epa.gov/Athens/learn2model/part-two/onsite/vgradient.htm. Calculated vertical gradients ranged from 0.01 to 0.19 feet per foot (ft/ft) (all upward), averaging 0.07ft/ft, as shown on **Table 3**.

This data gap has been addressed.

3. **Data Gap:** Reconcile the flow budget around the west and east end of the barrier wall.

   Proposal: To further evaluate the movement of groundwater around the west and east ends of the barrier wall, Tronox proposed to install at total of five monitor wells just past the ends of the barrier wall.

   Results: As shown on **Figure 2**, wells M-129 and M-130 were installed east of the barrier wall on TIMET property and wells M-131, M-135 and M-136 were installed west of the barrier wall. Well I-AA was also installed, though to support an enhancement to groundwater recovery on the west end of the barrier wall. **Table 1** summarizes the well completion, water elevation and chemical data for each well. The cross section of the Interceptor well field (Figure 2 of the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate) shows that the M-130 boring encountered the previously inferred Muddy Creek formation ridge that separates I-K from CLD2-R, that the water table is in the Muddy Creek, and that the Quaternary alluvium (Qal) is dry. On the west, **Figure 2** shows that I-AA and M-131 intersected an at least 12-foot-wide previously unknown alluvial channel to the west of an unsaturated Muddy Creek formation high. The thickness of saturated Qal in I-AA and M-131 is about 0.25 feet and 0.46 feet, respectively. After well I-AA was developed, short-term pumping showed that the well could only sustain a maximum pumping rate of about 1.3 gpm (see **Table 2** of this report). Extraction well I-AA will be hooked up to the Interceptor well field and begin pumping by the 4th quarter 2008.

   As discussed in Section 2.1.2 below, the significant majority of groundwater flow, and thus mass flux, is within the saturated alluvium in the area of the barrier wall and interceptor well field. As seen on the cross section (Figure 2 of the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate) there is no alluvial groundwater flowing past the east side of the barrier wall and minimal alluvial groundwater (0.35 feet of average saturation) flowing around the west side. Additional information is required to complete the evaluation of the heretofore unknown alluvial channel on the west end of the barrier wall in the area of well M-131. However, it appears that groundwater flow in the alluvium around the barrier wall would be minimal by comparison to the flow captured by the barrier wall and interceptor well field.

Additionally, in an effort to improve well efficiency, 21 of 23 Interceptor wells were video taped to check for well screen encrustations (none were found) and 22 of 23 of the wells were redeveloped using the surge, bail and pump development method (see **Table 2**). Theoretical pumping rates for most of the wells were improved. **Attachment C** presents the redevelopment records for each well.

This data gap has been partially addressed. Two additional borings (M-147 and M-148) are proposed on the west end of the barrier wall in the area of well M-131 to further evaluate the lateral extent of the alluvial channel identified in this area (**Figure 2**). The proposed borings will be drilled to a depth of 35 feet bgs or to a sufficient depth to delineate the extent of saturated alluvium.

4. **Data Gap**: Demonstrate that there are overlapping cones of depression for the Interceptor extraction wells.

   Proposal: Conduct short-term shutdowns of up to four interceptor wells with low pumping rates in areas lacking monitoring coverage within the well field in order to obtain water elevation data to aid in contouring cones of depression. Perform distance drawdown plots following procedures outlined in Driscoll (1986 pg. 244-245) to evaluate pumping well efficiency.

   Results: Between June 2 and 4, 2008, extraction wells I-B, I-E, I-F, I-J, I-K, I-N, I-R, I-T, and I-U were turned off for between 7 to 19 hours and water levels were allowed to recover. The static water levels were recorded and used to construct the cross section (Figure 2) provided in the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate.

   Secondly, utilizing this data, distance drawdown tests were performed in wells I-K, I-N, I-R and I-T, wherein the wells were pumped at rates ranging from 0.4 to 4.2 gpm for a period between 150 and 200 minutes **(Attachment E)**. The results from well I-T provided adequate drawdown data in adjacent observation wells to estimate the pumping well efficiency, which was estimated to be about 84 percent. In the case of the other three wells (I-K, I-N and I-R), either drawdown could not be measured or there was only one well with measurable drawdown, which precluded evaluation of well efficiency following the methods described by Driscoll (1986). With regard to the influence measured during the short-term pumping, measureable drawdown was observed in observation wells located about 20 to 25 feet from the pumping well. Beyond this distance, measureable drawdown was not recorded in observation wells during the period of short-term pumping. The absence of drawdown beyond 20 to 25 feet is likely a function well spacing and the short-term nature of the testing, which may not have been long enough to adequately assess the influence of the pumping and the boundary affect that would be induced by the barrier wall. It would be anticipated that with a longer period of testing the extent of the influence would have been greater than measured. Additionally, in addition to the boundary caused by the barrier, additive effects of adjacent well pumping would also improve influence in these areas. .

   This data gap has been addressed. In the future, additional distance drawdown testing will be considered to further evaluate well efficiency during period where portions of the interceptor well field are shutdown. These data will be used to determine formational pumping levels and will be used to support future construction of the net-drawdown map. Well efficiency data derived from the testing of well I-T will be used to contour pumping data from this well.

2.1.2 Performance Evaluation

The current lines of evidence for effective groundwater capture include:

Capture Zone: The 1,600-foot wide barrier wall was designed to provide a physical barrier to groundwater migration across most of the identified perchlorate plume. As mapped on Plate 4 of the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate (ENSR 2008d) the barrier wall and Interceptor well field is stopping the downgradient flow of perchlorate above 35 mg/L on the east end and 120 mg/L on the west end. The average perchlorate concentration from water samples collected from wells behind the barrier wall in May 2008 is 1,001 mg/L. Considering this average concentration upgradient of the barrier wall, and the highest reported concentration in water samples from wells east and west of the barrier wall, the effective capture rate equates to about 88 percent [(1001-120)/1001=0.88)] on the west end of the barrier, and about 97 percent [(1001-35)/1001=0.97)] on the east end of the barrier.

Flow Budget: The barrier wall, installed in 2001, has dramatically improved groundwater capture. Current capture rates of about 61 gpm are double those before the wall was installed. Water level data indicate the alluvial aquifer has been mined and is effectively dewatered behind the barrier wall. The barrier wall is keyed into at least 30 feet of the fine-grained facies of the Muddy Creek Formation (MCf), and as noted above there is an upward vertical gradient in the vicinity of the wall. It would be anticipated that the upward flow of groundwater is enhanced by pumping upgradient of the barrier wall. Given this enhancement to upward flow, perchlorate mass present within the upper portion of the MCf would be drawn upward in the vicinity of the Interceptor well field and barrier wall.

The possible sources of water contributing to the Qal for ultimate capture by the Interceptor well field and barrier wall are:

- Upgradient (offsite) contribution of groundwater to the Qal
- MCf “daylighting” groundwater into the Qal upgradient of the Interceptor well field and barrier wall
- MCf upwelling groundwater into the Qal upgradient of the Interceptor well field and barrier wall
- Rainfall
- Onsite water line leaks

Upgradient (Offsite) Contribution of Groundwater to the Qal: Previous subsurface investigations in the southern (upgradient) portion of the facility indicate that the water table resides in either the Mc coarse-grained unit (vicinity of Lake Mead Parkway) or the Mc fine-grained unit (vicinity of the unit buildings). The Qal unconformably overlies both. Water occurring in the Qal in the upgradient area is due to precipitation and over-watering of residential landscaping and is subject to evapotranspiration. Any water that percolates through the vadose zone joins groundwater in the MCf.

MCf Daylighting Groundwater into the Qal: Groundwater flow from the upgradient MCf begins to “daylight” into the overlying Qal northeast of the unit buildings within one discrete alluvial channel cut into the MCf. The average beginning point of this daylighting occurs approximately 1200 feet south of the Interceptor well field. The width of this zone is defined as approximately the length of the barrier wall. Saturated alluvium thicknesses vary based on the topography of the MC erosion surface.

MCf upwelling groundwater into the Qal: Since the vertical hydraulic gradient has been shown to be upward from the MC into the alluvium the upward movement of groundwater continues to supplement the

water already in the alluvium within this same area. This upwelling groundwater is in addition to the daylighting groundwater.

Rainfall: Rainfall is not considered to be a significant source of recharge to the Qal at the site due to the minimal amount of annual precipitation (4 to 5 inches/year).

Onsite Water Line Leaks: The majority of the older water distribution lines at the facility carry untreated Lake Mead water. These lines were installed in the 1940s and have been the source of line failures and leaks many times in the past. Even though subsurface water delivery line leaks have occurred and are occurring onsite, the volume of water released to the subsurface cannot be quantified.

Since the installation of the barrier well, the Interceptor well field at the barrier wall is recovering between 60 to 65 gpm. Based on this review of possible water sources for the saturated alluvium at the Interceptor well field, the only significant source for the groundwater in the Qal is groundwater moving from the MCf laterally into and upward into the alluvium and sporadic water distribution line leaks. Whereas a volume calculation for groundwater moving from the MCf can be determined, the actual total groundwater budget available for recovery at the Interceptor well field cannot be determined due to the non-quantifiable nature of water line leak contributions.

An estimate of the groundwater flow at the interceptor well field and barrier wall was developed based on a solution of Darcy's Law assuming two main sources of groundwater potentially available for capture (ignoring the contribution of water line leaks):

- Groundwater in the Qal upgradient of the barrier wall;
- Groundwater in the MCf upwelling into the Qal upgradient of the barrier wall

Groundwater in the Qal: As mentioned above, an area upgradient of the barrier wall contains variable thicknesses of saturated Qal. A flow budget was prepared using saturated alluvial thicknesses from the May 2008 data plotted on the hydrogeologic cross section (Figure 2) found in the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate (ENSR, 2008d). The cross sectional area used in the calculations is the plane of the barrier wall. From this estimate, a total of about 52.3 gpm is flowing toward the barrier wall in the Qal. Calculations and assumptions are shown on **Table 4** of this report.

Groundwater upwelling from the MCf: As previously confirmed, groundwater in the MCf has an upward vertical hydraulic gradient averaging about 0.07ft/ft and hydraulic conductivities on the order of 10^{-6} centimeters per second (cm/s) or about 0.06 gpd/ft^2. The southernmost upwelling occurs at about 1,200 feet upgradient of the barrier wall and the width of the zone is the length of the barrier or about 1,600 feet. This is an area of about 1,900,000 ft^2. Solving for Darcy's Law (Q = KiA) gives 0.06 gpd/ft^2 X 0.07 ft/ft X 1,900,000 ft^2 = 8,064 gpd or 5.6 gpm flowing upward into the alluvium from the MCf upgradient of the barrier wall. Calculations and assumptions are shown on **Table 4** of this report.

The total flow budget approaching the barrier wall from these two sources is about 57.9 gpm and that an undeterminable amount – probably due to water line leaks – also makes a contribution. It is not possible to calculate a more exact flow budget because of the unknown quantity of water released from line leaks. However, the flow is estimated to be no more than about 67 gpm based on the technique described in the next section.

Downgradient Concentration Declines over Time: Perchlorate itself is an effective tracer, since it migrates advectively, and is not readily adsorbed to soils. The perchlorate plume map (Plate 4) found in the 2008 Annual Remedial Performance report for Chromium and Perchlorate (ENSR, 2008d) indicates expansion of a zone containing less than 100 mg/L perchlorate downgradient of the recharge trenches where stabilized lake water is added to offset extracted groundwater and maintain groundwater flow. As the recharge water flow is slightly less than the water volume being extracted upgradient of the barrier wall, the rapidly expanding area containing less than 100 mg/L perchlorate indicates perchlorate capture. Recently, because of trench clogging and diminished water infiltration, the expansion of the area of less than 100 mg/L perchlorate has slowed. With the recent refurbishment of the trenches this expansion is expected to accelerate. Comparison of the current plume map with previous maps shows a continuing trend moving the 100 mg/L perchlorate contour line eastward. The expansion of the less than 100 mg/L perchlorate zone is occurring in an area that has historically contained greater than 1,000 mg/L perchlorate. This is a 10:1 (90 percent) decrease of perchlorate concentrations. If the infiltration of about 60 gpm of clean [(less than 5 micrograms per liter (µg/L) perchlorate)] Lake Mead water in the recharge trenches is totally responsible for this 10:1 decrease then no more than 6 gpm (60 gpm X 10 percent remaining) can be leaking around the barrier wall to keep the downgradient perchlorate plume at about 100 mg/L. The Interceptor well field was pumping 61 gpm in June 2008 (ENSR 2008d). The flow budget at the well field is therefore no more than 67 gpm (61 + 6), which demonstrates a 90 percent capture efficiency [(61-6)/61=0.902]. Therefore the amount of water line leakage upgradient of the barrier wall is about 9 gpm (67-58.9 = 9.1 gpm).

Overlapping Cones of Depression: **Plate 1** and **Table 5** of this report show the drawdown in the Interceptor well field between 1987 and May 2008. Additional monitoring wells (idle pumping wells) were used this year to contour this plate and are listed on the cross-section of the Interceptor well field (Figure 2) from the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate (ENSR, 2008d). **Plate 1** shows that the maximum drawdown is 15.5 ft and 15.3 ft in wells M-68 and I-J, respectively, and that drawdown decreases westward to about 4.6 ft in well I-B.

Figure 3, *The Interceptor Well Field Diagram*, is a schematic block diagram summarizing the hydrogeologic conditions around the well field as is interpreted to date. The diagram shows that the groundwater flows northward from the MCf coarse-and fine-grained units beneath Lake Mead Parkway, entering into the Qal channels south of the well field. Flow is interrupted by the barrier wall and groundwater is extracted at a current rate of about 61 gpm by the well field. North of the barrier the recharge trenches infiltrate Lake Mead water back into the aquifer. Because of the recent problems with the trenches plugging up the water levels, downgradient wells (M-98 to M-102) are at or below the Qal/MC contact. Nested wells, such as the M-74, M-132 and M-133 set shown here, exhibit upward vertical gradients. Deeper MCf groundwater flows on to the Tronox site in a southwest direction.

2.1.3 Evaluation of Groundwater Velocity Downgradient of the Barrier

As suggested by NDEP (2007b), Tronox has completed a qualitative evaluation to determine the times at which perchlorate and chromium plumes might reach the Athens Road well field. The evaluation was done through an analysis of “break over”, wherein the effect of the recharged Lake Mead water was used to approximate the groundwater velocity south of the barrier. The resulting groundwater velocity was used to approximate the travel time to the Athens Road well field for both the perchlorate and chromium plumes. The calculations indicate that the mitigating effects of the on-site barrier wall will reach the Athens Road well field between the years 2010 and 2015, depending on velocity. This discussion can be found in Appendix C of the *Revised Work Plan to Evaluate Effective Groundwater Capture at Tronox Extraction Systems* (ENSR, 2007c).

2.1.4 Data Gaps and Proposed Additional Evaluation

To strengthen the lines of evidence for capture, Tronox has identified several data gaps and corresponding proposals to address them. These are in addition to the previously identified uncompleted data gaps discussed above:

1. **Data Gap:** More impacted groundwater should be recovered from the Interceptor well field.

   Proposal: Tronox will connect wells I-X, I-W, and I-Y to the recovery system by the 4th quarter 2008. Capacity to handle the additional groundwater in the GWTP will be made available by routing the discharge from selected wells connected to the west header, directly to the GW-11 pond or by removing the GW-11 pond water stream from the chromium treatment plant (GW-11 chromium concentration about 0.08 mg/L).

2. **Data Gap:** The width of the new alluvial channel intersected by wells I-AA and M-131 is unknown.

   Proposal: Tronox proposes to drill up to two bore holes (M-147 and M-148) at 25-foot spacing west of M-131 to a depth of 35 feet bgs to determine the width of the channel. The locations of which are shown on **Figure 2** of this report, and on Figure 2 of the of the accompanying 2008 Remedial Performance Report.

2.2 Athens Road Well Field

In their assessment of the Athens Road well field, McGinley (2007) compared both analog methods and numerical groundwater modeling to USEPA guidance for determining capture effectiveness and mass recovery efficiency.

Results of the numerical groundwater model showed:

- Two-hundred and sixty particles released at the southern boundary of the model were all captured by the Athens Road well field; and,
- A mass flux evaluation indicated the well field was over 99 percent efficient in mass recovery.

Results of the analog assessment showed:

- Flow vectors using triangulated extraction wells (“ART”) and downgradient monitor wells (“ARP”) did not show inward flow, suggesting capture might not be achieved using the ARP wells as the compliance boundary.

McGinley (2007) concluded that the numerical groundwater model provided some use in showing the well field had a high degree of efficiency, but that installed well pairs did not exist that could validate model predictions. They recommended that:

- Analog capture analysis be considered using a standard procedure;
- Additional nested monitor wells be located to evaluate inward flow and to provide vertical definition across the extraction well field; and
- Data gathered from pump tests conducted on the proposed new wells be used in expanding the site conceptual model and for possible updating of the numerical groundwater model.

The McGinley groundwater modeling results fairly match the results from a model previously constructed by Tronox that was used in designing the Athens Road well field. In both cases, calibrated numerical models, constructed independently, demonstrated complete particle capture, one of the USEPA criteria required to demonstrate capture. Further, McGinley's 99+ percent mass recovery is also a significant result that would support the demonstration of effective well field capture.

2.2.1 Previously Identified Data Gaps and Discussion of Results

To further evaluate the capture zone at Athens Road and strengthen the lines of evidence for capture, Tronox identified the following data gaps and proposed methods to address them:

1. **Data Gap:** In contrast to numerical modeling results, McGinley (2007) was not able to demonstrate inward flow using water level data from the second half of 2006 due to the absence of sufficient monitor wells. Also, there are insufficient data to demonstrate influence from pumping of the Athens Road well field on water within the underlying MCf.

   Proposal: In order to demonstrate upward vertical head and inward flow, two additional nested wells will be completed within 100 feet downgradient of recovery wells ART-3 and ART-9 in the western and eastern sub-channels, respectively. The new wells will allow calculation of flow vectors and vertical head to confirm capture.

   Results: Nested wells PC-134 and PC-135 were constructed 41 and 38 feet north, respectively, of ART-3, whereas nested wells PC-136 and PC-137 were constructed 47 and 54 feet north, respectively, of ART-9 (see **Figure 4** of this report). The cross-section of the Athens Road well field (**Figure 3**) from the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate (ENSR, 2008d) shows the new wells projected into the plane of the section. The May 2008 water data from the PC-134/135 pair (**Table 1**) show that the water elevation is highest in the deepest well confirming upward vertical gradient. Likewise, in the PC-136/137 pair the deepest well has the highest water elevation. Calculations of vertical gradient for these nested well sets utilized an USEPA tool found at www.epa.gov/Athens/learn2model/part-two/onsite/vgradient.htm. Calculated vertical gradients ranged from 0.08 to 0.09 ft/ft (both upward), averaging 0.085 ft/ft, and are shown on **Table 3**.

   One core sample from each of the two well pairs was collected from the MCf and tested for various physical properties including hydraulic conductivity. **Table 1** shows the tests performed and that the hydraulic conductivities of both samples are in the 10^{-6} cm/s range.

   Calculations of flow vectors using the US EPA online tool at www.epa.gov/athens/learn2model/part-two/onsite/gradient3ns.htm and May 2008 water elevations indicates inward flow is being achieved at ART-3, but not at ART-9. The ART-3 three-point problem consisted of a triangle of wells made up of ART-4A, PC-17, and PC-135. The resultant hydraulic gradient is 0.01157 ft/ft and the flow vector is S40E. The ART-9 three-point problem consisted of a triangle of wells made up of ART-6, ART-7A, and PC-136. The resultant hydraulic gradient is 0.01152 ft/ft and the flow vector is N32E. Concerning the ART-9 well triangle, the differences in groundwater elevation among the wells is very slight – ART-7A is at 1584.30 ft whereas PC-136 is at 1584.22 ft, and ART-6 is at 1584.99 ft – indicating that additional pumping may be all that is necessary to form a flow divide and produce inward flow under this configuration of wells.

Plate 2 of the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate (ENSR, 2008d) shows the contoured potentiometric surface in the well field area. Although controversial, the 1585-foot contour at the eastern subchannel was drawn as a closed contour based on the significant mapped drawdown (see **Plate 2** of this report) and the near identical water elevations in the wells.

This data gap has not been filled and will be addressed by increasing the pumping rates to achieve inward flow in the area of ART-9 as described in Section 2.2.3 of this report.

2. **Data Gap:** Since the abandonment of downgradient monitor wells ARP-4, ARP-5 and ARP-6A in March 2007, there is inadequate monitoring capability north of the well field.

   Proposal: The three recently abandoned ARP-series piezometers, ARP-4R, ARP-5R, and ARP-6R downgradient of the well field will be re-established nearby their former locations.

   Results: Three new wells ARP-4A, ARP-5A, and ARP-6B were installed near the abandoned wells. **Table 1** shows a summary of the well completion, groundwater elevation and chemical data. **Appendix B** contains the lithology logs and well completion diagrams.

   This data gap has been fully addressed.

2.2.2 Performance Evaluation

Capture Zone: The Athens Road well field was designed to provide a hydraulic barrier spanning the approximately 1,200-foot width of the identified perchlorate plume in this area. Perchlorate is an effective tracer to assess groundwater capture. As mapped on Plate 4 of the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate (ENSR 2008d) the well field is stopping the downgradient flow of perchlorate above about 1 mg/L perchlorate on the west end and about 5 mg/L on the east end. At an average concentration of 216 mg/L perchlorate approaching the well field, this equates to an effective capture rate of about 98 percent [216-5)/216=0.977]. This means that the capture zone is defined as extending from 50 feet west of ART-2 to 50 feet east of PC-122.

Flow Budget: The Athens Road wells are extracting groundwater at a rate of about 266 gallons of per minute and perchlorate at a rate of approximately 627 pounds per day. This volume of groundwater and perchlorate removal compares favorably with the flow budget and mass flux calculated from the May 2008 data calculations at Sunset Road, 1,375 feet upgradient of the well field (see **Table 6**). The results indicate that about 195 gpm of groundwater and 505 pounds per day (lbs/day) perchlorate were passing Sunset Road in May 2008. This calculation is the result of using hydraulic conductivity data from slug tests performed on the Sunset Road wells which are upgradient of Athens Road.

Overlapping Cones of Depression: As shown on **Plate 2** and **Table 7** of this report, overlapping cones of depression are evident from data collected from adjacent piezometers and monitoring wells, indicating that the well field has developed a capture zone sufficient to encompass the width of the plume in this area. In fact, the entire 1,200 feet length of the target capture zone is within an area of overlapping cones of depression. Significant drawdown of as much as 12.9 feet in monitor well ART-3 and a large zone of greater than 10 feet drawdown that extends at least 350 feet north to the ARP wells is shown on **Plate 2**.

Numerical Modeling: A numerical evaluation by an NDEP contractor (McGinley, 2007) using MODFLOW showed that particles released in the model were completely captured by the Athens Road well field and that mass flux within the model showed greater than 99 percent capture efficiency.

Downgradient Concentration Declines over Time: Figures 24 and 24A, the *COH WRF Well Line Perchlorate Trend* graphs of the accompanying 2008 Annual Remedial Performance report for Chromium and Perchlorate (ENSR, 2008d) show that downgradient wells PC-98R and MW-K5 have exhibited consistent decreasing trends of perchlorate concentrations with time. Since full-scale system operation of the Athens Road well field in October 2002, perchlorate concentrations in groundwater samples from well PC-98R and MW-K5 have been reduced 83 and 95 percent, respectively. These wells are located about 2,000 feet downgradient of the Athens Road well field.

Figure 5 is a schematic block diagram summarizing the condition around the well field as it exists now. Groundwater flows northward in the alluvium beneath Sunset Road toward the well field. The ART-series wells extract the impacted water at a current rate of about 266 gpm and pump it back to the Fluid Bed Reactors (FBRs) on the Tronox plant site. The well field is dewatering the alluvium and deeper water from the MCf is flowing upward based on vertical gradient calculation from deep well pair such as PC-136 and PC-137 shown here.

2.2.3 Data Gaps and Proposed Additional Evaluation

To further evaluate the capture zone at Athens Road, Tronox has identified one additional data gap and has developed a proposal to address it; this is in addition to the previously identified uncompleted data gaps discussed above:

1. **Data Gap:** Tronox was not able to demonstrate inward flow in the eastern subchannel using water level data from May 2008.

   Proposal: Tronox will increase pumping rates to develop a flow divide and demonstrate inward flow. ART-6, the buddy well for ART-9, can be brought back online and can pump directly into ART-9, and water from both wells can be pumped to Lift Station #3. ART-7 and ART-9 are currently pumping at full capacity. If ART-6 is dewatered by this pumping and can not contribute then larger pumps can be installed in ART-7 and 9. This will be completed by the 4th quarter 2008.

2.3 Seep Area Well Field and Seep Stream Collection System

Figure 6 of this report shows the locations of the three monitor wells that are still planned to be installed in the well field. Access agreement issues have kept this work from being completed but are now resolved. Drilling and well completion will commence by the 4th quarter 2008.

Perchlorate concentrations have dropped over the last year in the well field (see Plate 4, ENSR 2008d) to the point that the highest concentrations in the pumping wells is currently only 9.5 mg/L compared to 2002 when the highest concentration was 200 mg/L representing a 95.2 percent capture efficiency.

2.3.1 Performance Evaluation

Capture Zone: The goal of the Seep Area collection system is to provide a hydraulic containment along the approximately 800-foot width of the perchlorate plume and to reduce the concentration in the surface water of the Las Vegas Wash to below 100 µg/L at Northshore Road. The Seep Area system is less than 1,000 feet from the Las Vegas Wash and multiple lines of evidence such as decreasing analyte concentrations in downgradient monitor wells (Plate 4, ENSR 2008d) indicate that the Las Vegas Wash underflow is encroaching on the well field. Because of this complex situation the Seep well field capture zone is defined as that area influenced by the current overlapping drawdown cone.

Flow Budget: A flow budget calculation was prepared and input parameters are presented in **Table 8** of this report. The cross-sectional area used in the calculations is shown on the Seep well field hydrogeologic cross-section (Figure 4, ENSR, 2008d). The area extends from 50 feet west of PC-120 to 175 feet east of PC-133. The Seep Area System, which was installed beginning in 2001, is currently extracting about 630 gpm of groundwater at an average concentration of 5.6 mg/L perchlorate. This equates to about 44 lbs/day of perchlorate that would otherwise discharge into the adjacent Las Vegas Wash. The estimate derived from the Seep well field pump tests show that 455 gpm and 20 lbs/day perchlorate are flowing at the well field and that the extra groundwater being pumped is probably Las Vegas Wash underflow. The mass flux calculation suggests that the well field demonstrates significant capture efficiency.

Overlapping Cones of Depression: **Plate 3**, the *Net Drawdown Map, Seep Well Field* and **Table 9** of this report show a greater than 2,000-foot wide zone where there are overlapping cones of depression with a maximum 7.5 feet of drawdown.

Inward Flow: Partial inward flow is not demonstrated by potentiometric surface maps (Plate 2, ENSR 2008d) created with groundwater level data from monitoring wells in the area. Additional monitor wells are required to close data gaps in areas where there is insufficient well coverage to adequately evaluate drawdown in the pumping wells, and thus confirm inward flow.

Downgradient Concentration Declines over Time: Perchlorate concentrations in the Southern Nevada Water Authority (SNWA) irrigation wells in Las Vegas Wash downstream of the Seep Area collection system shows a 97.6 percent decrease from 45.6 mg/L in June 2002 to 1.1 mg/L in June 2008. Additionally, Las Vegas Wash surface water sampling shows a 93.3 percent decrease in perchlorate loading (pounds/day) from 1,104 lbs/day in May 1999 to 74 lbs/day in May 2008 [(1104-74)/1104 = 0.933].

Figure 7, is a schematic block diagram summarizing the condition around the Seep well field as it exists now. Groundwater is flowing northward from below the Lower Ponds toward the well field. The well field intercepts and extracts impacted water at a current rate of about 630 gpm. Underflow from Las Vegas Wash and the underlying MCf is being drawn toward the well field based on water chemistry in monitor wells PC-95 through PC-97 and vertical gradient calculations in well pairs such as PC-90/88 shown here.

2.3.2 Data Gaps and Proposed Additional Evaluation

To further evaluate the capture zone at the Seep Area Collection System, the following data gaps have been identified and measures to address them are proposed:

1. **Data Gap:** Demonstrate inward flow within the overlapping cones of depression.

   Proposal: Install three additional wells (PC-138, PC-139 and PC-140) near recovery wells PC-117, PC-118 and PC-133 to support the understanding of drawdown in these wells and the delineation of the capture zone (**Figure 6**). Proposed well completions are provided on **Table 10**.

   Additionally, use the water level data from the new wells and the current well field to construct plan-view and cross-sectional view flow nets from which to demonstrate the inward flow of groundwater and to calculate capture zone width.

   Lastly, develop distance drawdown plots following procedures outlined in Driscoll (1986) to evaluate pumping well drawdown and efficiency.

3.0 CONCLUSIONS

The evaluation of groundwater capture found that multiple lines of evidence exist to support the conclusion that the Tronox extraction systems are effective at hydraulic capture. The decrease in perchlorate loading in Las Vegas Wash since 1999 is a strong line of evidence of the effectiveness of the combined systems over the last nine years. In May 1999, the perchlorate loading in the Wash was 1,104 pounds/day versus. 58 pounds/day in June 2008, a 94.7 percent drop.

The individual components of the extraction system show effective hydraulic and contaminant capture. The Interceptor well field shows at least a 90 percent capture rate. The Athens Road well field, according to the McGinley and Associates 2007 Modflow study, has greater than 99 percent capture efficiency, and the Seep well field exhibits a 97 percent capture rate.

Data gaps still remain and Tronox is committed to filling these gaps as described in Section 2.1.4, Section 2.2.3, and Section 2.3.2 of this report. Up to two borings are proposed to be drilled in the Interceptor well field and three monitor wells are proposed be installed in the Seep well field. Pumping will be increased in the area of well ART-9 to determine if inward flow can be achieved for the eastern portion of the Athens Road well field. The additional borings and wells and modification to the Athens Road pumping scheme will be completed by the 4th quarter of 2008.

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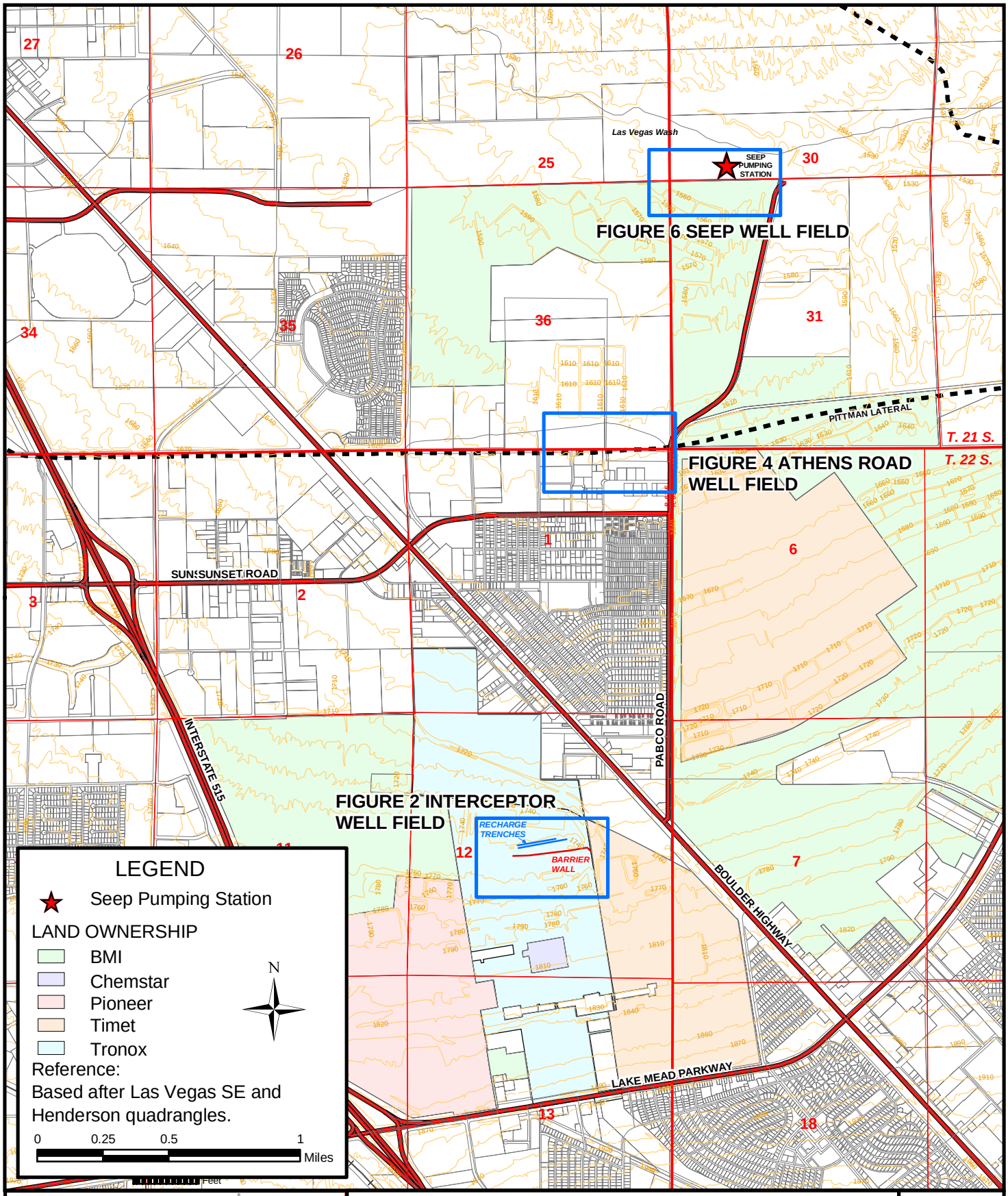
FIGURES



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LOCATION MAP

Groundwater Capture Evaluation
Tronox Facility
Henderson, Nevada

FIGURE NUMBER:	
1	

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M. Scop	7/28/2008	04020-023-160	X

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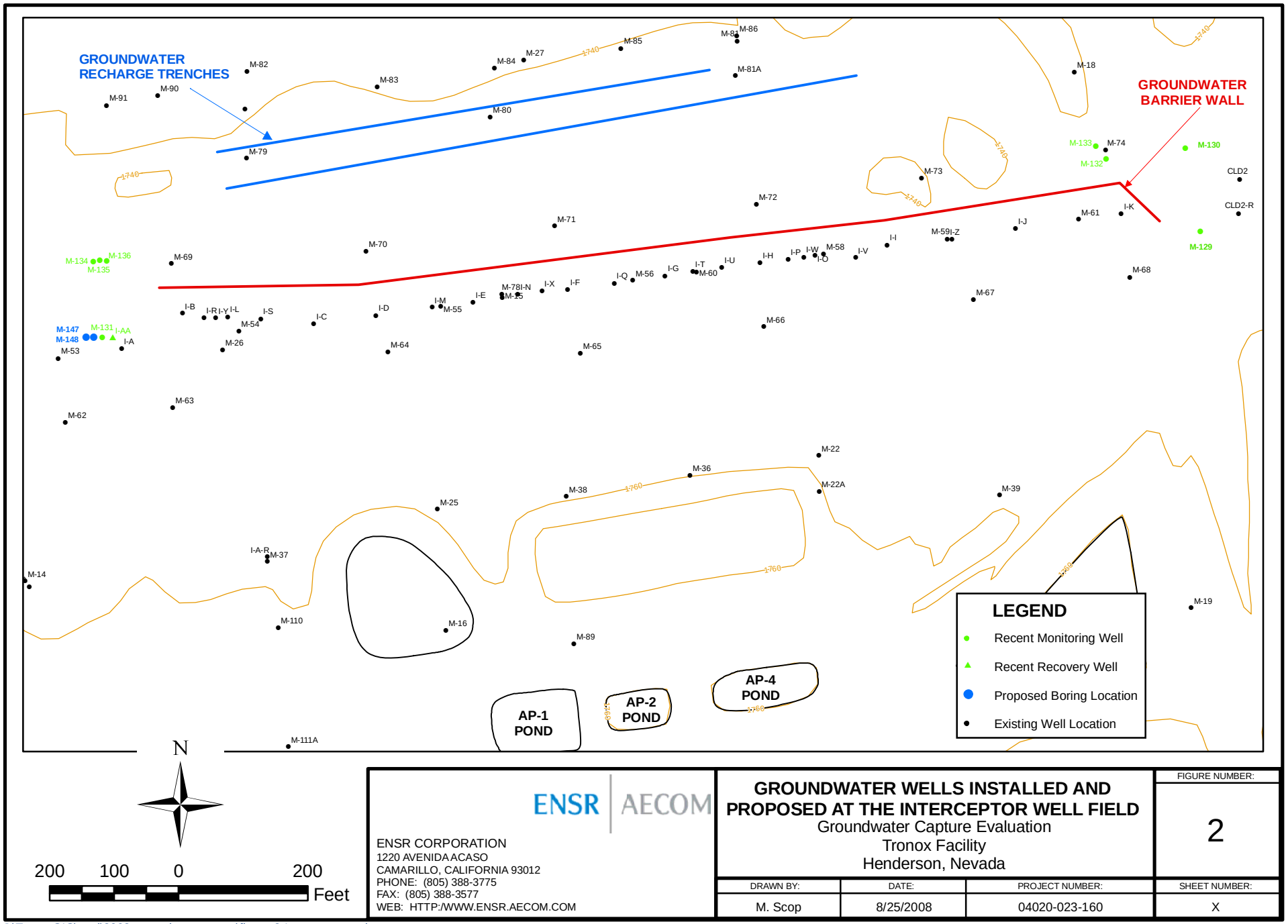

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GROUNDWATER WELLS INSTALLED AND PROPOSED AT THE INTERCEPTOR WELL FIELD

Groundwater Capture Evaluation
Tronox Facility
Henderson, Nevada

FIGURE NUMBER:			
2			
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M. Scop	8/25/2008	04020-023-160	X

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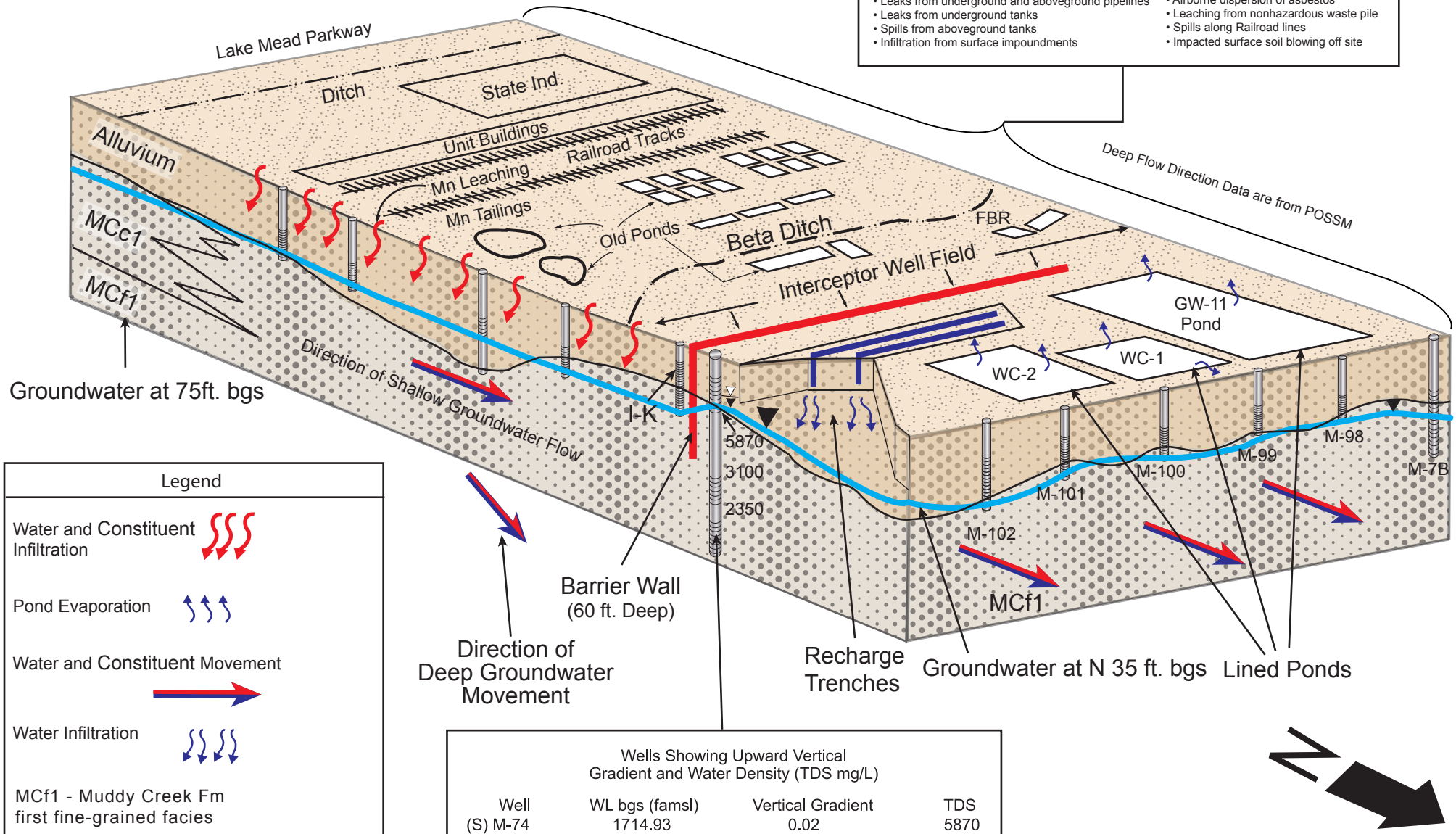
M08100_C

Potential Contaminant Source Areas
(69 LOUs Identified)

- Unit Building operations
- Manufacturing activities
- Spills and leaks from storage activities
- Leaks from underground and aboveground pipelines
- Leaks from underground tanks
- Spills from aboveground tanks
- Infiltration from surface impoundments
- Infiltration from ditches
- Overtopping from surface impoundments
- Incidental spills from roasting operations
- Airborne dispersion of asbestos
- Leaching from nonhazardous waste pile
- Spills along Railroad lines
- Impacted surface soil blowing off site



Legend

Water and Constituent Infiltration

Pond Evaporation

Water and Constituent Movement

Water Infiltration

MCf1 - Muddy Creek Fm first fine-grained facies

MCc1 - Muddy Creek Fm first coarse-grained facies

(S) Shallow Well
(M) Middle Well
(D) Deep Well

famsl = ft above mean sea level
bgs = below ground surface
wl = water level

Wells Showing Upward Vertical Gradient and Water Density (TDS mg/L)

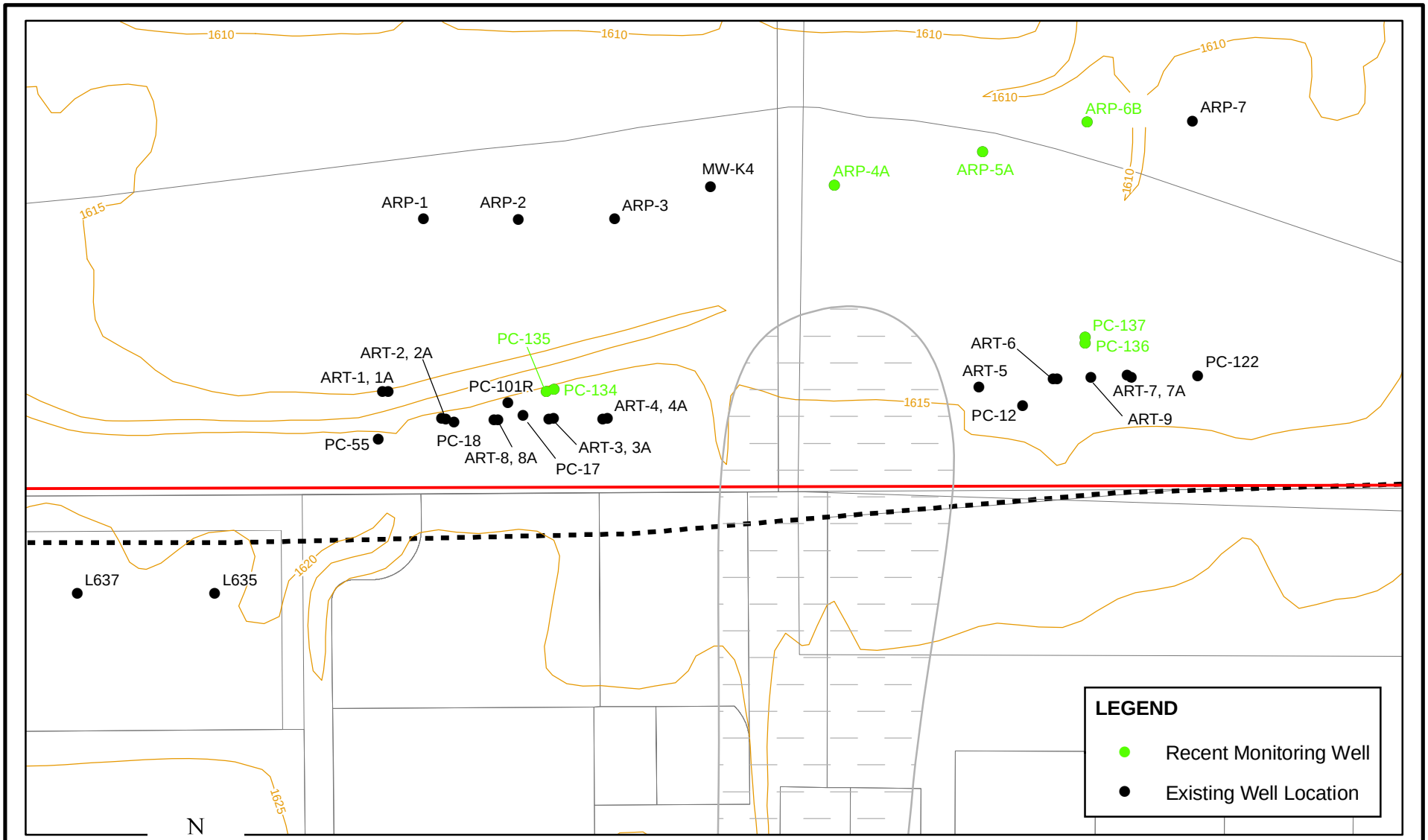
Well	WL bgs (famsl)	Vertical Gradient	TDS
(S) M-74	1714.93	0.02	5870
(M) M-133	1715.63	0.07	6270
(D) M-132	1716.99	up	2350

Figure 3

Interceptor Well Field Diagram

Tronox LLC
Henderson, Nevada

Aug 2008 No Scale



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200 100 0 200 Feet

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INSTALLED WELLS AT THE ATHENS ROAD WELL FIELD

Groundwater Capture Evaluation
Tronox Facility
Henderson, Nevada

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4			
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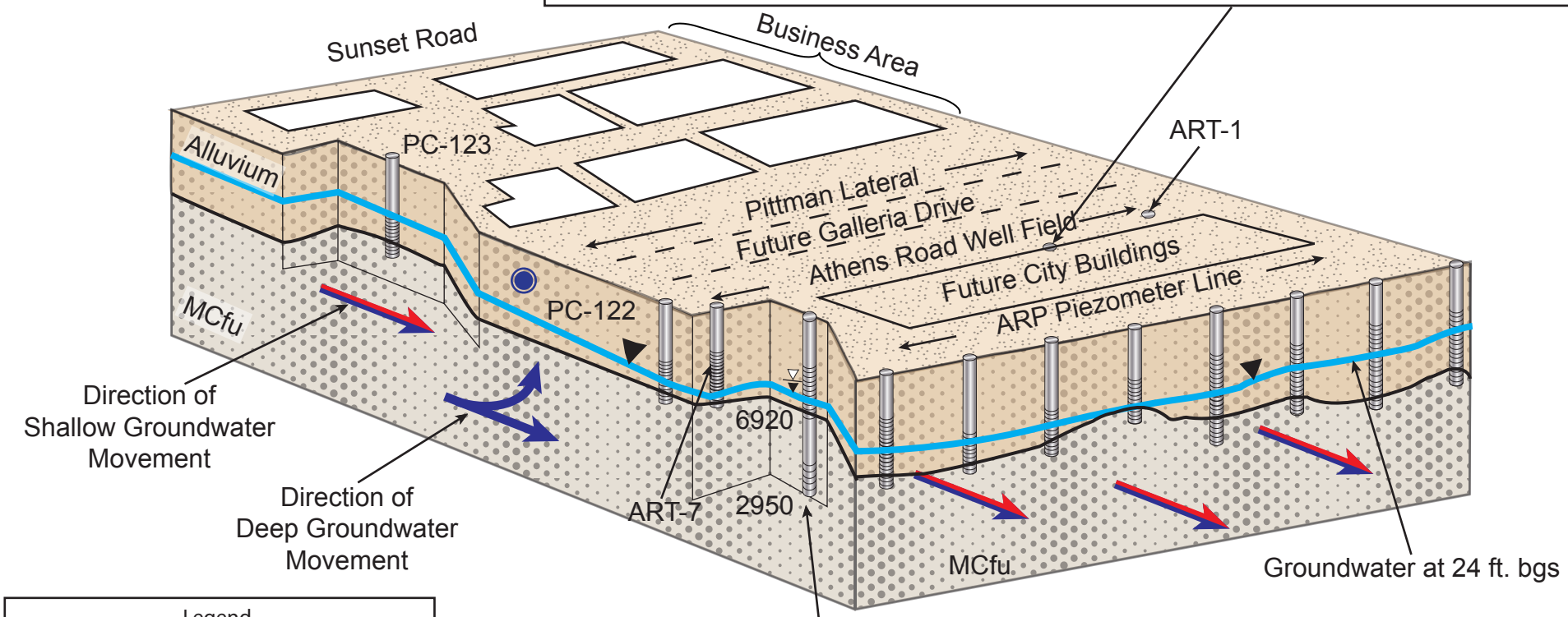
Wells showing upward vertical gradient, inward flow and water density (TDS mg/L)

Well	WL bgs (famsl)	Vertical Gradient	FlowDirection	TDS
(S) PC-135	1588.70	0.09 up	S40E*	8350*
(D) PC-134	1591.06			1640

* Using PC-135, PC-17, ART- 4A
** from ART-3



Legend

Shallow Water and Constituent Movement

Deep Water Movement

MCfu - Muddy Creek Fm fine-grained facies undifferentied

(S) Shallow Well
(D) Deep Well
NA No Analysis

famsl = ft above mean sea level
bgs = below ground surface
wl = water level

Nested Wells Showing Upward Vertical Gradient and Water Density (TDS mg/L)

Well	WL bgs (famsl)	Vertical Gradient	TDS
(S) PC-136	1584.22	0.08 up	6920
(D) PC-137	1586.72		2950

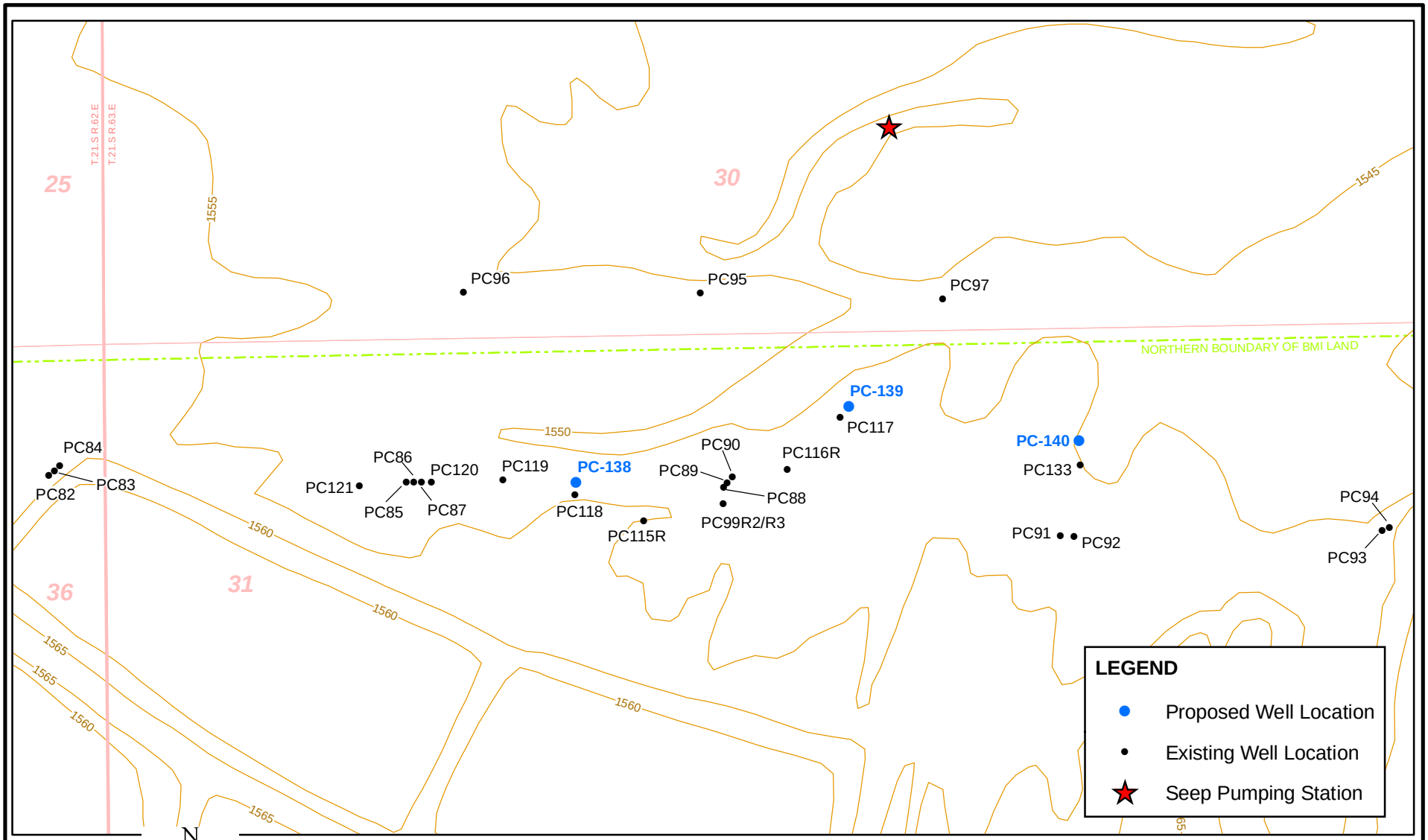
N

Figure 5

Athens Road Well Field Diagram

Tronox LLC
Henderson, Nevada

Aug 2008 No Scale



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PROPOSED WELLS AT THE SEEP WELL FIELD

Groundwater Capture Evaluation
Tronox Facility
Henderson, Nevada

FIGURE NUMBER:			
6			
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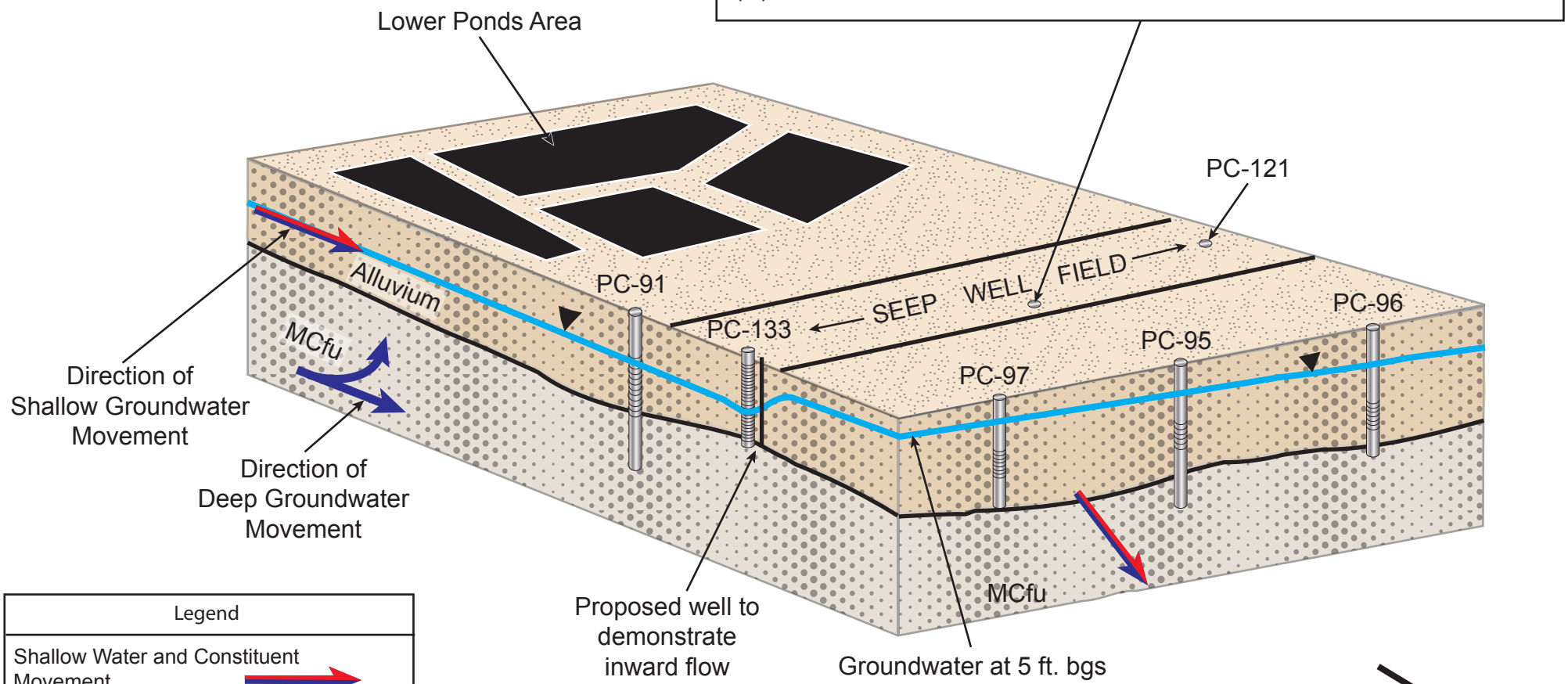
Nested Wells Showing Upward Vertical Gradient and Water Density (TDS mg/L)

Well	WL bgs (famsl)	Vertical Gradient	TDS
(S) PC-90	1543.59	0.03 up	4070
(D) PC-88	544.48		NA



Legend

Shallow Water and Constituent Movement

Deep Water Movement

MCfu - Muddy Creek Fm fine-grained facies undifferentied

(S) Shallow Well
(D) Deep Well
NA No Analysis

famsl = ft above mean sea level
bgs = below ground surface
wl = water level

Figure 7

Seep Well Field Diagram

Tronox LLC
Henderson, Nevada

Aug 2008 | No Scale

TABLES

Well Number[1]	Aquifer Unit[2]	Northing[3]	Easting[3]	Well Diameter	Top of Casing	Depth to Top of Screen	Depth to Bottom of Screen	Total Well Depth	Elevation Top of Screen	Elevation Bottom of Screen	Elevation Mid-Point of Screen	Well Location	Sample Date	Chemical Data: Prechlorate	Chemical Data: Total Chromium	Groundwater: Measured DTW	Groundwater: GW Elevation	Physical Properties[4]: Sample Depth	Pore Fluid Saturation API RP40	Porosity API RP40 Total	Porosity API RP40 Air-filled	Denisty API RP40 Bulk	Denisty API RP40 Grain	Moisture Content ASTM D2216 API RP40	Effective Permeability ASTM D5084 API RP40 USEPA 9100	Hydraulic Conductivity ASTM D5084 API RP40 USEPA 9100	Lithology: Field	Lithology: Lab[5]	Lithology: Weight Percent Clay and Silt
		NAD	NAD	inches	ft-msl	ft-msl	ft-bgs	ft-bgs	ft-msl	ft-msl	ft-msl			mg/L	mg/L	ft-bgs	ft-msl	ft-bgs	Water (%PV)	%	%	g/cc	g/cc	% (weight)	millidarcy	cm/s			%
BARRIER WALL AND INTERCEPTOR WELL FIELD																													
M-129	MCf1	26720079.640	828,806.426	2	1747.26	20	40	40	1724.48	1704.48	1714.5	East Barrier (Timet)	5/9/08	35.8	0.55	32.76	1714.50	35.5-36							1.10	1.05E-06	Clayey Silt	--	--
													6/2/08	37.0	0.67	31.35	1715.91												
M-130	MCf1	26719919.700	828,832.009	2	1749.23	20	40	40	1726.55	1706.55	1716.6	East Barrier (Timet)	5/9/08	35.5	0.021	28.12	1721.11	35.5-36							1.01	9.60E-07	Clayey Silt	--	--
													6/2/08	37.8	0.048	28.07	1721.16												
M-131	MCf1	26719770.566	827158.077	2	1754.13	29	39	40	1722.36	1712.36	1717.4	West Barrier	1/17/08	68.5	--	33.16	1720.97												
													2/5/08	67.7	0.061	33.19	1720.94												
													5/6/08	62.9	0.061	32.79	1720.94												
M-132	MCf1	26720048.491	828714.609	2	1744.27	79.7	89.7	90	1664.57	1654.57	1659.6	East Barrier	1/17/08	24.0	0.041	27.35	1716.92	60-60.5	91.7	59.6	4.9	1.08	2.68	50.8	2.97	2.87E-06	Sandy Silt	Silt	68.92
													2/5/08	23.2	0.046	27.51	1716.76												
													5/6/08	15.7	<0.01	27.28	1716.99												
M-133	MCf1	26720067.292	828698.608	2	1743.62	60	70	70	1683.62	1673.62	1678.6	East Barrier	1/17/08	8.85	0.28	27.96	1715.66												
													2/5/08	8.8	0.36	28.23	1715.39												
													5/12/08	10.6	0.97	27.99	1715.63												
M-134	MCf1	26719889.138	827144.353	2	1752.14	60	70	70	1692.14	1682.14	1687.1	West Barrier	1/17/08	124	0.056	34.51	1717.51												
													2/5/08	122	0.079	34.64	1717.50												
													5/11/08	122	0.12	33.22	1718.92												
M-135	MCf1	26719890.173	827154.482	2	1751.85	29	39	39	1722.85	1712.85	1717.9	West Barrier	1/17/08	48.1	0.079	34.63	1717.22												
													2/5/08	46.5	0.081	36.69	1715.16												
													5/6/08	42.8	0.085	33.46	1718.71												
M-136	MCf1	26719889.774	827165.342	2	1751.87	80	90	90	1671.87	1661.87	1666.9	West Barrier	1/17/08	168	0.087	29.54	1722.33	62-62.5	89.4	65.1	6.9	0.94	2.68	63.3	3.08	2.91E-06	Clayey Silt	Silt	77.65
													2/5/08	116	0.073	29.77	1722.10												
													5/11/08	109	<0.01	29.16	1722.71												
I-AA	Muddy Creek	26719770.850	827174.400	6	1753.93	26	46	46	1727.93	1707.93	1717.9	West Barrier (Recovery)	1/17/08	173	--	33.06	1720.87												
													2/5/08	134	0.06	32.97	1720.96												
													5/6/08	120	0.08	32.61	1721.32												
ATHENS ROAD																													
ARP-4A	Qal	26728411.808	829167.886	2	1615.47	17.7	32.7	33	1597.77	1582.77	1590.3	Athens - Downgradient	1/9/08	30.4	--	--	--												
													2/13/08	37.1	<0.01	29.33	1586.14												
													3/12/08	35.5	--	29.09	1586.38												
													4/17/08	38.0	--	29.31	1586.16												
													5/14/08	30.8	<0.01	29.30	1586.17												
													6/17/08	30.0	--	29.23	1586.24												
ARP-5A	Qal	26728458.427	829375.005	2	1616.10	12.7	37.7	38	1603.4	1578.4	1590.9	Athens - Downgradient	1/9/08	35.6	--	--	--												
													2/13/08	37.7	0.03	32.92	1583.18												
													3/12/08	37.7	--	32.47	1583.63												
													4/17/08	31.7	--	32.64	1583.46												
													5/14/08	20.5	0.035	32.69	1583.41												
													6/17/08	24.6	--	32.73	1583.37												
ARP-6B	Qal	26728499.917	829520.516	2	1615.56	27.7	42.7	43	1587.86	1572.86	1580.4	Athens - Downgradient	1/9/08	16.9	--	--	--												
													2/13/08	16.6	0.096	32.19	1583.37												
													3/12/08	16.5	--	31.92	1583.64												
													4/17/08	17.2	--	32.14	1583.42												
													5/14/08	15.0	0.11	32.23	1583.33												
													6/17/06	14.8	--	32.23	1583.33												
PC-134	MCf1	26728126.415	828776.171	2	1613.35	59.7	69.7	70	1553.65	1543.65	1548.7	Athens - West Subchannel	1/18/08	<0.008	--	--	--												
													2/13/08	<0.008	<0.02	26.14	1587.21												
													5/11/08	0.04	<0.02	25.95	1591.06												
PC-135	Qal	26728123.177	828765.250	2	1612.79	19.7	49.7	50	1593.09	1563.09	1578.1	Athens - West Subchannel	1/18/08	11.2	--	28.71	1584.08	51-51.5	92.2	61	4.8	0.99	2.55	58.2	9.19	8.67E-06	Silty Sand	SiltySand	38.62
													2/13/08	10.7	<0.02	28.72	1584.07												
													6/26/08	--	--	28.55	1588.7												
PC-136	Qal	26728191.374	829517.888	2	1615.08	17.7	37.7	38	1597.38	1577.38	1587.4	Athens - East Subchannel	1/18/08	139	--	30.83	1584.25												
													2/13/08	167	1.2	30.92	1584.16												
													5/14/08	169	4.0	30.86	1584.22												
PC-137	MCf1	26728198.976	829517.568	2	1614.83	59.7	69.7	70	1555.13	1545.13	1550.1	Athens - East Subchannel	1/18/08	0.111	--	28.37	1586.46	61-61.5	89.6	59.9	6.2	1.09	2.73	49.4	1.12	1.05E-06	Silt	Silt	59.03
													2/13/08	0.103	<0.01	28.11	1586.72												
													5/11/08	0.054	<0.01	28.11	1586.72												

DEFINITIONS

API	American Petroleum Institute
ASTM	American Standards Testing Materials
CPT	cone penetrometer
DTW	depth to water
FEET BGS	depth in feet below ground surface
LAB	certifiedanalytical laboratory (PTS Labs, Santa Fe Springs, California)
MCf1	Muddy Creek - First Fine-grain Unit (Tronox June 27, 2008, "Proposed Hydrostratigraphic Nomenclature - Bleack Mountain Industrial Complex and Common Areas")
NAD	North American Data
Qal	Quaternary Alluvium (Tronox June 27, 2008, "Proposed Hydrostratigraphic Nomenclature - Bleack Mountain Industrial Complex and Common Areas")
USEPA	United States Environmental Protection Agency
cm/s	centimeters per second
ft-msl	feet-mean sea level
ft-bgs	feet-below surface grade
g/cc	grams per cubic centimeter (or milliliter)
mg/kg	milligrams per kilogram
millidarcy	millidarcy - unit of permeability. Equivalent to the passage of one cubic centimeter of fluid of one centipoise viscosity in one second under a pressure differential of one atmosphere thorugh a porous medium having an area of on square centrmeter and a length of one centimeter.
mg/L	milligrams per liter
%	Pecent
%PV	Percent of pore volume
%weight	Percent by weight
--	Not tested

NOTES

(1) Well locations shown on Figure 2 (Barrier Wall and Interceptor Well Field) and Figure 4 (Athens Road)
(2) Hydrostratigraphic nomenclature after Tronox (June 27, 2008), "Proposed Hydrostratigraphic Nomenclature - Bleack Mountain Industrial Complex and Common Areas".
(3) Survey data for wells installed as part of the capture zone investigation are provided in Attachment D of this document.
(4) Laboratory reports are presented in Appendix D of 2007-2008 Annual Performance Report (ENSR, 2008d)
(5) Laboratory based its determination of soil type based on the 50th percentile (cummulative)

TABLE 2
REDEVELOPMENT OF THE INTERCEPTOR WELL FIELD AREA WELLS
Tronox LLC, Henderson, Nevada

WELL DEVELOPMENT

Well	Video	Video Remarks	Develop Date	Develop Method	Develop Time (min)	Purge Method	Purge Volume (gallons)	Purge Time (min)	Purge Volume (gallons)	Measured (gpm)
I-AA	no	none	12/15/07	Surge, Bail	40	Bail, Pump	72	60	75	1.3
I-AR	no	none	NR							
I-B	yes	staing on screen; minor sediment	12/13/07	Surge, Bail	45	Bail, Pump	64	60	75	1.3
I-C	yes	staing on screen; minor sediment	12/18/07	Surge, Bail	40	Bail, Pump	62	90	280	3.1
I-D	yes	staing on screen; minor sediment	12/18/07	Surge, Bail	60	Bail, Pump	74	100	160	1.6
I-E	no	none	2/4/08	Surge, Bail, Brush	60	Bail, Pump	65	75	135	1.8
I-F	yes	staing on screen; minor sediment	2/4/08	Surge, Bail, Brush	60	Bail, Pump	80	30	440	14.0
I-G	yes	staing on screen; minor sediment	12/15/07	Surge, Bail	45	Bail, Pump	55	60	60	1.0
I-H	yes	staing on screen; minor sediment	2/6/08	Surge, Bail, Brush	40	Bail, Pump	68	100	100	0.9
I-I	yes	staing on screen; minor sediment	2/8/08	Surge, Bail, Brush	45	Bail, Pump	91	25	250	9.7
I-J	yes	staing on screen; minor sediment	2/9/08	Surge, Bail, Brush	45	Bail, Pump	77	32	238	7.3
I-K	yes	staing on screen; minor sediment	2/9/08	Surge, Bail, Brush	45	Bail, Pump	73	53	240	4.5
I-L	yes	staing on screen; minor sediment	12/14/07	Surge, Bail	40	Bail, Pump	62	100	138	1.4
I-M	yes	staing on screen; minor sediment	12/19/07	Surge, Bail	40	Bail, Pump	55	35	69	2.0
I-N	yes	staing on screen; minor sediment	2/4/08	Surge, Bail, Brush	60	Bail, Pump	60	70	290	4.0

TABLE 2 (continued)
REDEVELOPMENT OF THE INTERCEPTOR WELL FIELD AREA WELLS
Tronox LLC, Henderson, Nevada

WELL DEVELOPMENT

Well	Video	Video Remarks	Develop Date	Develop Method	Develop Time (min)	Purge Method	Purge Volume (gallons)	Purge Time (min)	Purge Volume (gallons)	Measured (gpm)
I-O	yes	staing on screen; minor sediment	2/7/08	Surge, Bail, Brush	45	Bail, Pump	61	50	110	2.2
I-P	yes	staing on screen; minor sediment	2/7/08	Surge, Bail, Brush	45	Bail, Pump	80	36	155	4.3
I-Q	yes	heavy staing on screen; major sediment on bottom	2/5/08	Surge, Bail, Brush	45	Bail, Pump	60	130	120	0.9
I-R	yes	heavy staing on screen; major sediment on bottom	12/13/07	Surge, Bail	40	Bail, Pump	69	60	132	2.3
I-S	yes	staing on screen; minor sediment	12/14/07	Surge, Bail	40	Bail, Pump	86	60	180	3.0
I-T	yes	heavy staing on screen; major sediment on bottom	2/5/08	Surge, Bail, Brush	45	Bail, Pump	84	285	100	0.4
I-U	yes	heavy staing on screen; major sediment on bottom	2/6/08	Surge, Bail, Brush	45	Bail, Pump	77	105	80	0.8
I-V	yes	staing on screen; minor sediment	2/7/08	Surge, Bail, Brush	45	Bail, Pump	78	21	145	6.8
I-W	yes	clean	NR							
I-X	yes	clean	NR							
I-Y	no	none	NR							
I-Z	yes	staing on screen; minor sediment	2/8/08	Surge, Bail, Brush	45	Bail, Pump	33	35	220	6.3
M-70	no	none	2/7/08	Surge, Bail, Brush	45	Bail, Pump	4.5	60	40	0.667
M-71	no	none	2/7/08	Surge, Bail, Brush	45	Bail, Pump	5.0	30	22.5	0.750
M-72	no	none	2/8/08	Surge, Bail, Brush	45	Bail, Pump	2.5	40	2.5	0.063

* = three casing volumes
NR = Not redeveloped

TABLE 3
EVALUATION OF VERTICAL HYDRAULIC GRADIENTS
Tronox LLC, Henderson, Nevada

Well ID	Well Depth	Gauging Date	Top of Screen (ft bgs)	Screen Length (ft)	Surface Elevation	Depth to Water (ft bgs)	Compared Wells (shallow - deep)	Vertical Gradient	Gradient Direction
M-74	shallow	5/8/08	9.2	29.6	1742.51	27.58	M-74 & M-132	0.04	Up
M-133	middle	5/12/08	59.7	10.0	1740.93	25.30	M-74 & M-133	0.02	Up
M-132	deep	5/12/08	79.7	10.0	1741.41	24.42	M-133 & M-132	0.07	Up
M-135	shallow	5/11/08	28.7	10.0	1749.17	30.45	M-135 & M-136	0.08	Up
M-134	middle	5/11/08	59.7	10.0	1749.39	30.46	M-135 & M-134	0.01	Up
M-136	deep	5/11/08	79.7	10.0	1749.09	26.38	M-134 & M-136	0.19	Up
PC-135	shallow	6/26/08	19.7	30.0	1617.52	28.82	PC-135 & PC-134	0.09	Up
PC-134	deep	5/11/08	59.7	10.0	1617.43	26.38			
PC-136	shallow	5/14/08	17.7	20.0	1615.46	31.24	PC-136 & PC-137	0.08	Up
PC-137	deep	5/11/08	59.7	10.0	1615.19	28.47			
PC-90	shallow	5/14/08	4.5	10.0	1550.53	6.94	PC-90 & PC-88	0.03	Up
PC-88	deep	5/14/08	40.0	10.0	1550.91	6.43			

Notes:
ft = feet
ft bgs = feet below ground surface
Surface elevation in feet above mean sea level
Water elevation in feet above mean sea level
Gradient caclulator from USEPA Online Tools at http://www.epa.gov/athens/learn2model/part-two/onsite/vgradient.htm
Gradient direction convention - Up indicates deep to shallow groundwater flow direction

TABLE 4
GROUNDWATER UNDERFLOW AND MASS FLUX CONDITION - MAY 2008
INTERCEPTOR WELL FIELD
Tronox LLC, Henderson, Nevada

ALLUVIUM								
CELL ID [1]	**M-131**	**I-Y**	**M-55**	**I-X**	**I-G**	**I-U**	**I-Z**	**TRAVERSE TOTAL**
Cell Width (ft)	90	195	170	170	100	50	560	**1,245**
Cell Height (ft) [2]	0.5	1.8	2	4.3	2.5	0.3	3.9	
Cell Area (A) (ft^2)	45	351	340	731	250	15	2184	**3,871**
K (gpd/ft2) [3]	972	972	972	972	972	972	972	
Q (gpd) (Q = KiA) [4]	875	6,823	6,610	14,211	4,860	292	42,457	**75,252**
Q (gpm)	0.6	4.7	4.6	9.9	3.4	0.2	29.5	**52.3**

MUDDY CREEK - UPFLOW		
CELL ID	**MC-U**	**TRAVERSE TOTAL**
Cell Width East-West (ft)	1,600	**1,600**
Cell Length North-South (ft) [5]	1,200	
Cell Area (A) (ft^2)	1,920,000	
K (gpd/ft2) [6]	0.06	
Q (gpd) (Q = KiA) [7]	8,064	
Q (gpm)	5.6	**5.6**
TOTAL GPM		**57.9**

NOTES

(1) Cell ID is well name in center of cell - locations shown on Figure 2 (this document) and Figure 2 (ENSR, 2008d). Cell width was centered on these borings/wells.
(2) Cell height is saturated thickness of alluvium from well field cross section (Figure 2) (ENSR 2008d)
(3) Hydraulic conductivity = average from well M-27 slug test (1,496 gpd/ft^2) plus average of six other M-series Qal slug tests (449 gpd/ft^2)
(4) Hydraulic Gradient (i) is 0.02 ft/ft
(5) Since Muddy Creek upflow is near vertical the horizontal dimension = length of "daylighting" into Qal
(6) Hydraulic conductivity measured in Muddy Creek Fm cores from M-132 and M-136
(7) Vertical hydraulic gradient calculated and average taken from well sets M-74, M-132, M-133 and M-134, M-135, M-136

DEFINITIONS

A	Area
ClO4	Perchlorate
ft	feet
ft^2	feet squared
gpd	gallons per day
gpd/ft^2	gallons per day per foot squared
gpm	gallons per minute
i	gradient
K	hydraulic conductivity
lbs/day	pounds per day
MCD	Muddy Creek "dammed" groundwater
MCU	Muddy Creek "upward flow" groundwater (water from the Muddy Creek to Alluvium)
mg/L	milligrams per liter
Q	flow

REFERENCES

ENSR 2008d, Annual Remedial Performance Report for Chromium and Perchlorate, July 2007-June 2008, Submitted in Accordance with Chromium Mitigation Program and Perchlorate Performance Consent Orders: ENSR, Camarillo, California, August 28, 2008, 4020-023-110.

TABLE 5
NET DRAWDOWN CALCULATIONS FOR THE INTERCEPTOR WELL FIELD
SEPTEMBER 1987 TO MAY 2008
Tronox LLC, Henderson, Nevada

Well ID	Elevation TOC (ft above MSL)	9/14/87 Depth to Water (ft above TOC)	9/14/87 Water Elevation (ft above MSL)	5/6/08 to 6/4/08 Depth to Water (ft above TOC)	5/6/08 to 6/4/08 Water Elevation (ft above MSL)	5/6/08 to 6/4/08 Net Drawdown (feet)
I-B	1752.70	24.98	1727.72	29.58	1723.12	**4.6**
I-E	1752.40	23.53	1728.87	32.12	1720.28	**8.6**
I-F	1749.70	20.73	1728.97	30.70	1719.00	**10.0**
I-G	1752.50	22.13	1730.37	30.76	1721.74	**8.6**
I-J	1750.10	12.67	1737.43	27.97	1722.13	**15.3**
I-L	1751.70	20.00	1731.70	28.78	1722.92	**8.8**
I-N	1751.40	22.50	1728.90	32.40	1719.00	**9.9**
I-R	1751.35	23.10	1728.25	28.61	1722.74	**5.5**
I-T	1751.66	21.15	1730.51	30.39	1721.27	**9.2**
I-U	1752.17	20.80	1731.37	31.08	1721.09	**10.3**
I-W	1751.50	19.00*	1732.50	30.73	1720.77	**11.7**
I-X	1748.60	20.00*	1728.60	29.62	1718.98	**9.6**
I-Y	1751.40	23.00*	1728.40	28.37	1723.03	**5.4**
M-14A	1760.93	28.55**	1732.38	33.28	1727.65	**4.7**
M-17A	1768.99	27.6**	1741.39	33.47	1735.52	**5.9**
M-19	1766.77	25.18	1741.59	35.00	1731.77	**9.8**
M-22A	1759.46	20.5**	1738.96	30.97	1728.49	**10.5**
M-25	1759.93	25.69	1734.24	33.82	1726.11	**8.1**
M-36	1759.82	23.47	1736.35	32.72	1727.10	**9.3**
M-37	1761.06	26.15	1734.91	32.80	1728.26	**6.6**
M-38	1759.73	24.04	1735.69	31.46	1728.27	**7.4**
M-39	1761.13	19.75	1741.38	32.55	1728.58	**12.8**
M-55	1750.88	22.11	1728.77	29.79	1721.09	**7.7**
M-56	1750.83	20.94	1729.89	29.64	1721.19	**8.7**
M-57A	1753.44	21.30**	1732.14	30.12	1723.32	**8.8**
M-58	1751.25	18.76	1732.49	30.19	1721.06	**11.4**
M-60	1750.94	20.41	1730.53	29.62	1721.32	**9.2**
M-61	1746.83	11.74	1735.09	24.57	1722.26	**12.8**
M-64	1749.76	22.21	1727.55	29.64	1720.12	**7.4**
M-65	1753.91	22.92	1730.99	31.79	1722.12	**8.9**
M-66	1754.24	19.83	1734.41	31.77	1722.47	**11.9**
M-67	1745.91	10.20	1735.71	22.51	1723.40	**12.3**
M-68	1748.72	10.11	1738.61			
M-68	1750.23^			27.10	1723.13	**15.5**
M-78	1751.50	22.83	1728.67	30.83	1720.67	**8.0**
M-89	1766.19	28.39#	1737.80	33.87	1732.32	**5.5**

ft = feet
MSL = Mean Sea Level
TOC= top of column
* = Extrapolated from Interceptor WF cross section
** = Depth of water from M-14, 17, 22 and 57
# = Extrapolated from contouring
^ = reconstructed and resurveyed

TABLE 6
GROUNDWATER UNDERFLOW AND MASS FLUX CONDITION - MAY 2008
ATHENS ROAD WELL FIELD- USING SUNSET ROAD SLUG TEST PARAMETERS
Tronox LLC, Henderson, Nevada

SLUG TEST PARAMETERS											
CELL ID [1]	**PC-132**	**PC-131**	**PC-50**	**PC-130**	**PC-129**	**PC-128**	**PC-25**	**PC-127**	**PC-24**	**PC-126**	**Traverse Total**
Cell Width (ft)	175	200	200	200	200	200	200	200	200	200	**1,975**
Cell Height (ft) [2]	22.1	28.6	22.3	28.5	20.2e	13.09	2.7e	13.8	6.4	13.5e	
Cell Area (A) (ft^2)	3864	5722	5980	5698	4040	2618	540	2764	1400	2700	
Aquifer parameters (K) from well	**PC-132**	**PC-131**	**PC-50**	**PC-130**	**PC-129**	**PC-128**	**PC-127 & PC-128(Av)**	**PC-127**	**PC-24**	**PC-126**	
K (gpd/ft^2) [3]	670	577	594	390	731	235	581	926	473	473	
Q (gpd) (Q = KiA) [4]	36244	46222	49730	31111	41345	8613	4392	35832	9271	17879	**280,641**
Q (gpm)	25	32	35	22	29	6	3	25	6	12	**195**
ClO4 (mg/L) (May 2008)	2.5	8.5	222	453	415	193	100e*	430	16	9.9	
ClO4 (lbs/day)	1	3	92	117	143	.14	4	128	0.5	1	**505**

NOTES

(1) Cell ID is well or soil boring name - locations shown on Plate 4 (ENSR, 2008d). Cell width was centered on these borings/wells.
(2) Cell height is saturated thickness of alluvium from cross section (Figure 3) (ENSR, 2008d).
(3) Hydraulic conducitivity is from slug test data.
(4) Hydraulic gradient (i) is 0.014 ft/ft

DEFINITIONS

A	Area
ClO4	Perchlorate
e	estimate
e*	estimate from April 1998
ft	feet
ft^2	feet squared
gpd	gallons per day
gpd/ft^2	gallons per day per foot squared
gpm	gallons per minute
i	gradient
K	hydraulic conductivity
lbs/day	pounds per day
mg/L	milligrams per liter
Q	flow

REFERENCES:

ENSR 2008d, Annual Remedial Performance Report for Chromium and Perchlorate, July 2007- June 2008, ENSR, Camarillo, California, August 28, 2008, 4020-023-110.

TABLE 7
NET DRAWDOWN CALCULATIONS FOR THE ATHENS ROAD WELL FIELD
APRIL 2002 TO MAY 2008
Tronox LLC, Henderson, Nevada

Well ID	Elevation TOC (ft below MSL)	4/30/02 Depth to Water (ft below TOC)	4/30/02 Water Elevation (ft below MSL)	5/14-16/08 Depth to Water (ft below TOC)	5/14-16/08 Water Elevation (ft below MSL)	5/14-16/08 Net Drawdown (feet)
ARP-1	1613.32	16.18	1597.14	24.32	1589.00	**8.1**
ARP-2	1612.79	15.90	1596.89	24.20	1588.59	**8.3**
ARP-3	1612.17	16.26	1595.91			
ARP-4A	1615.47	20.50*	1594.97	29.30	1586.17	**8.8**
ARP-5A	1616.10	22.20*	1593.89	32.69	1583.41	**10.5**
ARP-6B	1615.56	22.03*	1593.53	32.23	1583.33	**10.2**
ARP-7	1613.20	19.63	1593.57	29.62	1583.58	**10.0**
ART-1	1614.47	15.46	1599.01	24.22	1590.25	**8.8**
ART-2	1617.10			27.60	1589.50	**P**
ART-2A	1616.81	18.05**	1598.76			**9.5**
ART-3	1617.94	18.30	1599.64	31.19	1586.75	**12.9**
ART-3A	1617.60					**P**
ART-4	1617.46					**P**
ART-4A	1617.46	19.13	1598.33	29.69	1587.77	**10.6**
ART-5	1614.06	17.85	1596.21	25.90	1588.16	**>8.1**
ART-6	1615.31	19.09	1596.22	30.32	1584.99	**11.2**
ART-7	1615.38	19.21	1596.17			**P**
ART-7A	1614.78			30.48	1584.30	**11.9**
ART-8	1617.69	18.75	1598.94			**P**
ART-8A	1617.10			28.09	1589.01	**9.9**
ART-9	1615.06					**P**
L635	1620.94	13.93	1607.01	15.59	1605.35	**1.7**
L637	1621.60	9.70	1611.90	10.58	1611.02	**0.9**
MW-K4	1614.96	19.91	1595.05	28.26	1586.70	**8.3**
PC-12	1616.37	19.89	1596.48	29.63	1586.74	**9.7**
PC-17	1617.00	18.14	1598.86	28.36	1588.64	**10.2**
PC-18	1618.47	19.44	1599.03	28.76	1589.71	**9.3**
PC-55	1617.19	17.89	1599.30	26.46	1590.73	**8.6**
PC-101R	1618.12	19.41	1598.71	29.77	1588.35	**10.4**
PC-122	1617.39	21.28*	1596.11	32.43	1584.96	**11.2**
PC-123	1626.44	21.77*	1604.67	22.31	1604.13	**0.5**
PC-135	1617.25	18.00*	1599.25	28.55	1588.70	**10.6**
PC-136	1615.08	19.30*	1595.78	30.86	1584.22	**11.6**

ft = feet
MSL = Mean sea level
TOC = top of column
* = Extrapolated from contouring
** = Water level from ART-2
# = Water level below screen
P = Pumping well on 5/16/08

TABLE 8
GROUNDWATER UNDERFLOW AND MASS FLUX CONDITION - MAY 2008
SEEP WELL FIELD - USING SEEP WELLS PUMP TEST PARAMETERS
Tronox LLC, Henderson, Nevada

CELL ID (1)	PC-119	PC-118	PC-115R	PC-99R	PC-116R	PC-117	PC-133	TRAVERSE TOTAL
Cell Width (ft)	100	100	110	85	80	200	350	1,025
Cell Height (ft) (2)	40.3	41.7	37.2	34.4	29.7	39.4	22.7	
Cell Area (A) (ft^2)	4,026	4,171	4,090	2,924	2,380	7,884	7,932	
Aquifer parameters (K) from well	PC-119	PC-118	PC-115R	PC-99	PC-116R	PC-117	PC-133	
K (gpd/ft^2) (3)	34,112	1,052	128	5,000	5,000	207	95	
Q (gpd) (Q = KiA) (4)	525,306	16,784	2,002	55,917	45,513	6,242	2,882	**654,646**
Q (gpm)	365	12	1	39	32	4	2	**455**
ClO4 (mg/L) (May 2008)	3.0	7.6	9.2	7.8	5.1	1.9	2.6	
ClO4 (lbs/day)	13	1	0.2	4	2	0.1	0.1	**20**

NOTES:

(1) Cell ID is well or soil boring name - locations shown on Figure 4 (this report). Cell width was centered on these borings/wells.
(2) Cell height is saturated thickness of alluvium from cross section (Figure 4) (ENSR, 2008d).
(3) Hydraulic Conducitivity is from pumping test data.
(4) Hydraulic Gradient (i) is 0.003825 ft/ft.

DEFINITIONS

A	Area
ClO4	Perchlorate
ft	feet
ft^2	feet squared
gpd	gallons per day
gpd/ft^2	gallons per day per foot squared
gpm	gallons per minute
i	gradient
K	hydraulic conductivity
lbs/day	pounds per day
mg/L	milligrams per liter
Q	flow

REFERENCES

ENSR 2008d, Annual Performance Report for Chromium and Perchlorate, July 2007 - June 2008, Submitted in Accordance with Chromium Mitigation Program and Perchlorate Performance Consent Orders: ENSR, Camarillo, California, August 28, 2008, 4020-023-110

TABLE 9
NET DRAWDOWN CALCULATIONS FOR THE SEEP WELL FIELD
May 2001 TO MAY 2008
Tronox LLC,Henderson, Nevada

Well ID	Elevation TOC (ft below MSL)	5/8/01		5/14/08		5/14/2008
		Depth to Water (ft below TOC)	Water Elevation (ft below MSL)	Depth to Water (ft below TOC)	Water Elevation (ft above MSL)	Net Drawdown (feet)
PC-99R2/R3	1552.55	0.79	1551.764			**P**
PC-115R	1554.71	1.43	1553.28			**P**
PC-116R	1552.10	0.90	1551.20			**P**
PC-117	1552.26	0.85*	1551.41			**P**
PC-118	1554.53	1.10*	1553.43			**P**
PC-119	1554.66	0.90*	1553.76			**P**
PC-120	1554.64	0.60*	1554.04	5.11	1549.53	**4.5**
PC-121	1554.10	0.75*	1553.35	5.02	1549.08	**4.3**
PC-133	1553.00	6.00*	1547.00			**P**
PC-83	1559.32	3.69	1555.63	6.94	1552.38	**3.2**
PC-86	1553.85	0.58	1553.27	5.57	1548.28	**5.0**
PC-90	1551.10	0.00#	1551.10	6.87	1543.59	**7.5**
PC-91	1552.33	6.25	1546.08	9.59	1542.74	**3.3**
PC-93	1548.76	6.81	1541.95			**NR**
PC-95	1550.62	1.82	1548.80			**NR**
PC-96	1552.27	2.89	1549.38	6.57	1546.00	**3.4**
PC-97	1548.53	0.60	1547.93	5.31	1543.22	**4.7**

ft = feet
MSL = Mean sea level
TOC = top of column
* = Extrapolated from contouring
# = Water level from PC-88
NR = No reading
P = Pumping well

TABLE 10
PROPOSED MONITOR WELLS FOR GROUNDWATER CAPTURE EVALUATION
TRONOX LLC, HENDERSON, NEVADA

Proposed Well[1]	Location[2]	Well Construction[3]	Casing Diameter	Completion[4]	Screen Interval[5]	Depth to Water[6]	Rationale[7]
			inches		feet-bgs	feet-bgs	
SEEP WELL FIELD							
PC-138	Monitor well for Extraction Well 117	Single	2	Alluvium	5-35	9	Proposed by ENSR (May 30, 2007) and in response to NDEP Comment 25 (June 26, 2007) for additional wells to support mapping of the cone of depression.
PC-139	Monitor well for Extraction Well 118	Single	2	Alluvium	5-25	6	Proposed by ENSR (May 30, 2007) and in response to NDEP Comment 25 (June 26, 2007) for additional wells to support mapping of the cone of depression.
PC-140	Monitor well for Extraction Well 133	Single	2	Alluvium	5-30	10	Proposed by ENSR (May 30, 2007) and in response to NDEP Comment 25 (June 26, 2007) for additional wells to support mapping of the cone of depression.

TOTALS **3 Monitor wells**

NOTES

1 Wells proposed in the ENSR (May 30, 2007) Draft Work Plan and in response to comments from NDEP (June 26, 2007).
2 Locations for the proposed wells are shown on **Figure 6.**
3 Wells will be constructed of PVC casing and screen. Single, equates to one PVC well screen per borehole.
4 The well completion will depend upon conditions encountered during the boring. Wells will be installed in either the Alluvium and Muddy Creek or in some cases across the contact.
5 The screen interval and slot size will depend upon formation conditions encountered during drilling. What is proposed is based on adjacent well lithology and recent water levels.
6 Depth to groundwater is from May 2008 and from wells adjacent to the proposed well location as shown on Cross Sections (Figures 2, 3, and 4) in the Annual Remedial Performance Report (ENSR 2008d).
7 Rationale as proposed in the draft work plan (May 30, 2007) and in response to comments received from NDEP (June 26, 2007) and McGinley and Associates (June 30, 2007).

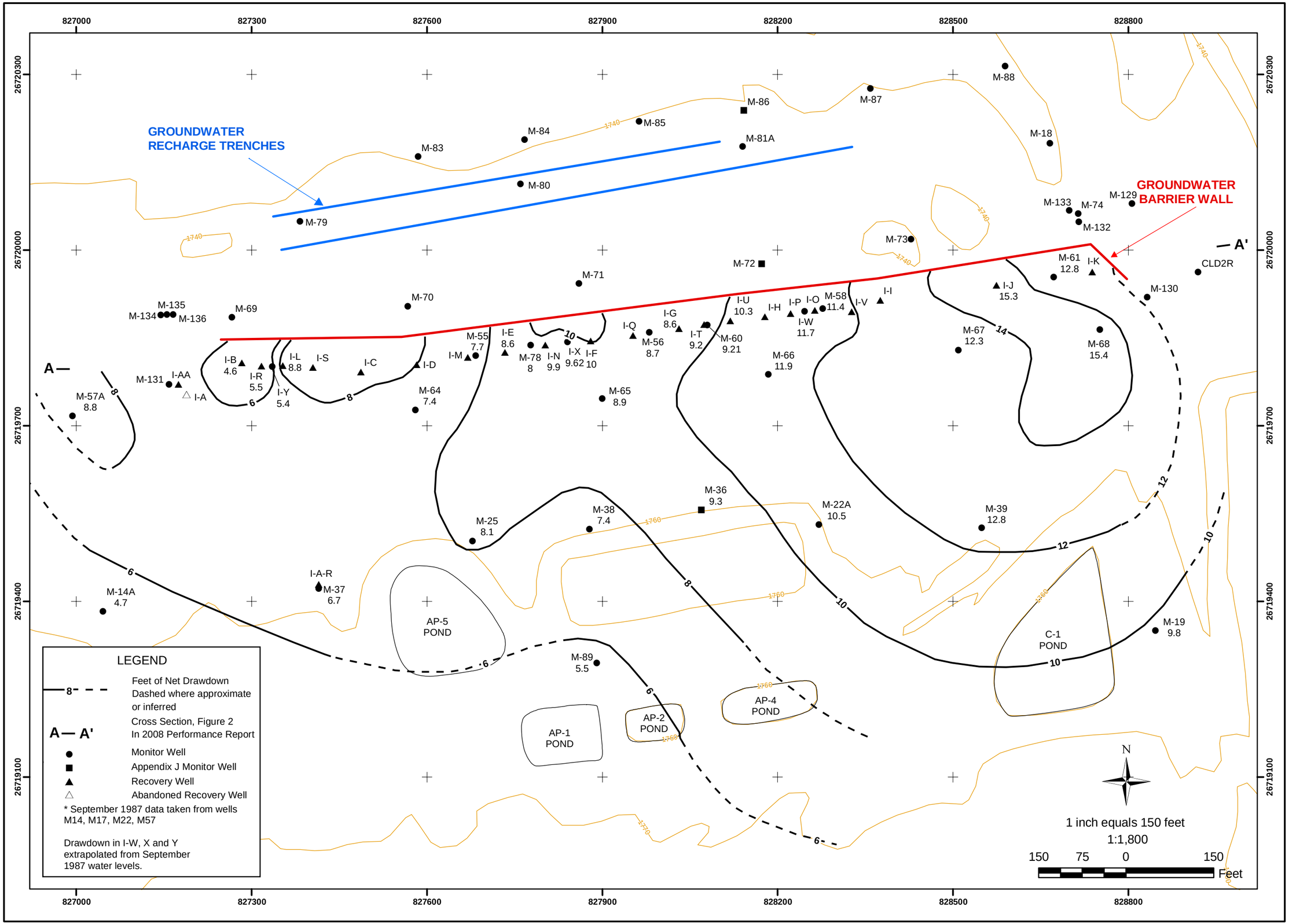
DEFINITIONS

feet-bgs feet below ground surface

REFERENCES:

ENSR May 30, 2007, Draft Work Plan to Evaluate the Effective Groundwater Capture at TRONOX Extraction Systems, Henderson, Nevada: ENSR, Camarillo, California.
ENSR 2008d, Annual Remedial Performance Report for Chromium and Perchlorate, July 2007-June 2008, Submitted in Accordance with Chromium Mitigation Program and Perchlorate Performance Consent Orders: ENSR, Camarillo, California, August 29, 2007, 4020-023-110.
NDEP June 26, 2007, Response to NDEP Comments of the Tronox Semi-Annual Performance Report Dated February 28, 2007 and the Required Work Plan to Evaluated effective Groundwater Capture at Tronox Extraction Systems, Henderson, Nevadata, dated May 30, 2007: Nevada Division of Enviornmental Protection, Las Vegas, Nevada.

PLATES



REVISIONS: NO:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
E. Krish	T. McAdam	E. Krish	S. Bilodeau

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NET DRAWDOWN AT THE INTERCEPTOR WELL FIELD
SEPTEMBER 1987 TO MAY 2008
Groundwater Capture Evaluation
Tronox Facility
Henderson, Nevada

SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	8/12/2008	04020-023-110

PLATE NUMBER: **1**

SHEET NUMBER: 1

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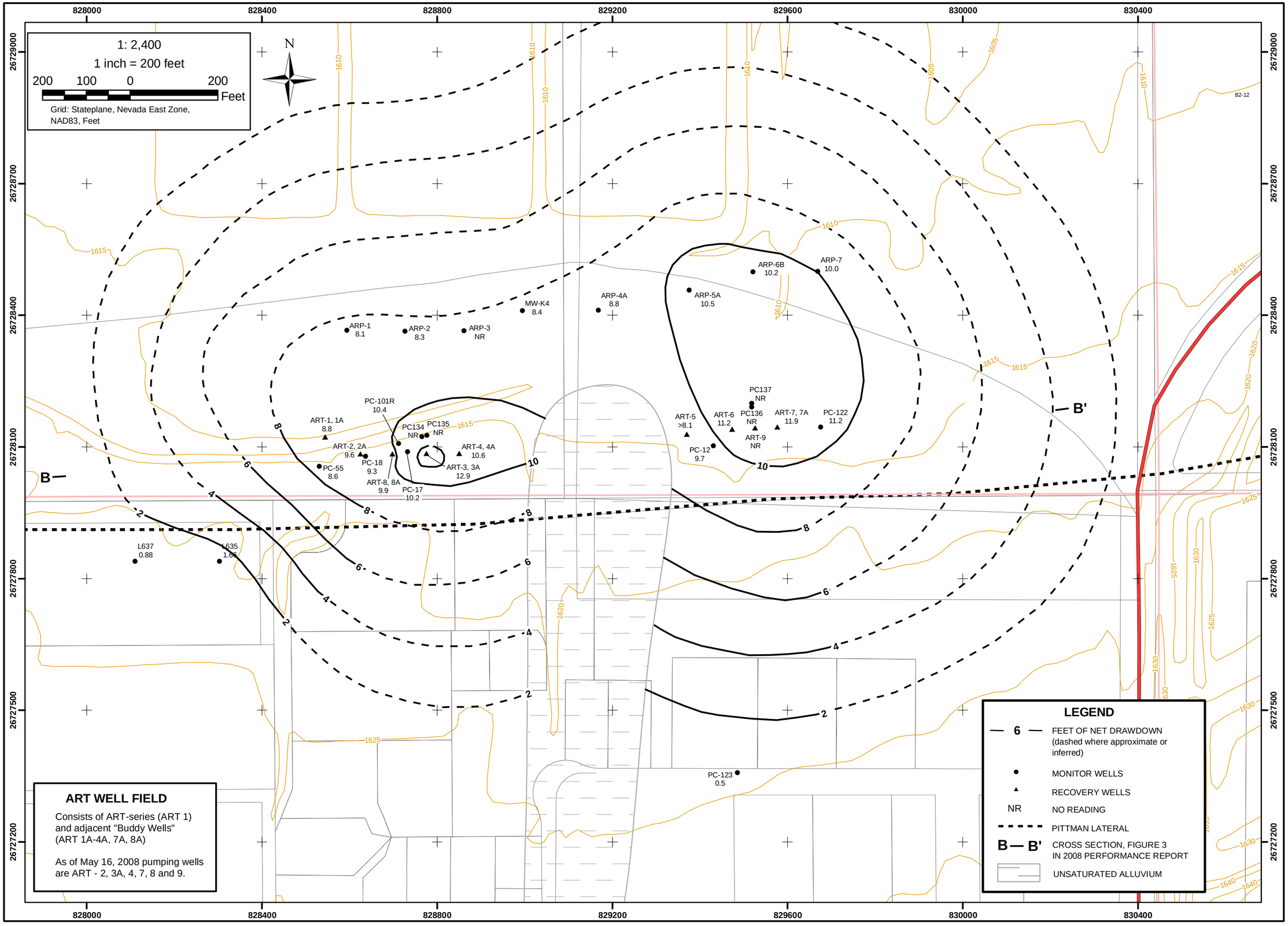

REVISIONS:			
NO:	DESCRIPTION:	DATE:	BY:

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DRAWN BY:	M. Scop
CHECKED BY:	E. Krish
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NET DRAWDOWN ATHENS ROAD WELL FIELD
APRIL 2002 TO MAY 2008
Groundwater Capture Evaluation
Tronox Facility
Henderson, Nevada

SCALE:	DATE:	PROJECT NUMBER:
1" = 200'	8/18/2008	04020-023-110

PLATE NUMBER:
2

SHEET NUMBER:
1

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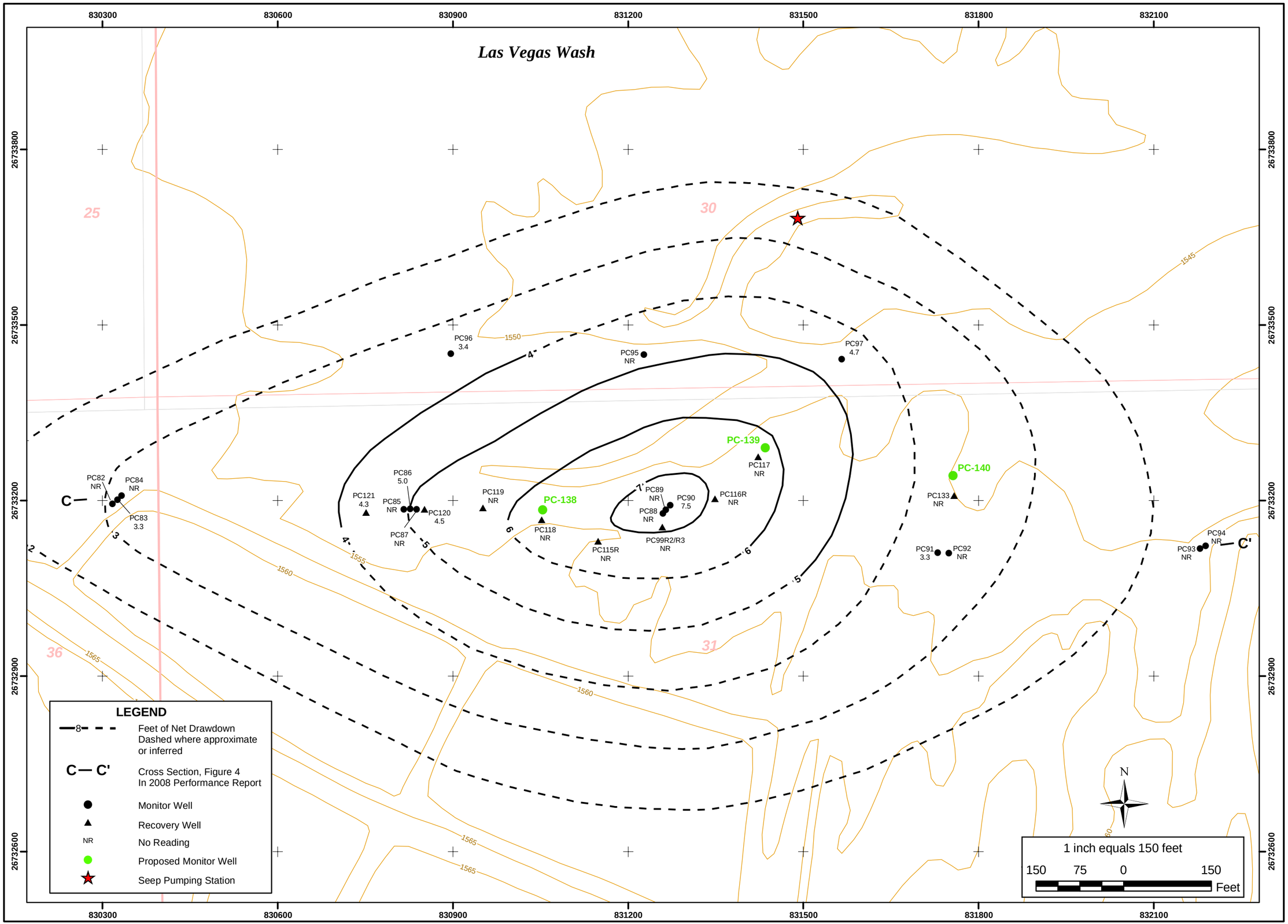

REVISIONS:		
NO:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	E. Krish
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NET DRAWDOWN
SEEP WELL FIELD
MAY 2001 TO MAY 2008
Groundwater Capture Evaluation
Tronox Facility
Henderson, Nevada

SCALE:	DATE:	PROJECT NUMBER:
AS SHOWN	8/19/2008	04020-023-110

PLATE NUMBER:
3

SHEET NUMBER:
1

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ATTACHMENT A TO THE GROUNDWATER CAPTURE REPORT

NDEP and Tronox Correspondence

ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION

Jim Gibbons, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

6/29 Digital to ECA Doc. Dist.

June 26, 2007

JUN 28 2007

Ms. Susan Crowley
Tronox LLC
PO Box 55
Henderson, Nevada 89009

Re: **Tronox LLC (TRX)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection Response to:
Response to NDEP Comments of the Tronox Semi-Annual Performance Report dated February 28, 2007 and the Required Work Plan to Evaluate Effective Groundwater Capture at Tronox Extraction Systems, Henderson, Nevada dated May 30, 2007

Dear Ms. Crowley,

The NDEP has received and reviewed TRX's report/work plan identified above and has provided comments in Attachment A. It is requested that TRX resubmit this document with annotated response to comments **by July 31, 2007**. It is suggested that TRX discuss these issues with the NDEP prior to resubmittal.

If there are any questions, please do not hesitate to contact me.

Sincerely,

Shannon Harbour, P.E.
Staff Engineer
Bureau of Corrective Actions
Special Projects Branch
NDEP-Las Vegas Office

CC: Jim Najima, NDEP, BCA, Carson City
Brian Rakvica, NDEP, BCA, Las Vegas
Todd Croft, NDEP, BCA, Las Vegas
Keith Bailey, Tronox, Inc, PO Box 268859, Oklahoma City, Oklahoma 73126-8859
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
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Chris Sylvia, Pioneer Americas LLC, PO Box 86, Henderson, Nevada 89009
Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, CA 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Paul Hackenberry, Hackenberry Associates, LLC, 550 W. Plumb Lane B425, Reno, Nevada 89509

Attachment A

1. General comment, the subject work plan must be signed by a CEM per NAC 459.9719.
2. General comment, the Flow Budgets presented herein could be improved by calculating the estimated groundwater flow at one or more cross sectional areas and comparing these values to the volume of groundwater extracted at the respective well field.
3. General comment, TRX must discuss the relationship between perchlorate, hexavalent chromium and other Site-related chemicals. Some portions of the plume which contain high TDS water may migrate in a fashion that is atypical (due to density gradients or other reasons).
4. General Comment, TRX must include a map(s) illustrating the proposed locations of piezometers and groundwater monitoring wells.
5. Section I, page 1 of 7, footnote #1, the NDEP recommends adding the following reference: Capture Zone Analysis for Pump-and-Treat Systems, EPA NARPM Conference May 24, 2005.
6. Section I, page 2 of 7, 2nd paragraph, 2nd bullet, "Demonstration of overlapping cones of depression via flow nets both in plan view and vertical cross section." This is not included in EPA (2002) reference as a line of evidence. The EPA (2005) clearly indicates that drawdown (cone of depression) and capture zone are not the same. The capture zone and cone of depression will only be the same if background hydraulic gradient is zero. However, given the geometry of the line of extraction wells within and extending across a mapped paleochannel, the NDEP acknowledges that overlapping cones of depression can be a line of evidence. This comment is applied to a number of Sections of the report and will not be repeated.
7. Section II, page 2 of 7, Capture Zone, TRX indicates that the barrier wall was designed "to provide a physical barrier to groundwater migration across the width of the identified perchlorate plume." It is important to frame this discussion in terms of concentration because it is obvious that the lower concentration portions of the perchlorate plume are not being captured.
8. Section II, page 2 of 7, Flow Budget, TRX needs to support the argument about upward hydraulic gradient with on-site data including both water level elevation and water quality. In addition, TRX states "Current capture rates (70 gpm) are double those before the wall was installed." Please note that the rate of capture is irrelevant when the upgradient flow rate is unknown.
9. Section II, page 3 of 7, 1st paragraph 2nd sentence, Flow Budget, please provide the calculations and input parameters.
10. Section II, page 3 of 7, 2nd and 3rd paragraphs, last sentences, Flow Budget, the NDEP has the following comments:
    a. The NDEP requests that this statement be supported with the installation of at least two monitoring wells at both locations as illustrated in Figure 1 (see following comment) to measure gradient. Flow may then be calculated using these newly installed monitoring wells and M69 (west side) and M74 (east side).
    b. Please note that the NDEP is including Figure 1 as example of possible well locations for comment clarity. TRX may propose different well locations.
    c. TRX should include a map illustrating the proposed locations of the monitoring wells. This comment applies to other portions of the work plan as well.
    d. TRX states "the volume of groundwater migrating around the…end of the barrier wall is estimated to be less than 1 gpm." It is not evident how this number was derived and what concentration applies to the 1 gpm number. Based on the data provided by TRX and others, the NDEP believes that a >1 mg/l plume impacts the northern 50% of the TIMET property. The source of this plume appears to be TRX.

11. Section II, page 3 of 7, 4th paragraph, Flow Budget, TRX must provide basis for this evaluation, i.e., calculations and input parameters.
12. Section II, page 3 of 7, Downgradient Concentration Declines over Time, water from Lake Mead is likely 0.010 mg/L or less based on historical analysis. Thus, the expansion of a zone containing less than 100 mg/L could occur through dilution alone by the addition of low perchlorate concentration water regardless whether the extraction wells were achieving capture at the rate in which TRX describes.
13. Section II, page 3 of 7, Downgradient Concentration Declines over Time, please delete the last two sentences from this paragraph because the addition of low perchlorate concentration water invalidates the analysis.
14. Section II, page 4 of 7, Proposed Additional Evaluation, 1st bullet, as noted above, the NDEP is not sure what this will prove because low perchlorate concentration water from Lake Mead is being injected downgradient of these wells.
15. Section II, page 4 of 7, Proposed Additional Evaluation, 3rd bullet, the NDEP requests three shallow (water table) monitoring wells at each end of the barrier wall to evaluate effectiveness of the barrier. (See also comment above.)
16. Section II, page 4 of 7, Proposed Additional Evaluation, 5th bullet, the NDEP requires contouring water level elevation excluding the use of pumping water levels from extraction wells. TRX may propose a method to estimate water levels for pumping wells taking into account well losses (inefficiency). Alternately, TRX could install piezometers in this area.
17. Section II, page 4 of 7, Proposed Additional Evaluation, the NDEP suggests that TRX consider installation of monitoring wells in a north south line along the TIMET-TRX border to delineate the extent of the plume in this area. Alternately, TRX could utilize some existing TIMET wells if they are adequate. Based upon the recently completed TIMET CSM the concentrations of perchlorate at TIMET range from 0.069 mg/l (along Lake Mead Parkway) to a high of 4.3 mg/l on the western side of the TIMET property (well CLD1-R).
18. Section II, page 4 of 7, Performance Evaluation, TRX should examine the concentration versus time trend graphs for the Athens Road well field. The NDEP notes that no appreciable change can be discerned from September 2001 to the most current quarterly report. The NDEP acknowledges that some of the declines may be obscured by the scale of the Figure. In any case, TRX should discuss these trends specifically and present Figures which are legible and appropriately scaled. In addition, TRX should discuss these concentrations versus time trend graphs in relation to the estimated travel times of the remedial system. For example, discuss the concentrations in the Athens Road well field from the time of the installation of the slurry wall until the present time and then explain why the concentrations are not declining. It appears to the NDEP that some portion of the 100 mg/l perchlorate plume is not being captured on-Site.
19. Section II, page 5 of 7, Athens Road Extraction Gallery, Flow Budget, the NDEP requires TRX to provide the calculations and input parameters before the NDEP will comment on the results of the calculations.
20. Section II, page 5 of 7, Athens Road Extraction Gallery, Overlapping Cones of Depression, see comment above regarding overlapping cones of depression. The 11 foot drawdown reported for ART-3 in the *Semi-Annual Performance Report for Chromium and Perchlorate* dated February 6, 2007 may be the result of well inefficiency.
21. Section II, page 5 of 7, Athens Road Extraction Gallery, Inward Flow, the NDEP does not agree that inward flow is demonstrated by the Potentiometric Surface Map, Fourth Quarter 2006. West of the TMCf high the groundwater elevation contours and data as posted on the map show a gradient south to north, *i.e.*, towards the wash. East of the TMCf high there is insufficient data to support the closed (depression)

contour as drawn on the map. No groundwater elevation data have been reported between the closed 1590 contour and the 1590 contour to the north to indicate a higher water level. An alternative way to map this data could include connecting the 1590 depression contour with the same 1590 contour to the north.

22. Section II, page 5 of 7, Athens Road Extraction Gallery, Proposed Additional Evaluation, 2nd bullet, unless the "available and accessible monitor wells along the width of Athens Road" lie between the ART-series and ARP-series wells there may still not be adequate groundwater level data to demonstrate inward flow. It may be necessary to install one or more well pairs to the ART "buddy" wells to achieve this purpose. If well pairs are installed NDEP should review and approve the location for these wells.
23. Section II, page 5 of 7, Numerical Modeling, this discussion has no references and hence cannot be verified by the NDEP. In addition, the NDEP noted that the numerical modeling completed previously (but not referenced in this report) does not demonstrate the 97.5% capture purported by TRX.
24. Section II, page 6 of 7, Seep Area Collection System, Flow Budget, no flow budget is presented or referenced in this section. The NDEP requires a flow budget calculation to be presented or referenced.
25. Section II, page 6 of 7, Seep Area Collection System, Overlapping Cones of Depression, see comment above. In addition, the NDEP does not believe that overlapping cones of depression have been demonstrated to exist in this area.
26. Section II, page 6 of 7, Seep Area Collection System, it is not clear to the NDEP that full capture in the Seep Area is warranted or feasible. The goals for this area should be discussed and a capture zone should be agreed upon. It is evident that the remedial system can be optimized in this well field and others.

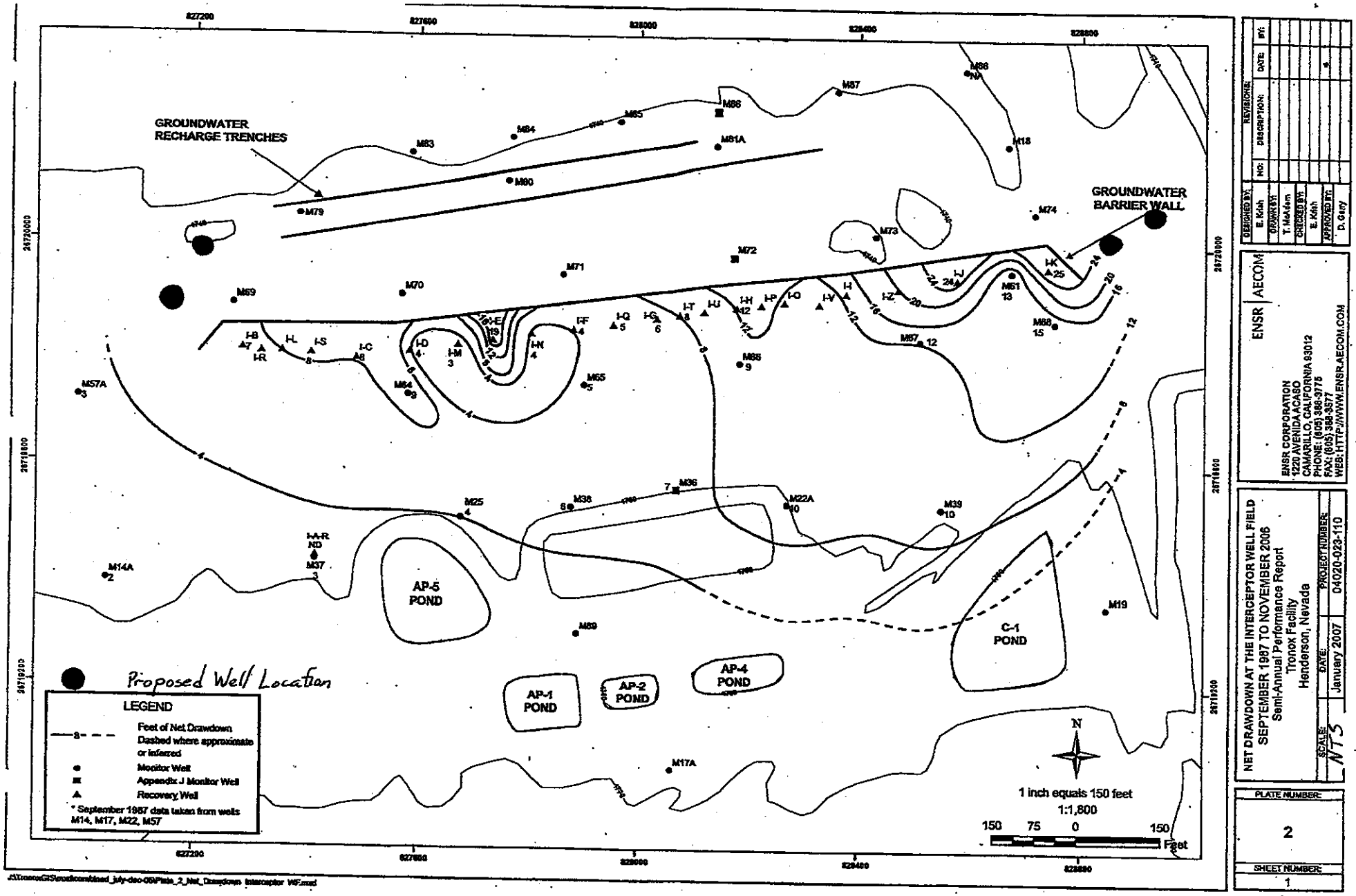
GROUNDWATER RECHARGE TRENCHES
GROUNDWATER BARRIER WALL
AP-5 POND
AP-1 POND
AP-2 POND
AP-4 POND
C-1 POND
Proposed Well Location
LEGEND
Feet of Net Drawdown
Dashed where approximate or inferred
Monitor Well
Appendix J Monitor Well
Recovery Well
* September 1987 data taken from wells M14, M17, M22, M57
N
1 inch equals 150 feet
1:1,800
150 75 0 150
Feet
NET DRAWDOWN AT THE INTERCEPTOR WELL FIELD
SEPTEMBER 1987 TO NOVEMBER 2006
Semi-Annual Performance Report
Tronox Facility
Henderson, Nevada
ENSR CORPORATION
1220 AVENIDA ACASO
CAMARILLO, CALIFORNIA 93012
PHONE: (805) 388-3775
FAX: (805) 388-3577
WEB: HTTP://WWW.ENSR.AECOM.COM
DATE: January 2007
PROJECT NUMBER: 04020-023-110
SCALE: NTS
PLATE NUMBER: 2
SHEET NUMBER: 1

Figure 1

Tronox Response to NDEP June 26, 2007 Comments on the Draft Groundwater Capture Work Plan dated May 30, 2007

1. NDEP Comment

The subject work plan must be signed by a CEM per NAC 459.9719.

Tronox Response

The revised work plan will have a CEM jurat and signature.

2. NDEP Comment

The Flow Budgets presented herein could be improved by calculating the estimated groundwater flow at one or more cross sectional areas and comparing these values to the volume of groundwater extracted at the respective well field.

Tronox Response

The Flow Budgets will be evaluated as suggested and provided in the revised work plan.

3. NDEP Comment

TRX must discuss the relationship between perchlorate, hexavalent chromium and other Site-related chemicals. Some portions of the plume which contain high TDS water may migrate in a fashion that is atypical (due to density gradients or other reasons).

Tronox Response

TRX will include a generalized discussion of the relationship of perchlorate, total chromium, and other specific site-related chemicals to TDS and how the plume(s) relate to the various recovery areas.

4. NDEP Comment

TRX must include a map(s) illustrating the proposed locations of piezometers and groundwater monitoring wells.

Tronox Response

Maps illustrating the proposed locations of piezometers and groundwater monitoring wells will be provided in the revised work plan.

5. NDEP Comment

Section I, page 1 of 7, footnote #1, the NDEP recommends adding the following reference: Capture Zone Analysis for Pump-and-Treat Systems, EPA NARPM Conference May 24, 2005.

Tronox Response

The reference will be added.

6. NDEP Comment

Section I, page 2 of 7, 2nd paragraph, 2nd bullet, "Demonstration of overlapping cones of depression via flow nets both in plan view and vertical cross section." This is not included in EPA (2002) reference as a line of evidence. The EPA (2005) clearly indicates that drawdown (cone of depression) and capture zone are not the same. The capture zone and cone of depression will only be the same if background hydraulic gradient is zero. However, given the geometry of the line of extraction wells within and extending across a mapped paleochannel, the NDEP acknowledges that overlapping cones of depression can be a line of evidence. This comment is applied to a number of Sections of the report and will not be repeated.

Tronox Response

TRX generally agrees with the information discussed in this comment. TRX also believes that the presence of the slurry wall plays a major role in the capture of the onsite plume. TRX will endeavor to better define the impact of the wall on the USEPA's capture zone line of evidence.

7. NDEP Comment

Section II, page 2 of 7, Capture Zone, TRX indicates that the barrier wall was designed "to provide a physical barrier to groundwater migration across the width of the identified perchlorate plume." It is important to frame this discussion in terms of concentration because it is obvious that the lower concentration portions of the perchlorate plume are not being captured.

Tronox Response

The length of the slurry wall was limited by physical barriers both to the east and the west at the time of installation. The discussion of the wall can be revised to be more accurate by saying it is a physical barrier across the higher concentration portion of the perchlorate plume.

8. NDEP Comment

Section II, page 2 of 7, Flow Budget, TRX needs to support the argument about upward hydraulic gradient with on-site data including both water level elevation and water quality. In addition, TRX states "Current capture rates (70 gpm) are double those before the wall was installed." Please note that the rate of capture is irrelevant when the upgradient flow rate is unknown.

Tronox Response

TRX will be installing two nested piezometers to demonstrate the vertical component of the groundwater regime under the facility. These piezometers will be installed at appropriate multiple depths and will be located in an area outside the main groundwater impact plume to minimize potential cross contamination. The groundwater will also be sampled for appropriate water quality parameters.

9. NDEP Comment

Section II, page 3 of 7, 1st paragraph 2nd sentence, Flow Budget, please provide the calculations and input parameters.

Tronox Response

TRX will provide calculations in the revised work plan based on known and estimated input parameters for the flow budget at the onsite recovery area.

10. NDEP Comment

Section II, page 3 of 7, 2nd and 3rd paragraphs, last sentences, Flow Budget, the NDEP has the following comments:

a. The NDEP requests that this statement be supported with the installation of at least two monitoring wells at both locations as illustrated in Figure 1 (see following comment) to measure gradient. Flow may then be calculated using these newly installed monitoring wells and M69 (west side) and M74 (east side).
b. Please note that the NDEP is including Figure 1 as example of possible well locations for comment clarity. TRX may propose different well locations.
c. TRX should include a map illustrating the proposed locations of the monitoring wells. This comment applies to other portions of the work plan as well.
d. TRX states "the volume of groundwater migrating around the...end of the barrier wall is estimated to be less than 1 gpm." It is not evident how this number was derived and what concentration applies to the 1 gpm number. Based on the data provided by TRX and others, the NDEP believes that a >1 mg/l plume impacts the northern 50 percent of the TIMET property. The source of this plume appears to be TRX.

Tronox Response

a. /b. /c. TRX will install groundwater monitor wells at each end of the barrier wall at locations shown in Figure 2 of the Revised Work Plan to Evaluate Effective Capture at Tronox Extraction Systems (August 2007). TRX will provide a map showing the proposed well locations along with any other proposed monitor wells piezometers, or additional recovery wells in the revised work plan.

d. TRX will be reevaluating the eastern edge of the plume boundaries following installation of the proposed monitor wells. Whether the chromium and perchlorate plumes on TIMET property are residual (prior to slurry wall installation) or ongoing has yet to be determined. Based on second quarter 2007 data, it is unclear why the total chromium and perchlorate concentrations are higher in well CLD-1R further away from the TRX boundary than those in well CLD-2R, adjacent to TRX property. Also, the TDS value for CLD-2R is more than three times higher than the groundwater values on adjacent TRX property and the TDS concentration in CLD-1R.

11. NDEP Comment

Section II, page 3 of 7, 4th paragraph, Flow Budget, TRX must provide basis for this evaluation, i.e., calculations and input parameters.

Tronox Response

TRX will provide the requested information in the revised work plan. We intend to further refine this estimate using the additional data from the proposed east and west monitor wells.

12. NDEP Comment

Section II, page 3 of 7, Downgradient Concentration Declines over Time, water from Lake Mead is likely 0.010 mg/L or less based on historical analysis. Thus, the expansion of a zone containing less than 100 mg/L could occur through dilution alone by the addition of low perchlorate concentration water regardless whether the extraction wells were achieving capture at the rate in which TRX describes.

Tronox Response

The expansion of the less than 100 mg/L perchlorate zone is occurring in an area that historically contained perchlorate concentrations exceeding 1,000 mg/L (see Plate 6, Phase II Groundwater Perchlorate

Investigation Report, July 15, 1998). If approximately 60 gpm recharge of stabilized Lake Mead water with less than 4 µg/L perchlorate (3/17/07 value from April 26, 2007 UIC Permit report) is capable of a ten to one reduction of perchlorate by simple dilution only, then the groundwater flow in this area would have to be approximately 6 gpm or less. If this is true, then based on the current capture rate, the extraction wells must be capturing more than 90 percent of the flow as we now perceive it.

13. NDEP Comment

Section II, page 3 of 7, Downgradient Concentration Declines over Time, please delete the last two sentences from this paragraph because the addition of low perchlorate concentration water invalidates the analysis.

Tronox Response

Based on the analysis presented under #12 above, there is some rationale for the statements; however, TRX will evaluate the sentences and revise or eliminate them if appropriate.

14. NDEP Comment

Section II, page 4 of 7, Proposed Additional Evaluation, 1st bullet, as noted above, the NDEP is not sure what this will prove because low perchlorate concentration water from Lake Mead is being injected downgradient of these wells.

Tronox Response

Wells M-71 and M-72 are two of the wells in the "dead zone" immediately downgradient from the slurry wall but upgradient from the recharge trenches. TRX believes that the impacted groundwater in this area is trapped between the slurry wall and the recharge trenches in an area of essentially no groundwater flow. There is recent evidence that this area is beginning to "drain" downgradient to the northeast towards monitor well M-86. TRX has noted that well M-72 has declined in concentration while well M-86 has correspondingly increased.

TRX is planning to pump these wells to extract (or "mine") much of the impacted groundwater from this area in an attempt to clean it out. In response to the groundwater extraction, injected Lake Mead water could migrate further into this area and assist in lowering the groundwater concentrations via flushing or dilution.

15. NDEP Comment

Section II, page 4 of 7, Proposed Additional Evaluation, 3rd bullet, the NDEP requests three shallow (water table) monitoring wells at each end of the barrier wall to evaluate effectiveness of the barrier. (See also comment above.)

Tronox Response

TRX has proposed the installation of groundwater monitor wells and/or piezometers on the east end of the barrier wall (see RTC 10 a/b/c), and plans to install at least one new recovery well with attendant monitor wells or piezometers on the west end. This request for three shallow monitor wells at each end of the barrier wall will be reviewed in conjunction with the planned well installation proposals.

16. NDEP Comment

Section II, page 4 of 7, Proposed Additional Evaluation, 5th bullet, the NDEP requires contouring water level elevation excluding the use of pumping water levels from extraction wells. TRX may propose a method to estimate water levels for pumping wells taking into account well losses (inefficiency). Alternately, TRX could install piezometers in this area.

Tronox Response

TRX will base water level contouring on existing monitor wells and non-pumping extraction wells along the Interceptor well line and may add additional piezometer(s) in areas with minimal coverage. Further, data from the monitor and non-pumping wells may be used to estimate well efficiency such that the pumping wells can be included in the contouring. A method to estimate well efficiency will be considered and may be included in the revised work plan.

17. NDEP Comment

Section II, page 4 of 7, Proposed Additional Evaluation, the NDEP suggests that TRX consider installation of monitoring wells in a north south line along the TIMET-TRX border to delineate the extent of the plume in this area. Alternately, TRX could utilize some existing TIMET wells if they are adequate. Based upon the recently completed TIMET Conceptual Site Model the concentrations of perchlorate at TIMET range from 0.069 mg/l (along Lake Mead Parkway) to a high of 4.3 mg/l on the western side of the TIMET property (well CLD1-R).

Tronox Response

TRX will consider this well placement proposal in conjunction with the monitor well installation already proposed in this area (see RTC 10 a/b/c). TRX will utilize Timet wells CLD1-R, 2-R and 4-R to delineate the plume.

18. NDEP Comment

Section II, page 4 of 7, Performance Evaluation, TRX should examine the concentration versus time trend graphs for the Athens Road well field. The NDEP notes that no appreciable change can be discerned from September 2001 to the most current quarterly report. The NDEP acknowledges that some of the declines may be obscured by the scale of the Figure. In any case, TRX should discuss these trends specifically and present Figures which are legible and appropriately scaled. In addition, TRX should discuss these concentrations versus time trend graphs in relation to the estimated travel times of the remedial system. For example, discuss the concentrations in the Athens Road well field from the time of the installation of the slurry wall until the present time and then explain why the concentrations are not declining. It appears to the NDEP that some portion of the 100 mg/l perchlorate plume is not being captured on-Site.

Tronox Response

There is no appreciable change in the concentrations at the Athens Road well field because the mitigating effect of the slurry wall has yet to reach the well field. If perchlorate is moving at approximately the same velocity as the groundwater, then the break-over point, the point at which steady concentration decline begins to occur in a given well due to the influence of the slurry wall and the recharge trenches, is still several years away from reaching Athens Road. TRX will discuss the breakover analyses for several key wells downgradient from the on-site system and will present approximate time frames for expected declines in the perchlorate concentrations at the Athens Road well field.

19. NDEP Comment

Section II, page 5 of 7, Athens Road Extraction Gallery, Flow Budget, the NDEP requires TRX to provide the calculations and input parameters before the NDEP will comment on the results of the calculations.

Tronox Response

Calculations and input parameters will be provided in the revised work plan.

20. NDEP Comment

Section II, page 5 of 7, Athens Road Extraction Gallery, Overlapping Cones of Depression, see comment above regarding overlapping cones of depression. The 11-foot drawdown reported for ART-3 in the *Semi-Annual Performance Report for Chromium and Perchlorate* dated February 6, 2007 may be the result of well inefficiency.

Tronox Response

Plate 3 of the Semi-Annual Performance Report for Chromium and Perchlorate dated February 6, 2007 shows that the drawdown in ART-3 is 9.0 feet, not 11.0 feet. This drawdown is valid because at the time of calculation adjacent buddy well ART-3A was the pumping well, whereas ART-3 was the monitor well.

21. NDEP Comment

Section II, page 5 of 7, Athens Road Extraction Gallery, Inward Flow, the NDEP does not agree that inward flow is demonstrated by the Potentiometric Surface Map, Fourth Quarter 2006. West of the Tertiary Muddy Creek Formation(TMCf) high the groundwater elevation contours and data as posted on the map show a gradient south to north, *i.e.*, towards the wash. East of the TMCf high there is insufficient data to support the closed (depression) contour as drawn on the map. No groundwater elevation data have been reported between the closed 1,590-contour and the 1,590-contour to the north to indicate a higher water level. An alternative way to map this data could include connecting the 1,590-depression-contour with the same 1,590-contour to the north.

Tronox Response

Groundwater elevation data to be presented in the July 2006 – June 2007 Annual Performance Report show that a closed contour (depression) is mapped encircling Athens Road WF drawdown on both sides of the Muddy Creek Fm. high. To test the validity of this interpretation of the potentiometric data TRX will install additional nested piezometer wells downgradient of the ART wells to demonstrate inward flow.

22. NDEP Comment

Section II, page 5 of 7, Athens Road Extraction Gallery, Proposed Additional Evaluation, 2nd bullet, unless the "available and accessible monitor wells along the width of Athens Road" lie between the ART-series and ARP-series wells there may still not be adequate groundwater level data to demonstrate inward flow. It may be necessary to install one or more well pairs to the ART "buddy" wells to achieve this purpose. If well pairs are installed NDEP should review and approve the location for these wells.

Tronox Response

The available and accessible monitor wells are currently being monitored. TRX will install additional nested piezometer wells downgradient of the ART wells at locations agreeable to the NDEP.

23. NDEP Comment

Section II, page 5 of 7, Numerical Modeling, this discussion has no references and hence cannot be verified by the NDEP. In addition, the NDEP noted that the numerical modeling completed previously (but not referenced in this report) does not demonstrate the 97.5 percent capture purported by TRX.

Tronox Response

TRX will reference the numerical modeling report in the revised work plan. Under direction of NDEP, McGinley [June 30, 2007] has recently completed a particle-tracking model indicating over 99 percent capture. The McGinley report identifies several data gaps which will need resolution to confirm capture. Tronox is working to address those data gaps which will allow a more robust demonstration of capture.

24. NDEP Comment

Section II, page 6 of 7, Seep Area Collection System, Flow Budget, no flow budget is presented or referenced in this section. The NDEP requires a flow budget calculation to be presented or referenced.

Tronox Response

A flow budget calculation will be presented in the revised work plan.

25. NDEP Comment

Section II, page 6 of 7, Seep Area Collection System, Overlapping Cones of Depression, see comment above. In addition, the NDEP does not believe that overlapping cones of depression have been demonstrated to exist in this area.

Tronox Response

Three additional piezometer wells are proposed by TRX in the Seep well field in order to map cones of depression (See Figure 4, Revised Work Plan to Evaluate the Effectiveness of Capture at Tronox Extraction Systems, August 2007). Plate 5 (ENSR, 2007b) shows an overlapping cone of depression based solely on monitoring well data. Considering the proximity of the well field to Las Vegas Wash, it is unlikely that full capture can expected.

26. NDEP Comment

Section II, page 6 of 7, Seep Area Collection System, it is not clear to the NDEP that full capture in the Seep Area is warranted or feasible. The goals for this area should be discussed and a capture zone should be agreed upon. It is evident that the remedial system can be optimized in this well field and others.

Tronox Response

The goals for the Seep well field will be discussed in the revised work plan and a capture zone agreed upon.

ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION

Jim Gibbons, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

10/4/07 Digital to ECA Document Distribution

October 3, 2007

OCT - 4 2007

Susan Crowley
Tronox LLC
PO Box 55
Henderson, Nevada 89009

Re: **Tronox LLC (TRX)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection Response to:
Revised Work Plan to Evaluate Effective Groundwater Capture at Tronox Extraction Systems, Tronox LLC, Henderson, Nevada
Dated August 29, 2007

Dear Ms. Crowley,

The NDEP has received and reviewed TRX's Work Plan identified above and provides comments in Attachment A. The NDEP has received and reviewed the aforementioned Deliverable and finds that the Deliverable is acceptable. Please note that the comments provided below should be reviewed and incorporated into the capture zone evaluation report. It is requested that TRX review the comments below and schedule a meeting with the NDEP by **October 31, 2007.** This meeting can be in-person or via telephone.

Please contact the undersigned with any questions at sharbour@ndep.nv.gov or (702) 486-2850 x 240.

Sincerely,

Shannon Harbour, P.E.
Staff Engineer III
Bureau of Corrective Actions
Special Projects Branch
NDEP-Las Vegas Office

SH:bar:sh

CC: Jim Najima, NDEP, BCA, Carson City
Brian Rakvica, NDEP, BCA, Las Vegas
Keith Bailey, Environmental Answers, 3229 Persimmon Creek Drive, Edmond, OK 73013
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Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Rob Mrowka, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
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Chris Sylvia, Pioneer Americas LLC, PO Box 86, Henderson, Nevada 89009
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Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Paul Hackenberry, Hackenberry Associates, LLC, 550 W. Plumb Lane B425, Reno, Nevada 89509

Attachment A

1. General comment: TRX interchangeably uses the terms "slurry wall" and "barrier wall" in the text and figures of the Work Plan. Please resolve this terminology in future Deliverables.
2. General comment: the NDEP did not note the reference of any standard operating procedures (SOPs) in the Work Plan. Please provide references for all applicable, approved SOPs by **October 24, 2007**. If new SOPs are needed please forward them to the NDEP as soon as possible for review.
3. General comment, please discuss if any hydraulic testing will be conducted in the wells that are proposed to be installed (e.g.: slug testing or pump testing) **at the meeting referenced in the cover letter**.
4. Section 2.1.1, Performance Evaluation, Flow Budget, the NDEP has the following comments (please note that these comments are also applicable to Appendix B):
    a. TRX states that "The presumed upward flow of groundwater is further enhanced by the pumping upgradient of the barrier. Given this enhancement to upward flow, it would be anticipated that perchlorate mass if present within the upper portion of the Muddy would be locally influenced in the vicinity of the barrier and interceptor well field." The first sentence starts with a presumption about upward flow and the second sentence starts with the upward flow as a "given." Please clarify what is meant by this statement and if this refers to the unconfined portion of the Muddy Creek formation or the confined portions.
    b. TRX states that the "Groundwater in the Muddy Creek, subsequently "dammed up" behind the groundwater barrier wall…" Please provide a cross-section of the Interceptor Well Field including the as-built dimensions of the barrier wall for a comparison of well depths versus the depth of the barrier wall and the depths of the geologic units.
    c. TRX states that the "Groundwater flowing vertically and "daylighting" from the Muddy Creek upwards into the incised alluvial channels up-gradient from the slurry wall. The third flow element is included in the budget, since the estimates of flow from the alluvium and Muddy Creek dammed behind the barrier do not adequately account for the water being pumped at the interceptor well field. The calculations and input parameters are provided in Appendix B." If this is truly a vertical flow component then the hydraulic conductivity used should not be the same as the horizontal hydraulic conductivity. Vertical hydraulic conductivity is typically several orders of magnitude less than horizontal hydraulic conductivity. It is suggested that TRX collect this data as part of the implementation of the Work Plan. **Please discuss this matter with the NDEP at the meeting referenced in the cover letter.**
    d. Please consider that the existence of water dammed up behind the barrier wall and water mounded in the "dead zone" may produce a downward gradient into the Muddy Creek formation.
    e. Please consider that the density of the water may produce a downward gradient into the Muddy Creek formation.
    f. Please consider installing several co-located wells which are screened in the various portions of the unconfined aquifer (e.g.: the Quaternary alluvium; the transition zone; and the Tertiary Muddy Creek formation). **Please discuss this matter with the NDEP at the meeting referenced in the cover letter.**

g. Please develop a block diagram for each well field which demonstrates the relationships between the water bearing zones and utilizes existing gradients and density data. If sufficient information is not available to develop these block diagrams the scope of work for this Work Plan should be revised. **Please discuss this matter with the NDEP at the meeting referenced in the cover letter.**

5. Section 2.1.1, Performance Evaluation, Downgradient Concentration Declines over Time, the NDEP has the following comments:
   a. The NDEP does not believe that the recharge water is "totally" responsible for the expansion of the area containing less than100 mg/L perchlorate but a contributing factor. Incremental analysis using either concentrations or pumping rates does not adequately demonstrate what is responsible for the expanding area of < 100 mg/L perchlorate. The NDEP suggests that this analysis requires a mass balance approach.
   b. TRX calculated the percent decrease of the perchlorate concentration downgradient of the barrier wall from approximately 1,000 mg/L in July 1998 to less than 100 mg/L currently. TRX then used this percent decrease to determine that a maximum of 6 gpm of 1,000 mg/L perchlorate could be flowing around the barrier wall. This calculation assumes that the groundwater concentration for perchlorate flowing around the barrier wall is 1,000 mg/L. Please discuss this assumption. As part of this discussion, TRX should consider the groundwater containing less than 10 mg/l and 25 mg/l which is traveling around the east and west ends of the barrier wall, respectively. This groundwater could certainly contribute to the expansion of the less than 100 mg/l zone of perchlorate.
   c. TRX states that "clean Lake Mead water" is injected for infiltration to the area north of the barrier wall. Please quantify what is meant by "clean". There is an incremental concentration of perchlorate in Lake Mead water which has varied over time. For clarity it would be helpful to understand this range of inputs.
   d. Additionally see Appendix A, RTC 12 below.
6. Section 2.1.3, Data Gaps and Proposed Additional Evaluation, the NDEP has the following comments:
   a. In the second bullet, TRX proposes the installation of two monitoring wells at the east and west ends of the barrier wall to demonstrate the existence of an upward gradient from the MCFf to the alluvium. As noted above, the NDEP additionally suggests that core samples should be collected and tested for vertical hydraulic conductivity from the proposed monitoring wells to be installed in the Tertiary Muddy Creek formation (TMCf). The assessed vertical hydraulic conductivity should then be substituted into Table B-1 for the "Muddy Creek Upflow" to be used for calculations.
   b. In the last paragraph of section, TRX states that "Though not a data gap…" The NDEP believes that a data gap does exist in this area; however, the NDEP does acknowledge that proposed monitoring wells IM-2 and IM-4 are being installed to address the data gap to the west of the barrier wall and that the purpose for installing proposed extraction well, IEX-1, is for remediation and not necessarily for additional characterization.
7. Section 2.2, Athens Road Well Field, the NDEP has the following comments:
   a. In this Section and throughout the Work Plan, TRX refers to the model completed by the NDEP's contractor, however, TRX does not recognize all of the data gaps identified by the model. Examples follow.

b. The model states "Perchlorate concentration data for key well positions do not appear to indicate complete ARF capture is being achieved. The results of this analysis are not consistent with the results of the particle tracking exercise described above, which indicated that all particle pathways end at extraction well locations, and that "complete capture" is achieved."
c. The Model also states "Additional modeling efforts beyond those described herein, pending the discovery of significantly different data, may include expanding the model to three dimensions (e.g., simulating interaction between Qal and MCf or the Muddy Creek transition zone). Also, calibration of the current solute transport model may be warranted in the case of modified project objectives (e.g., more precise evaluation of mass removal efficiency is deemed necessary).
d. Another noted limitation of the model was stated as "Given the large hydraulic conductivity contrast between the Qal and MCf, groundwater flow and solute transport are inferred to be largely dominant in the alluvium. However, some degree of communication is presumed to occur."

8. Section 2.2.1, Performance Evaluation, Overlapping Cones of Depression, TRX states that "Overlapping cones of depression are evident from data collected from adjacent piezometers and monitoring wells, indicating that the well field has developed a capture zone sufficient to encompass the width of the plume in this area." Please note that drawdown does not equal capture. The NDEP suggests that it would be more accurate to state "Overlapping cones of depression are evident from data collected from adjacent piezometers and monitoring wells, indicating that the well field has developed <u>an area of drawdown sufficient to encompass the width of the plume in this area</u>."
9. Table 1, the NDEP requests that TRX prepare and submit cross-sections which present the proposed locations and depths of the new wells relative to existing wells, geologic units and saturated thicknesses. Please provide this at the meeting referenced in the cover letter.
10. Appendix A, the NDEP has the following comments:
    a. Response to comment (RTC) 12, the NDEP has the following comments:
        i. The NDEP acknowledges TRX's RTC but please note that the RTC does not rebut the implication that dilution could also be a factor in the concentration decline.
        ii. In Section 2.1.1 Performance Evaluation, Flow Budget, TRX states that "The slurry wall, installed in 2001, has dramatically improved groundwater capture. Current capture rates of about 65 gpm are double those before the wall was installed." Please reconcile the above-statement with RTC 12.
        iii. Additionally see comments above for Section 2.1.1.
    b. RTC 14, TRX proposes to "mine" wells M-70 and M-71 by pumping contaminated groundwater from the "dead zone" north of the barrier wall allowing the injected Lake Mead water to "migrate further into this area and assist in lowering the groundwater concentrations via flushing or dilution. In Section 2.1.3, TRX proposes to pump wells M-70 and M-71 and monitor the perchlorate concentration over time to "demonstrate the slurry wall is continuous and does not leak significantly along its length". The NDEP does not understand that if TRX is expecting the infiltration of Lake Mead water into this area, thereby reducing the contaminant concentrations, how pumping M-70 and M-71 will demonstrate the integrity of the barrier wall.

Please explain if the injection of Lake Mead water will be halted during these pump tests. Please clarify. **This matter must be discussed at the meeting requested in the cover letter.**

11. Appendix B, the NDEP has the following comments:
    a. Table B-1, as noted previously, the NDEP does not agree with the use of a horizontal hydraulic conductivity to calculated vertical flow.
    b. Table B-2, the NDEP noted that the electronic version provided with the original document included a duplicate of Table B-1 instead of Table B-2. Please provide a corrected electronic version of this Work Plan to the NDEP by **October 24, 2007**.
12. Appendix C, the NDEP has the following comments:
    a. TRX states that "… Lake Mead water containing very low concentrations of total chromium and perchlorate has moved a sufficient distance in the groundwater to a monitor well…" Please quantify what is meant by "very low concentrations of total chromium and perchlorate" and "sufficient distance".
    b. In Table C-1, TRX reports groundwater velocities ranging from 1.1 ft/d to 12.3 ft/d. Please discuss if separate groundwater velocities should be calculated for the alluvium, alluvial channels, and the inter-channel areas.
    c. The NDEP requests that the seepage velocity be calculated using hydraulic parameters for comparison. It is requested that TRX also collect physical parameter data in applicable geologic units during the implementation of this Work Plan (e.g.: dry bulk density, specific gravity, etc.). **Please discuss this matter with the NDEP at the meeting referenced in the cover letter.**

TRONOX

Susan Crowley
Staff Environmental Specialist

(702) 651-2234
Fax (405) 302-4607
Susan.crowley@tronox.com

November 28, 2007

Ms. Shannon Harbour, P.E.
Nevada Division of Environmental Protection
2030 East Flamingo Road, Suite 230
Las Vegas, Nevada 89119-0818

Subject: Response to Nevada Division of Environmental Protection (NDEP) Comments to the Revised Work Plan to Evaluate Effective Groundwater Capture at Tronox LLC, Henderson, Nevada

Dear Ms. Harbour:

Tronox LLC (Tronox) has undertaken an Environmental Conditions Assessment (ECA) as directed by the Nevada Division of Environmental Protection (NDEP). On August 29, 2007, Tronox provided a revised work plan to NDEP outlining our approach to evaluate the effectiveness of groundwater systems at the Henderson site. On October 3, 2007, NDEP provided comments to the draft work plan, which were subsequently discussed in during a conference call between NDEP and Tronox on November 14, 2007. Attached is our annotated response to the October 3 NDEP comments, which incorporate the discussions of our conference call. Additionally, Tronox initiated the proposed field program to evaluate groundwater capture on November 25, 2007 following verbal approval from NDEP received during the conference call.

Additionally, per our discussions, attached is an electronic copy of the August 29, 2007 revised work plan in Adobe format which has been revised to include the corrected tables in Appendix B. Please contact me at (702) 651-2234 if you have any comments or questions concerning this correspondence.

Sincerely,

Susan M. Crowley
Staff Environmental Specialist

Overnight Mail

Attachment: As stated
CC: See attached Distribution List

Tronox response to October 3, 2007 NDEP comments on
Capture Work Plan dated August 29, 2007

NDEP Comment

1. General comment: TRX interchangeably uses the terms "slurry wall" and "barrier wall" in the text and figures of the Work Plan. Please resolve this terminology in future Deliverables.

Tronox Response

The term "barrier wall" will be used in future documents.

NDEP Comment

2. General comment: the NDEP did not note the reference of any standard operating procedures (SOPs) in the Work Plan. Please provide references for all applicable, approved SOPs by **October 24, 2007**. If new SOPs are needed please forward them to the NDEP as soon as possible for review.

Tronox Response

The Standard Operating Procedures applicable to the work proposed are identified below and are provided in the BRC Field Sampling and Standard Operating Procedures – BMI Common Areas, Clark County, Nevada, ERM-West, Incorporated, Sacramento, California and Montgomery-Watson Harza, Sacramento, California, August 2007:

SOP-1 Drilling Methods
SOP-2 Groundwater Monitoring Well Design
SOP-3 Groundwater Monitoring Well Development
SOP-4 Aquifer Testing
SOP-5 Water Sampling and Field Measurements
SOP-6 Sampling Management and Shipping
SOP-10 Surveying
SOP-13 Operating and Calibration Procedures – Field Equipment
SOP-14 Field Documentation
SOP-15 Field Logbook
SOP-17 Soil Logging
SOP-20 Filter Pack and Well Screen Slot Size Determination
SOP-23 Split Spoon Sampling
SOP-31 Drilling Equipment Decontamination
SOP-34 Investigative Derived Waste (IDW) Management

NDEP Comment

3. General comment, please discuss if any hydraulic testing will be conducted in the wells that are proposed to be installed (e.g.: slug testing or pump testing) **at the meeting referenced in the cover letter**.

Tronox Response

As discussed during our November 14, 2007 conference call, Tronox will evaluate the vertical permeability of the Muddy Creek Formation with ASTM 5084 using a constant head method. A soil sample will be collected from the Muddy Creek Formation at the following proposed wells at both the Interceptor and Athens Road Well Fields:

M-129 (IM-1)
M-130 (IM-2)
M-134 (IM-5b)
M-136 (IM-6b)
PC-134 (AM-1a)
PC-136 (AM-2a)

The locations of these wells are shown on the revised figures attached to this document. Please note the change in the nomenclature and the reference to the prior well identification in parentheses.

NDEP Comment

4. Section 2.1.1, Performance Evaluation, Flow Budget, the NDEP has the following comments (please note that these comments are also applicable to Appendix B):
    a. TRX states that "The presumed upward flow of groundwater is further enhanced by the pumping upgradient of the barrier. Given this enhancement to upward flow, it would be anticipated that perchlorate mass if present within the upper portion of the Muddy would be locally influenced in the vicinity of the barrier and interceptor well field." The first sentence starts with a presumption about upward flow and the second sentence starts with the upward flow as a "given." Please clarify what is meant by this statement and if this refers to the unconfined portion of the Muddy Creek formation or the confined portions.
    b. TRX states that the "Groundwater in the Muddy Creek, subsequently "dammed up" behind the groundwater barrier wall…" Please provide a cross-section of the Interceptor Well Field including the as-built dimensions of the barrier wall for a comparison of well depths versus the depth of the barrier wall and the depths of the geologic units.
    c. TRX states that the "Groundwater flowing vertically and "daylighting" from the Muddy Creek upwards into the incised alluvial channels up-gradient from the slurry wall. The third flow element is included in the budget, since the estimates of flow from the alluvium and Muddy Creek dammed behind the barrier do not adequately account for the water being pumped at the interceptor well field. The calculations and input parameters are provided in Appendix B." If this is truly a vertical flow component then the hydraulic conductivity used should not be the same as the horizontal hydraulic conductivity. Vertical hydraulic conductivity is typically several orders of magnitude less than horizontal hydraulic conductivity. It is suggested that TRX collect this data as part of the implementation of the Work Plan. **Please discuss this matter with the NDEP at the meeting referenced in the cover letter.**
    d. Please consider that the existence of water dammed up behind the barrier wall and water mounded in the "dead zone" may produce a downward gradient into the Muddy Creek formation.
    e. Please consider that the density of the water may produce a downward gradient into the Muddy Creek formation.
    f. Please consider installing several co-located wells which are screened in the various portions of the unconfined aquifer (e.g.: the Quaternary alluvium; the transition zone; and the Tertiary Muddy Creek formation). **Please discuss this matter with the NDEP at the meeting referenced in the cover letter**.
    g. Please develop a block diagram for each well field which demonstrates the relationships between the water bearing zones and utilizes existing gradients and density data. If sufficient information is not available to develop these block diagrams the scope of work for this Work Plan should be revised. **Please discuss this matter with the NDEP at the meeting referenced in the cover letter.**

Tronox Response

a. The statement refers to the unconfined portion of the Muddy Creek formation and upward gradients are believed to be present. The work proposed under the Capture workplan will generate data to evaluate vertical gradients in the Muddy Creek.

b. Figure 2 of the Annual Remedial Performance Report for Chromium and Perchlorate, Tronox LLC, Henderson, Nevada, July 2006 – June 2007 is a cross section of the Interceptor well field and includes the dimensions of the barrier wall for a comparison of well depths versus the depth of the barrier wall and the depths of the geologic units. This figure was also provided for the conference call on November 14, 2007 and is attached as Figure 6 to this document.

c. As discussed during the conference call of November 14, 2007, vertical gradients and hydraulic conductivity will be evaluated through the installation of nested wells M-133, M-134, M-135, M-136, PC-134, PC-135, PC-136 and PC-137, which will be installed at various depths within the Muddy Creek Formation. The approximate depth and completion of the

proposed wells that will be installed as part of the Capture Zone evaluation are shown on the attached hydrogeologic cross sections (see Figures 6, 7 and 8).

d. *Tronox will consider the potential for a downward gradient induced from groundwater mounded behind the barrier wall. Though as discussed during the November 14, 2007 conference call, the nested monitor wells proposed under the capture evaluation workplan will provide data to further evaluate this potential hydrologic condition and hypothesized potential downward vertical gradient suggested by NDEP.*
e. *Please see the response to comment 4d above.*
f. *Two nested monitoring well sets (M-133/M134 and M135/M136) have already been proposed to be screened at different levels of the Muddy Creek formation. Well M-74 on the east side of the barrier wall will serve as the alluvial well in the M-133/134 set whereas M-132 on the western side of the barrier wall will serve as the alluvial well in the M-135/136 set. Tronox has not observed a "Transition Zone" (i.e., reworked Muddy Creek Formation) in the Interceptor well field area.*
g. *As discussed during the November 14, 2007 conference call, block diagrams consistent to those provided via email by NDEP on November 14, 2007, will be prepared from the data gathered during the Capture Zone evaluation.*

NDEP Comment

5. Section 2.1.1, Performance Evaluation, Downgradient Concentration Declines over Time, the NDEP has the following comments:
   a. The NDEP does not believe that the recharge water is "totally" responsible for the expansion of the area containing less than100 mg/L perchlorate but a contributing factor. Incremental analysis using either concentrations or pumping rates does not adequately demonstrate what is responsible for the expanding area of < 100 mg/L perchlorate. The NDEP suggests that this analysis requires a mass balance approach.
   b. TRX calculated the percent decrease of the perchlorate concentration downgradient of the barrier wall from approximately 1,000 mg/L in July 1998 to less than 100 mg/L currently. TRX then used this percent decrease to determine that a maximum of 6 gpm of 1,000 mg/L perchlorate could be flowing around the barrier wall. This calculation assumes that the groundwater concentration for perchlorate flowing around the barrier wall is 1,000 mg/L. Please discuss this assumption. As part of this discussion, TRX should consider the groundwater containing less than 10 mg/l and 25 mg/l which is traveling around the east and west ends of the barrier wall, respectively. This groundwater could certainly contribute to the expansion of the less than 100 mg/l zone of perchlorate.
   c. TRX states that "clean Lake Mead water" is injected for infiltration to the area north of the barrier wall. Please quantify what is meant by "clean". There is an incremental concentration of perchlorate in Lake Mead water which has varied over time. For clarity it would be helpful to understand this range of inputs.
   d. Additionally see Appendix A, RTC 12 below.

Tronox Response

a. *The analysis provided in the revised work plan was to demonstrate, through a simple mass balance, that the mass of perchlorate getting around the slurry wall is only a very small fraction of the mass flowing toward the barrier wall.*
b. *This calculation assumes a concentration of 1,000 mg/L based on the June 2007 average perchlorate concentration in the Interceptor Well Field. The calculation was presented to help quantify the maximum mass of perchlorate that could be getting around the barrier wall. Tronox has proposed an additional recovery well at the west end of the barrier wall to improve capture. In addition, Tronox will be installing observation wells at both the east and west ends of the barrier wall to determine the nature of groundwater flow at the ends of the barrier wall. In the Annual Remedial Performance Report for Chromium and Perchlorate, Tronox LLC, Henderson, Nevada, July 2006 – June 2007 the average perchlorate concentration in the well field for June 2007is 1079 mg/L.. Tronox has considered the*

contribution of the groundwater containing less than 10 mg/L and 25 mg/L which is traveling around the east and west ends of the barrier wall, respectively.

c. "Clean Lake Mead water" refers to water obtained from Lake Mead which has not been processed or re-used within the BMI complex. It comes directly from the lake to the City of Henderson's reservoir and then is piped directly to the BMI companies, including the Tronox facility. This water is now less than 5 ug/L perchlorate. The perchlorate concentration has been below 6 ug/L since January 2006 and below 10 ug/L since November 2003.

d. The NDEP Comments on Appendix A, RTC 12 are provided below.

NDEP Comment

6. Section 2.1.3, Data Gaps and Proposed Additional Evaluation, the NDEP has the following comments:
    a. In the second bullet, TRX proposes the installation of two monitoring wells at the east and west ends of the barrier wall to demonstrate the existence of an upward gradient from the MCFf to the alluvium. As noted above, the NDEP additionally suggests that core samples should be collected and tested for vertical hydraulic conductivity from the proposed monitoring wells to be installed in the Tertiary Muddy Creek formation (TMCf). The assessed vertical hydraulic conductivity should then be substituted into Table B-1 for the "Muddy Creek upflow" to be used for calculations.
    b. In the last paragraph of section, TRX states that "Though not a data gap…" The NDEP believes that a data gap does exist in this area; however, the NDEP does acknowledge that proposed monitoring wells IM-2 and IM-4 are being installed to address the data gap to the west of the barrier wall and that the purpose for installing proposed extraction well, IEX-1, is for remediation and not necessarily for additional characterization.

Tronox Response

a. As noted under comment No. 3 above, core samples will be collected and tested for vertical permeability by ASTM Method 5084.

b. The NDEP comment has been noted and Tronox agrees.

NDEP Comment

7. Section 2.2, Athens Road Well Field, the NDEP has the following comments:
    a. In this Section and throughout the Work Plan, TRX refers to the model completed by the NDEP's contractor; however, TRX does not recognize all of the data gaps identified by the model. Examples follow.
    b. The model states "Perchlorate concentration data for key well positions do not appear to indicate complete ARF capture is being achieved. The results of this analysis are not consistent with the results of the particle tracking exercise described above, which indicated that all particle pathways end at extraction well locations, and that "complete capture" is achieved."
    c. The Model also states "Additional modeling efforts beyond those described herein, pending the discovery of significantly different data, may include expanding the model to three dimensions (e.g., simulating interaction between Qal and MCf or the Muddy Creek transition zone). Also, calibration of the current solute transport model may be warranted in the case of modified project objectives (e.g., more precise evaluation of mass removal efficiency is deemed necessary).
    d. Another noted limitation of the model was stated as "Given the large hydraulic conductivity contrast between the Qal and MCf, groundwater. However, some degree of communication is presumed to occur."

Tronox Response

a. Tronox recognizes that data gaps exist at the Athens Road Well Field as discussed in the McGinley and Associates Report (June 30, 2007) and during their presentation at the Desert Research Institute on November 7, 2007. Tronox believes that the numerical model provides

important lines of evidence showing capture at Athens Road, but, also acknowledges that additional wells are required to evaluate inward flow.

b. *Tronox will be installing monitor wells downgradient of ART recovery wells in both the eastern and western subchannels in order to establish inward flow, further supporting the effectiveness of up to 95% for the capture system at Athens Road. Tronox agrees that the analog modeling done by NDEP's contractor is not consistent with the results of their particle tracking exercise which indicated complete capture.*

c. *Tronox does not believe that this is a data gap. Expanding the modeling into a third dimension would not likely provide significantly different results, as the contrast in horizontal hydraulic conductivity between the alluvium and Muddy Creek Formation would be several orders of magnitude. As noted, by McGinley and Associates in their report and during the November 7, 2007 presentation, while the solute model was not calibrated, the approach taken provided a reasonable evaluation of the mass flux and capture for the well field. Tronox believes that the additional wells proposed in the work plan to evaluate inward flow will serve along with the numerical modeling results to provide sufficient lines of evidence that capture is being achieved at Athens Road.*

d. *Since "vertical hydraulic conductivity is typically several orders of magnitude less that the horizontal hydraulic conductivity" (see NDEP Comment 4c, above) and that flow and solute transport are inferred to be largely dominant in the alluvium. To evaluate vertical flux, as noted in Comment No. 3 above, soil cores will be tested for vertical permeability from the Muddy Creek Formation and nested wells are proposed to evaluate vertical gradients at the Athens Road Well Field.*

NDEP Comment

8. Section 2.2.1, Performance Evaluation, Overlapping Cones of Depression, TRX states that "Overlapping cones of depression are evident from data collected from adjacent piezometers and monitoring wells, indicating that the well field has developed a capture zone sufficient to encompass the width of the plume in this area." Please note that drawdown does not equal capture. The NDEP suggests that it would be more accurate to state "Overlapping cones of depression are evident from data collected from adjacent piezometers and monitoring wells, indicating that the well field has developed <u>an area of drawdown sufficient to encompass the width of the plume in this area</u>."

Tronox Response

Tronox acknowledges this statement, though in the June 26, 2007 letter commenting on the Tronox Groundwater Capture Work Plan, the NDEP Comment 6 says regarding EPA lines of evidence and capture zones, "However, given the geometry of the line of extraction wells within and extending across a mapped paleochannel, the NDEP acknowledges that overlapping cones of depression can be a line of evidence".

NDEP Comment

9. Table 1, the NDEP requests that TRX prepare and submit cross-sections which present the proposed locations and depths of the new wells relative to existing wells, geologic units and saturated thicknesses. Please provide this at the meeting referenced in the cover letter.

Tronox Response

Tronox provided draft cross sections for the November 14, 2007 conference call with NDEP. These sections have been revised showing the corrected nomenclature for the well identification and are provided as Figures 6, 7 and 8 (attached). In addition, the plan-view maps provided in the work plan have also been revised to reflect the corrected nomenclature and are also attached.

NDEP Comment

10. Appendix A, the NDEP has the following comments:

a. Response to comment (RTC) 12, the NDEP has the following comments:

i. The NDEP acknowledges TRX's RTC, but please note that the RTC does not rebut the implication that dilution could also be a factor in the concentration decline.
ii. In Section 2.1.1 Performance Evaluation, Flow Budget, TRX states that "The slurry wall, installed in 2001, has dramatically improved groundwater capture. Current capture rates of about 65 gpm are double those before the wall was installed." Please reconcile the above-statement with RTC 12.
iii. Additionally see comments above for Section 2.1.1.

b. RTC 14, TRX proposes to "mine" wells M-70 and M-71 by pumping contaminated groundwater from the "dead zone" north of the barrier wall allowing the injected Lake Mead water to "migrate further into this area and assist in lowering the groundwater concentrations via flushing or dilution. In Section 2.1.3, TRX proposes to pump wells M-70 and M-71 and monitor the perchlorate concentration over time to "demonstrate the slurry wall is continuous and does not leak significantly along its length". The NDEP does not understand that if TRX is expecting the infiltration of Lake Mead water into this area, thereby reducing the contaminant concentrations, how pumping M-70 and M-71 will demonstrate the integrity of the barrier wall. Please explain if the injection of Lake Mead water will be halted during these pump tests. **Please clarify. This matter must be discussed at the meeting requested in the cover letter.**

Tronox Response

a.i Tronox certainly agrees that dilution can be a factor in the concentration decline.

a.ii. The text was meant to demonstrate that the groundwater flow getting around the barrier wall is only a very small fraction of the groundwater flow flowing toward the barrier wall and captured by the Interceptor Well Field.

a.iii. Comments regarding Section 2.1.1 have been responded to above.

b. As discussed during the November 14, 2007 conference call, injection of Lake Mead water will not be halted during the proposed tests, though the recent decline in flow and pending replacement of the infiltration trenches will likely produce a short period of reduced influence from the injected Lake Mead water. The text of the workplan will be revised to clarify the purpose and expected outcome of the activities proposed in this area. As discussed, weekly water levels and groundwater samples will be collected to from these wells to monitor performance. It is proposed that onsite screening level analysis of the water samples could be performed by Tronox to track the progress of water mining.

NDEP Comment

11. Appendix B, the NDEP has the following comments:
    a. Table B-1, as noted previously, the NDEP does not agree with the use of a horizontal hydraulic conductivity to calculated vertical flow.
    b. Table B-2, the NDEP noted that the electronic version provided with the original document included a duplicate of Table B-1 instead of Table B-2. Please provide a corrected electronic version of this Work Plan to the NDEP by **October 24, 2007**.

Tronox Response

a. As noted previously, TRX will collect cores and test for vertical hydraulic conductivity.

b. The corrected "electronic" version of the Work Plan is provided in the attached CD.

NDEP Comment

12. Appendix C, the NDEP has the following comments:
    a. TRX states that "… Lake Mead water containing very low concentrations of total chromium and perchlorate has moved a sufficient distance in the groundwater to a monitor well…" Please quantify what is meant by "very low concentrations of total chromium and perchlorate" and "sufficient distance".
    b. In Table C-1, TRX reports groundwater velocities ranging from 1.1 ft/d to 12.3 ft/d. Please discuss if separate groundwater velocities should be calculated for the alluvium, alluvial channels, and the inter-channel areas.

c. The NDEP requests that the seepage velocity be calculated using hydraulic parameters for comparison. It is requested that TRX also collect physical parameter data in applicable geologic units during the implementation of this Work Plan (e.g.: dry bulk density, specific gravity, etc.). Please discuss this matter with the NDEP at the meeting referenced in the cover letter.

Tronox Response

a. *"Very low concentrations" are those concentrations that are present in the injected Lake Mead water which have ranged up to 24 µg/L though most recently equate to less than 6 ug/l perchlorate and less than 50 ug/l total chromium concentrations. Perchlorate in the injected water is several orders of magnitude lower than historic concentrations down-gradient of the barrier wall. "Sufficient distance" is the distance from the monitor wells used in the evaluation and the on-site recharge trenches.*

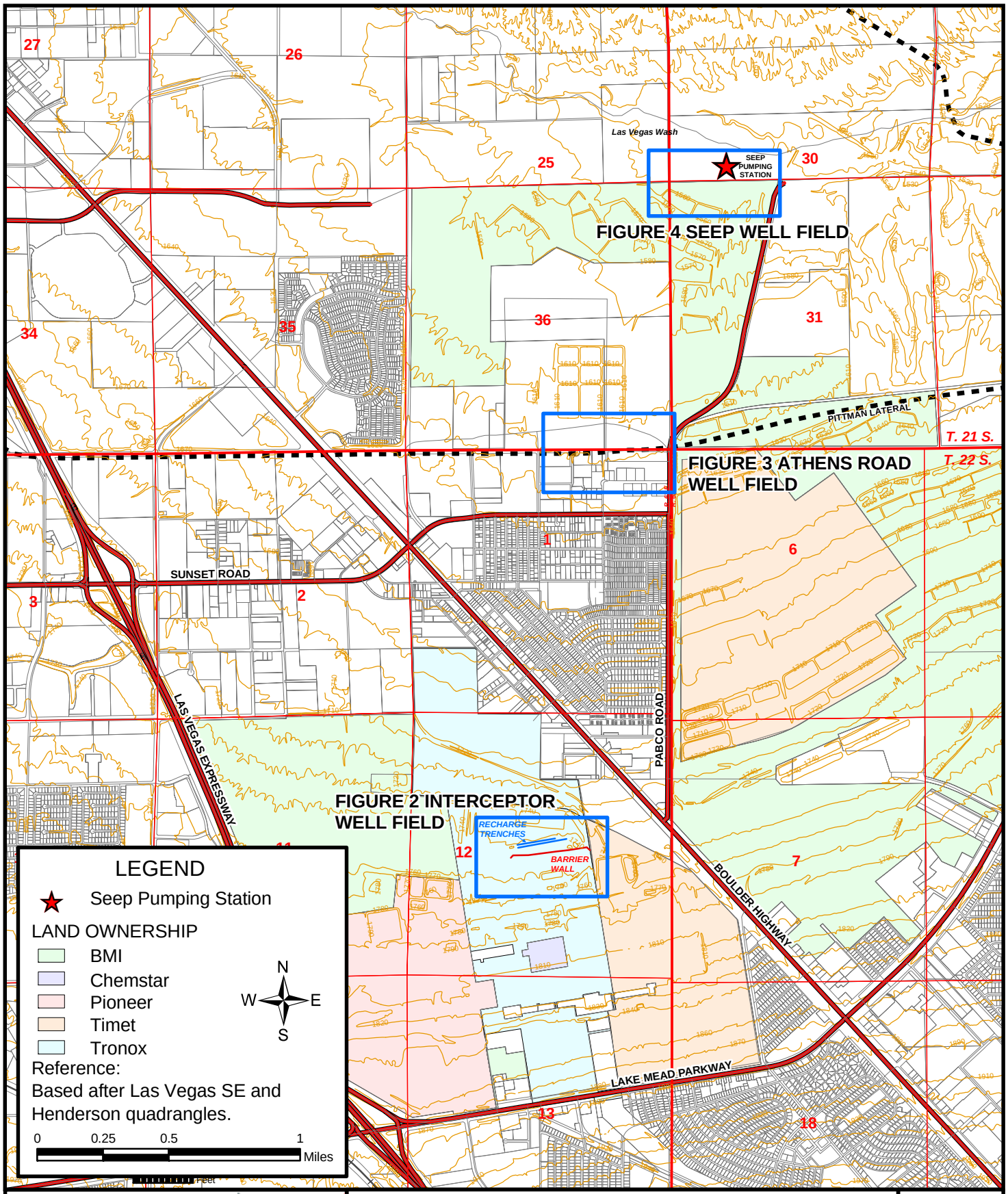
b. *The bulk of the estimated groundwater velocities generated from both the perchlorate and total chromium decline curves fall within the 1 to 4 ft/day range and the most common velocity estimates is between 1 and 2 ft/day. The highest (11.4 and 12.3 ft/day for perchlorate and total chromium, respectively), and the lowest (0.9 ft/day for perchlorate) estimates were found to be data outliers. TRX therefore does not think that separate groundwater velocities should be calculated for the alluvium, alluvial channels, and the inter-channel areas.*

c. *Hydraulic conductivity values listed in Appendix B, Tables B-1, B-2, and B-3 were utilized to calculate average and high/low groundwater seepage velocities for the alluvium. The seepage velocity calculations utilized an average gradient of 0.015 and an average porosity of 0.20. The groundwater seepage velocity values for the Interceptor well area (Table B-1), Sunset Road traverse (Table B-2), and Seep(Table B-3) are as follows:*

- *Interceptor well area: K= 453 gpd/ft^2* ***v= 4.5 ft/day***
- *Sunset Road traverse: K= 565 gpd/ft^2 (average of 10 wells)* ***v= 5.7 ft/day*** *(note: the highest velocity was 9.3 ft/day and the lowest was 2.4 ft/day)*
- *Seep traverse: K= 6547 gpd/ft^2 (average of 8 wells)* ***v= 65 ft/day*** *(note: the highest velocity was 341 ft/day and the lowest was 1 ft/day)*

In addition, hydraulic conductivities were taken from onsite well testing conducted in 1986 prior to installation of the initial Interceptor wells. These wells (7) had an average K= 577 gpd/ft^2 and a calculated seepage velocity of 5.8 ft/day. The highest calculated velocity was 15.5 ft/day and the lowest was 0.5 ft/day.

These seepage velocity values compare well with the groundwater velocity data listed in Table C-1 of Appendix C (0.9 – 12.3 ft/day).



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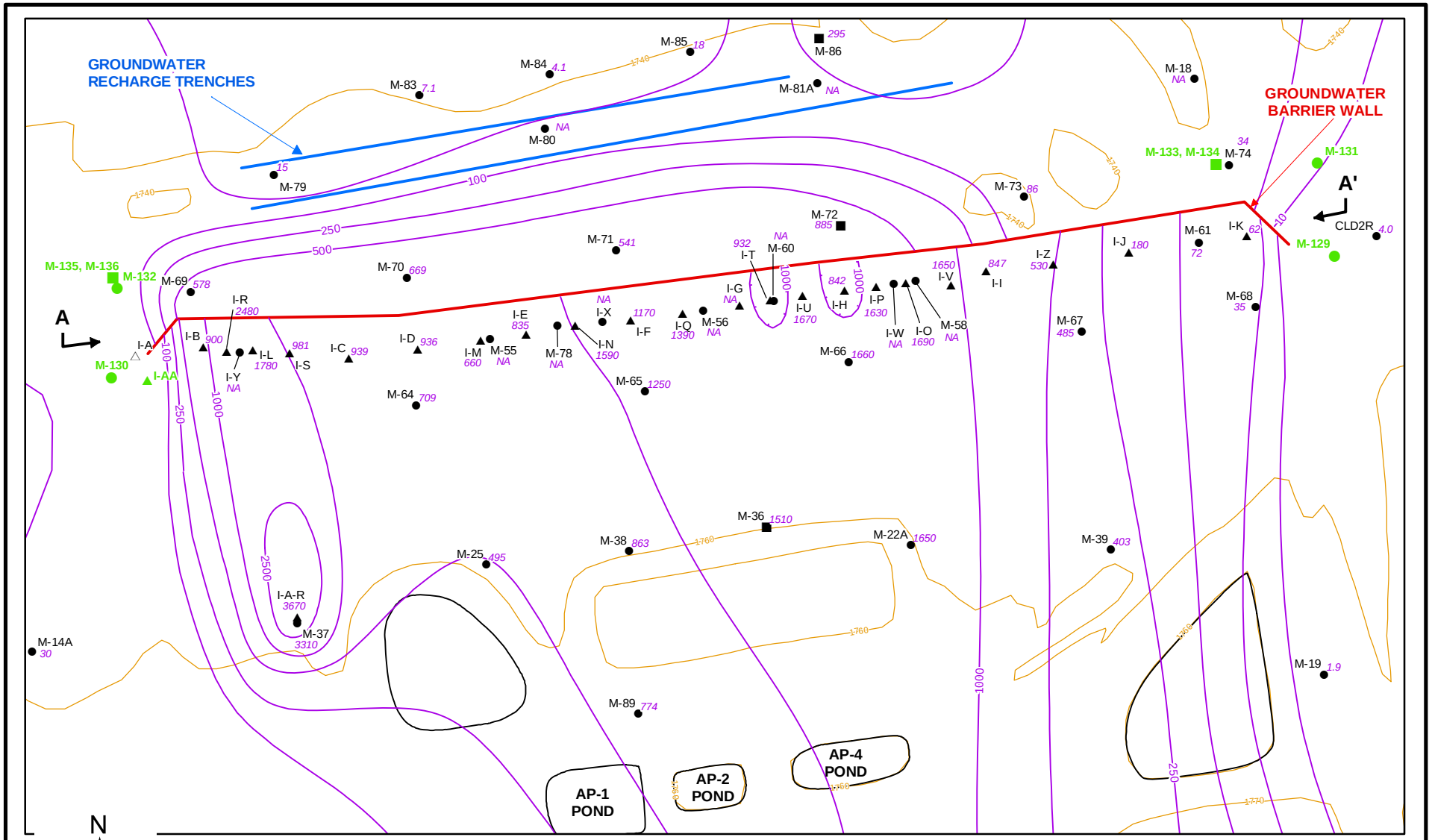
LOCATION MAP

Capture Zone Work Plan
Tronox Facility
Henderson, Nevada

FIGURE NUMBER:
1

DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
M. Scop	8/27/2007	04020-023-160	X



SEE FIGURE 5 FOR EXPANDED LEGEND ELEMENTS

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PROPOSED WELLS AT THE INTERCEPTOR WELL FIELD

Capture Zone Work Plan
Tronox Facility
Henderson, Nevada

FIGURE NUMBER:			
2			
DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
M. Scop	8/27/2007 Rev-1 11/21/07	04020-023-160	X

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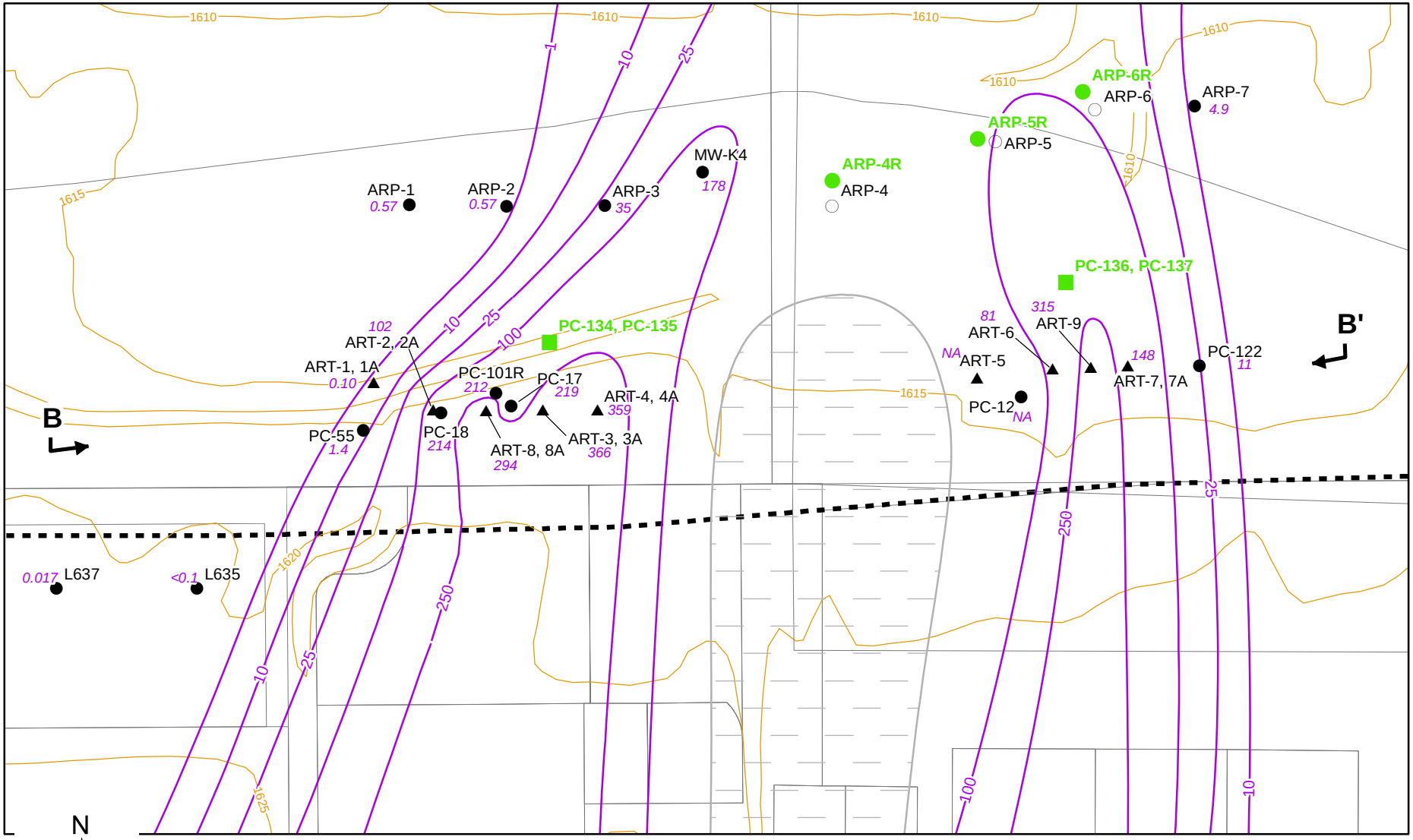

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SEE FIGURE 5 FOR EXPANDED LEGEND ELEMENTS

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PROPOSED WELLS AT THE ATHENS ROAD WELL FIELD
Capture Zone Work Plan
Tronox Facility
Henderson, Nevada

FIGURE NUMBER:
3

DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
M. Scop	8/27/2007 Rev-1 11/21/07	04020-023-160	X

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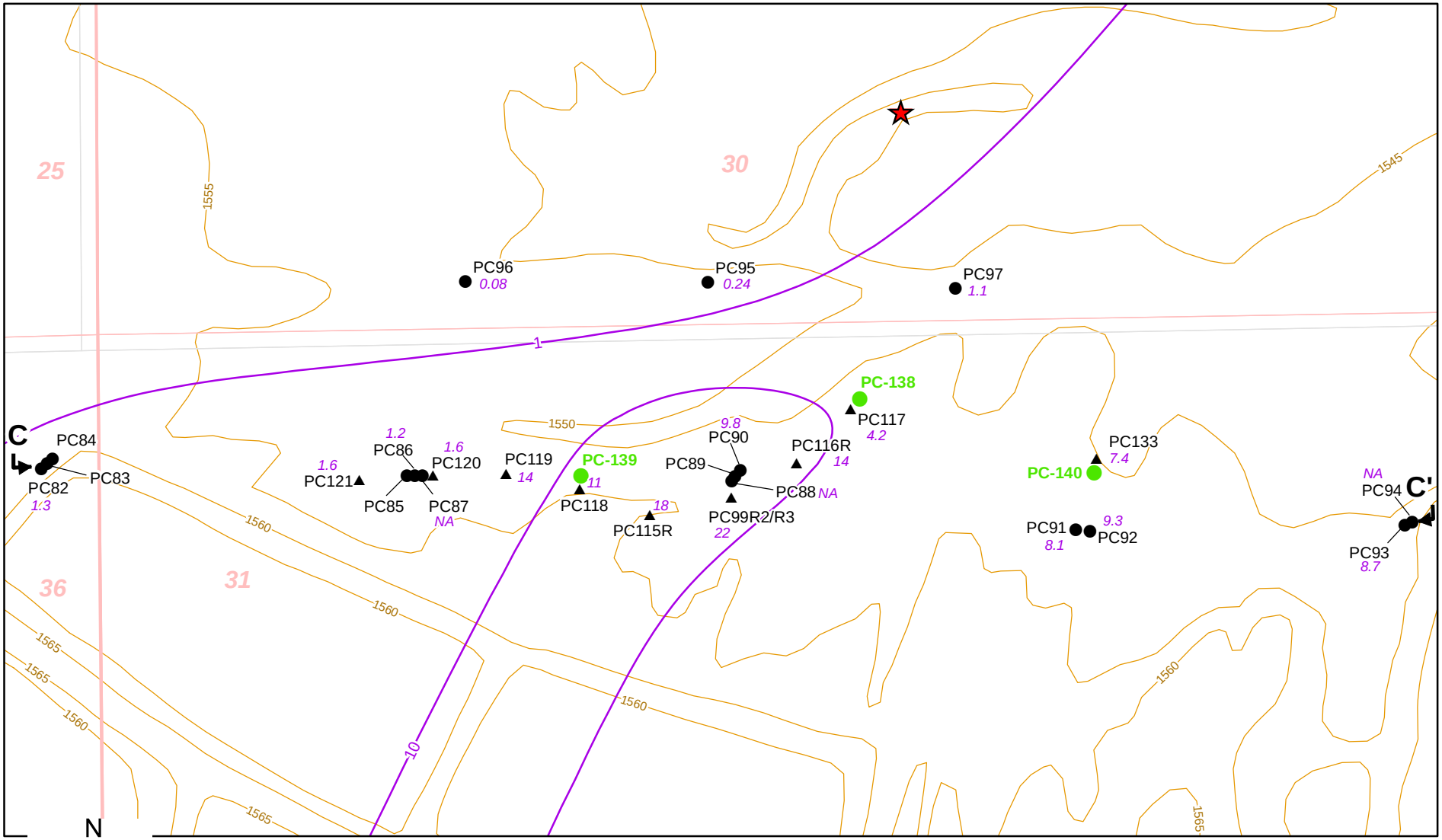

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SEE FIGURE 5 FOR EXPANDED LEGEND ELEMENTS

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PROPOSED WELLS AT THE SEEP WELL FIELD

Capture Zone Work Plan
Tronox Facility
Henderson, Nevada

FIGURE NUMBER:			
4			
DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
M. Scop	8/27/2007 Rev-1 11/26/07	04020-023-160	X

LEGEND

- Monitoring Well
- Appendix J Monitoring Well
- Recovery Well
- Abandoned Monitoring Well
- Abandoned Recovery Well
- Proposed Monitor Well
- Proposed Nested Monitoring Well
  Wells will be installed either one bore hole or in seperate boreholes at in close proximity to one another.
- Proposed Recovery Well
- PC-139 — Well Identification, Two IDs are Provided for Nested Well Locations.
- Seep Pumping Station

15 — Perchlorate Concentration (mg/L)
May 2007 (ENSR 2007b, Plate 7)

Perchlorate Contour (mg/L)
(Dashed where approximate)
May 2007 (ENSR 2007b, Plate 7)

Closed Perchlorate Contour (mg/L)
Concentrations are lower inside relative to surrounding values
May 2007 (ENSR 2007b, Plate 7)

Unsaturated Alluvium

1760 — Topographic Contour Line

A A' — Line of Hydrogeologic Cross Section
(see figures 6, 7 & 8)

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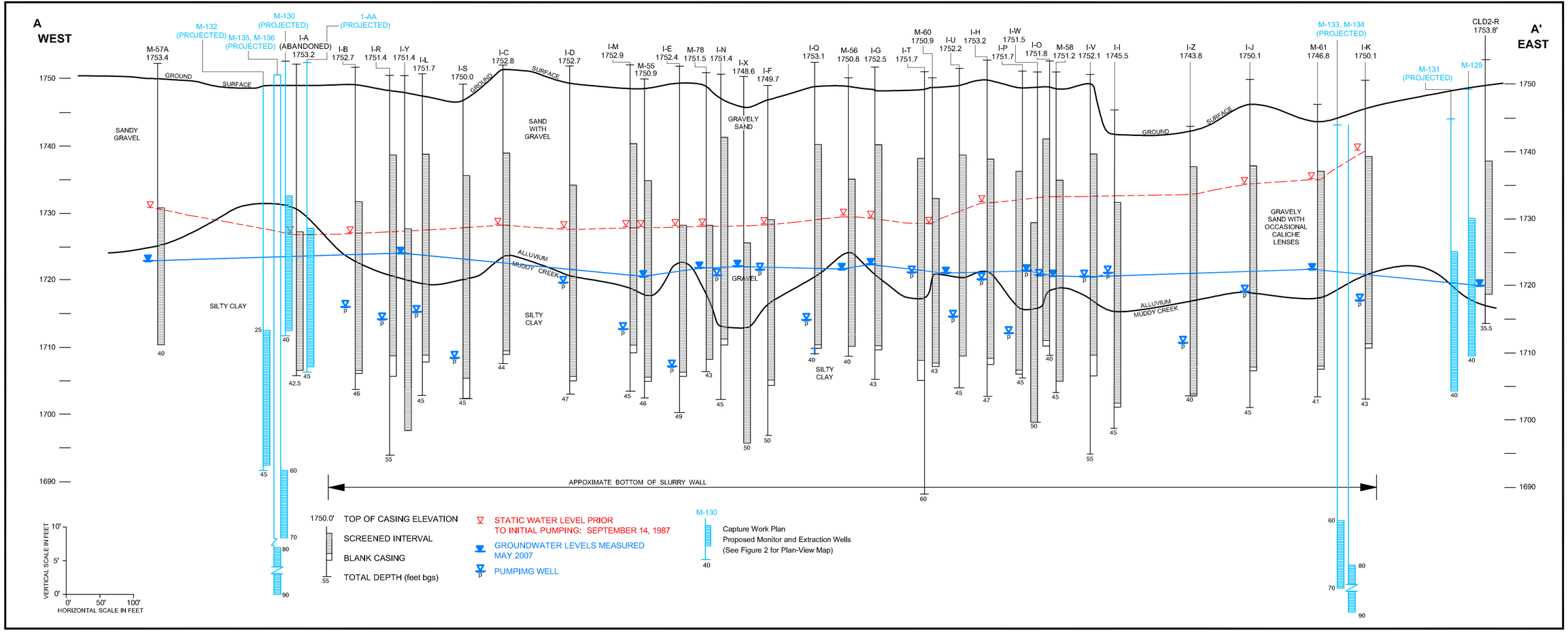
EXPANDED LEGEND ELEMENTS

Capture Zone Work Plan
Tronox Facility
Henderson, Nevada

FIGURE NUMBER:	
5	

DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
M. Scop	8/27/2007 Rev-1 11/26/07	04020-023-160	X



DESIGNED BY:	E. Krish
DRAWN BY:	M. Scop
CHECKED BY:	M. Flack
APPROVED BY:	M. Flack

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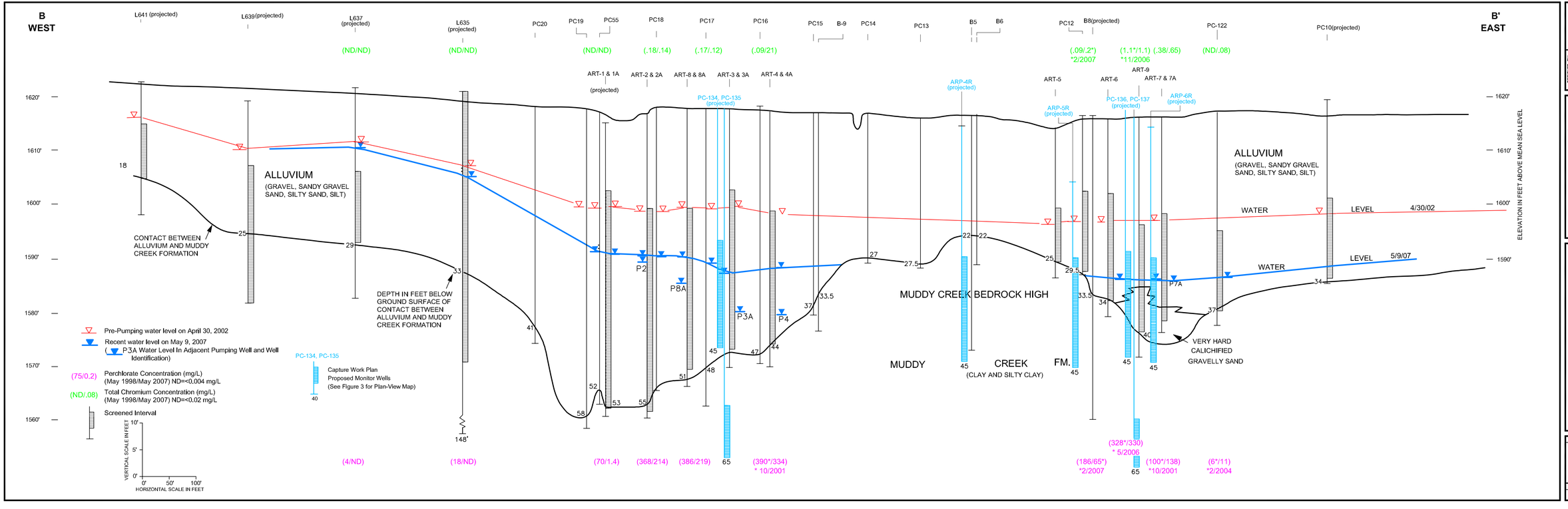
WEST - EAST HYDROGEOLOGIC CROSS SECTION A-A' INTERCEPTOR WELL FIELD

Proposed Monitoring Wells
Capture Zone Workplan
Tronox Facility, Henderson, Nevada

SCALE:	as noted
DATE:	7/19/2007 Rev: 10/8/07
PROJECT NUMBER:	04020-023-160

FIGURE NUMBER: **6**

SHEET NUMBER: X



DESIGNED BY: E. Krish
DRAWN BY: M. Scop
CHECKED BY: M. Flack
APPROVED BY: M. Flack

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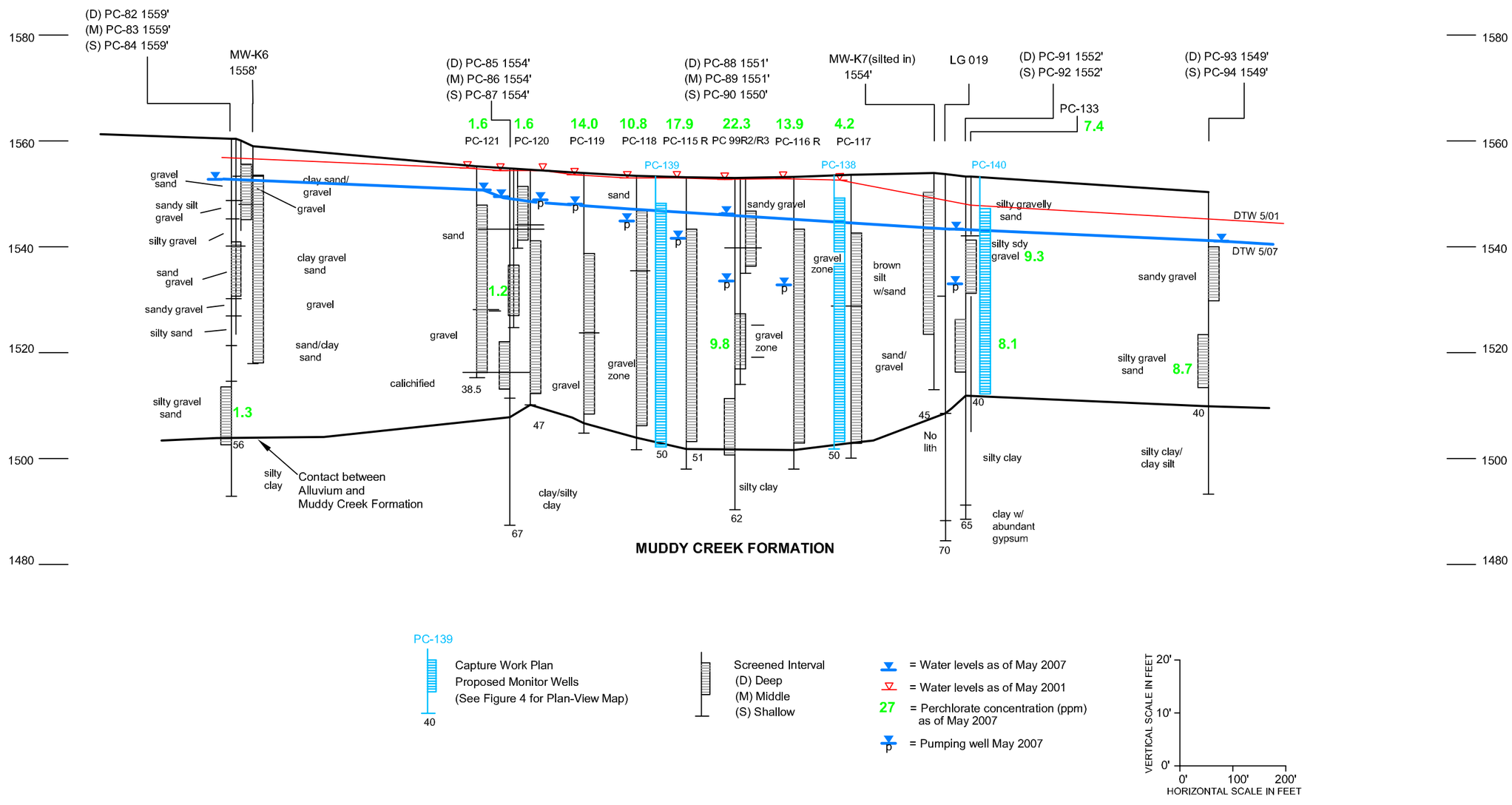
WEST - EAST HYDROGEOLOGIC CROSS SECTION B-B'
ATHENS ROAD WELL FIELD

Proposed Monitoring Wells
Capture Zone Workplan
Tronox Facility, Henderson, Nevada

SCALE: as noted
DATE: 11/7/2008
REV: 1/12/2009
PROJECT NUMBER: 04204/4/23-160

FIGURE NUMBER: 7

SHEET NUMBER: X



FILENAME:

DESIGNED BY: E. Krish
DRAWN BY: M. Scop
CHECKED BY: M. Flack
APPROVED BY: M. Flack

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WEST - EAST HYDROGEOLOGIC CROSS SECTION C-C'
SEEP WELL FIELD
Proposed Monitoring Wells
Capture Zone Workplan
Tronox Facility, Henderson, Nevada

PROJECT NUMBER: 04020-023-160
DATE: 7/19/2007 Rev-1 1/12/07
SCALE: as noted

FIGURE NUMBER: **8**

SHEET NUMBER: X

ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION

Jim Gibbons, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

12-14-07 Digital to ECA Document Distribution

DEC 13 2007

December 11, 2007

Susan Crowley
Tronox LLC
PO Box 55
Henderson, Nevada 89009

Re: **Tronox LLC (TRX)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection Response to:
Response to Nevada Division of Environmental Protection (NDEP) Comments to the Revised Work Plan to Evaluate Effective Groundwater Capture at Tronox LLC, Henderson, Nevada
Dated November 28, 2007

Dear Ms. Crowley,

The NDEP has received and reviewed TRX's response to comments identified above and finds that the document is acceptable with the following exceptions noted for the administrative record: (Please note that nothing further is required by the NDEP for this Deliverable.)

- General comment, the NDEP recognizes that the new wells PC-134 and PC-135 are located within the highest concentration area. The NDEP believes that providing monitor wells at this one location on the western lobe of the paleochannel will provide the minimum amount of data to demonstrate inward flow. Please note that after collecting and analyzing the data from this location, TRX may find it necessary to install an alluvial well to the west of PC-134 to provide more data for gradient mapping and groundwater elevation contouring for the western lobe of the paleochannel and/or to the east of PC-136 for the eastern lobe of the paleochannel.
- TRX Response to NDEP comment #3, please note that the NDEP's comment requested information on the type of hydraulic testing that TRX was proposing and was not specific to vertical hydraulic conductivity.
- TRX response to NDEP comment #8.c, the NDEP does acknowledge their June 26, 2007 comment that "overlapping cones of depression can be a line of evidence" for demonstrating groundwater capture. However, the June 26, 2007 comment also stated that "The capture zone and cone of depression will only be the same if background hydraulic gradient is zero." Also, the NDEP did not state that overlapping cones equate to capture in the June 26, 2007 comments. Given the current data set at Athens Rd Well Field; the drawdown data indicate capture while more importantly the groundwater elevation maps do not have closed contours indicating inward flow from down gradient. Please note that TRX has drawn the contour map

for the eastern lobe of the channel to show a closed contour but the elevation data on the map do not support that interpretation.

Please contact the undersigned with any questions at sharbour@ndep.nv.gov or (702) 486-2850 x 240.

Sincerely,

Shannon Harbour, P.E.
Staff Engineer III
Bureau of Corrective Actions
Special Projects Branch
NDEP-Las Vegas Office

SH:bar:sh

CC: Jim Najima, NDEP, BCA, Carson City
Brian Rakvica, NDEP, BCA, Las Vegas
Keith Bailey, Environmental Answers LLC, 3229 Persimmon Creek Drive, Edmond, OK 73013
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Barry Conaty, Akin, Gump, Strauss, Hauer & Feld, L.L.P., 1333 New Hampshire Avenue, N.W., Washington, D.C. 20036
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
Mitch Kaplan, U.S. Environmental Protection Agency, Region 9, mail code: WST-5, 75 Hawthorne Street, San Francisco, CA 94105-3901
Rob Mrowka, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
Rick Kellogg, BRC, 875 West Warm Springs, Henderson, NV 89011
Mark Paris, Landwell, 875 West Warm Springs, Henderson, NV 89011
Craig Wilkinson, TIMET, PO Box 2128, Henderson, Nevada, 89009-7003
Kirk Stowers, Broadbent & Associates, 8 West Pacific Avenue, Henderson, Nevada 89015
George Crouse, Syngenta Crop Protection, Inc., 410 Swing Road, Greensboro, NC 27409
Nick Pogoncheff, PES Environmental, 1682 Novato Blvd., Suite100, Novato, CA 94947
Lee Erickson, Stauffer Management Company, P.O. Box 18890, Golden, CO 80402
Stan Smith, Olin Chlor Alkali, PO Box 86, Henderson, Nevada 89009
Michael Bellotti, Olin Corporation, PO Box 248 1186 Lower River Road, Charleston TN 37310-0248
Curt Richards, Olin Corporation, PO Box 248 1186 Lower River Road, Charleston TN 37310-0248
Paul Sundberg, Montrose Chemical Corporation, 3846 Estate Drive, Stockton, California 95209
Joe Kelly, Montrose Chemical Corporation of CA, 600 Ericksen Avenue NE, Suite 380, Bainbridge Island, WA 98110
Paul Hackenberry, Hackenberry Associates, LLC, 550 W. Plumb Lane B425, Reno, Nevada 89509
Brian Giroux, McGinley and Associates, 425 Maestro Drive, Suite 202, Reno, NV 89511

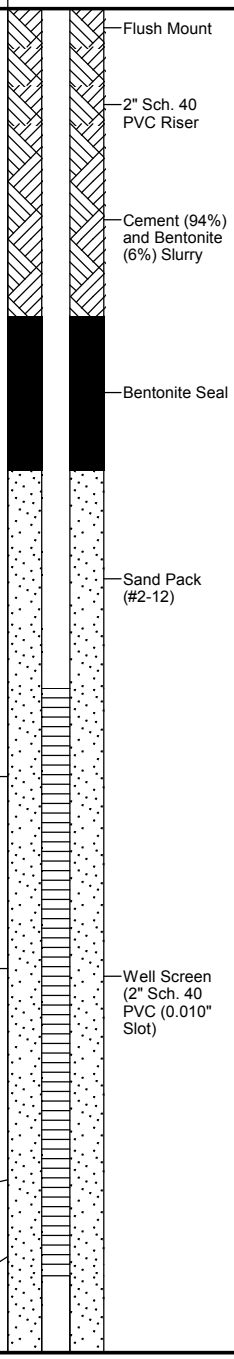
ATTACHMENT B TO THE GROUNDWATER CAPTURE REPORT

Borehole Lithology Logs and Well Completion Diagrams

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. ARP-4A**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Athens Road Well Field, Henderson, NV		
	Coordinates: 26728411.81 N 829167.89 E *Elevation:* 1615.47 FT		*Sheet:* 1 *of* 1
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 17.7-32.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/14/2007 14:15	*Depth of Boring:* 35 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/14/2007 17:00	*Water Level:* 30 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.
						SW-SM		**ALLUVIUM:** SILTY GRAVELLY SAND, moderate brown (5YR 4/4), 10% silt, 60% very fine to very coarse grained subangular to subrounded sand, 30% fine angular to subangular volcanic pea gravel to 3/4", moderate soft calcareous cement.
5								
10								
15								-from 15 to 25 feet bgs, scattered cobbles up to 2 1/2" diameter
20						GP-GM		SILTY SANDY GRAVEL, moderate brown (5YR 4/4), 10% silt, 40% very fine grained subangular to subrounded sand, 50% fine grained angular to subangular pea gravel, up to 3/4" in diameter volcanic clasts, moderately calcarious
25						SM		SILTY GRAVELLY SAND, gray orange pink (5YR 7/2), 20% silt, 50% fine grained angular to subangular volcanic pea gravel to 3/4", 40% very fine to very coarse grained subangular to subrounded sand, 15% fine grained angular to subangular volcanic pea gravel, hard caliche stringers from 25-25.5 and 27-27.5 feet bgs.
30								SILTY GRAVELLY SAND, groundwater encountered at 30 feet bgs.
						SM		SILTY SAND, light brown (5YR 6/4), 20% silt, 75% very fine to very coarse grained subangular to subrounded sand, 5% fine grained pea gravel to 1/4", calcareous with nodules to 2", wet - from 32-32.5 feet bgs, hard caliche
35						CL		**MUDDY CREEK FORMATION:** SILTY CLAY, light greenish gray (10G 7/1), non-calcareous, trace gypsum crystals.

Well Diagram



Notes: Muddy Crk Formation begins at 32.5 ft bgs

Total Depth = 35 feet.
Boring Terminated
Target depth achieved

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC	**Well No. ARP-5A**
	Project Number: 04020-023-160	
	Site Description/Location: East Side of Athens Road Well Field, Henderson, NV	
	Coordinates: 26728458.43 N 829375.01 E *Elevation:* 1616.10 FT	*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring	*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core *Boring Diameter:* 8 In.	*Screened Interval:* 12.7-37.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish *Date/Time Started:* 12/13/2007 17:30	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA *Date/Time Finished:* 12/14/2007 08:45	*Water Level:* 33 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						SM		**ALLUVIUM:** SILTY GRAVELLY SAND, moderate brown (5YR 4/4), 15% silt, 55% very fine to very coarse grained subrounded sand, 30% fine grained angular to subangular volcanic pea gravel to 1/2" with trace 1-2" cobbles, common calcareous (soft) cement.	Flush Mount 2" Sch. 40 PVC Riser Cement (94%) and Bentonite (6%) Slurry
5						SP-SM		SAND, moderate brown (5YR 4/4), 10% silt, trace fine pea gravel to 1/8", 90% very fine to very coarse grained subangular to subrounded sand with moderately soft calcareous cement.	Bentonite Seal
						SM		SILTY GRAVELLY SAND, moderate brown (5YR 4/4), 20% silt, 30% fine grained pea gravel to 1/2", 50% very fine to very coarse grained subrounded to subangular (dominant fine to coarse grained) sand, calcareous.	
10									Sand Pack (#2-12)
						GM		SANDY SILTY GRAVEL, moderate brown (5YR 4/4), 20% silt, 30% very fine to very coarse grained subangular to subrounded sand, 50% angular to subangular volcanic gravel to 1" wtih minor 4", locally thin (<3") caliche stringers.	
15									
20									
25									Well Screen (2" Sch. 40 PVC (0.010" Slot)
						SW-SM		GRAVELLY SILTY SAND, moderate brown (5YR 4/4), 10% silt, 30% fine angular to subangular gravel to 1/4", 60% very fine to very coarse grained subangular to subrounded sand (dominant fine to coarse grained).	
30									
						GP-GM		SANDY SILTY GRAVEL, pale yellowish brown (10YR 6/2), 10% silt, 60% fine angular to subangular pea gravel to 3/4", 30% very fine to very coarse grained subangular to subrounded sand. SANDY SILTY GRAVEL, abundant calichification with vuggy porosity, hard from 33-37.5 feet bgs. Groundwater encountered at 33 feet bgs.	
35									

Notes: Muddy Creek Formation begins at 37.5 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC	**Well No. ARP-5A**
	Project Number: 04020-023-160	
	Site Description/Location: East Side of Athens Road Well Field, Henderson, NV	
	Coordinates: 26728458.43 N 829375.01 E *Elevation:* 1616.10 FT	*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring	*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core *Boring Diameter:* 8 In.	*Screened Interval:* 12.7-37.7 ft.

Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/13/2007 17:30	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/14/2007 08:45	*Water Level:* 33 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						GP-GM		SANDY SILTY GRAVEL, pale yellowish brown (10YR 6/2), 10% silt, 60% fine angular to subangular pea gravel to 3/4", 30% very fine to very coarse grained subangular to subrounded sand. *(continued)*	
40						CL		**MUDDY CREEK FORMATION:** SILTY CLAY, light greenish gray (5GY 8/1), 90% clay, 10% silt, trace very fine grained sand, non-calcareous.	

Total Depth = 40 feet.
Boring Terminated
Target depth achieved

Notes: Muddy Creek Formation begins at 37.5 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. ARP-6B**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Athens Road Well Field, Henderson, NV		
	Coordinates: 26728499.92 N 829520.52 E *Elevation:* 1615.56 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 27.7-42.7 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 12/19/2007	*Depth of Boring:* 43 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/19/2007	*Water Level:* 32 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
5						GW-GM		**ALLUVIUM:** SANDY GRAVEL, light brown (5YR 6/4), 10% silt, 30% very fine to very coarse grained subrounded to subangular sand, 60% volcanic pea gravel to 3/4" with minor pebbles to 2" Moderate calcareous coatings.	Flush Mount 2" Sch. 40 PVC Riser
10						SM		SILTY GRAVELLY SAND, moderate brown (5YR 5/4), 15% silt, 35% fine grained angular to subangular volcanic pea gravel grannules to 3/8" with minor 1", 50% very fine to very coarse grained subrouned to subangular sand, moderate calcareous coatings, locally thin calichified stringers.	Cement (94%) and Bentonite (6%) Slurry
15									
20									Bentonite Seal
25						GM		SILTY SANDY GRAVEL, moderate yellowish brown (10YR 5/4), 20% silt, 30% very fine to very coarse grained subangular to subrouned sand, 50% fine grained angular to subangular pea gravel grannules up to 3/4" diameter.	Sand Pack (#2-12)
30									
35						GP-GM		SANDY GRAVEL, dark yellowish brown (10YR 4/2), 5% silt, 35% very fine to very coarse grained subangular to subrouned sand, 60% fine grained angular to subangular pea gravel grannules, non-calcareous. Groundwater encountered at 32 feet bgs.	

Notes: Muddy Creek Formation begins at 42 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. ARP-6B**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Athens Road Well Field, Henderson, NV		
	Coordinates: 26728499.92 N 829520.52 E *Elevation:* 1615.56 FT		*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 27.7-42.7 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 12/19/2007	*Depth of Boring:* 43 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/19/2007	*Water Level:* 32 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
40						GP-GM		SANDY SILTY GRAVEL, very hard calichification in sandy pea gravel, minor thin very silty zones with no calichification angular to subangular gravel up to 1/2".	Well Screen (2" Sch. 40 PVC (0.010" Slot)
						CL		**MUDDY CREEK FORMATION:** CLAY, light greenish gray (10Y 7/1), 10% silt, non calcareous.	

Total Depth = 43 feet.
Boring Terminated
Target depth achieved

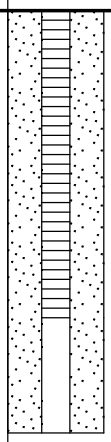
Notes: Muddy Creek Formation begins at 42 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. I-AA**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719770.85 N 827174.4 E	*Elevation:* 1753.93 FT	*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 11 In.	*Screened Interval:* 26-46 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 12/2/2007 11:45	*Depth of Boring:* 47 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/4/2007 10:00	*Water Level:* 30 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						SM		**ALLUVIUM:** SILTY GRAVELLY SAND, moderate yellowish brown (10YR 5/4), 20% silt, 25% fine grained angular to subangular pea gravel to 1/2" with minor gravel to 11/2" , 55% very fine to medium grained with common coarse to very coarse grained subangular to subrounded sand, moderately soft calcareous cement in matrix.	Steel Guard Pipe 3 Feet Above Ground Surface
5									Top of Riser 2.6 Feet Above Ground Surface
10									6" Sch. 40 PVC Riser
									Cement (94%) and Bentonite (6%) Slurry
15									Bentonite Seal
						SM		SILTY SAND, very pale brown (10YR 7/4), 30% silt, 70% very fine to fine grained subangular sand, common soft calcareous cement in matrix.	
20									Sand Pack (#2-12)
						GM		SILTY SANDY GRAVEL, moderate yellowish brown (10YR 5/4), hard, calichified, 15% silt, 25% of very fined to coarse grained subangular to subroundedsand, 60% medium pea gravel to 3/4".	
						SM		GRAVELLY SILTY SAND, moderate yellowish brown (10YR 5/4), 25% silt, 15% fine grained angular to subangular pea gravel to 1/8", 60% very fine to fine grained subangular to subrounded sand with common medium to very coarse grained, common moderately hard calcareous cement.	
25						SM		GRAVELLY SAND, pale yellowish brown (10YR 6/2), 10% silt, 30% fine grained pea gravel to 1/8", 60% very fine to very coarse grained subangular to subrounded sand, moderately hard calcareous cement.	
						SW		GRAVELLY SAND, moderate yellowish brown (10YR 5/4), no silt, 40% fine grained subangular to subrounded volcanic pea gravel , 60% very fine to very coarse subangular to subrounded sand, no calcareous cement.	
30						ML		**MUDDY CREEK FORMATION:** INTERBEDDED CLAYEY SILT AND SILT, light brown (10YR 5/6), non-calcareous except in the thin scattered nodular caliche zones, locally contains trace very fine to medium grained sand, 5-10% clay nodular caliche zone at 30-31 bgs. Groundwater encountered at 30 feet bgs.	
35									Well Screen (6" Sch. 40 PVC, 0.01" Slot)

Notes: Muddy Creek Formation begins at 30 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. I-AA**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719770.85 N 827174.4 E	*Elevation:* 1753.93 FT	*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 11 In.	*Screened Interval:* 26-46 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 12/2/2007 11:45	*Depth of Boring:* 47 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/4/2007 10:00	*Water Level:* 30 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						ML		**MUDDY CREEK FORMATION:** INTERBEDDED CLAYEY SILT AND SILT, light brown (10YR 5/6), non-calcareous except in the thin scattered nodular caliche zones, locally contains trace very fine to medium grained sand, 5-10% clay nodular caliche zone at 30-31 bgs. Groundwater encountered at 30 feet bgs. *(continued)*	
40									
45								CLAYEY SILT AND SILT, 5-10% clay nodular caliche zone from 46 to 47 feet bgs.	

Total Depth = 47 feet.
Boring Terminated
Target depth achieved

Notes: Muddy Creek Formation begins at 30 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-111A**
	Project Number: 04020-023-160		
	Site Description/Location: 500' South of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719134.857 N 827447.185 E *Elevation:* 1768.77 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 29.7-39.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/5/2007 12:00	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/10/2007 11:15	*Water Level:* 34 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						SM		**ALLUVIUM:** SILTY GRAVELLY SAND, moderate yellowish brown (10YR 5/4), 20% silt, 30% subangular to subrounded fine grained volcanic pea gravel to 1/2" with local calichification, 50% very fine to very coarse grained subangular to subrounded sand (dominant fine to coarse grained).	Steel Guard Pipe 3 Feet Above Ground Surface
5						SM		GRAVELLY SILTY SAND, moderate yellowish brown (10YR 5/4), 20% silt, 20% angular to subrounded fine grained volcanic pea gravel to 3/8", 60% very fine to very coarse grained (dominant fine to coarse grained) subangular to subrounded moderately calcareous sand.	Top of Riser 2.6 Feet Above Ground Surface
10						SM		SILTY GRAVELLY SAND, moderate yellowish brown (10YR 5/4), 20% silt, 30% pea gravel (dominant up to 1/2-3/4" with trace 2-3" angular to subangular volcanic clasts), 50% very fine to very coarse grained (dominant fine to medium grained) subangular to subrounded sand. Moderately common calichification.	6" Sch. 40 PVC Riser
								-at 13 feet bgs 6" calichified sandy pea gravel.	
15						SM		SILTY SAND, moderate yellowish brown (10YR 5/2), 30% silt, 5% 1/10-1/8" fine grained volcanic pea gravel, 70% very fine to very coarse grained (dominant very fine to medium grained) subangular to subrounded sand.	Cement (94%) and Bentonite (6%) Slurry
						SM		SILTY GRAVELLY SAND, moderate yellowish brown (10YR 5/2), 20% silt, 30% fine grained pea gravel to 1/2-3/4" angular to subangular volcanic moderately calichified sand gravel clasts, 50% very fine to very coarse grained (dominant fine to medium grained) subangular to subrounded sand.	
20								-local hard calichified zone, pale orange (10YR 8/2), at 19-19.5 feet bgs.	
								-local hard calichified zone, pale orange (10YR 8/2), at 21-21.5 feet bgs.	Bentonite Seal
25								-local hard calichified zone, pale orange (10YR 8/2), at 24-25 feet bgs.	Sand Pack (#2-12)
30								-local hard calichified zone, pale orange (10YR 8/2), at 29-29.5 feet bgs.	
						ML		**MUDDY CREEK FORMATION:** CLAYEY SILT, SILT, AND SANDY SILT, light brown (5YR 6/4), interbedded, common local nodular caliche zones. At 30-34 feet bgs nodules to 3" in clayey silt, moist.	
35								-from 34-36 feet bgs 65% silt, 10% clay, 25% very fine grained sand. Groundwater encountered at 34 feet bgs.	Well Screen

Notes: Muddy Creek Formation begins at 30 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-111A**
	Project Number: 04020-023-160		
	Site Description/Location: 500' South of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719134.857 N 827447.185 E *Elevation:* 1768.77 FT		*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 29.7-39.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/5/2007 12:00	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/10/2007 11:15	*Water Level:* 34 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
.... 40						ML		**MUDDY CREEK FORMATION:** CLAYEY SILT, SILT, AND SANDY SILT, light brown (5YR 6/4), interbedded, common local nodular caliche zones. At 30-34 feet bgs nodules to 3" in clayey silt, moist. *(continued)* -from 36-38 feet bgs 80% silt, 10% clay, 10% very fine grained sand. -from 38-40 feet bgs 65% silt, 10% clay, 25% very fine grained sand.	(2" Sch. 40 PVC, 0.01" Slot)

Total Depth = 40 feet.
Boring Terminated
Target depth achieved

Notes: Muddy Creek Formation begins at 30 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-126**
	Project Number: 04020-023-160		
	Site Description/Location: 500' South of the SW corner of GW11 Pond, Henderson, NV		
	Coordinates: 26719505.57 N 826569.37 E *Elevation:* 1759.01 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 20-40 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/4/2007 11:00	*Depth of Boring:* 50 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/4/2007 16:00	*Water Level:* 35 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						SM		**ALLUVIUM:** SILTY GRAVELLY SAND, moderate yellowish brown (10YR 5/4), 15% silt, 25% gravel (1/8" to 1/2") with trace volcanic clasts to 1-2", angular to subrounded, 60% very fine to very coarse grained (dominant fine to coarse grained), subangular to subrounded sand, poorly graded sand, calcareous cement commonly coating grains, loose.	Steel Guard Pipe 3 Feet Above Ground Surface
5									Top of Riser 2.6 Feet Above Ground Surface
10									2" Sch. 40 PVC Riser Cement (94%) and Bentonite (6%) Slurry
15								-hard from 13-15.5 feet bgs	Bentonite Seal
						SM		SILTY SAND, moderate yellowish brown (10YR 5/4), 20% silt, trace fine grained pea gravel, 80% very fine to fine grained with medium grained subangular to subrounded sand, loose calcareous cement common-locally thin hard zones, hard caliche from 19.5-20 feet bgs.	Sand Pack (#2-12)
20						ML		**MUDDY CREEK FORMATION:** INTERBEDDED, CLAYEY SILT, SILT, SANDY SILT, moderate yellowish brown (10YR 5/2) and light brown (5YR 5/6), from 20-22 feet bgs vuggy-silt (vugs from dissolved medium to very coarse grained size nodules). Locally contains nodular calichified zones.	
						ML		SILT, from 22-27 feet bgs, moist	
25									
						ML		INTERBEDDED SANDY SILT, SILT, from 27-37 feet bgs	
30									Well Screen (2" Sch. 40 PVC, 0.01" Slot)
								-organic odor starts at 32 feet bgs.	
35									

Notes: Muddy Creek Formation begins at 20 feet bgs. Organic odor begins at 32 feet bgs.

ENSR | AECOM	Client: Tronox LLC	Well No. M-126
	Project Number: 04020-023-160	
	Site Description/Location: 500' South of the SW corner of GW11 Pond, Henderson, NV	
ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	Coordinates: 26719505.57 N 826569.37 E Elevation: 1759.01 FT	Sheet: 2 of 2
	Drilling Method: Sonic with continuous coring	Monitoring Well Installed: Yes
	Sample Type(s): Split Spoon and Core Boring Diameter: 8 In.	Screened Interval: 20-40 ft.

Weather: Sunny, cool	Logged By: E. Krish	Date/Time Started: 12/4/2007 11:00	Depth of Boring: 50 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	Backfill: NA	Date/Time Finished: 12/4/2007 16:00	Water Level: 35 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						ML		INTERBEDDED SANDY SILT, SILT, from 27-37 feet bgs *(continued)* -groundwater encoutered at 35 feet bgs	
								-dark greenish yellow (10YR 6/6), vertical root traces at 37 feet bgs -from 37.5-42 feet bgs, silt	
40									
								-6" nodular caliche zone, nodules medium to coarse grained size sand	
45									Bottom 10 Feet Filled with Bentonite
								-from 47-50 feet bgs, interbeded silt, sandy silt, moderate yellowish brown (10YR 5/4)	
50									

Total Depth = 50 feet.
Boring Terminated
Target depth achieved

Notes: Muddy Creek Formation begins at 20 feet bgs. Organic odor begins at 32 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-129**
	Project Number: 04020-023-160		
	Site Description/Location: Henderson, NV		
	Coordinates: Not Surveyed	*Elevation:*	*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 20-40 ft.
Weather:	*Logged By:* A. Niemand	*Date/Time Started:* 3/19/2008	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear	*Backfill:* NA	*Date/Time Finished:* 3/19/2008	*Water Level:* 35 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						SM		**ALLUVIUM:** SILTY SAND, grayish brown (5YR 5/2), 20% silt, 65% sand, 15% gravel, subangular to subrounded, very loose, slightly moist	
								-pale brown (10YR 6/3) below 2 feet bgs	
5									Grout Seal
								-caliche veining and hardpan from 8 to 10 feet bgs	
10								-hardpan increases between 10 and 15 feet bgs	Bentonite Seal
15								-light brown (7.5YR 6/4) below 15 feet bgs, no hardpan	#3 Sand
20									
								-very pale brown (10YR 7/3) at 21.5 feet bgs	
								-yellowish brown (10YR 5/4) at 22.5 feet bgs	
								-no recovery from 23.5 to 25 feet bgs	
25						ML		**MUDDY CREEK:** CLAYEY SILT, light yellowish brown (10YR 6/4), 90% silt, 10% clay, very stiff, moist	
30									0.010" Slotted Screen
35									

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-129**
	Project Number: 04020-023-160		
	Site Description/Location: Henderson, NV		
	Coordinates: Not Surveyed	*Elevation:*	*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 20-40 ft.
Weather:	*Logged By:* A. Niemand	*Date/Time Started:* 3/19/2008	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear	*Backfill:* NA	*Date/Time Finished:* 3/19/2008	*Water Level:* 35 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
	35-35.5 35.5-36 36-36.5					ML		**MUDDY CREEK:** CLAYEY SILT, light yellowish brown (10YR 6/4), 90% silt, 10% clay, very stiff, moist *(continued)* -saturated, very soft at 35 feet bgs	
40									

Total Depth = 40 feet.
Boring Terminated
Target depth achieved

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-130**
	Project Number: 04020-023-160		
	Site Description/Location: Henderson, NV		
	Coordinates: Not Surveyed	*Elevation:*	*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 20-40 ft.
Weather:	*Logged By:* A. Niemand	*Date/Time Started:* 3/19/2008	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear	*Backfill:* NA	*Date/Time Finished:* 3/19/2008	*Water Level:* 31.22 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						SM		**ALLUVIUM:** GRAVELLY SILTY SAND, brown (7.5YR 5/4), 20% silt, 45% sand, 35% gravel, subrounded to subangular, loose, moist	
5								-hardpan from 5-6.5 feet bgs	Grout Seal
								-light yellowish brown (10YR 6/4) at 7.5 feet bgs	
10									
									Bentonite Seal
15								-alternating layers of clayey silt and silty sand with gravel cemented with caliche and hardpan from 13.5-15 feet bgs	
						GM		SILTY SANDY GRAVEL, brown (7.5YR 5/4), 15% silt, 35% sand, 50% gravel, subrounded to subangular, loose, moist	#3 Sand
20									
						SP-SM		GRAVELLY SAND TO SILTY SAND, brown (7.5YR 5/3), 5% clay, 5% silt, 50% sand, 40% gravel, subrounded to subangular, loose, moist, gravel increases with depth	
25						ML		**MUDDY CREEK FORMATION:** CLAYEY SILT, brownish yellow (10YR 6/6), 10% clay, 90% silt, medium stiff, moist	
30									0.01" Slotted Screen
35								-no recovery from 34.25-35 feet bgs	

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-130**
	Project Number: 04020-023-160		
	Site Description/Location: Henderson, NV		
	Coordinates: Not Surveyed	*Elevation:*	*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 20-40 ft.
Weather:	*Logged By:* A. Niemand	*Date/Time Started:* 3/19/2008	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear	*Backfill:* NA	*Date/Time Finished:* 3/19/2008	*Water Level:* 31.22 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
	35-35.5 35.5-36 36-36.5					GM		SILTY GRAVEL, gray (10YR 5/1), 15% silt, 85% gravel, subangular, medium dense, wet, gravel finger from 35-35.5 feet bgs	
						ML		CLAYEY SILT, brownish yellow (10YR 6/6), very soft, wet	
40									

Total Depth = 40 feet.
Boring Terminated
Target depth achieved

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-131**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719770.566 N 827158.077 E *Elevation:* 1754.13 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 29-39 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 12/1/2007 14:00	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/2/2007 10:30	*Water Level:* 29.5 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
								ASPHALT, black.	Steel Guard Pipe 3 Feet Above Ground Surface
						SM		**ALLUVIUM:** GRAVELLY SILTY SAND, moderate yellowish brown (10YR 5/4), 20% silt, 20% angular to subangular volcanic pea gravel (dominant 1/4-1/2") with common clasts to 2-3", 60% very fine to medium grained with common coarse to very coarse grained subangular to subrounded sand, moderate calcareous cement in matrix.	Top of Riser 2.6 feet Above Ground Surface
5									2" Sch. 40 PVC Riser
10									Cement (94%) and Bentonite (6%) Slurry
15									
						SM		SILTY SAND, very pale brown (10YR 7/4), 30% silt, 70% very fine to fine grained subangular sand, common calcareous cement.	
20									Bentonite Seal
						SM		GRAVELLY SILTY SAND, moderate yellowish brown (10YR 5/4), 20% silt, 15% fine grained well graded angular to subangular volcanic pea gravel to 1/8", 65% very fine to very coarse grained subangular to subrounded sand, common calcareous cement-soft to locally hard.	
25									Sand Pack (#2-12)
								-from 28-29.5 feet bgs hard cemented calichified gravelly sand	
30						ML		GRAVELLY SAND TO GRAVELLY SILTY SAND, from 29.5-30 feet bgs clean well graded sand, 10% silt, 10% fine pea gravel to 1/8", 80% fine to coarse grained subangular to rounded sand, very slight calcareous cement, groundwater encountered at 29.5 feet bgs **MUDDY CREEK FORMATION:** CLAYEY SILT AND SILT, light brown (5YR 5/6), 0-10% clay, non-calcareous except in local nodular caliche zones, nodular caliche at 54-56 feet below ground surface, locally with 5% very fine grained sand, wet.	
35									Well Screen (2" Sch. 40 PVC, 0.01"

Notes: Muddy Creek Formation begins at 30 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-131**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719770.566 N 827158.077 E *Elevation:* 1754.13 FT		*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 29-39 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 12/1/2007 14:00	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/2/2007 10:30	*Water Level:* 29.5 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
.... 40						ML		**MUDDY CREEK FORMATION:** CLAYEY SILT AND SILT, light brown (5YR 5/6), 0-10% clay, non-calcareous except in local nodular caliche zones, nodular caliche at 54-56 feet below ground surface, locally with 5% very fine grained sand, wet. *(continued)*	Slot)

Total Depth = 40 feet.
Boring Terminated
Target depth achieved

Notes: Muddy Creek Formation begins at 30 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-132**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26720048.491 N 828714.609 E *Elevation:* 1744.27 FT		*Sheet:* 1 *of* 3
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 79.7-89.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/11/2007 15:00	*Depth of Boring:* 90 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/12/2007 13:30	*Water Level:* 32 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
5						SM		**ALLUVIUM:** GRAVELLY SILTY SAND, moderate brown (5YR 4/4), 15% silt, 15% fine grained angular to subangular volcanic pea gravel to 1/2" with trace cemented gravel to 1", 70% very fine to very coarse grained subangular to subrounded sand (dominant very fine to medium grained), common soft calcareous cement, moderate well graded. (Note: unit is comprised of thin (3-6") fining-upward, beds grading from sandy gravel at base to silty sand at top.)	Steel Guard Pipe 3 Feet Above Ground Surface 2" PVC Riser
10									
15									
20						GM		SANDY SILTY GRAVEL, grayish orange (10YR 7/4), 30% silt, 20% very fine to medium grained subangular to subrounded sand, 50% fine grained subangular to subrounded pea gravel to 1/8", common abundant calcareous cement - soft to 20.5 feet bgs, then hard calichified silty sandy gravel.	
25						ML		**MUDDY CREEK FORMATION:** SANDY SILT, CLAYEY SILT AND SILT INTERBEDDED WITH POORLY GRADED SAND, light brown (5YR 5/4), trace scattered caliche nodules throughout -6" thick zone with common caliche nodules to 11/2" at 22 feet bgs -from 22-44 feet bgs, silt slightly clayey (5-10%) within interbeds of the clayey sandy (10-15% very fine grained) sandy silt	
30								-groundwater encountered at 32 feet bgs	
35									

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-132**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26720048.491 N 828714.609 E *Elevation:* 1744.27 FT		*Sheet:* 2 *of* 3
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 79.7-89.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/11/2007 15:00	*Depth of Boring:* 90 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/12/2007 13:30	*Water Level:* 32 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						ML		**MUDDY CREEK FORMATION:** SANDY SILT, CLAYEY SILT AND SILT INTERBEDDED WITH POORLY GRADED SAND, light brown (5YR 5/4), trace scattered caliche nodules throughout *(continued)*	
40									Cement (94%) and Bentonite (6%) Slurry
45								-from 44-47 feet bgs, 5% clay, 70% silt, 25% very fine grained sand, non-calcareous	
								-from 47-90 feet bgs, with minor clayey and sandy silt (0 to 15% clay, 0-20% very fine grained sand), non-calcareous, wet	
50									
55									
60				1.5				-Split Spoon Sample: Clayey sandy SILT, 70% silt, 10% clay, 20% very fine grained sand, few caliche nodules to 1" diameter	
								-from 62-62.5 feet bgs, with 30% very fine grained sand, wet -from 62.5-65 feet bgs, pale red brown (10R 5/4) clayey silt	
65								-from 65-67 feet bgs sandy silt with 25% very fine grained sand	
								-from 69-78 feet bgs sandy silty with 30% very fine grained sand.	
70									

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-132**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26720048.491 N 828714.609 E *Elevation:* 1744.27 FT		*Sheet:* 3 *of* 3
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 79.7-89.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/11/2007 15:00	*Depth of Boring:* 90 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/12/2007 13:30	*Water Level:* 32 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						ML		**MUDDY CREEK FORMATION:** SANDY SILT, CLAYEY SILT AND SILT INTERBEDDED WITH POORLY GRADED SAND, light brown (5YR 5/4), trace scattered caliche nodules throughout *(continued)*	
								-from 72.5-73 feet bgs 10-15% coarse to very coarse sand and very fine pea gravel suspended in matrix.	Bentonite Seal
75									
									3" Thick Filter #2-12 Sand Pack
80									
								-from 82-84 feet bgs 25% sandy very fine grained silt	
85								-from 85 to 85.5 feet bgs grayish orange pink (5YR 7/2), slightly calcareous clayey silt. -from 85.5 to 90 feet bgs light brown (5YR 5/4) sandy (20-30% very fine grained) silt	Screen Zone - 2" PVC 0.01" Slotted
90									

Total Depth = 90 feet.
Boring Terminated
Target depth achieved

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-133**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26720067.292 N 828698.608 E *Elevation:* 1743.62 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 60-70 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/12/2007 13:30	*Depth of Boring:* 70 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/12/2007 16:00	*Water Level:* 32 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
5						SW-SM		**ALLUVIUM:** GRAVELLY SILTY SAND, moderate brown (5YR 4/4), up to 15% silt, trace clay, 70% very fine to very coarse grained subangular to subrounded sand (dominant very fine to medium grained), 15% fine subangular to subrounded volcanic pea gravel to 1/2" with minor cemented gravel clasts to 1", moderately common soft calcareous cement	Steel Guard Pipe 3 Feet Above Ground Surface
10									Top of Riser 2.6 Feet Above Ground Surface
15									2" Sch. 40 PVC Riser
20						GM		SANDY SILTY GRAVEL, grayish orange (10YR 7/4), 30% silt, 20% very fine to medium grained subangular to subrounded sand, 50% fine subangular to subrounded pea gravel to 1/8-1/4". Common soft calcareous cement thin hard caliche stringer at 22 feet bgs	
25						ML		**MUDDY CREEK FORMATION:** SANDY AND CLAYEY SILT, light brown (5YR 5/4), interbedded, locally containing nodular caliche to 1" at 22 feet bgs 6" nodular caliche. From 22-42 feet bgs silt, slightly clayey with minor sandy silt.	
30								-groundwater encountered at 32 feet bgs.	
35									Cement (94%) and Bentonite (6%) Slurry

Notes: Muddy Creek Formation begins at 32 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-133**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26720067.292 N 828698.608 E *Elevation:* 1743.62 FT		*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 60-70 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/12/2007 13:30	*Depth of Boring:* 70 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/12/2007 16:00	*Water Level:* 32 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						ML		**MUDDY CREEK FORMATION:** SANDY AND CLAYEY SILT, light brown (5YR 5/4), interbedded, locally containing nodular caliche to 1" at 22 feet bgs 6" nodular caliche. From 22-42 feet bgs silt, slightly clayey with minor sandy silt. *(continued)*	
40									
								-from 42-65 feet bgs sandy silt, non-calcareous with 25% very fine grained sand, slightly clayey	
45								-from 45-65 feet bgs silt with minor clayey and sandy silt interbeds, 5-10% clay, 5-20% very fine grained sand, non-calcareous	
50									
55									Bentonite Seal
60									Sand Pack (#2-12)
65								-from 65-70 feet bgs sandy silt, 20-25% very fine grained sand, non-calcareous.	Well Screen (2" Sch. 40 PVC, 0.01" Slot)
70									

Notes: Muddy Creek Formation begins at 32 feet bgs.

Total Depth = 70 feet.
Boring Terminated
Target depth achieved

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-134**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719889.138 N 827144.353 E *Elevation:* 1752.14 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 60-70 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 11/30/2007 14:30	*Depth of Boring:* 70 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/1/2007 09:30	*Water Level:* 30 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
5, 10, 15						SM		**ALLUVIUM:** GRAVELLY SILTY SAND, moderate brown (5YR 4/4), 20% silt, 25% subangular volcanic pea gravel to 1/2", 55% very fine to very coarse grained (mostly fine to medium grained) well graded subangular to subrounded sand, slight calichification, some gravel lenses present	Steel Guard Pipe 3 Feet Above Ground Surface 2" Sch. 40 PVC Riser
20, 25						SM		SILTY SAND, moderate yellowish brown (10YR 5/4), 20% silt, trace clay, trace pea gravel, 80% very fine to fine grained with minor medium to very coarse grained moderately graded sand, slight to moderate calichification	
30						SM		SILTY SAND, pale yellowish brown (10YR 6/2), 25% silt, 75% very fine to medium grained with minor coarse grained subangular to subrounded sand, abundant calcareous cement as matrix - difficult to drill SILTY SAND, pale yellowish brown (10YR 6/2) and moderate brown (5YR 5/4), from 28-30 feet bgs irregular, deformed "bedding" filled fractures, soft sediment derformation, moist.	Cement (94%) and Bentonite (6%) Slurry
35						ML		**MUDDY CREEK FORMATION:** CLAYEY SILT AND SILT, moderate yellowish brown (10YR 5/4), from 30-70 feet bgs, Interbedded 0-20% clay, 0-5% very fine to fine grained sand, 75-100% silt, local thin zones of nodular caliche, wet -groundwater encountered at 32 feet bgs.	

Notes: Muddy Creek Formation begins at 30 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-134**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719889.138 N 827144.353 E *Elevation:* 1752.14 FT		*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 60-70 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 11/30/2007 14:30	*Depth of Boring:* 70 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/1/2007 09:30	*Water Level:* 30 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						ML		**MUDDY CREEK FORMATION:** CLAYEY SILT AND SILT, moderate yellowish brown (10YR 5/4), from 30-70 feet bgs, Interbedded 0-20% clay, 0-5% very fine to fine grained sand, 75-100% silt, local thin zones of nodular caliche, wet *(continued)*	
40								-from 42-45 feet bgs abundant nodular caliche to 2" in clayey silt, light brown (5YR 6/4)	
45									
50									Bentonite Seal
55				1.5				-from 55-56.5 feet below ground surface moderate yellowish brown (10YR 5/4) non-calcareous silt with trace very fine to fine grained sand, no gravel	
								-from 57-60 feet bgs abundant nodular caliche	Sand Pack (#2-12)
60									
65								-from 66-67 feet bgs slight calcareous clayey silt with silty clay, very pale orange (10YR 8/2)	Well Screen (2" Sch. 40 PVC, 0.01" Slot)
70									

Notes: Muddy Creek Formation begins at 30 feet bgs.

Total Depth = 70 feet.
Boring Terminated
Target depth achieved

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-135**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719890.173 N 827154.482 E *Elevation:* 1751.85 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 29-39 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 11/30/2007	*Depth of Boring:* 39 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 11/30/2007 14:30	*Water Level:* 29 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
5, 10, 15, 20, 25, 30, 35						SM		**ALLUVIUM:** GRAVELLY SILTY SAND, moderate brown (5YR 4/4), 20% silt, 25% angular to subangular volcanic pea gravel to 1/2", 55% very fine to very coarse grained sand, well graded, subangular to subrounded mostly fine to medium grained. Slight calichification.	Steel Guard Pipe 3 Feet Above Ground Surface 2" Sch. 40 PVC Riser Cement (94%) and Bentonite (6%) Slurry
						SW-SM		GRAVELLY SAND TO SILTY SAND, moderate brown (5YR 4/4), 5% silt, 30%subangular volcanic pea gravel to 1", 65% very fine to very coarse grained sand (mostly fine to coarse grained) slight calichificaiton.	
						SW-SM		GRAVELLY SILTY SAND, moderate yellowish brown (10YR 5/4), 10% silt, 20% subangular volcanic pea gravel to 1/2", 70 % very fine to very coarse grained sand (well graded) mostly fine to coarse grained. Slightly modified calichification.	Bentonite Seal
						SM		SILTY SAND, pale yellowish brown (10YR 6/2), 20% silt, trace clay, no gravel, 80% very fine to medium grained with moderate coarse to very coarse grained sand subangular to subrounded. Abundant calcareous cement - moderately hard, moist.	Sand Pack (#2-12)
						ML		**MUDDY CREEK FORMATION:** CLAYEY SILT, moderate yellowish brown (10YR 5/4), 10% clay, 5% very fine grained sand, 85% silt. Low calcareous thin zones of nodular caliche. Groundwater encountered at 30 feet bgs.	Well Screen (2" Sch. 40 PVC, Slot

Notes: Muddy Creek Formation begins at 30 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-135**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719890.173 N 827154.482 E *Elevation:* 1751.85 FT		*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 29-39 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 11/30/2007	*Depth of Boring:* 39 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 11/30/2007 14:30	*Water Level:* 29 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
.....						ML		**MUDDY CREEK FORMATION:** CLAYEY SILT, moderate yellowish brown (10YR 5/4), 10% clay, 5% very fine grained sand, 85% silt. Low calcareous thin zones of nodular caliche. Groundwater encountered at 30 feet bgs. *(continued)*	0.01")

Total Depth = 39 feet.
Boring Terminated
Target depth achieved

Notes: Muddy Creek Formation begins at 30 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-136**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719889.774 N 827165.342 E *Elevation:* 1751.87 FT		*Sheet:* 1 *of* 3
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 80-90 ft.
Weather: Sun, rain, clouds, wind	*Logged By:* E. Krish	*Date/Time Started:* 11/28/2007 21:20	*Depth of Boring:* 90 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 11/29/2007 13:30	*Water Level:* 30 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						SM		**ALLUVIUM:** SILTY GRAVELLY SAND, pale yellowish brown (10YR 7/2), 20% silt, 20% angular to subangular volcanic pea gravel to 1/2", 60% very fine to fine grained sand with minor coarse and very coarse grained. Well graded with slight calichification	Steel Guard Pipe 3 Feet Above Ground Surface
						GM		SANDY SILTY GRAVEL, pale brown (5YR 5/2), 30% fine to medium grained angular to subangular sand, 10% silt, 60% volcanic pea gravel to 1/2", slight calichification	
						SM		GRAVELLY SILTY SAND, moderate brown (5YR 4/4), 20% silt, 25% angular to subangular volcanic pea gravel to 1/4", 55% very fine to medium grained with minor coarse to very coarse grained sand. Well graded, moderate to common calichification with nodules to 21/2"	
5									
10									2" Sch. 40 PVC Riser
15						SW		GRAVELLY SAND, moderate brown (5YR 4/4), 5% silt, 30% angular to subangular volcanic pea gravel to 1", 65% very fine to very coarse grained (dominant fine to medium grained) subangular to subrounded sand, slight calichification	
						GP		CALICHIFIED GRAVEL, very light gray (N8), 5% silt, 25% subangular very fine to medium sand, 70% pea gravel angular to subangular to 1/2", abundant calcareous hard matrix	
20									
						SM		GRAVELLY SILTY SAND, moderate yellowish brown (10YR 5/4), 10% silt, 15% subangular volcanic pea gravel to 3/8", 75% very fine to very coarse grained (dominant fine to medium grained) subangular to subrounded sand, slight calichification, moist	
25									
						SM		CALCAREOUS SILTY SAND, moderate yellowish brown (10YR 5/2), 25% silt, 5% volcanic pea gravel to 1/2" (trace gravel to 21/2"), 70% very fine to fine grained with minor medium to very coarse grained subangular to subrounded sand, abundant calcareous semi-hard calcareous cement, moist	
30									
						SP		GRAVELLY SAND, moderate yellowish brown (10YR 4/4), 5% silt, 25% volcanic pea gravel to 1/2", 70% very fine to very coarse grained (dominant medium to very coarse grained) subangular to subrounded sand, scattered hard calichified nodules, wet	
						ML		**MUDDY CREEK FORMATION:** INTERBEDDED CLAYEY SILT AND SILT, moderate yellowish brown (10YR 4/4)-groundwater encountered at 30 feet bgs	
35									

Notes: Muddy Creek Formation begins at 30.5 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-136**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719889.774 N 827165.342 E *Elevation:* 1751.87 FT		*Sheet:* 2 *of* 3
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 80-90 ft.
Weather: Sun, rain, clouds, wind	*Logged By:* E. Krish	*Date/Time Started:* 11/28/2007 21:20	*Depth of Boring:* 90 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 11/29/2007 13:30	*Water Level:* 30 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						ML		**MUDDY CREEK FORMATION:** INTERBEDDED CLAYEY SILT AND SILT, moderate yellowish brown (10YR 4/4)-groundwater encountered at 30 feet bgs *(continued)*	
40								-from 39-40 feet bgs scattered thin nodular caliche zones (nodules to 1")	Cement (94%) and Bentonite (6%) Slurry
								-from 42-43 feet bgs scattered thin nodular caliche zones (nodules to 1")	
45									
50									
								-from 53-54 feet bgs scattered thin nodular caliche zones (nodules to 1")	
55								-from 55-56 feet bgs scattered thin nodular caliche zones (nodules to 1")	
60									
				1.5				-from 61-61.5 feet bgs common caliche nodules (nodules to 1") -from 61.5-62.5 feet bgs clayed silt with trace caliche, zone continues very fine grained sized aggregates of silt, wet	
65								-from 63-75 feet bgs common dark grained yellowish brown (10YR 6/6) and black vertical root traces in moderate yellow brown (10YR 5/4) clayey silt. Individual root traces 1" long X 0.5" wide. Some with red iron oxide.	
70									

Notes: Muddy Creek Formation begins at 30.5 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. M-136**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Interceptor Well Field, Henderson, NV		
	Coordinates: 26719889.774 N 827165.342 E *Elevation:* 1751.87 FT		*Sheet:* 3 *of* 3
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 80-90 ft.
Weather: Sun, rain, clouds, wind	*Logged By:* E. Krish	*Date/Time Started:* 11/28/2007 21:20	*Depth of Boring:* 90 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 11/29/2007 13:30	*Water Level:* 30 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						ML		**MUDDY CREEK FORMATION:** INTERBEDDED CLAYEY SILT AND SILT, moderate yellowish brown (10YR 4/4)-groundwater encountered at 30 feet bgs *(continued)* -from 70-75 feet bgs common calcareous cement, pale yellow brown (10YR 6/2) -from 72-73 feet bgs scattered thin nodular caliche zones (nodules to 1 1/2")	Bentonite Seal
75									Sand Pack (#2-12)
80						SM		SILTY SAND, moderate yellowish brown (10YR 5/4), 30-40% silt with very fine grained subangular to subrounded sand, wet.	
85								SANDY SILT, from 84-86 feet bgs, 15-20% silt, 5-10% small volcanic pea gravel subangular to subrounded to 1/4", 70-80% very fine to very coarse grained sand (dominant fine to coarse grained) with minor very coarse grained.	Well Screen (2" Sch. 40 PVC, Slot 0.01")
						ML		SANDY SILT, 75% silt, 25% very fine grained sand with minor floating coarse to very coarse angular to subangular volcanic grains. SANDY SILT, moderate calichification from 87.5-90 feet bgs.	
90									

Total Depth = 90 feet.
Boring Terminated
Target depth achieved

Notes: Muddy Creek Formation begins at 30.5 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. MW-16**
	Project Number: 04020-023-160		
	Site Description/Location: 100' west of the SW corner of the GW11 Pond, Henderson, NV		
	Coordinates: 26719904.41 N 826447.64 E *Elevation:* 1754.81 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 24.7-39.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/5/2007 09:00	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/10/2007 16:00	*Water Level:* 34 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						SM		**ALLUVIUM:** SILTY GRAVELLY SAND, pale yellowish brown (10YR 6/4), 15% silt, 25% fine grained angular to subrounded volcanic pea gravel to 3/4" with trace 1-1.5", 60% very fine to very coarse grained subangular to subrounded (dominant fine to medium grained with common coarse to very coarse grained) sand, mud-common calcareous cement in matrix.	Steel Guard Pipe 3 Feet Above Ground Surface
5									Top of Riser 2.4 Feet Above Ground Surface
									2" Sch. 40 PVC Riser
10									
								-from 13-14 feet bgs, abundant calcareous cement and calichified gravelly sand.	Cement (94%) and Bentonite (6%) Slurry
15									
									Bentonite Seal
20								-from 19-26 feet bgs, abundant calcareous cement with thin stringers of hard calichified gravelly sand, moderate yellowish brown (10YR 5/4) .	
									Sand Pack (#2-12)
25									
						ML		**MUDDY CREEK FORMATION:** SILT TO SANDY SILT, moderate yellowish brown (10YR 5/4) to brown (5YR 5/4), locally clayey or sandy, 5-10% clay, 5-25% sand.	
30									
									Well Screen (2" Sch. 40 PVC, 0.010" Slot)
35								-groundwater encountered at 34 feet bgs.	

Notes: Organic odor begins at 38 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. MW-16**
	Project Number: 04020-023-160		
	Site Description/Location: 100' west of the SW corner of the GW11 Pond, Henderson, NV		
	Coordinates: 26719904.41 N 826447.64 E *Elevation:* 1754.81 FT		*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 24.7-39.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/5/2007 09:00	*Depth of Boring:* 40 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/10/2007 16:00	*Water Level:* 34 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						ML		**MUDDY CREEK FORMATION:** SILT TO SANDY SILT, moderate yellowish brown (10YR 5/4) to brown (5YR 5/4), locally clayey or sandy, 5-10% clay, 5-25% sand. *(continued)*	
40						SC-SM		SILTY SAND, from 37-37.5 feet bgs 25% silt, 10% clay, 65% very fine to fine grained subrounded sand with common coarse very coarse grains, non-calcareous. -from 37.5-40 feet bgs, clayey and silty sand, 5-10% clay and 10-15% very fine to fine grained with poorly graded sand common, fine grained pea gravel to 1/8", non-calcareous. -from 38-40 feet bgs slight orgainic odor.	

Total Depth = 40 feet.
Boring Terminated
Target depth achieved

Notes: Organic odor begins at 38 feet bgs.

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. PC-134**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Athens Road Well Field, Henderson, NV		
	Coordinates: 26728365.46 N 828593.15 E *Elevation:* 1613.35 FT		*Sheet:* 1 *of* 3
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 59.7-69.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/15/2007 13:30	*Depth of Boring:* 70 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/16/2007 08:00	*Water Level:* 25 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
5, 10						SM		**ALLUVIUM:** GRAVELLY SILTY SAND, moderate brown (5YR 4/4), 15% silt, 60% very fine to very coarse grained sand with 25% fine grained angular to subangular volcanic pea gravel to 1/2", moderately soft calcareous cement.	Flush Mount 2" Sch. 40 PVC Riser
15						GP-GM		SANDY SILTY GRAVEL, moderate yellowish brown (10YR 6/4), 10% silt, 50% fine grained subangular volcanic pea gravel to 1/2", 40% very fine to very coarse grained subangular to subrounded sand, moderately soft calcareous cement.	
20						SW-SM		GRAVELLY SILTY SAND, moderate yellowish brown (10YR 6/4), 10% silt, 60% very fine to very coarse grained subangular to subrounded sand, 30% fine grained pea gravel to 1/4", thin caliche stringer at 18-18.5 feet bgs, moderately soft calcareous cement.	
25						GP-GM		SANDY SILTY GRAVEL, very pale orange (10YR 8/2), common moderately hard calcareous cement, 20% silt, 45% fine angular to subangular volcanic pea gravel to 3/4 " with trace 2", 35% very fine to very coarse grained subangular to subrounded sand.	
30						SW-SM		SILTY GRAVELLY SAND, moderate yellowish brown (10YR 5/4), 20% silt, 25% fine grained angular to subangular volcanic pea gravel to 3/8", 55% very fine to very coarse grained subangular to subrounded sand, common soft calcareous coatings. Groundwater encountered at 25 feet bgs.	Cement (94%) and Bentonite (6%) Slurry
35						SM		SILTY SAND, moderate yellowish brown (10YR 5/4), 20% silt, trace pea gravel to 1/4", 80% very fine to very coarse grained subangular to subrounded sand with common calcareous coatings.	

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC	**Well No. PC-134**
	Project Number: 04020-023-160	
	Site Description/Location: West Side of Athens Road Well Field, Henderson, NV	
	Coordinates: 26728365.46 N 828593.15 E *Elevation:* 1613.35 FT	*Sheet:* 2 *of* 3
	Drilling Method: Sonic with continuous coring	*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core *Boring Diameter:* 8 In.	*Screened Interval:* 59.7-69.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish *Date/Time Started:* 12/15/2007 13:30	*Depth of Boring:* 70 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA *Date/Time Finished:* 12/16/2007 08:00	*Water Level:* 25 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						GM		SILTY SANDY GRAVEL, moderate yellowish brown (10YR 5/4), 20% silt, 5-10% very fine to very coarse sand, 70% fine pea gravel to 1/2".	
40						SM		SANDY SILTY INTERBEDDED GRAVEL AND SILTY SAND, moderate yellowish brown (10YR 5/4), fine grained upward sequences, 10-30% silt, 30-50% fine grained pea gravel, 30-50% very fine to very coarse grained subangular to subrounded sand.	
								-poorly graded gravel lens, clean pea gravel from 41-42 feet bgs.	
								-sandy silty interbedded gravel and silty sand lens, very hard calichified sandy gravel from 48.5-49 feet bgs.	
45								-clean pea gravel lens from 45-47 feet bgs.	
								-clean pea gravel from 48-48.5 feet bgs.	
50						CL-ML		**MUDDY CREEK FORMATION:** INTERBEDDED CLAY AND SILT, light greenish gray (5G 8/1) and light brown (5YR 4/6)	Bentonite Seal
55								-silty clay and clayey silt, light greenish gray (5G 8/1) at 54 feet bgs.	Sand Pack (#2-12)
60				1.5				-from 60-62 feet bgs silt sand, 80% very fine grained subrounded to rounded sand with 20% silt.	
								-from 62-70 feet bgs silty clay and clayey silt from 62-64 feet bgs muffled zone of light greenish gray (5G 8/1) and light brown (5YR 6/4) below 64 feet bgs all light brown (5YR 6/4).	
65								-6" lens of sandy (30% very fine grained) silt at 64 feet bgs .	Well Screen (2" Sch. 40 PVC Slot 0.01")
70								-6" zone of 5-10% medium to coarse grained sand in clayey silt at 69.5 feet bgs .	

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. PC-134**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Athens Road Well Field, Henderson, NV		
	Coordinates: 26728365.46 N 828593.15 E *Elevation:* 1613.35 FT		*Sheet:* 3 *of* 3
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 59.7-69.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/15/2007 13:30	*Depth of Boring:* 70 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/16/2007 08:00	*Water Level:* 25 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
								Total Depth = 70 feet. Boring Terminated Target depth achieved	

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. PC-135**
	Project Number: 04020-023-160		
	Site Description/Location: West Side of Athens Road Well Field, Henderson, NV		
	Coordinates: 26728363.6 N 828726.41 E	*Elevation:* 1612.79 FT	*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 19.7-49.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish	*Date/Time Started:* 12/16/2007 08:00	*Depth of Boring:* 51.5 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/16/2007 14:15	*Water Level:* Not Encountered

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
5, 10, 15, 20, 25, 30, 35						SP-SM		**ALLUVIUM:** GRAVELLY SILTY SAND, moderate orange brown (10YR 5/4), 15% silt, 60% very fine to very coarse grained subangular to subrounded sand, 25% fine grained angular to subrounded volcanic pea gravel to 1/2", common calcareous grain coatings (soft).	Flush Mount; 2" Sch. 40 PVC Riser; Cement (94%) and Bentonite (6%) Slurry; Bentonite Seal
						GP-GM		SANDY SILTY GRAVEL, moderate yellowish brown (10YR 6/4), 10% silt, 50% fine grained subangular to subrounded pea gravel to 1/2", 40% very fine to very coarse grained subangular to subrounded sand, moderately soft calcareous grain coatings.	Sand Pack (#2-12)
						SM		INTERBEDDED GRAVELLY SILTY SAND AND GRAVEL, moderate yellowish brown (10YR 5/4), stacked fining-upward sequences 3-5 feet thick, 0-25% silt, 40-60% very fine to very coarse grained subangular to subrounded sand, 15-60% fine grained pea gravel to 1/2". -clean gravel lens from 27.5-28 feet bgs.	
						SW-SM		INTERBEDDED GRAVELLY SILTY SAND AND GRAVEL	
						SM		-clean gravel from 31-32 feet bgs. INTERBEDDED GRAVELLY SILTY SAND AND GRAVEL, groundwater encountered at 32 feet bgs.	Well Screen

Notes:

WELL CONSTRUCTION TRONOX TRONOX CAPTURE WP.GPJ ENSR CA.GDT 4/29/08

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC	**Well No. PC-135**
	Project Number: 04020-023-160	
	Site Description/Location: West Side of Athens Road Well Field, Henderson, NV	
	Coordinates: 26728363.6 N 828726.41 E *Elevation:* 1612.79 FT	*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring	*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core *Boring Diameter:* 8 In.	*Screened Interval:* 19.7-49.7 ft.
Weather: Sunny, cool	*Logged By:* E. Krish *Date/Time Started:* 12/16/2007 08:00	*Depth of Boring:* 51.5 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA *Date/Time Finished:* 12/16/2007 14:15	*Water Level:* Not Encountered

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						GP		INTERBEDDED GRAVELLY SILTY SAND AND GRAVEL, clean gravel from 35-37 feet bgs.	(2" Sch. 40 PVC, 0.01" Slot)
40						SM		INTERBEDDED GRAVELLY SILTY SAND AND GRAVEL	
						GP		INTERBEDDED GRAVELLY SILTY SAND AND GRAVEL, clean gravel from 41-43 feet bgs.	
45						SM		INTERBEDDED GRAVELLY SILTY SAND AND GRAVEL	
						GP		INTERBEDDED GRAVELLY SILTY SAND AND GRAVEL, clean gravel from 45-48 feet bgs.	
						SP		GRAVELLY SILTY SAND, moderate yellowish brown (10YR 5/4), very silty (30%), 20% fine grained subangular pea gravel to 3/8", 50% very fine to very coarse grained subangular to subrounded sand.	
50				1.5		CL		**MUDDY CREEK FORMATION:** SILTY CLAY, light greenish gray (5GY 8/1), 80% clay, 20% silt. -split spoon lithology, silty clayey very fine grained sand, moderate greenish gray (5GY 8/1) at 51.5 feet bgs.	

Total Depth = 51.5 feet.
Boring Terminated
Target depth achieved

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. PC-136**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Athens Road Well Field, Henderson, NV		
	Coordinates: 26728191.37 N 829517.89 E *Elevation:* 1615.08 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 17.7-37.7 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 12/18/2008 11:30	*Depth of Boring:* 38 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/18/2007 15:00	*Water Level:* Not Encountered

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						SP-SM		**ALLUVIUM:** GRAVELLY SAND, light brown (5YR 5/4), 10% silt, 35% fine grained gravel to 3/4" with minor 1-3" from 6-9" , 55% very fine to very coarse grained subangular to subrounded sand, moderate calcareous coatings.	Flush Mount 2" Sch. 40 PVC Riser Cement (94%) and Bentonite (6%) Slurry Bentonite Seal
5									
10									
15						GP-GM		SANDY GRAVEL, light brown (5YR 6/4), 10% silt, 40% very fine to very coarse grained subangular to subrouned sand, 50% fine grained gravel to 3/4" with minor 1-3" ,	Sand Pack (#2-12)
								SANDY GRAVEL, at 17.5 feet bgs cobbles to 6".	
20								SANDY GRAVEL, caliche zone from 19-19.5 feet bgs.	
								SANDY GRAVEL, caliche zone from 22.5-23 feet bgs.	
25								SANDY GRAVEL, groundwater encountered at 32 feet bgs.	
						SM		SILTY GRAVELLY SAND, dark yellowish brown (10YR 4/2), locally up to 25% silt, 35% fine grained angular to subrounded volcanic pea gravel, up to 40% very fine to very coarse grained subangular to subrounded sand, alternating silty and clean sand.	Well Screen (2" Sch. 40 PVC, 0.01" Slot)
30									
						GP-GM		SANDY SILTY GRAVEL, brownish gray, very hard calichification, 20-30% very fine to coarse grained sand in matrix, 10-20% silt. SANDY SILTY GRAVEL, from 32.5-33 feet bgs very silty-40%.	
35									

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. PC-136**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Athens Road Well Field, Henderson, NV		
	Coordinates: 26728191.37 N 829517.89 E *Elevation:* 1615.08 FT		*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 17.7-37.7 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 12/18/2008 11:30	*Depth of Boring:* 38 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/18/2007 15:00	*Water Level:* Not Encountered

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						GP-GM		SANDY SILTY GRAVEL, brownish gray, very hard calichification, 20-30% very fine to coarse grained sand in matrix, 10-20% silt. *(continued)*	
						CL		**MUDDY CREEK FORMATION:** CLAY, light greenish gray (10Y 7/1).	

Total Depth = 38 feet.
Boring Terminated
Target depth achieved

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC		**Well No. PC-137**
	Project Number: 04020-023-160		
	Site Description/Location: East Side of Athens Road Well Field, Henderson, NV		
	Coordinates: 26728198.98 N 829517.57 E *Elevation:* 1614.83 FT		*Sheet:* 1 *of* 2
	Drilling Method: Sonic with continuous coring		*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core	*Boring Diameter:* 8 In.	*Screened Interval:* 59.7-69.7 ft.
Weather: NA	*Logged By:* E. Krish	*Date/Time Started:* 12/17/2007 14:15	*Depth of Boring:* 70 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA	*Date/Time Finished:* 12/17/2007 17:30	*Water Level:* 28 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
5, 10, 15						SP-SM		**ALLUVIUM:** GRAVELLY SAND, light brown (5YR 6/4), 10% silt, 70% very fine to very coarse grained, subangular to subrounded sand, 20% fine grained volcanic pea gravel, subangular to subrounded to 3/4" with minor 1-2", moderately soft calcareous grain coatings.	Flush Mount 2" Sch. 40 PVC Riser
20, 25						GP-GM		SANDY GRAVEL, light brown (5YR 6/4), 10% silt, 30% very fine to very coarse grained subangular to subrounded sand, 60% fine, angular to subrounded, pea gravel to 1/4", moderate calcareous coatings. -groundwater encoutered at 21 feet bgs.	
30						SP		GRAVELLY SAND, moderate brown (5YR 4/2), 5% silt, 15% fine grained angular to subrounded , volcanic pea gravel to 3/8", 80% very fine to very coarse grained, subangular to subround sand	Cement (94%) and Bentonite (6%) Slurry
35						GM		SANDY SILTY GRAVEL, very pale orange (10YR 8/2), 20% silt, 30% very fine to very coarse grained subangular to subrounded sand, 50% fine grained angular to subangular pea gravel to 3/8" with minor 1". -hard calichified zone from 34-36 feet bgs.	

Notes:

ENSR | AECOM ENSR 1220 Avenida Acaso Camarillo, CA 93012 (805)388-3775	*Client:* Tronox LLC	**Well No. PC-137**
	Project Number: 04020-023-160	
	Site Description/Location: East Side of Athens Road Well Field, Henderson, NV	
	Coordinates: 26728198.98 N 829517.57 E *Elevation:* 1614.83 FT	*Sheet:* 2 *of* 2
	Drilling Method: Sonic with continuous coring	*Monitoring Well Installed:* Yes
	Sample Type(s): Split Spoon and Core *Boring Diameter:* 8 In.	*Screened Interval:* 59.7-69.7 ft.
Weather: NA	*Logged By:* E. Krish *Date/Time Started:* 12/17/2007 14:15	*Depth of Boring:* 70 ft.
Drilling Contractor: Boart Longyear / D. Cervantez	*Backfill:* NA *Date/Time Finished:* 12/17/2007 17:30	*Water Level:* 28 ft.

DEPTH (ft)	Sample ID	Sample Depth (ft)	Blows per 6"	Recovery (ft)	Headspace (ppm)	USCS	Graphic Log	MATERIAL IDENTIFICATION, color, description of fine grained material (silt and clay) description of coarse grained material (sand and gravel), structural or mineralogical features, density or stiffness, moisture content, odors or staining.	Well Diagram
						GM			
						CL-ML		**MUDDY CREEK FORMATION:** INTERBEDDED SILTY CLAY AND SANDY CLAYEY SILT, yellow gray (5Y8/1) to medium gray (N5), predominately low plastic fines with up to 20% very fine grained sand present	
								-light greenish gray (5GY 8/1) from 38 to 40 feet bgs.	
40								-yellowish gray (5Y 7/2) from 40 to 49 feet bgs.	
45									
50								-mottled dark yellowish green (5Y 6/2) to dark gray (5Y 9/1) from 49 to 50.5 feet bgs.	
						CL-ML		SANDY AND SILTY CLAY, medium gray (N5) and light gray (N7) 25% silt, 15% very fine grained sand.	Bentonite Seal
55						ML		SANDY SILT, dusky yellow (5Y 6/4) , 20% very fine grained sand.	
						ML		SANDY SILT, pale olive (10YR 6/2)	Sand Pack #2-12
						SM		SILTY SAND, medium blue gray (5B 5/1), 30% silt, 70% very fine grained sand.	
60				1.5		CL		SILTY CLAY AND CLAYEY SILT, greenish gray (5G 6/1), disseminated very fine grained marcasite.	
						SM		SILTY AND CLAYEY SAND, greenish gray (5G 6/1), 40% silty clay, 60% very fine grained sand, disseminated very fine grained marcasite.	
65						CL		CLAY WITH GYPSUM CRYSTALS, dark yellowish brown (10YR 4/2), abundant gypsum crystals 3/8 to 11/2".	Well Screen (2" Sch. 40 PVC 0.01" Slot)
						CL		INTERBEDDED SILTY CLAY AND CLAYEY SILT, moderate brown (10YR 5/4), no crystals.	
70									

Notes:

Total Depth = 70 feet.
Boring Terminated
Target depth achieved

ATTACHMENT C TO THE GROUNDWATER CAPTURE REPORT

Well/Piezometer Well Development Records

ENSR

Well/Piez. ID: I-2

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/8/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter ~~6"~~ 4" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 16.6

Depth to Bottom of Screen (ft.) 36.6

Total Well Depth (ft.) 38.42

Depth to Static Water Level (ft.) 21.9

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1525

Calculate Purge Volume (gal.) 33

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 6/03

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1545	94	25.87	7.40	10234	—	50.5	lt brn		200.9
50	124	25.70	7.37	10282	—	49.1	"		202.1
55	154	25.76	7.37	10317	—	48.7	clear		203.7
1600	184	26.10	7.36	10304	—	46.2	"		204.4
05	214	26.01	7.36	10327	—	47.8	"		203.8
1606	220	25.92	7.37	10301	—	48.1	"		203.1

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 33 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No turbidity meter

Signature Ed Krish Date: 2/8/08

ENSR

Well/Piez. ID: I-V

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/7/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description: PVC-TOC

Depth to Top of Screen (ft.): 14.7

Depth to Bottom of Screen (ft.): 44.7

Total Well Depth (ft.): 47.4

Depth to Static Water Level (ft.): 29.95

Geology at Screen Interval (if known): Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement: 1445

Calculate Purge Volume (gal.): 78

Disposal Method: GWTP Sump

Wellhead PID/FID: NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development: 2/99

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1510	9	24.61	7.46	14358	—	79.6	lt brn		183.3
15	41	24.82	7.47	14377	-	78.9	clear		183.9
20	77	24.90	7.46	14309	-	79.2	"		185.0
25	111	25.01	7.47	14360	-	80.1	"		184.7
1530	145	25.00	7.46	14319	-	78.9	"		183.9

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 78 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No turbidity meter

Signature: Sal Krish Date: 2/7/08

ENSR

Well/Piez. ID: I-4

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/6/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 14.6

Depth to Bottom of Screen (ft.) 44.6

Total Well Depth (ft.) 47.50

Depth to Static Water Level (ft.) 30.34

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 0730

Calculate Purge Volume (gal.) 77

Disposal Method GWTP sump

Wellhead PID/FID N/A

Original Well Development ☐ Redevelopment ☒ Date of Original Development 2/99

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
		27.44	7.23	19079	—	46.6	lt brn		188.2
		28.47	7.20	19610	—	46.1	"		186.8
		28.89	7.21	19690	—	42.4	clear		186.2
		29.15	7.20	19648	—	40.6	"		186.3
	80	29.26	7.19	19721	—	41.8	"		186.2

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 77 gallons

Maximum Turbidity Allowed N/A NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/6/08

ENSR

Well/Piez. ID: I-T

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/5/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description TOC - PVC

Depth to Top of Screen (ft.) 14.6

Depth to Bottom of Screen (ft.) 44.6

Total Well Depth (ft.) 47.83

Depth to Static Water Level (ft.) 29.25

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine-grained facies

Time of Water Level Measurement 1420

Calculate Purge Volume (gal.) 84

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 2/99

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1640	88	23.81	7.07	17179	—	67.6	lt brn		212.6
1645	90	25.66	7.05	17859	—	66.6	"		209.8
1650	92	27.21	7.04	18320	—	60.1	clear		204.9
1655	94	27.58	7.05	18553	—	59.4	"		201.4
1700	96	28.61	7.06	18666	—	60.5	"		200.2
1710	100	28.99	7.05	18338	—	60.4	"		196.7

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 84 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/5/08

ENSR

Well/Piez. ID: I-S

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - VEOLIA SITE

Project No: 04020-023-160 Date: 12/14/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 14.5

Depth to Bottom of Screen (ft.) 44.5

Total Well Depth (ft.) 47.7

Depth to Static Water Level (ft.) 28.49

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1330

Calculate Purge Volume (gal.) 86

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 2/99

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1340	3				—		lt brn		
1400	60						milky		
1420	120						clear		
1440	180						"		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) _____ gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No parameter meters

Signature Ed Krish Date: 12/14/07

ENSR

Well/Piez. ID: I-R

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - VEOLIA SITE

Project No: 04020-023-160 Date: 12/13/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 12.1

Depth to Bottom of Screen (ft.) 42.1

Total Well Depth (ft.) 45.3

Depth to Static Water Level (ft.) 30.0

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1150

Calculate Purge Volume (gal.) 69

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development _____

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1200	1				—		lt brn		
1215	33						milky		
1230	67						clear		
1300	132						"		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 69 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No parameter meters

Signature _____ Date: _____

ENSR

Well/Piez. ID: I-9

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/5/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description TOC-PVC

Depth to Top of Screen (ft.) 13.3

Depth to Bottom of Screen (ft.) 43.3

Total Well Depth (ft.) 43.8

Depth to Static Water Level (ft.) 30.5

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine-grained facies

Time of Water Level Measurement 0930

Calculate Purge Volume (gal.) 60

Disposal Method GWTP Sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 3/58

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1255	50	27.45		17689	—	48.0	lt brn		199.6
1320	75	27.26		16921		60.9	clear		200.5
1330	85	27.56		18189		62.9	"		194.7
1340	95	27.73		18387		63.9	"		196.4
1355	120	27.83		18278		61.7	"		198.2

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 60 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/5/08

ENSR

Well/Piez. ID: I-P

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/7/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 16.5

Depth to Bottom of Screen (ft.) 46.5

Total Well Depth (ft.) 47.3

Depth to Static Water Level (ft.) 30.54

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 0610

Calculate Purge Volume (gal.) 80

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 3/98

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
0730	26	24.07	7.19	16177	—	77.1	lt brn		179.8
0735	41	24.51	7.14	16252	—	78.4	"		174.5
40	69	24.58	7.17	16408	—	83.5	clear		175.3
50	112	24.95	7.22	16377	—	83.8	"		170.7
0800	155	25.38	7.21	16377	—	84.3	"		170.0

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 80 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/7/08

ENSR

Well/Piez. ID: I-0

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/7/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 12.8

Depth to Bottom of Screen (ft.) 42.8

Total Well Depth (ft.) 43.9

Depth to Static Water Level (ft.) 30.35

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1030

Calculate Purge Volume (gal.) 61

Disposal Method GWTP Sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 10/93

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1100	44	24.23	7.45	16008	—	85.0	lt brn		190.6
10	66	24.49	7.41	16154	-	83.7	clear		190.9
20	88	24.87	7.39	16222	-	82.2	"		190.7
1130	110	24.96	7.42	16243	-	82.7	"		188.8

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 61 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/7/08

ENSR

Well/Piez. ID: I-N

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/4/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description TOC-PVC

Depth to Top of Screen (ft.) 10.6

Depth to Bottom of Screen (ft.) 40.6

Total Well Depth (ft.) 41.6

Depth to Static Water Level (ft.) 28.5

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1200

Calculate Purge Volume (gal.) 60

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 10/93

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1445	194	25.54	6.97	12283	—	38.3	Hbrn		171.8
1450	234	25.44	6.96	12490	—	26.3	clear		173.0
1500	274	25.19	6.97	12488	—	32.4	clear		173.0
1504	290	25.60	6.95	12444	—	29.8	clear		173.2

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 60 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Kirk Date: 2/4/08

ENSR.

Well/Piez. ID: I-M

Well/Piezometer Development Record

Client: Tronox Site Location: VEOLIA

Project No: 04020-023-160 Date: 12-19-07 Developer: Ken Maye (Boart Longyear)

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Schd. 40 PVC

Measuring Point Description: TOC-PVC

Depth to Top of Screen (ft.): 12.7

Depth to Bottom of Screen (ft.): 42.7

Total Well Depth (ft.): 43.50

Depth to Static Water Level (ft.): 31.40

Geology at Screen Interval (if known): Qal / MC

Time of Water Level Measurement: 0700

Calculate Purge Volume (gal.): ~55

Disposal Method: GWTP Sump

Wellhead PID/FID: NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development: 10/92

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Grundfos.

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
0743	2						Brown		
0750	12						Lt Brn.		
0844	30						Clear		
0904	69						Clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 55 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☐	☐	☒

If no or N/A explain below: Did not have water quality meter.

Signature [signature] Date: 12-19-07

ENSR

Well/Piez. ID: I-L

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - VEOLIA SITE

Project No: 04020-023-160 Date: 12/14/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 12.4

Depth to Bottom of Screen (ft.) 42.4

Total Well Depth (ft.) 43.40

Depth to Static Water Level (ft.) 29.52

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 0920

Calculate Purge Volume (gal.) 62.5

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development _____

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
0930	1				—		lt brn		
0945	34						clear		
1000	68						"		
1030	138						"		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) _____ gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No parameter meters

Signature _____ Date: _____

ENSR

Well/Piez. ID: I-K

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/9/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 11.1

Depth to Bottom of Screen (ft.) 39.3

Total Well Depth (ft.) 39.89

Depth to Static Water Level (ft.) 23.57

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement

Calculate Purge Volume (gal.) 73

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 12/86

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1110	13.5	25.99	7.52	6344	—	34.4	lt brn		170.7
20	60	25.91	7.56	6960	—	30.5	"		167.2
30	105	25.84	7.55	6952	—	29.3	"		165.9
40	150	25.75	7.58	6956	—	29.7	clear		163.6
50	195	25.90	7.55	6965	—	30.3	"		164.3
1200	240	25.98	7.56	6970	—	30.5	"		165.3

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 73 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/9/08

ENSR

Well/Piez. ID: I-J

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/9/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 14.8

Depth to Bottom of Screen (ft.) 44.1

Total Well Depth (ft.) 44.54

Depth to Static Water Level (ft.) 27.33

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 0800

Calculate Purge Volume (gal.) 77

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 12/86

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
0815	108	23.08	7.80	7221	—	90.2	lt brn		161.7
20	144	23.30	7.79	7261	—	82.9	lt brn		162.0
25	180	24.09	7.76	7285	—	81.1	clear		163.4
30	216	23.81	7.77	7295	—	80.5	"		163.4
33	238	24.00	7.76	7275	—	80.9	"		162.9

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 77 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/9/08

ENSR

Well/Piez. ID: I-I

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/8/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 14.5

Depth to Bottom of Screen (ft.) 43.7

Total Well Depth (ft.) 42.58

Depth to Static Water Level (ft.) ~~24.6~~ 22.3

Geology at Screen Interval (if known) Alluvium/muddy creek - fine grained facies

Time of Water Level Measurement 1215

Calculate Purge Volume (gal.) 91

Disposal Method GWTP sump

Wellhead PID/FID N/A

Original Well Development ☐ Redevelopment ☒ Date of Original Development 12/86

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1220	50	25.37	7.48	13497	—	84.3	lt brn		206.2
25	100	25.46	7.48	13537	–	78.3	lt brn		208.6
30	150	25.58	7.48	13573	–	77.2	clear		210.6
35	200	25.50	7.47	13560	–	79.2	"		209.3
40	250	25.61	7.47	13580	–	79.9	"		208.9

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 91 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature _____ Date: _____

ENSR

Well/Piez. ID: I-H

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/6/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 16.5

Depth to Bottom of Screen (ft.) 46.0

Total Well Depth (ft.) 46.2

Depth to Static Water Level (ft.) 31.1

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement

Calculate Purge Volume (gal.) 68

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 9/86

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1240	60	25.03	7.19	17256	—	83.0	lt brn		192.3
50	70	26.24	7.19	17530	—	82.6	clear		196.3
1300	80	26.37	7.18	17562	—	82.3	"		196.7
10	90	26.47	7.19	17531	—	82.2	"		196.3
20	100	26.34	7.18	17640	—	82.0	"		197.4

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 68 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/6/08

ENSR

Well/Piez. ID: I-G

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - VEOLIA SITE

Project No: 04020-023-160 Date: 12/15/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 12.8

Depth to Bottom of Screen (ft.) 42.1

Total Well Depth (ft.) 42.60

Depth to Static Water Level (ft.) 30.39

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1250

Calculate Purge Volume (gal.) 55

Disposal Method GWTP Sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 12/86

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1300	1				—		lt brn		
1315	15						"		
1330	30						milky		
1400	60						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 55 gallons

Maximum Turbidity Allowed NA NTUs

Stablization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No parameter meters

Signature Ed Kirk Date: 12/15/07

ENSR

Well/Piez. ID: I-F

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/5/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description

Depth to Top of Screen (ft.) 13.8

Depth to Bottom of Screen (ft.) 45.3

Total Well Depth (ft.) 45.8

Depth to Static Water Level (ft.) 28.05

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 0630

Calculate Purge Volume (gal.) 80

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 9/86

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
0645	100	24.78	7.07	15289	—	24.2			162.8
0700	160	25.68	7.17	15558	—	43.7			169.5
0715	300	24.86	7.28	15314	—	43.8			160.3
0730	440	24.63	7.15	15293	—	42.7			168.5

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 80 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krisly Date: 2/5/08

ENSR

Well/Piez. ID: I-E

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/4/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description: TOC-PVC

Depth to Top of Screen (ft.): 23.90

Depth to Bottom of Screen (ft.): 45.90

Total Well Depth (ft.): 46.58

Depth to Static Water Level (ft.): 32.1

Geology at Screen Interval (if known): Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement: 0700

Calculate Purge Volume (gal.): 65

Disposal Method: GWTP sump

Wellhead PID/FID:

Original Well Development ☐ Redevelopment ☒ Date of Original Development: 12/86

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
10:38	98	26.17	7.06	6106	—	47.5	Lt Brn		121.6
:42	1	27.32	7.08	12390	—	56.9	lt Brn		121.4
44		26.50	7.16	12155	—	59.5	lt brn		126.3
46		26.89	7.11	12050	—	59.9	clear		130.4
48		26.85	7.12	12178	—	86.7	clear		133.4
55		27.18	7.14	12301	—	90.0	clear		133.4
11:00	135	27.25	7.13	12300	—	87.3	clear		132.6

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 65 gallons

Maximum Turbidity Allowed N/A NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/4/08

ENSR.

Well/Piez. ID: I-D

Well/Piezometer Development Record

Client: TRONOX Site Location: VEOLIA

Project No: 04020-023 Date: 12-18-07 Developer: Ken May

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch. 40 PVC

Measuring Point Description: N. Rim of casing

Depth to Top of Screen (ft.): ~~~~ 18.7

Depth to Bottom of Screen (ft.): ~~~~ 47.2

Total Well Depth (ft.): 48.05

Depth to Static Water Level (ft.): 31.63

Geology at Screen Interval (if known): Gravelly Sand to 27.5, Silty Clay 27.5-43

Time of Water Level Measurement: 1230

Calculate Purge Volume (gal.): 74

Disposal Method: GWTP Sump

Wellhead PID/FID: NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development: 9/86

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bailer, Grundfos pump

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1255	0						Red/Brn.		
1311	18						Red/Brn.		
1348	50						Lt Brn		
1425	100						Clear		
1500	150						Clear		
1505	160						Clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 74 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☐	☐	☒

If no or N/A explain below:

Signature _____ Date: _____

ENSR.

Well/Piez. ID: I-C

Well/Piezometer Development Record

Client: Tronox Site Location: VEOLIA

Project No: 04020-023-160 Date: 12-18-07 Developer: Ken Maye

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sched. 40 PVC

Measuring Point Description: N. Rim

Depth to Top of Screen (ft.): ~~~13~~ 14

Depth to Bottom of Screen (ft.): ~43.3

Total Well Depth (ft.): 45.33

Depth to Static Water Level (ft.): 31.60

Geology at Screen Interval (if known): Gravelly Sand to 27.5; Silty Clay 27.5 to 43

Time of Water Level Measurement: 0650

Calculate Purge Volume (gal.): ~62

Disposal Method: GWTP Sump

Wellhead PID/FID: NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development: 9/86

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Grundfos Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
0930	0						Brn.		
0940	12						Brn.		
0951	22						Lt brn		
1012	100						Clear		
1029	150						Clear		
1045	200						Clear		
1100	250						Clear		
1115	280						Clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 62 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☐	☐	☒

If no or N/A explain below: Did not have water quality Meter

Signature [signature] Date: 12-18-07

ENSR

Well/Piez. ID: I-B

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - VEOLIA SITE

Project No: 04020-023-160 Date: 12/13/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 20.5

Depth to Bottom of Screen (ft.) 45.2

Total Well Depth (ft.) 45.7

Depth to Static Water Level (ft.) 31.4

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1505

Calculate Purge Volume (gal.) 64

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 10/86

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1515	1				—		lt brn		
1530	19						milky		
1545	39						clear		
1615	75						"		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 64 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No parameter meters

Signature Ed Krish Date: 12/13/07

ENSR

Well/Piez. ID: I-AA

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - VEOLIA SITE

Project No: 04020-023-160 Date: 12/15/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 6" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 26.6

Depth to Bottom of Screen (ft.) 46.6

Total Well Depth (ft.) 48.9

Depth to Static Water Level (ft.) 32.85

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1130

Calculate Purge Volume (gal.) 72

Disposal Method GWTP Sump

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☒ Date of Original Development NA

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1115	1				—		lt brn		
1130	19						"		
1145	37						milky		
1215	75						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 72 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No parameter meters

Signature Ed Krish Date: 12/15/07

ENSR

Well/Piez. ID: M-72

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/7/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter ~~6"~~ 2" Material Sch 40 PVC

Measuring Point Description: PVC-TOC

Depth to Top of Screen (ft.): 12.0

Depth to Bottom of Screen (ft.): 36.7

Total Well Depth (ft.): 36.87

Depth to Static Water Level (ft.): 32.04

Geology at Screen Interval (if known): Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement:

Calculate Purge Volume (gal.): 2.5

Disposal Method: GWTP sump

Wellhead PID/FID: NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development: 12/86

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
1600	0	23.06	7.53	9486	—	62.9	lt brn		201.2
10	.625	23.60	7.55	9490	—	66.7	lt brn		203.1
20	1.25	23.65	7.56	9383	—	65.2	Clear		204.1
30	1.875	23.39	7.55	9426	—	67.2	"		203.8
1640	2.5	23.75	7.56	9455	—	65.8	"		204.1

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 2.5 gallons

Maximum Turbidity Allowed N/A NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/7/08

ENSR

Well/Piez. ID: M-70

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/8/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter ~~6"~~ 2" Material Sch 40 PVC

Measuring Point Description: PVC-TOC

Depth to Top of Screen (ft.): 17.5

Depth to Bottom of Screen (ft.): 42.2

Total Well Depth (ft.): 42.44

Depth to Static Water Level (ft.): 33.57

Geology at Screen Interval (if known): Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement: 0850

Calculate Purge Volume (gal.): 4.5

Disposal Method: GWTP sump

Wellhead PID/FID: NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development: 12/86

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
0900	1	23.43	7.53	10147	—	48.5	lt brn		183.6
15	10	24.00	7.50	10198	—	43.9	clear		166.6
30	20	24.22	7.51	10265	—	40.7	"		164.6
45	30.6	23.97	7.50	10231	—	38.9	"		165.0
1000	40	24.39	7.49	10294		39.2	"		167.2

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 4.5 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/8/08

ENSR

Well/Piez. ID: M-71

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 2/8/08 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter ~~6"~~ 2" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 19.7

Depth to Bottom of Screen (ft.) 44.2

Total Well Depth (ft.) 44.38

Depth to Static Water Level (ft.) 34.6

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 0700

Calculate Purge Volume (gal.) 5

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development 12/86

DEVELOPMENT METHOD Surge, Bail, Brush **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
YSI	650 D	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	% DO	Color	Odor	ORP Other
0730	11.25	23.58	7.48	8180	—	66.3	lt brn		204.9
40	15.0	23.39	7.42	8119	—	61.4	clear		204.5
0750	18.75	23.40	7.43	8095	—	63.2	"		201.9
0806	22.5	23.60	7.45	8120	—	63.9	"		202.8

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 5 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters 10 %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No turbidity meter

Signature Ed Krish Date: 2/8/08

ENSR

Well/Piez. ID: AA-MW-16

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 12/11/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 27.5

Depth to Bottom of Screen (ft.) 42.5

Total Well Depth (ft.) 42.8

Depth to Static Water Level (ft.) 34.40

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1315

Calculate Purge Volume (gal.) 4

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☐ Date of Original Development NA

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1320	1				—		lt brn		
1340	11						"		
1400	31						clear		
1420	52						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 4 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No parameter meters

Signature Ed Krish Date: 12/11/07

ENSR

Well/Piez. ID: ARP-4A

Well/Piezometer Development Record

Client: Tronox Site Location: Athens Road

Project No: 04020-023-160 Date: 12-17-07 Developer: Kenny Maye (Boart Longyear)

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Schedule 40 PVC

Measuring Point Description N. Rim (~2' stickup) Geology at Screen Interval (if known) Alluvium

Depth to Top of Screen (ft.) 17.4

Depth to Bottom of Screen (ft.) 32.4 Time of Water Level Measurement 1000

Total Well Depth (ft.) 35.50 Calculate Purge Volume (gal.) ~2

Depth to Static Water Level (ft.) 31.52 Disposal Method ~~55 gal. Drums~~ GWTP

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☐ Date of Original Development 12-17-07

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Sub. pump

Field Testing Equipment Used: Make Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1007	1						lt brn		
1015	2.5						lt brn		
1030	8						"		
1057	18						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (____ well volumes) _____gallons

Maximum Turbidity Allowed _____ NTUs

Stabilization of parameters _____%

	Yes	No	N/A
Has required volume been removed	☐	☐	☐
Has required turbidity been reached	☐	☐	☐
Have parameters stabilized	☐	☐	☐

If no or N/A explain below:

Signature Ed Krish Date: 12/17/07

ENSR

Well/Piez. ID: ARP-5A

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - Athens Rd Area

Project No: 04020-023-160 Date: 12/17/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 12.3

Depth to Bottom of Screen (ft.) 37.3

Total Well Depth (ft.) 41.5

Depth to Static Water Level (ft.) 35.67

Geology at Screen Interval (if known) Alluvium/~~Muddy Creek Formation~~ ~~gravel and fines~~

Time of Water Level Measurement 0800

Calculate Purge Volume (gal.) 2

Disposal Method GWTP Sump

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☐ Date of Original Development NA

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
0805	1				—		lt brn		
0819	4						"		
0835	9						"		
0845	12						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 2 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No parameter meters

Signature Ed Krish Date: 12/17/07

ENSR

Well/Piez. ID: M-111A

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - TRONOX SITE

Project No: 04020-023-160 Date: 12/16/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 32.2

Depth to Bottom of Screen (ft.) 42.2

Total Well Depth (ft.) 42.5

Depth to Static Water Level (ft.) 35.07

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1540

Calculate Purge Volume (gal.) 4

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☐ Date of Original Development NA

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1555	1				—		lt brn		
1600	4.5						"		
1620	9						"		
1640	16						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 4 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No parameter meters

Signature Ed Krish Date: 12/16/07

ENSR

Well/Piez. ID: M-126

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 12/11/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 22.3

Depth to Bottom of Screen (ft.) 42.3

Total Well Depth (ft.) 43.58

Depth to Static Water Level (ft.) 33.07

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 0900

Calculate Purge Volume (gal.) 5

Disposal Method GWTP Sump

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☒ Date of Original Development NA

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
0905	1				—		lt brn		
0930	26						"		
1000	56						clear		
1015	70						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 5 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No parameter meters

Signature Ed Krish Date: 12/11/07

ENSR

Well/Piez. ID: M-131

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 12/11/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 31.8

Depth to Bottom of Screen (ft.) 41.8

Total Well Depth (ft.) 42.1

Depth to Static Water Level (ft.) 30.51

Geology at Screen Interval (if known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement

Calculate Purge Volume (gal.) 6

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☒ Date of Original Development NA

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1545	2				—		lt brn		
1600	10						H brn		
1620	20						clear		
1640	24						"		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 6 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No parameter meters

Signature Ed Krish Date: 12/11/07

ENSR

Well/Piez. ID: M-132

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - VEOLIA SITE

Project No: 04020-023-160 Date: 12/16/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 82.6

Depth to Bottom of Screen (ft.) 92.6

Total Well Depth (ft.) 92.86

Depth to Static Water Level (ft.) 27.82

Geology at Screen Interval (If known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1325

Calculate Purge Volume (gal.) 33

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☒ Date of Original Development NA

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1335	1				—		lt brn		
1345	3						"		
1400	6						"		
1420	9						clear/ milky		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 33 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No parameter meters

well too slow recharging

Signature _____ Date: _____

ENSR

Well/Piez. ID: M-133

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - VEOLIA SITE

Project No: 04020-023-160 Date: 12/ /07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description: PVC-TOC

Depth to Top of Screen (ft.): 62.4

Depth to Bottom of Screen (ft.): 72.4

Total Well Depth (ft.): 72.69

Depth to Static Water Level (ft.): 28.98

Geology at Screen Interval (if known): Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement: 0915

Calculate Purge Volume (gal.): 22

Disposal Method: GWTP sump

Wellhead PID/FID: NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development _____

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
0920	2				—		lt brn		
1020	21						"		
1045	22						"		
1120	30						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 22 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No parameter meters

Signature _____ Date: _____

ENSR

Well/Piez. ID: M-134

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 12/ /07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 62.5

Depth to Bottom of Screen (ft.) 72.5

Total Well Depth (ft.) 72.76

Depth to Static Water Level (ft.) 31.87

Geology at Screen Interval (If known) Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement 1245

Calculate Purge Volume (gal.) 21

Disposal Method GWTP sump

Wellhead PID/FID NA

Original Well Development ☐ Redevelopment ☒ Date of Original Development _____

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1255	1.5				—		lt brn		
1300	3						"		
1330	12						clear		
1350	18						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 21 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No parameter meters

Signature Ed Kish Date: 12/12/07

ENSR

Well/Piez. ID: M-135

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV

Project No: 04020-023-160 Date: 12/12/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description: PVC-TOC

Depth to Top of Screen (ft.): 31.4

Depth to Bottom of Screen (ft.): 41.4

Total Well Depth (ft.): 42.33

Depth to Static Water Level (ft.): 32.16

Geology at Screen Interval (if known): Alluvium/Muddy Creek - fine grained facies

Time of Water Level Measurement: 0920

Calculate Purge Volume (gal.): 6

Disposal Method: GWTP Sump

Wellhead PID/FID: NA

Original Well Development ☒ Redevelopment ☐

Date of Original Development: NA

DEVELOPMENT METHOD Surge, Bail

PURGE METHOD Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
0925	3				—		lt brn		
0935	6						"		
1000	18						clear		
1020	36						clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 6 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No parameter meters

Signature Ed Krish Date: 12/12/07

ENSR

Well/Piez. ID: M-136

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - VEOLIA SITE

Project No: 04020-023-160 Date: 12/12/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description PVC-TOC

Depth to Top of Screen (ft.) 82.5

Depth to Bottom of Screen (ft.) 92.5

Total Well Depth (ft.) 92.78

Depth to Static Water Level (ft.) 27.85

Geology at Screen Interval (if known) Alluvium/muddy creek - fine grained facies

Time of Water Level Measurement 1515

Calculate Purge Volume (gal.) 33

Disposal Method GWTP sump

Wellhead PID/FID N/A

Original Well Development ☐ Redevelopment ☒ Date of Original Development _____

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used:

Make	Model	Serial Number
NA		

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1525	8				—		lt brn		
1545	38						clear		
1600	60						"		
1620	90						"		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 33 gallons

Maximum Turbidity Allowed N/A NTUs

Stabilization of parameters N/A %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below:

No parameter meters

Signature Ed Krish Date: 12/12/07

ENSR.

Well/Piez. ID: TC-134

Well/Piezometer Development Record

Client: TRONOX Site Location: Athens Road

Project No: 04020-023 Date: 12-17-07 Developer: Ken Mayo

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Schedule 40 PVC

Measuring Point Description N. Rim of casing. Geology at Screen Interval (if known) McFg 1

Depth to Top of Screen (ft.) 59.3

Depth to Bottom of Screen (ft.) 69.3 Time of Water Level Measurement 1430

Total Well Depth (ft.) 61.56 - 70.00 after bailed Calculate Purge Volume (gal.) ~20

Depth to Static Water Level (ft.) 25.73 Disposal Method ~~55-gal drums~~ GWTP

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☐ Date of Original Development 12-17-07

DEVELOPMENT METHOD bail, surge **PURGE METHOD** pump, bail

Field Testing Equipment Used:

Make	Model	Serial Number
Horiba	U-22	

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1436	0	23.9	6.94	8.49	—	2.81	Brown	None	
1455	10	22.2	8.12	5.99	-5.0	3.56	Brown	None	
1600	20	19.0	5.36	4.61	234	5.96	Clear	None	

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 20 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☐	☐	☒

If no or N/A explain below:

Signature [signature] Date: 12-17-07

ENSR.

Well/Piez. ID: PC-135

Well/Piezometer Development Record

Client: Tronox Site Location: Athens Road

Project No: 04020-623 Date: 12-17-07 Developer: Kenny Mage (Board Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Shedule 40

Measuring Point Description: N. Rim

Depth to Top of Screen (ft.): 19.4

Depth to Bottom of Screen (ft.): 49.4

Total Well Depth (ft.): 50.05

Depth to Static Water Level (ft.): 28.66

Geology at Screen Interval (if known): mcfg 1

Time of Water Level Measurement: 1145

Calculate Purge Volume (gal.): ~12

Disposal Method: ~~55 gal drums~~ GWTP

Wellhead PID/FID: NA

Original Well Development ☒ Redevelopment ☐ Date of Original Development: 12-17-07

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Sub Pump

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1241	0						Brown		
1246	10						Milky		
1251	20						Milky/Clear		
1301	40						Clear		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 12 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA%

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☐	☐	☒

If no or N/A explain below: Did not have water quality meter.

Signature [signature] Date: 12-17-07

ENSR

Well/Piez. ID: PC-136

Well/Piezometer Development Record

Client: TRONOX Site Location: Henderson, NV - Athens Rd Area

Project No: 04020-023-160 Date: 12/19/07 Developer: Ken Ney - Longyear

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch 40 PVC

Measuring Point Description PVC - TOC

Depth to Top of Screen (ft.) 17.3

Depth to Bottom of Screen (ft.) 37.3

Total Well Depth (ft.) 37.62

Depth to Static Water Level (ft.) 30.8

Geology at Screen Interval (if known) Alluvium / ~~Muddy Creek Fm~~ ~~gravel, fractures~~

Time of Water Level Measurement 1510

Calculate Purge Volume (gal.) 3.5

Disposal Method GWTP Sump

Wellhead PID/FID NA

Original Well Development ☒ Redevelopment ☒ Date of Original Development NA

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Pump

Field Testing Equipment Used: Make NA Model Serial Number

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1515	9				—		lt brn		
1530	36						clear		
1540	54						"		
1550	72						"		

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 3.5 gallons

Maximum Turbidity Allowed NA NTUs

Stabilization of parameters NA %

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☒	☐	☐

If no or N/A explain below: No parameter meters

Signature Ed Krish Date: 12/19/07

ENSR

Well/Piez. ID: PC-137

Well/Piezometer Development Record

Client: Tronox Site Location: Athens Road

Project No: 04020-023-160 Date: 12-19-07 Developer: Ken Maye

WELL/PIEZOMETER DATA

Well ☒ Piezometer ☐ Diameter 2" Material Sch. 40 PVC

Measuring Point Description: N. Rim of Casing

Depth to Top of Screen (ft.): 60

Depth to Bottom of Screen (ft.): 70

Total Well Depth (ft.): 70.25

Depth to Static Water Level (ft.): 28.22

Geology at Screen Interval (if known): silty clay (mc-gb)

Time of Water Level Measurement: 1119

Calculate Purge Volume (gal.): ~21

Disposal Method: GWTP Sump

Wellhead PID/FID: NA

Original Well Development ☒ Redevelopment ☐ Date of Original Development 12-19-07

DEVELOPMENT METHOD Surge, Bail **PURGE METHOD** Bail, Purge

Field Testing Equipment Used: Make / Model / Serial Number: NA

Field Testing Calibration Documentation Found in Field Notebook # _____ Page # _____

Time	Volume Removed (gal)	T° (C/F)	pH	Spec. Cond (umhos)	Turbidity (NTUs)	DO	Color	Odor	Other
1217	1						green gray		
1227	10						" "		
1237	15						" "		
1247	27						Milky		Increased flow to 1.8 gpm

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (3 well volumes) 21 gallons

Maximum Turbidity Allowed _____ NTUs

Stabilization of parameters _____%

	Yes	No	N/A
Has required volume been removed	☒	☐	☐
Has required turbidity been reached	☐	☐	☒
Have parameters stabilized	☐	☐	☒

If no or N/A explain below:

Signature Ed Krish Date: 12/19/07

ATTACHMENT D TO THE GROUNDWATER CAPTURE REPORT

Survey Information

ENSR

Monitor Wells

11-Feb-08

180900982

Well No.	Latitude (WGS 84)	Longitude (WGS 84)	Northing (SPC)	Easting (SPC)	Well Elevation	GROUND ELEVATION	Reference
AA-MW-16	36°02'55.83770"N	115°00'26.22327"W	26,719,904.41	826,447.64	1,754.81	1751.99	GROUND
ARP-5A	36°04'20.25941"N	114°59'49.94653"W	26,728,458.43	829,375.01	1,616.10	1616.50	LID
ARP-6B	36°04'20.66105"N	114°59'48.17094"W	26,728,499.92	829,520.52	1,615.56	1615.70	LID
ARP-4A	36°04'19.81070"N	114°59'52.47300"W	26,728,411.81	829,167.89	1,615.47	1615.72	LID
I-AA	36°02'54.47421"N	115°00'17.38244"W	26,719,770.85	827,174.40	1,753.93	1751.08	GROUND
M-126	36°02'51.88621"N	115°00'24.76960"W	26,719,505.57	826,569.37	1,759.01	1756.40	GROUND
M-132	36°02'57.12902"N	114°59'58.60562"W	26,720,048.49	828,714.61	1,744.27	1741.41	GROUND
M-133	36°02'57.31590"N	114°59'58.79910"W	26,720,067.29	828,698.61	1,743.62	1740.93	GROUND
M-134	36°02'55.64578"N	115°00'17.73979"W	26,719,889.14	827,144.35	1,752.14	1749.39	GROUND
M-135	36°02'55.65542"N	115°00'17.61637"W	26,719,890.17	827,154.48	1,751.85	1749.17	GROUND
M-136	36°02'55.65084"N	115°00'17.48415"W	26,719,889.77	827,165.34	1,751.87	1749.09	GROUND
M-68	36°02'55.30738"N	114°59'58.17631"W	26,719,864.51	828,750.97	1,750.23	1747.34	GROUND
M-131	36°02'54.47236"N	115°00'17.58124"W	26,719,770.57	827,158.08	1,754.13	1751.05	GROUND
PC-134	36°04'17.01161"N	114°59'57.26558"W	26,728,126.42	828,776.17	1,617.01	1617.43	LID
PC-135	36°04'16.98024"N	114°59'57.39884"W	26,728,123.18	828,765.25	1,617.25	1617.52	LID
PC-136	36°04'17.60989"N	114°59'48.22560"W	26,728,191.37	829,517.89	1,615.08	1615.46	LID
PC-137	36°04'17.68509"N	114°59'48.22895"W	26,728,198.98	829,517.57	1,614.83	1615.19	LID
PC-58	36°04'56.34770"N	114°59'28.37242"W	26,732,118.20	831,123.78	1,568.01	1568.24	LID
PC-79	36°05'07.58634"N	114°59'44.23248"W	26,733,246.70	829,815.15	1,564.06	1564.53	LID
PC-80	36°05'07.62306"N	114°59'44.12663"W	26,733,250.46	829,823.82	1,564.18	1564.49	LID
PC-81	36°05'07.66509"N	114°59'44.00956"W	26,733,254.77	829,833.40	1,563.96	1564.27	LID
PC-82	36°05'07.04470"N	114°59'38.12287"W	26,733,194.96	830,316.93	1,559.15	1559.40	LID
PC-83	36°05'07.10759"N	114°59'38.01882"W	26,733,201.37	830,325.43	1,559.22	1559.58	LID
M-111A	36°02'48.16853"N	115°00'14.10658"W	26,719,134.86	827,447.19	1,768.77	1766.25	GROUND

Note: All coordinates shown are based upon the Nevada State Plane Projection (SPC), East Zone 2701 as derived from NGS point W51, (also Clark County Vertical Control point W 51 1934) from survey dated January 16-17, 2008.

All elevations were established by GPS-RTK methods and are in direct relationship to previous work on Tronox Plant site using the reference Clark County bench mark, below. Elevations shown are on the top of well casing. Benchmark: USC & G brass cap, stamped W51 1934, 35' west of west "Edge of Oil". of Boulder Highway and 280' north of the centerline of Elliot Road

PROFESSIONAL LAND SURVEYOR STATE OF NEVADA
CHRISTOPHER L. ALBERS
Exp: 12/31/08
No. 8866

Christopher L. Albers

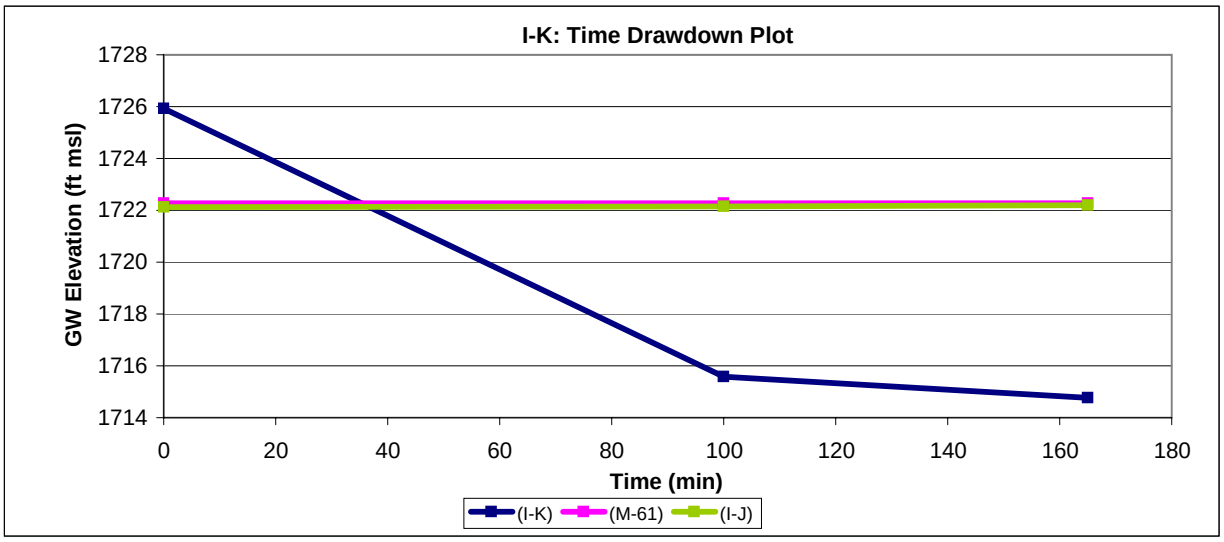
2/12/08

ATTACHMENT E TO THE GROUNDWATER CAPTURE REPORT

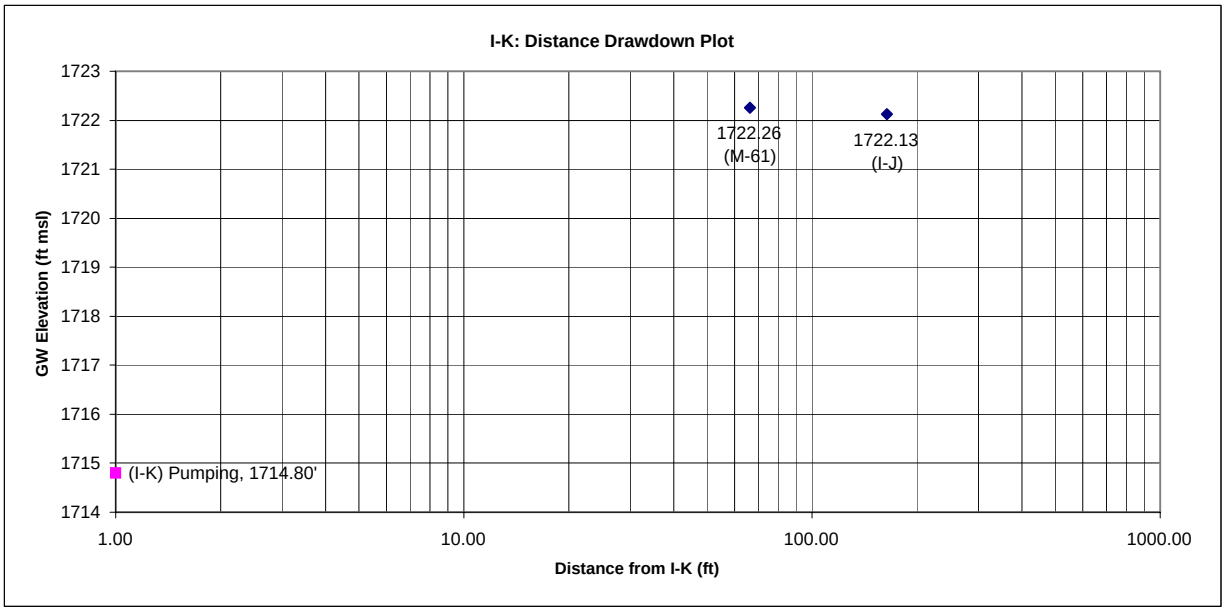
Distance Drawdown Data AND GRAPHS – Interceptor Well Field and Barrier Wall

Pumping well: I-K
Pumping Rate During the Test: 0.40 gpm

GW Elevation (ft msl)			
Time (min)	**(I-K)**	**(M-61)**	**(I-J)**
0	1725.93	1722.26	1722.13
100	1715.59	1722.26	1722.16
165	1714.76	1722.26	1722.19
200	1714.80	1722.27	1722.20
Total Drawdown (ft) End of test	11.17	0.01	0.07



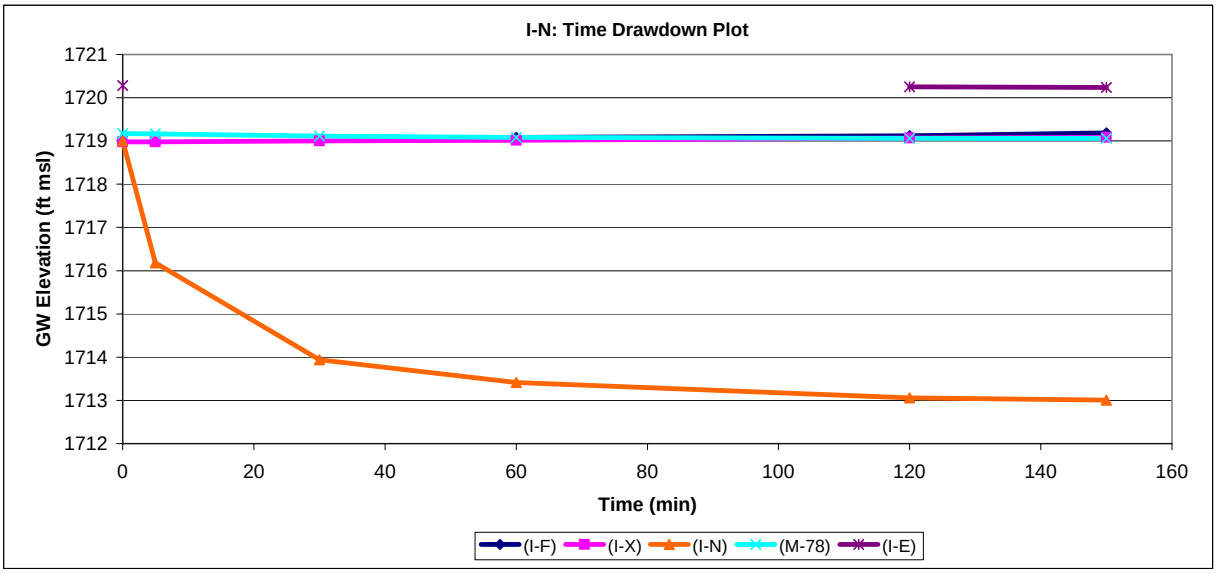
Distance Drawdown							
WELL	**Z (TOC)**	**Distance from I-K (ft)**	**Direction from I-K**	**DTW @T=0 min**	**GW Elev @T=0 min**	**DTW @T=200 min**	**GW Elev @T=200 min**
I-K	1750.08	Pump Well	--	24.15	1725.93	35.28	1714.80
M-61	1746.83	66.20	West	24.57	1722.26	24.56	1722.27
I-J	1750.10	164.20	West	27.97	1722.13	27.90	1722.20



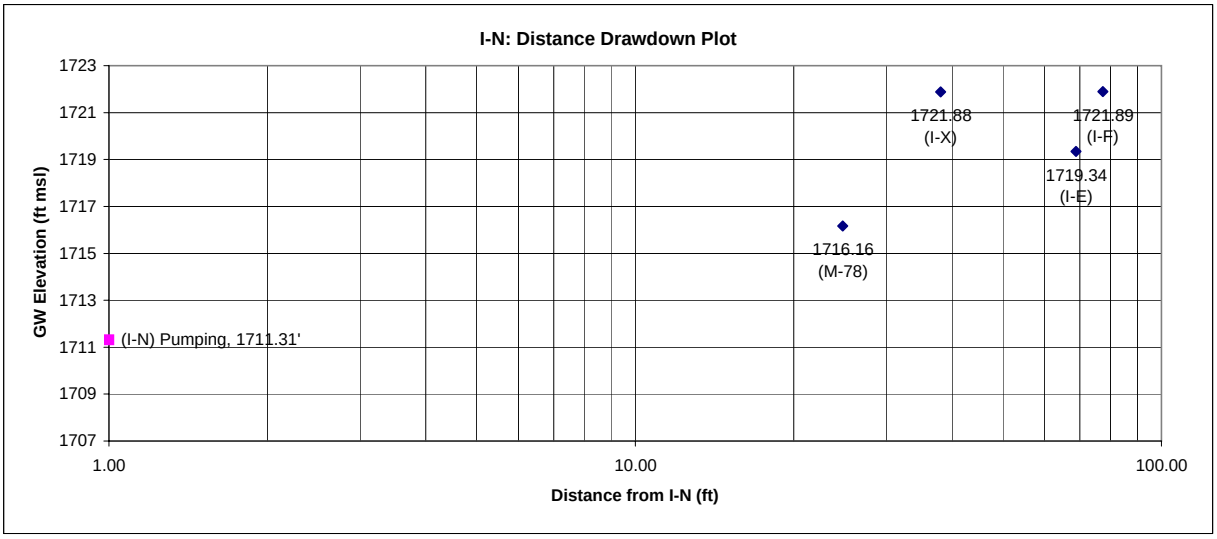
Note: Insufficient drawdown data to estimate well efficiency

Pumping well: I-N
Rate: 4.2 gpm

GW Elevation (ft msl)					
Time (min)	**(I-N)**	**(I-F)**	**(I-X)**	**(M-78)**	**(I-E)**
0	1719.00	1719.00	1718.98	1719.17	1720.28
5	1716.18		1718.98	1719.16	
30	1713.94		1719.00	1719.11	
60	1713.41	1719.08	1719.02	1719.08	
120	1713.06	1719.12	1719.07	1719.06	1720.25
150	1713.01	1719.19	1719.08	1719.06	1720.24
Total Drawdown (ft) End of test	5.99	0.19	0.10	0.11	0.04



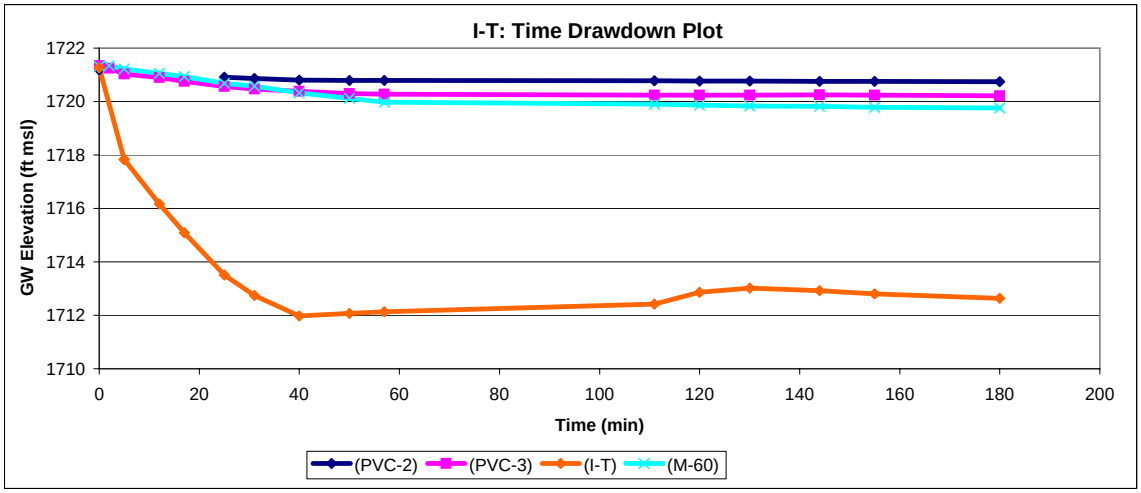
Distance Drawdown							
WELL	**Z (TOC)**	**Distance from I-N (ft)**	**Direction from I-N**	**DTW @T=0**	**GW Elev @T=0**	**DTW @T=150**	**GW Elev @T=150**
I-N	1749.70	Pump Well	--	32.40	1717.30	38.39	1711.31
M-78	1748.60	24.80	West	32.33	1716.27	32.44	1716.16
I-X	1751.4	38.05	East	29.62	1721.78	29.52	1721.88
I-E	1751.504	68.85	West	32.12	1719.38	32.16	1719.34
I-F	1752.4	77.45	East	30.70	1721.70	30.51	1721.89



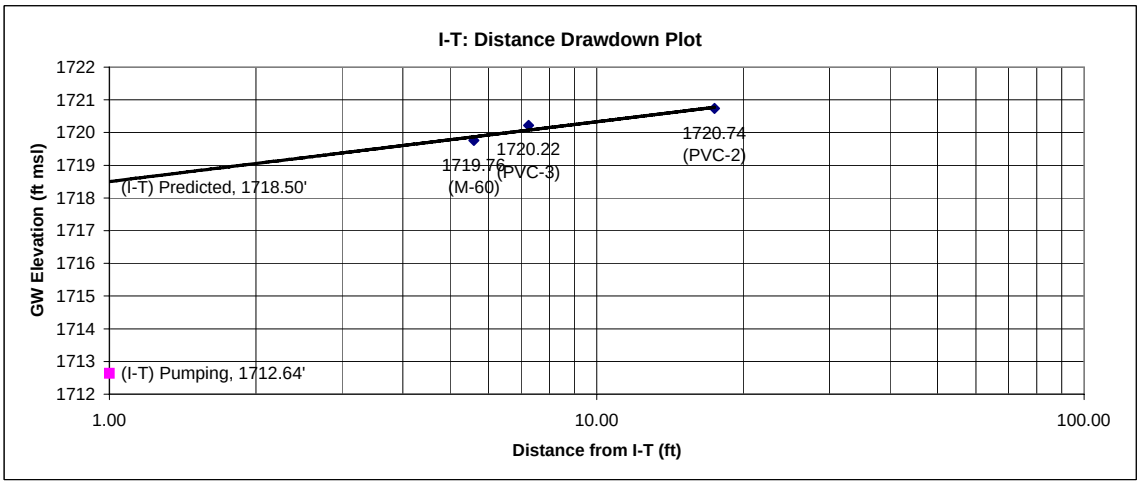
Note: Insufficient drawdown data to estimate well efficiency

Pumping well: I-T
Puming Rate During the Test: 0.40 gpm

GW Elevation (ft msl)				
Time (min)	**(I-T)**	**(PVC-2)**	**(PVC-3)**	**(M-60)**
0	1721.27	1721.19	1721.34	1721.32
2			1721.25	1721.34
5	1717.83		1721.03	1721.22
12	1716.17		1720.90	1721.05
17	1715.09		1720.75	1720.93
25	1713.51	1720.91	1720.56	1720.68
31	1712.75	1720.86	1720.47	1720.58
40	1711.98	1720.80	1720.38	1720.33
50	1712.07	1720.79	1720.30	1720.12
57	1712.14	1720.79	1720.27	1719.98
111	1712.42	1720.78	1720.24	1719.91
120	1712.86	1720.77	1720.24	1719.87
130	1713.02	1720.77	1720.24	1719.83
144	1712.93	1720.76	1720.25	1719.82
155	1712.80	1720.75	1720.24	1719.79
180	1712.64	1720.74	1720.22	1719.76
Total Drawdown (ft) End of test	9.29	0.45	1.12	1.58



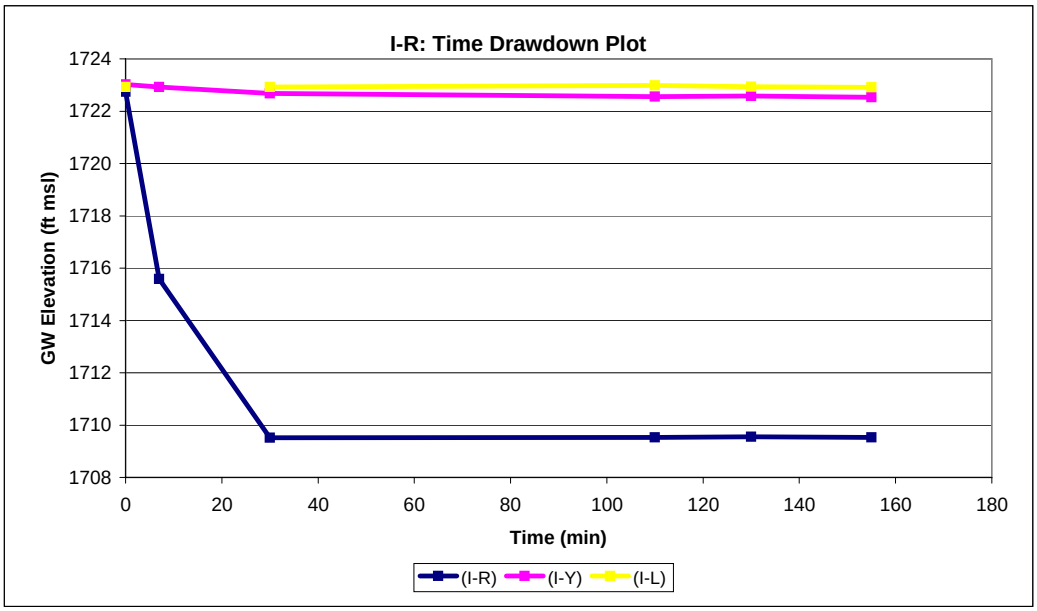
Distance Drawdown							
WELL	**Z (TOC)**	**Distance from I-T (ft)**	**Direction from I-T**	**DTW @T=0**	**GW Elev @T=0**	**DTW @T=180**	**GW Elev @T=180**
I-T	1751.66	Pump Well	--	30.39	1721.27	39.02	1712.64
M-60	1750.94	5.60	East	29.62	1721.32	31.18	1719.76
PVC-3	1750.76	7.25	West	29.42	1721.34	30.54	1720.22
PVC-2	1750.81	17.45	West	29.62	1721.19	30.07	1720.74



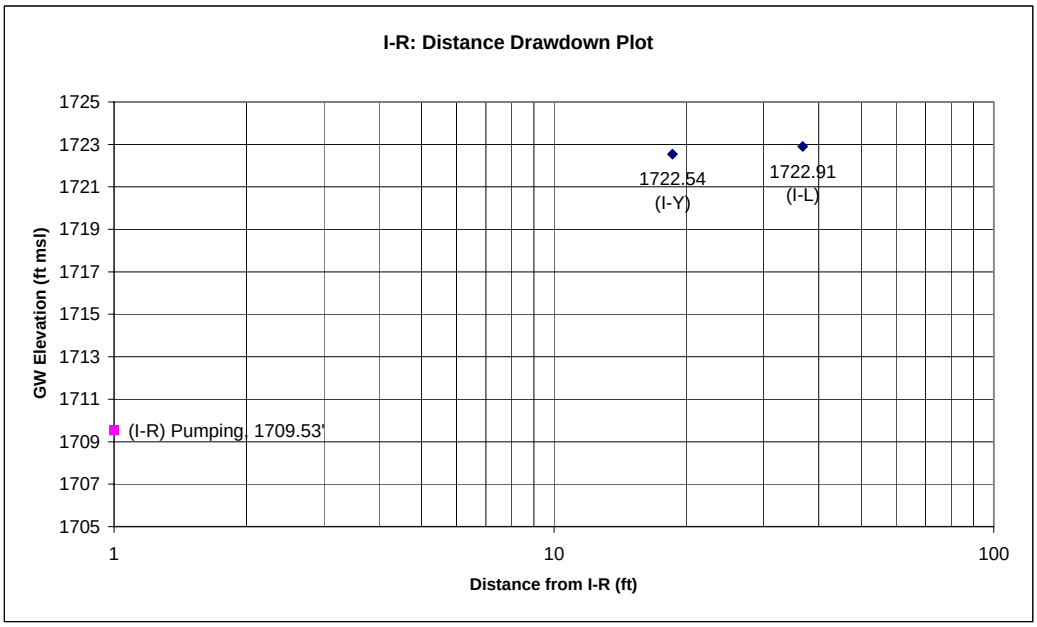
Note: Estimate of pumping well efficiency -
(Predicted drawdown / Actual drawdown) x 100% = 84%

Pumping well: I-R
Pumping Rate During the Test: 3.1 gpm

GW Elevation (ft msl)			
Time (min)	**(I-R)**	**(I-Y)**	**(I-L)**
0	1722.74	1723.03	1722.92
7	1715.59	1722.92	
30	1709.52	1722.68	1722.92
110	1709.53	1722.56	1722.98
130	1709.55	1722.58	1722.93
155	1709.53	1722.54	1722.91
Total Drawdown (ft) End of test	13.22	0.49	0.07



Distance Drawdown							
WELL	**Z (TOC)**	**Distance from I-R (ft)**	**Direction from I-N**	**DTW @T=0**	**GW Elev @T=0**	**DTW @T=150**	**GW Elev @T=150**
I-R	1751.35	Pump Well	--	28.61	1722.74	41.82	1709.53
I-Y	1751.40	18.6	East	28.37	1723.03	28.86	1722.54
I-L	1751.70	36.8	East	28.78	1722.92	28.79	1722.91



Note: Insufficient drawdown data to estimate well efficiency