ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
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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
Rob Mrowka, Clark County Comprehensive Planning, PO Box 551741, Las Vegas, NV, 89155-1741
Ranajit Sahu, BRC, 311 North Story Place, Alhambra, CA 91801
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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
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.

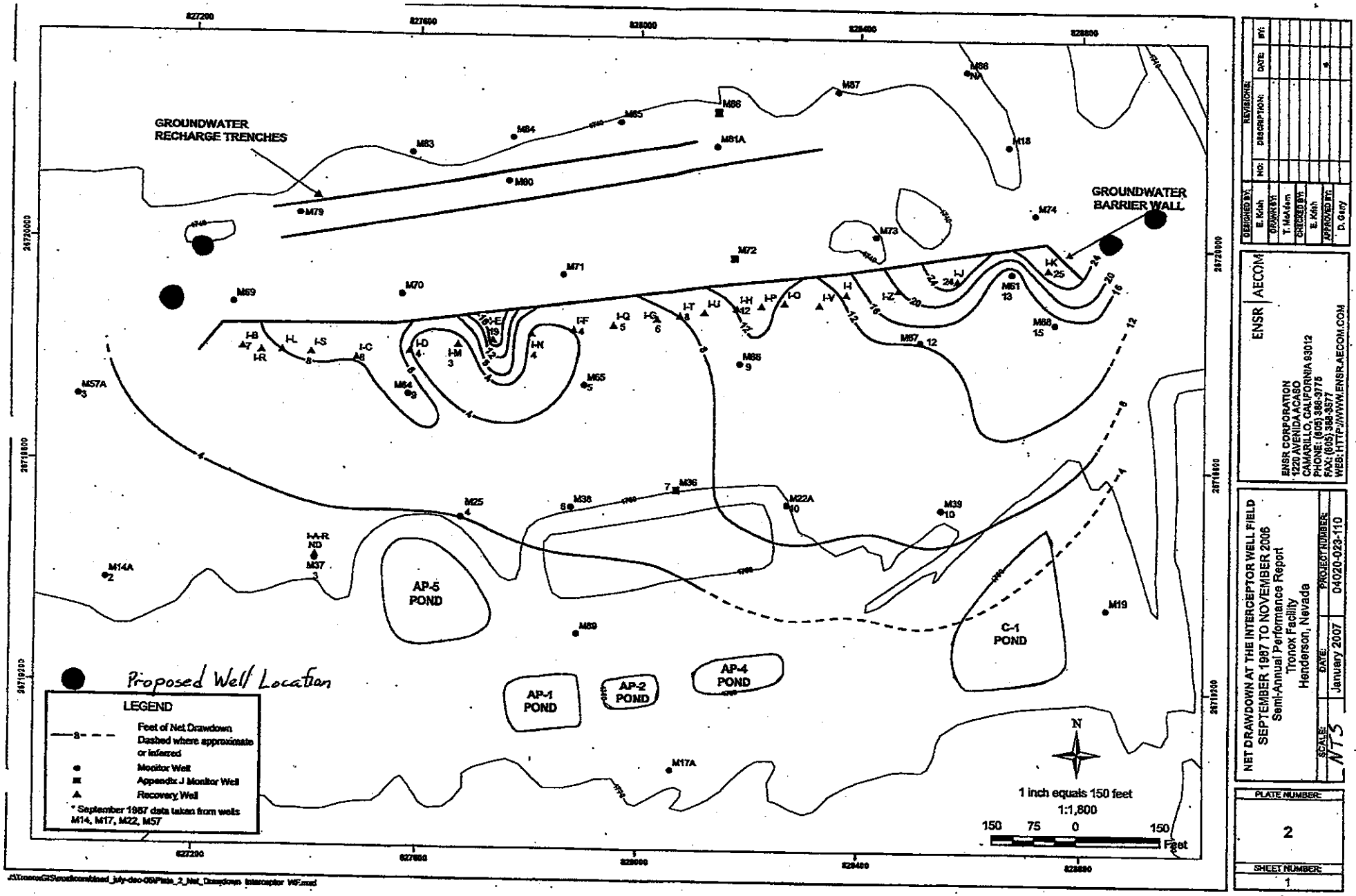
GROUNDWATER RECHARGE TRENCHES
GROUNDWATER BARRIER WALL
AP-5 POND
AP-1 POND
AP-2 POND
AP-4 POND
C-1 POND
Proposed Well Location
LEGEND
Feet of Net Drawdown
Dashed where approximate or inferred
Monitor Well
Appendix J Monitor Well
Recovery Well
* September 1987 data taken from wells M14, M17, M22, M57
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

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NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
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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
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
Chris Sylvia, Pioneer Americas LLC, PO Box 86, Henderson, Nevada 89009
Michael Bellotti, Olin, PO Box 248 1186 Lower River Road, Charleston TN 37310-0248
Curt Richards, Olin, 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

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.

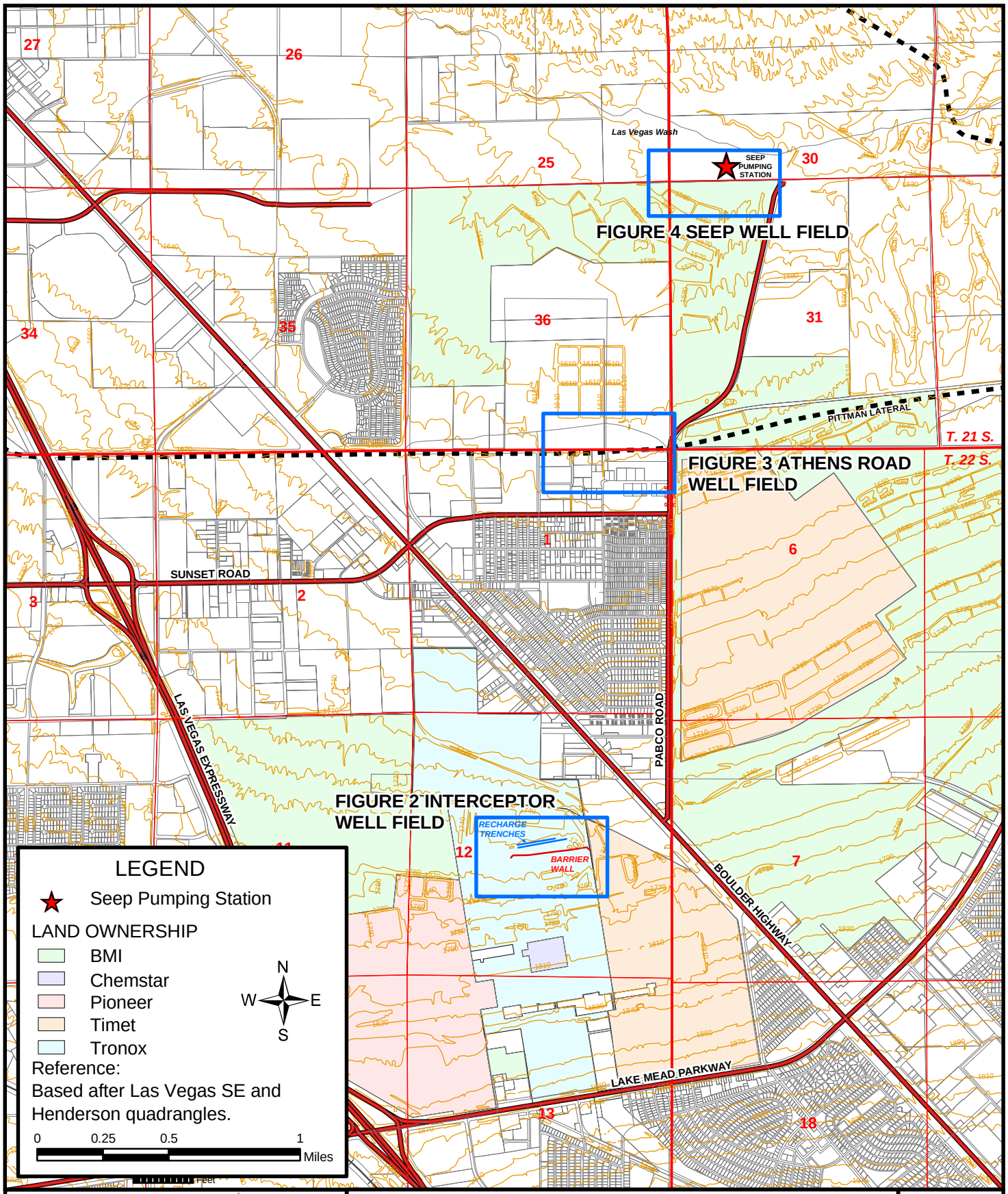
Tronox Response

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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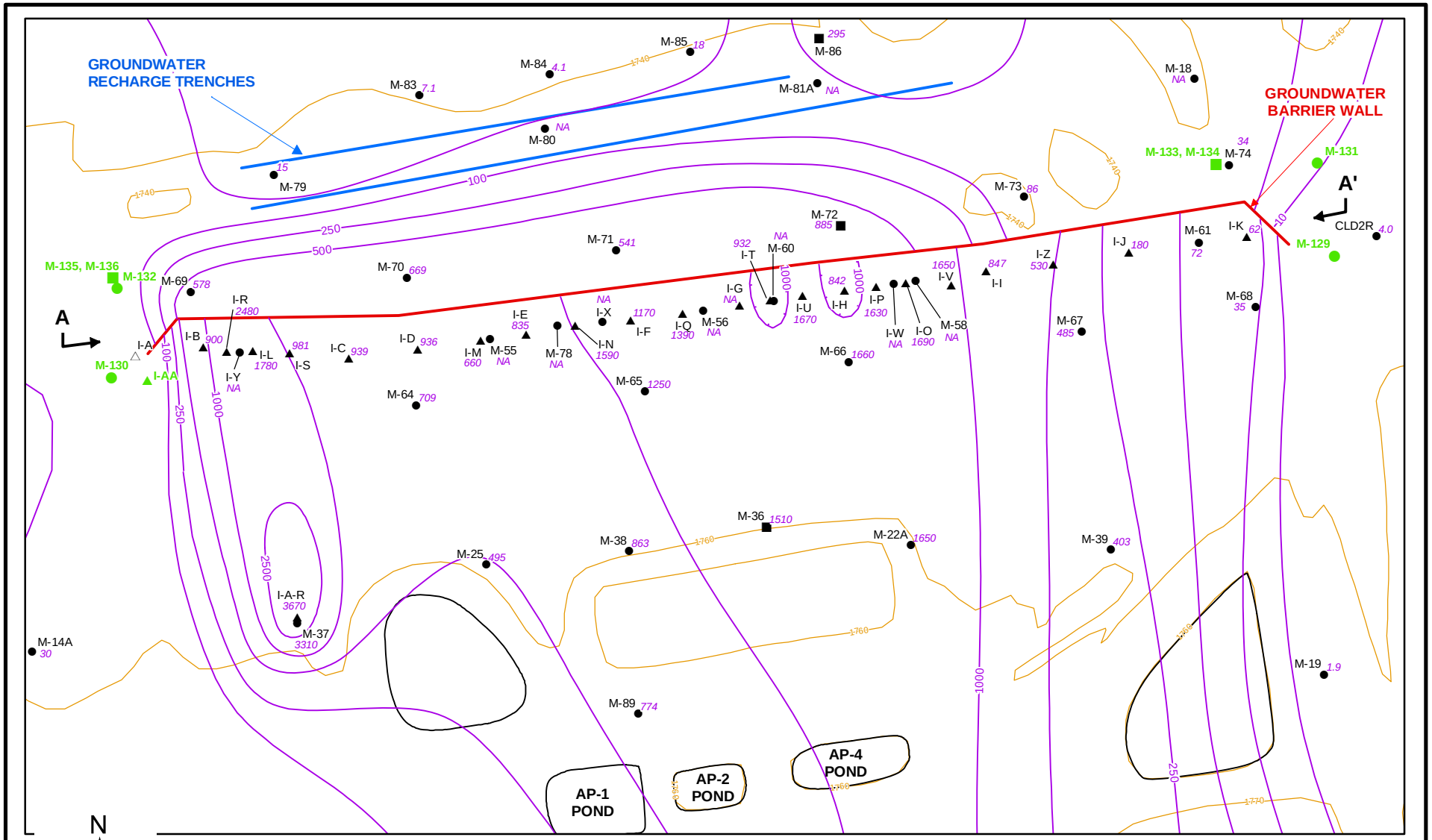
LOCATION MAP

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



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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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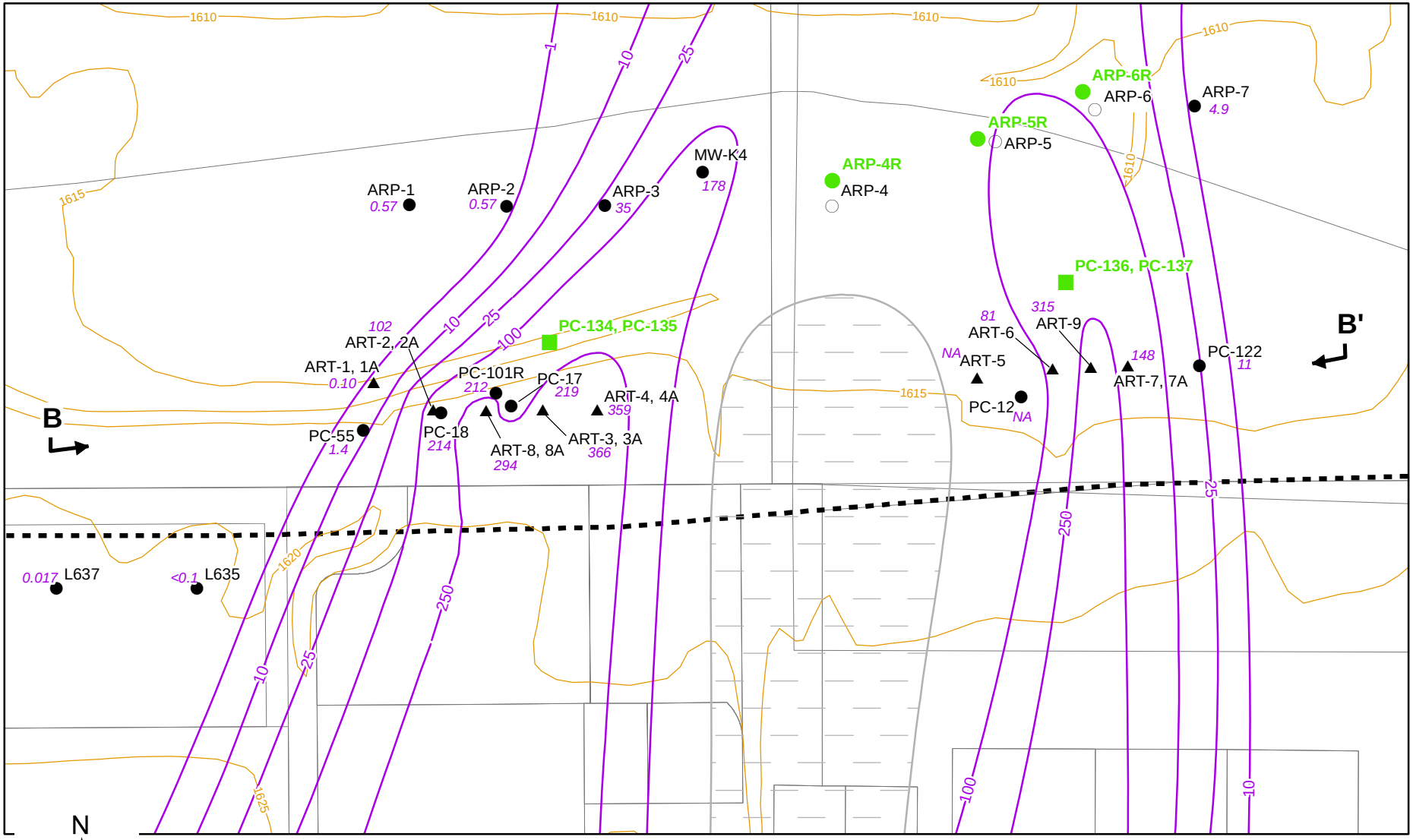

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SEE FIGURE 5 FOR EXPANDED LEGEND ELEMENTS

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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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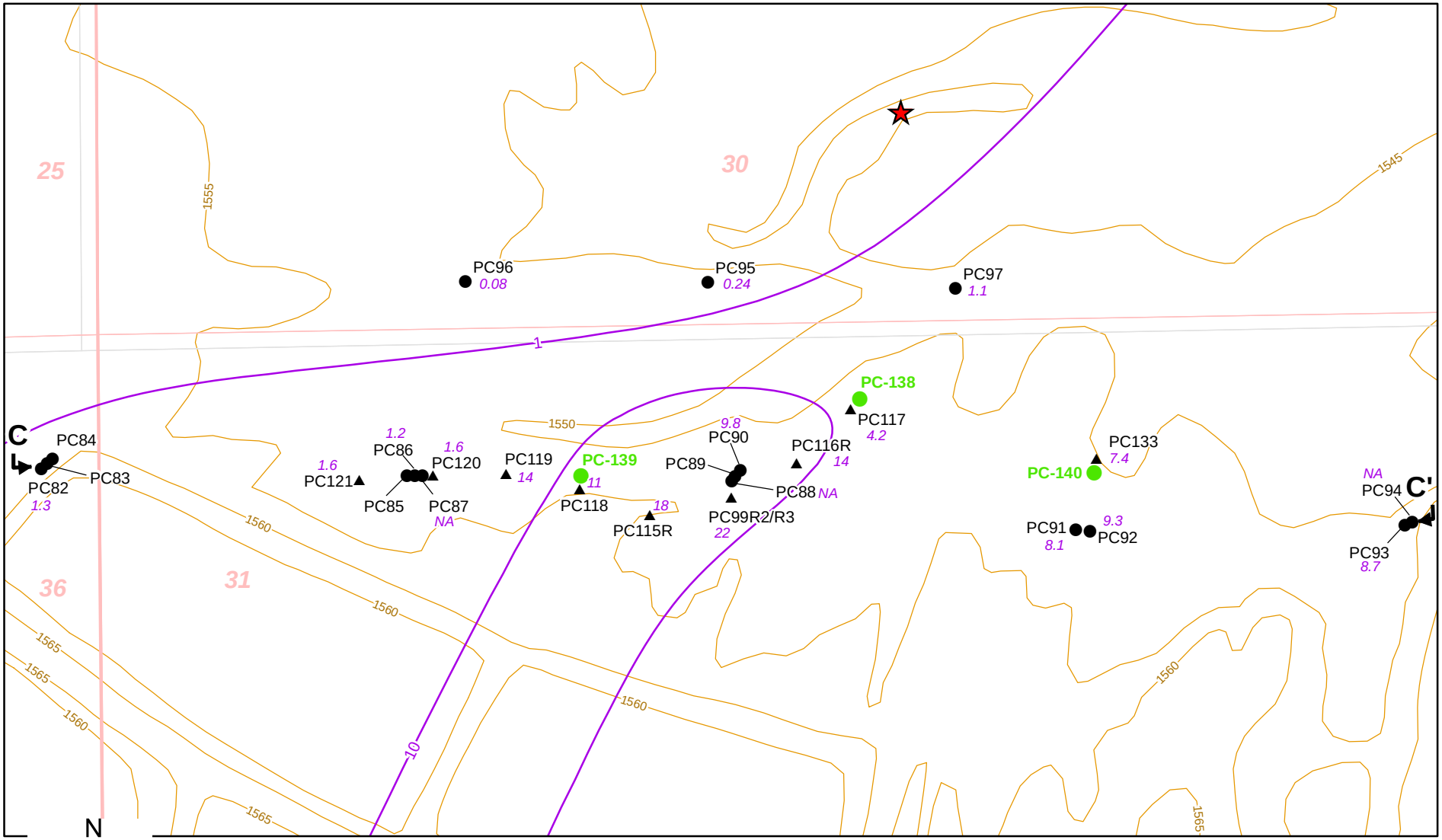

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SEE FIGURE 5 FOR EXPANDED LEGEND ELEMENTS

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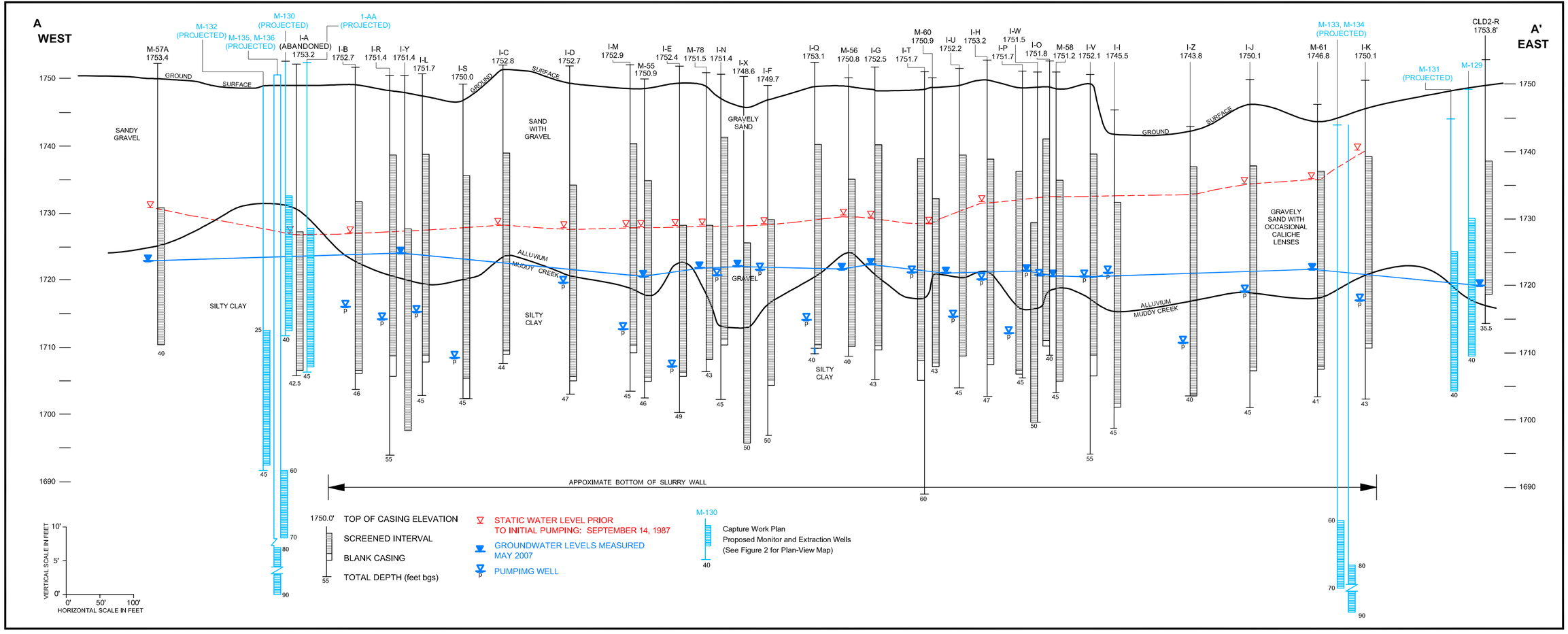
DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
M. Scop	8/27/2007 Rev-1 11/26/07	04020-023-160	X



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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:	DATE:	PROJECT NUMBER:
as noted	7/19/2007 Rev: 10/2/07	04020-023-160

FIGURE NUMBER:

6

SHEET NUMBER:

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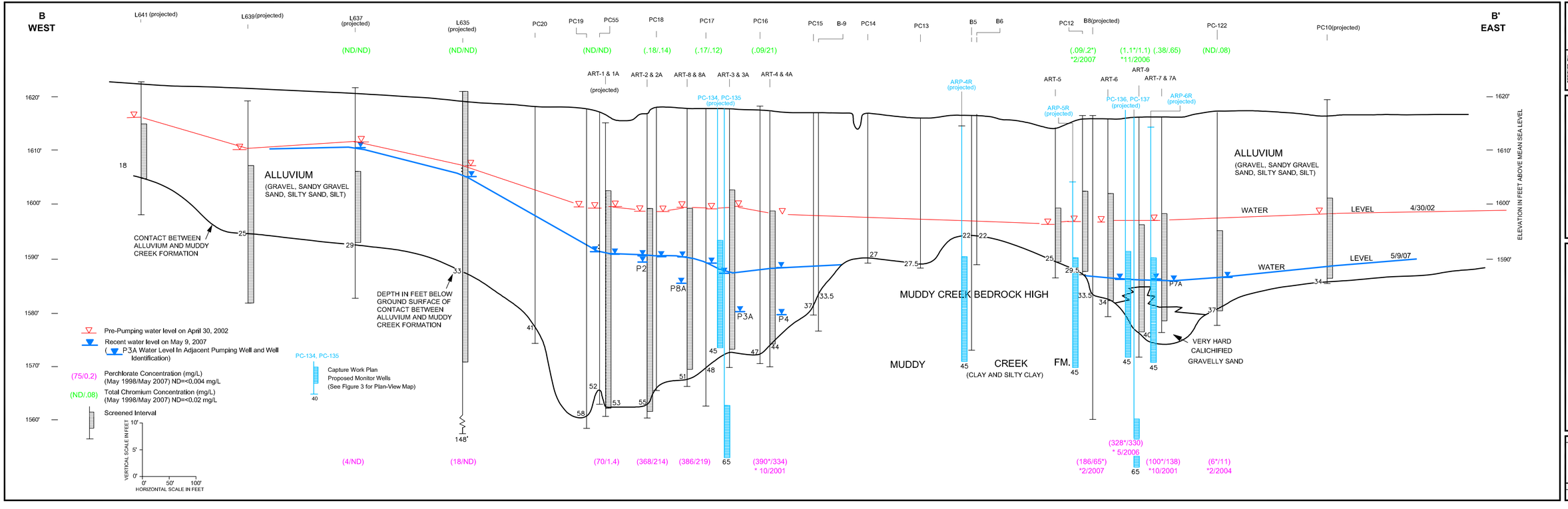

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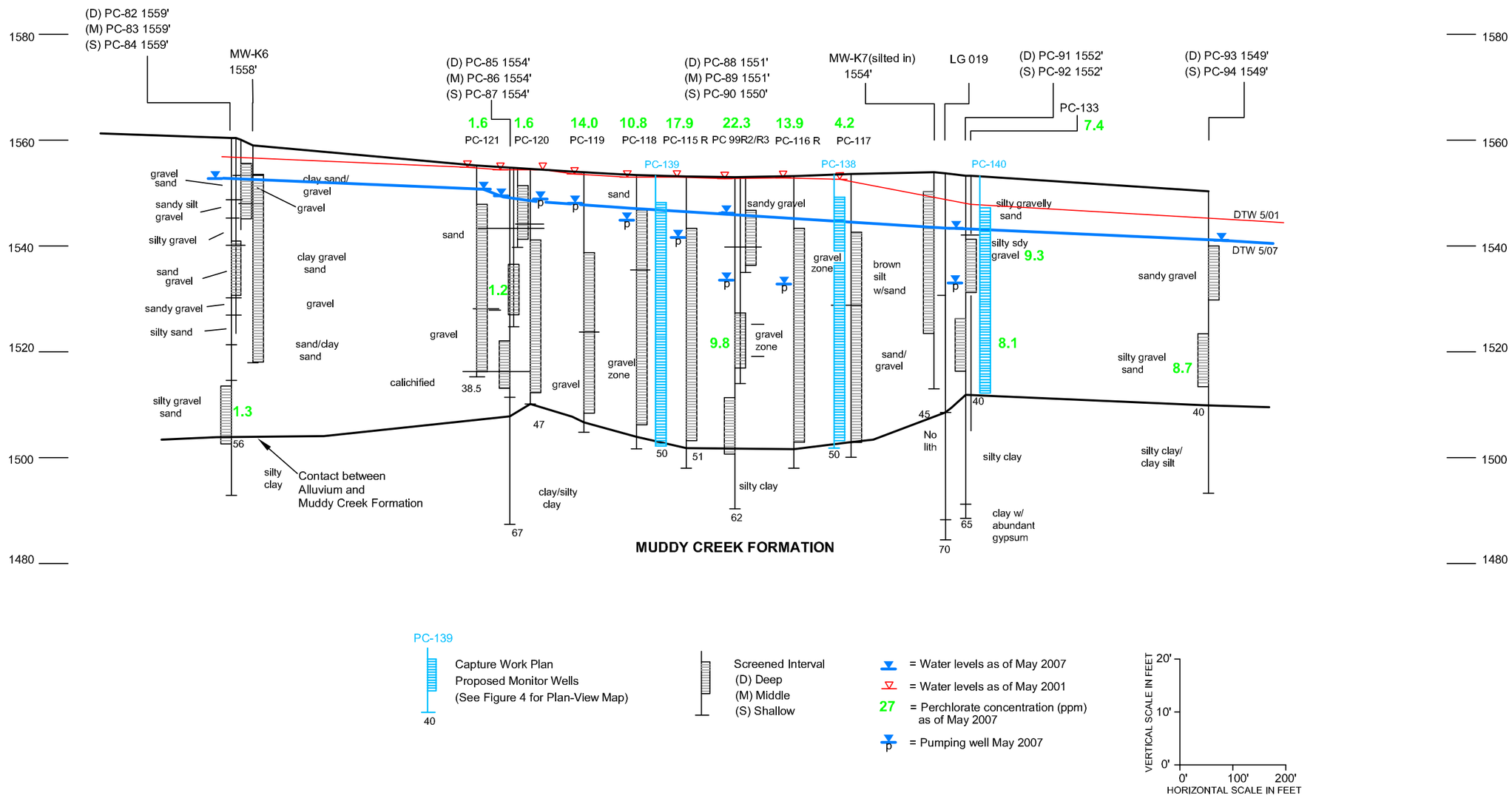
WEST - EAST HYDROGEOLOGIC CROSS SECTION B-B'
ATHENS ROAD WELL FIELD

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

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

FIGURE NUMBER: **7**

SHEET NUMBER: X



FILENAME:

DESIGNED BY: E. Krish
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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

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

Jim Gibbons, Governor
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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
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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

October 6, 2008

Susan Crowley
Tronox LLC
PO Box 55
Henderson, Nevada 89009

Re: **Tronox LLC (TRX)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection (NDEP) Response to:
Annual Remedial Performance Report for Chromium and Perchlorate, Tronox LLC, Henderson, Nevada, July 2007 – June 2008
Dated August 25, 2008

Dear Ms. Crowley,

The NDEP has received and reviewed TRX's Annual Report identified above and provides comments in Attachment A. TRX should provide an annotated response-to-comments (RTC) letter as part of the next Annual Report submittal with the following exceptions:

- Appendix B – Groundwater (GW) Capture Evaluation, TRX should respond to the comments in Attachment A for this appendix in a separate RTC that should be included in a Revised GW Capture Evaluation submitted as a stand-alone document. Please advise the NDEP **by October 13, 2008** regarding the schedule for this resubmittal.

- Appendix E – Data Validation Summary Report (DVSR), TRX should resubmit the DVSR for this Annual Report **by November 7, 2008** that addresses the comments provided in Attachment A. This may also be addressed as a stand-alone submittal.

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

Sincerely,

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

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Barry Conaty, Holland & Hart LLP, 975 F Street, N.W. Suite 900, Washington, D.C. 20004
Brenda Pohlmann, City of Henderson, PO Box 95050, Henderson, NV 89009
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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, NV 89509
Dave Gratson, Neptune and Company, 1505 15th Street, Suite B, Los Alamos, NM 87544

Attachment A

1. Section 2.0, page 2-1, TRX stated that "January/February 2008" data from TIMET was used to base the potentiometric surface in Plate 2; however, Appendix A includes May 2008 data from the TIMET wells. Please clarify whether January/February 2008 data was used and if it was, please justify its use over the May 2008 data.
2. Section 2.1, page 2-1, last paragraph, NDEP has the following comments:
   a. TRX stated that eight pumping wells were "turned off until static water levels were reached." Please list which wells were turned off.
   b. TRX used the term "section" in the paragraph when referring to Figure 2: East-West Hydrogeologic Cross Section. Please use the term "cross-section" in future reporting.
   c. TRX stated that "Recent installation of new wells on both ends of the barrier wall has affirmed the presence of inter-channel Muddy Creek ridges at both ends of the barrier wall. The tops of these bounding ridges are shown in the section to be above the adjacent potentiometric surface – separating the saturated alluvium at TIMET well CLD2-R from Interceptor well I-K on the east." Please discuss the implications of this statement as it relates to contaminant fate and transport.
   d. TRX uses the term "subparallel" to describe narrow alluvial channels separated by Muddy Creek ridges. Please define this term and provide discussion on the significance of these channels.
3. Section 2.2, page 2-3, 1st paragraph, TRX states that the Athens Road Well Field wells with the most subsidence are identified. Please clarify where these wells are identified.
4. Section 3.3, page 3-4, 2nd paragraph, the text in this paragraph is not consistent with Figure 10. Please revise either the text or the figure as appropriate for consistency.
5. Figures, NDEP has the following comments:
   a. Figure 2, NDEP has the following comments:
      i. TRX should include perchlorate and chromium concentration data for all wells sampled on the referenced date on this figure. Please address this comment in future submittals.
      ii. TRX should submit a separate figure of this cross-section that indicated which wells were shut-down between June 2 – 4, 2008, as stated in the last paragraph on page 2-1, with the resulting groundwater elevations measured as a result of this test for comparison.
   b. Figure 3, TRX should include perchlorate and chromium concentration data for all wells sampled on the referenced date on this figure. Please address this comment in future submittals.
   c. Figure 6, the current scale of this figure renders the data useless. Please revise the scale of the figure to improve readability in future submittals.
   d. Figure 10, text in 2nd paragraph on page 3-4 is not consistent with this figure. Please revise either the text or the figure as appropriate for consistency.
   e. Figure 11, the timeframe referenced in this figure should correspond with timeframe referenced on the report (i.e. July 2007 – June 2008). Please revise in future submittals.
   f. Figure 21, this figure referenced a Figure 21a that is not included in this report. Please correct this in future submittals.
6. Plates, NDEP has the following comments:

a. General comment, Plates should include data collected from the AMPAC and BRC wells shown on the Plates. Please include in future submittals.
b. General comment, Plates should at a minimum include all of the wells shown in the cross-sections (Figures 2 – 4). (e.g. Wells L639 and L641 are included in Figure 3 but are not shown on the Plates.)
c. Plate 2, NDEP has the following comments:
   i. General comment, this plate is not consistent with the Appendix A table. Please address this comment in future submittals.
   ii. Contours, TRX should note that dashed lines should be used only when there is not enough data presented due to well spacing, etc. Otherwise, if there is sufficient well data, the contour lines should be presented as a solid line. TRX should review the contour lines presented in this plate especially on the southern portion of the facility.
   iii. Inset B, it appears that 5-foot intervals were used in this Inset for the potentiometric surface contour lines. NDEP noted that there were several instances where additional contour lines should have been included using a 5-foot interval. Please add contour lines as appropriate to address this comment in future submittals.

7. Appendix A, TRX should provide the data for all wells posted on the figures and plates in this appendix. (e.g. Most of the TIMET wells posted on Plates 1 - 5 do not have data listed in this table.)
8. Appendix B, NDEP has the following comments:
   a. General comment, all Annual Performance Report (July 2007 – June 2008) data and figures referenced in the Appendix B GW Capture Evaluation should be included in revised stand-alone submittal. (Any comments made on these figures in this letter should be addressed in the Revised GW Capture Evaluation.)
   b. Section 1.2, page 1-2, 3rd bullet, the NDEP does not support the use of well pairs; please provide 3-point gradient solutions.
   c. Section 2.0, general comment, TRX should provide a schedule **by October 13, 2008** for all additional work proposed in this section to address the identified data gaps.
   d. Section 2.1.1, page 2-2, 1st Data Gap, Results, NDEP has the following comments:
      i. TRX should additionally include potential leakage under the barrier wall to this data gap.
      ii. 1st paragraph, please clarify whether there a reference figure or analysis to demonstrate that the mound dissipated. If none is provided, then please provide a figure or analysis to demonstrate that the mound dissipated.
      iii. 2nd paragraph, please provide a map or data to support the conclusion that "the barrier wall has negligible leakage."
      iv. This section and all similar sections need to consider and discuss the density of the water relative to vertical gradients. This comment will not be repeated for the remaining sections.
      v. Section 2.1.1, page 2-3, 2nd Data Gap, Results, 3rd paragraph, please clarify whether groundwater density is a factor in regards to groundwater head in the calculations for vertical groundwater gradient. TRX should discuss this point and support discussion with data in the Revised GW Capture Evaluation. (Please note that this comment should be applied to other areas of this document as appropriate.)

e. Section 2.1.1, page 2-4, 3rd Data Gap, 1st paragraph, TRX states that the "theoretical pumping rates for most of the wells were improved". Please discuss whether actual observed pumping rates improved in these wells.
f. Section 2.1.1, page 2-4, 4th Data Gap, Results, NDEP has the following comments,
   i. 2nd paragraph, TRX stated that, "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." Based on the calculation provided in Attachment B, the pumping well efficiency is about 20 percent. Please review the data and calculations for resubmittal in the Revised GW Capture Evaluation.
   ii. 2nd paragraph, TRX states that, "The absence of drawdown beyond 20 to 25 feet is likely a function (of) well spacing…" Drawdown during an aquifer test is not a function of well spacing. Please remove the text in future submittals.
   iii. 3rd paragraph, NDEP does not concur that this data gap has been addressed based on the results presented in Attachment E to the GW Capture Evaluation. One of the four tests presented was successful and the one successful test was incorrectly analyzed. Please review the data and calculations for resubmittal in the Revised GW Capture Evaluation.
   iv. 3rd paragraph, TRX states "In the future, additional distance drawdown testing will be considered…" It is not clear what is precluding TRX from completing this work; please provide a schedule for implementation.
   v. 3rd paragraph, last sentence, TRX states that "Well efficiency data derived from the testing of well I-T will be used to contour pumping data from this well." TRX should note that the well efficiency for well I-T was calculated incorrectly. Please review the data and calculations for resubmittal in the Revised GW Capture Evaluation.
g. Section 2.1.2, page 2-5, Capture Zone, TRX states, "…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 data on Plate 4, Inset B do not support this conclusion for the west end. Please review the Plate and associated data to address this comment.
h. Section 2.1.2, page 2-5, Capture Zone, TRX states that "Considering this average concentration up gradient of the barrier wall…" As commented in previous document responses, NDEP does not concur with this analysis based on concentration. Calculations must be made on a mass basis. Please revise the Revised GW Capture Evaluation accordingly.
i. Section 2.1.2, page 2-5, flow budget, it is suggested that TRX install wells within the Muddy Creek formation to address potential underflow issues and to refine the flow budget.
j. Section 2.1.2, page 2-7, Downgradient Concentration Declines over Time, one of the reasons that NDEP requested wells at the east and west ends of the barrier wall was so that flow at both ends of the barrier could be calculated; and thus, calculations could be made on a mass basis. Furthermore, concentration versus time series graphs are requested to present and discuss concentration declines over time.
k. Section 2.1.2, page 2-7, Overlapping Cones of Depression, please provide a map at the scale of Plate 1 for groundwater elevation and contour.
l. Section 2.1.4, page 2-8, Data Gaps, TRX should be include an additional data gap that discusses the upper most water bearing zone (water table) flow around the eastern and

western ends of the barrier wall using data from the new wells. If there is insufficient data for this, then TRX should propose additional wells for this purpose.

m. Section 2.2, page 2-8, last paragraph, 2nd bullet, TRX should note that McGinley recommended five new wells be installed. Please revise the text accordingly.
n. Section 2.2.1, page 2-9, 1st Data Gap, Results, TRX should discuss groundwater density as an influencing factor in regards to groundwater head. Please revise the text accordingly and support the discussion with data.
o. Section 2.2.1, page 2-10, 1st paragraph, the referenced Plate 2 (in the GW Capture Evaluation) shows the net drawdown. Please provide a groundwater elevation map at the same scale as the GW Capture Evaluation Plate 2.
p. Section 2.2.2, page 2-10, Capture Zone, NDEP does not concur with this analysis based on concentration. Calculations must be made on a mass basis. Please revise the Revised GW Capture Evaluation accordingly.
q. Section 2.2.2, page 2-10, Flow Budget, the analysis and discussion herein do not meet the EPA (2005) capture zone evaluation requirement. The EPA referenced document indicates that groundwater flow be calculated via Darcy's law and the results are compared to actual flow rate. Please revise the text and calculations accordingly.
r. Section 2.2.2, page 2-10, Overlapping Cones of Depression, TRX should note that there is very limited control for constructing the drawdown contours as drawn on Plate 2. Please discuss this in the Revised GW Capture Evaluation.
s. Section 2.2.2, page 2-11, Downgradient Concentration Declines over Time, both PC-98R and MW-K5 appear asymptotic (Figures 24 and 24A, Annual Remedial Performance Report). Please review and evaluate the long term trends and revise the text accordingly in the Revised GW Capture Evaluation.
t. Section 2.2.3, page2-11, Data Gaps and Proposed Additional Evaluation, this section is incomplete. Please review the above-comments to assist in identifying additional data gaps. The text of the Revised GW Capture Evaluation should be revised accordingly.
u. Section 2.3, page 2-11, last paragraph, please note that NDEP does not concur with this analysis based on concentration. Calculations must be made on a mass basis. Please revise the Revised GW Capture Evaluation accordingly.
v. Section 2.3.1, page 2-12, Overlapping Cones of Depression, please provide a map at the scale of Plate 1 for groundwater elevation and contour.
w. Section 2.3.1, page 2-12, Downgradient Concentration Declines over Time, NDEP has the following comments:
    i. 1st sentence, please note that NDEP does not concur with this analysis based on concentration. Calculations must be made on a mass basis. Please revise the Revised GW Capture Evaluation accordingly.
    ii. 2nd sentence, TRX should note that this section references concentration declines over time; mass is related to concentration but also includes flow. Please revise the Revised GW Capture Evaluation as necessary to clarify the difference in these two concepts.
x. Section 3.0, page 3-1, please update this section based on the comments contained in this letter.
y. Figure 3, please discuss how the represented vertical gradients relate to density driven flow. This comment also applies to Figures 5 and 7.
z. Tables, NDEP has the following comments:

i. Table 1, NDEP has the following comments:
   1. TRX should note that NDEP has recommended ASTM methods for all physical property analysis.
   2. In the following columns where two or more methods are listed, please clarify which method was used and whether the two methods are the same.
      a. Moisture Content – ASTM D2216 and API RP 40
      b. Effective permeability – ASTM D5084, API RP 40, and USEPA 9100 (Please note that TRX response (dated Nov. 28, 2007) to NDEP Comment #6 indicates that the ASTM method would be employed for the analysis.)
      c. Hydraulic conductivity ASTM D5084, API RP 40, and USEPA 9100

ii. Table 3, TRX should provide the TDS concentrations for these wells and determine whether there are density effects that may influence the calculated vertical gradients. Please revise the Revised GW Capture Evaluation accordingly.

iii. Table 4, the NDEP has the following comments:
   1. NDEP did not observe that mass flux calculations were completed in this table. Please include these calculations in the Revised GW Capture Evaluation.
   2. TRX should additionally include data east of I-Z.

aa. Attachment A, NDEP and TRX Correspondence, NDEP has the following comments:

i. TRX should note that NDEP's Response (dated December 12, 2007) to TRX's *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) was not included in this attachment. Please include this letter in the Revised GW Capture Evaluation.

ii. TRX's November, 20, 2007 response-to-comments (RTC), RTC 8, TRX should note that NDEP has previously indicated that overlapping cones of depression need to include the text as indicated in the NDEP Comment #8. The difficulty with utilizing drawdown to indicate capture zone is that drawdown does not include the prevailing hydraulic gradient in its calculation. Drawdown and capture only coincide when the prevailing hydraulic gradient is zero. In the case of the Athens Road Well Field an argument could be made, if the gradient is sufficiently flat, that the paleochannel geometry, extraction well locations, and overlapping cones of depression combine to form one line of evidence.

bb. Attachment D, please provide the survey data for wells M-129 and M-130 in the Revised GW Capture Evaluation.

cc. Attachment E, Distance Drawdown Data and Graphs – Interceptor Well Field and Barrier Wall, TRX should recalculate the well efficiencies in the Revised GW Capture Evaluation based on NDEP's following comments:

i. General comment, please note that NDEP used the following reference for the comments below: Roscoe Moss Company, 1990. Handbook of Ground Water Development. John Wiley & Sons, NY, pages 308 and 493.

ii. General comment, the formula provided by TRX for well efficiency is incorrect. The correct formula is Aquifer Loss / Total Drawdown * 100%. Aquifer Loss at an extraction well is determined by first using linear regression on the groundwater elevation (GWE) at T = X. Using the regression line equation, a T = 0 GWE can be calculated for the extraction well. The difference between the observed T = 0 GWE and the calculated T=0 GWE is the Aquifer Loss.

iii. Pumping well I-K, NDEP has the following comments:
   1. NDEP noted that the GWE at T=0 data points are nearly equal to T=200 data points. This could possibly mean that insufficient time elapsed for complete water level recovery and/or that other factors have a greater influence on the data points.
   2. TRX should note that at a flow rate of 0.40 gpm in I-K and with the closest observation well was 66.2 ft; extraction at well I-K would likely have had little if any effect on the observation wells.

iv. Pumping well I-N, NDEP has the following comments:
   1. If a linear regression is run for the GWE data for each well versus distance from pumping well at T = 150 minutes the R^2 value (0.3222) indicates that GWE has low relationship to distance from extraction well (i.e. other factors are likely to have greater influence); as opposed TRX's statement that there is "insufficient data to estimate well efficiency." This is at least partially due to the relatively large distance from the extraction well to the observation wells and comparatively low flow rate.
   2. NDEP also noted that at T=0 GWE data points are nearly equal to T=150 data points at the observation wells. This could possibly mean that insufficient time elapsed for complete water level recovery and/or that other factors have a greater influence on the data points.

v. Pumping well I-T, based on the well efficiency formula presented above, the well efficiency calculated by TRX is incorrect.

dd. Pumping well I-R, while the NDEP concur that two data points are really not sufficient for analysis, the data suggest that the extraction well may quite inefficient based on the formula presented above.

9. Appendix E, NDEP has the following comments:
   a. General comment, TRX should provide only the records applicable to a DVSR in the database that is included with each DVSR. This practice would not only facilitate review of the DVSR but also provide a more cost-effective means of incorporating new data into the regional database maintained by NDEP.
   b. Section 2.0, TRX indicates that 10% of the data packages were subject to full validation. Based on Table 4, there were 140 unique SDGs and only samples from two SDGs (239631, and 230066) were bolded indicating full validation. This equals 29 samples out of 790. To clarify, a minimum of 10% of the samples should undergo full Level IV data validation. If this full data validation indicates anomalous quality assurance problems, the number of samples validated should be expanded. TRX should resubmit the DVSR after a minimum of 10% of the samples have completed full Level IV data validation.
   c. Section 3.1, paragraph 2, TRX should correct the text to reflect EPA Method is 218.6 (incorrectly typed as 281.6).

Tronox Response to October 6, 2008 NDEP Comments on Groundwater Capture Evaluation (Appendix B of the Annual Remedial Performance Report, July 2007 – June 2008) dated August 25, 2008

NDEP Comment

8. Appendix B, NDEP has the following comments:
   a. General comment, all Annual Performance Report (July 2007 – June 2008) data and figures referenced in the Appendix B GW Capture Evaluation should be included in revised stand-alone submittal. (Any comments made on these figures in this letter should be addressed in the Revised GW Capture Evaluation.)
   b. Section 1.2, page 1-2, 3rd bullet, the NDEP does not support the use of well pairs; please provide 3-point gradient solutions.
   c. Section 2.0, general comment, TRX should provide a schedule **by October 13, 2008** for all additional work proposed in this section to address the identified data gaps.
   d. Section 2.1.1, page 2-2, 1st Data Gap, Results, NDEP has the following comments:
      i. TRX should additionally include potential leakage under the barrier wall to this data gap.
      ii. 1st paragraph, please clarify whether there a reference figure or analysis to demonstrate that the mound dissipated. If none is provided, then please provide a figure or analysis to demonstrate that the mound dissipated.
      iii. 2nd paragraph, please provide a map or data to support the conclusion that "the barrier wall has negligible leakage."
      iv. This section and all similar sections need to consider and discuss the density of the water relative to vertical gradients. This comment will not be repeated for the remaining sections.
      v. Section 2.1.1, page 2-3, 2nd Data Gap, Results, 3rd paragraph, please clarify whether groundwater density is a factor in regards to groundwater head in the calculations for vertical groundwater gradient. TRX should discuss this point and support discussion with data in the Revised GW Capture Evaluation. (Please note that this comment should be applied to other areas of this document as appropriate.)
   e. Section 2.1.1, page 2-4, 3rd Data Gap, 1st paragraph, TRX states that the "theoretical pumping rates for most of the wells were improved". Please discuss whether actual observed pumping rates improved in these wells.
   f. Section 2.1.1, page 2-4, 4th Data Gap, Results, NDEP has the following comments,
      i. 2nd paragraph, TRX stated that, "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." Based on the calculation provided in Attachment B, the pumping well efficiency is about 20 percent. Please review the data and calculations for resubmittal in the Revised GW Capture Evaluation.
      ii. 2nd paragraph, TRX states that, "The absence of drawdown beyond 20 to 25 feet is likely a function (of) well spacing…" Drawdown during an aquifer test is not a function of well spacing. Please remove the text in future submittals.
      iii. 3rd paragraph, NDEP does not concur that this data gap has been addressed based on the results presented in Attachment E to the GW Capture Evaluation. One of the four tests presented was successful and the one successful test was incorrectly analyzed. Please review the data and calculations for resubmittal in the Revised GW Capture Evaluation.
      iv. 3rd paragraph, TRX states "In the future, additional distance drawdown testing will be considered…" It is not clear what is precluding TRX from completing this work; please provide a schedule for implementation.
      v. 3rd paragraph, last sentence, TRX states that "Well efficiency data derived from the testing of well I-T will be used to contour pumping data from this well." TRX should note that the well efficiency for well I-T was calculated incorrectly. Please review the data and calculations for resubmittal in the Revised GW Capture Evaluation.
   g. Section 2.1.2, page 2-5, Capture Zone, TRX states, "…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 data on Plate 4, Inset B do not support this conclusion for the west end. Please review the Plate and associated data to address this comment.

h. Section 2.1.2, page 2-5, Capture Zone, TRX states that "Considering this average concentration up gradient of the barrier wall…" As commented in previous document responses, NDEP does not concur with this analysis based on concentration. Calculations must be made on a mass basis. Please revise the Revised GW Capture Evaluation accordingly.
i. Section 2.1.2, page 2-5, flow budget, it is suggested that TRX install wells within the Muddy Creek formation to address potential underflow issues and to refine the flow budget.
j. Section 2.1.2, page 2-7, Downgradient Concentration Declines over Time, one of the reasons that NDEP requested wells at the east and west ends of the barrier wall was so that flow at both ends of the barrier could be calculated; and thus, calculations could be made on a mass basis. Furthermore, concentration versus time series graphs are requested to present and discuss concentration declines over time.
k. Section 2.1.2, page 2-7, Overlapping Cones of Depression, please provide a map at the scale of Plate 1 for groundwater elevation and contour.
l. Section 2.1.4, page 2-8, Data Gaps, TRX should be include an additional data gap that discusses the upper most water bearing zone (water table) flow around the eastern and western ends of the barrier wall using data from the new wells. If there is insufficient data for this, then TRX should propose additional wells for this purpose.
m. Section 2.2, page 2-8, last paragraph, 2nd bullet, TRX should note that McGinley recommended five new wells be installed. Please revise the text accordingly.
n. Section 2.2.1, page 2-9, 1st Data Gap, Results, TRX should discuss groundwater density as an influencing factor in regards to groundwater head. Please revise the text accordingly and support the discussion with data.
o. Section 2.2.1, page 2-10, 1st paragraph, the referenced Plate 2 (in the GW Capture Evaluation) shows the net drawdown. Please provide a groundwater elevation map at the same scale as the GW Capture Evaluation Plate 2.
p. Section 2.2.2, page 2-10, Capture Zone, NDEP does not concur with this analysis based on concentration. Calculations must be made on a mass basis. Please revise the Revised GW Capture Evaluation accordingly.
q. Section 2.2.2, page 2-10, Flow Budget, the analysis and discussion herein do not meet the EPA (2005) capture zone evaluation requirement. The EPA referenced document indicates that groundwater flow be calculated via Darcy's law and the results are compared to actual flow rate. Please revise the text and calculations accordingly.
r. Section 2.2.2, page 2-10, Overlapping Cones of Depression, TRX should note that there is very limited control for constructing the drawdown contours as drawn on Plate 2. Please discuss this in the Revised GW Capture Evaluation.
s. Section 2.2.2, page 2-11, Downgradient Concentration Declines over Time, both PC-98R and MW-K5 appear asymptotic (Figures 24 and 24A, Annual Remedial Performance Report). Please review and evaluate the long term trends and revise the text accordingly in the Revised GW Capture Evaluation.
t. Section 2.2.3, page 2-11, Data Gaps and Proposed Additional Evaluation, this section is incomplete. Please review the above-comments to assist in identifying additional data gaps. The text of the Revised GW Capture Evaluation should be revised accordingly.
u. Section 2.3, page 2-11, last paragraph, please note that NDEP does not concur with this analysis based on concentration. Calculations must be made on a mass basis. Please revise the Revised GW Capture Evaluation accordingly.
v. Section 2.3.1, page 2-12, Overlapping Cones of Depression, please provide a map at the scale of Plate 1 for groundwater elevation and contour.
w. Section 2.3.1, page 2-12, Downgradient Concentration Declines over Time, NDEP has the following comments:
    i. 1st sentence, please note that NDEP does not concur with this analysis based on concentration. Calculations must be made on a mass basis. Please revise the Revised GW Capture Evaluation accordingly.
    ii. 2nd sentence, TRX should note that this section references concentration declines over time; mass is related to concentration but also includes flow. Please revise the Revised GW Capture Evaluation as necessary to clarify the difference in these two concepts.
x. Section 3.0, page 3-1, please update this section based on the comments contained in this letter.

y. Figure 3, please discuss how the represented vertical gradients relate to density driven flow. This comment also applies to Figures 5 and 7.
z. Tables, NDEP has the following comments:
    i. Table 1, NDEP has the following comments:
        1. TRX should note that NDEP has recommended ASTM methods for all physical property analysis.
        2. In the following columns where two or more methods are listed, please clarify which method was used and whether the two methods are the same.
            a. Moisture Content – ASTM D2216 and API RP 40
            b. Effective permeability – ASTM D5084, API RP 40, and USEPA 9100 (Please note that TRX response (dated Nov. 28, 2007) to NDEP Comment #6 indicates that the ASTM method would be employed for the analysis.)
            c. Hydraulic conductivity ASTM D5084, API RP 40, and USEPA 9100
    ii. Table 3, TRX should provide the TDS concentrations for these wells and determine whether there are density effects that may influence the calculated vertical gradients. Please revise the Revised GW Capture Evaluation accordingly.
    iii. Table 4, the NDEP has the following comments:
        1. NDEP did not observe that mass flux calculations were completed in this table. Please include these calculations in the Revised GW Capture Evaluation.
        2. TRX should additionally include data east of I-Z.
aa. Attachment A, NDEP and TRX Correspondence, NDEP has the following comments:
    i. TRX should note that NDEP's Response (dated December 12, 2007) to TRX's *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) was not included in this attachment. Please include this letter in the Revised GW Capture Evaluation.
    ii. TRX's November, 20, 2007 response-to-comments (RTC), RTC 8, TRX should note that NDEP has previously indicated that overlapping cones of depression need to include the text as indicated in the NDEP Comment #8. The difficulty with utilizing drawdown to indicate capture zone is that drawdown does not include the prevailing hydraulic gradient in its calculation. Drawdown and capture only coincide when the prevailing hydraulic gradient is zero. In the case of the Athens Road Well Field an argument could be made, if the gradient is sufficiently flat, that the paleochannel geometry, extraction well locations, and overlapping cones of depression combine to form one line of evidence.
bb. Attachment D, please provide the survey data for wells M-129 and M-130 in the Revised GW Capture Evaluation.
cc. Attachment E, Distance Drawdown Data and Graphs – Interceptor Well Field and Barrier Wall, TRX should recalculate the well efficiencies in the Revised GW Capture Evaluation based on NDEP's following comments:
    i. General comment, please note that NDEP used the following reference for the comments below: Roscoe Moss Company, 1990. Handbook of Ground Water Development. John Wiley & Sons, NY, pages 308 and 493.
    ii. General comment, the formula provided by TRX for well efficiency is incorrect. The correct formula is Aquifer Loss / Total Drawdown * 100%. Aquifer Loss at an extraction well is determined by first using linear regression on the groundwater elevation (GWE) at T = X. Using the regression line equation, a T = 0 GWE can be calculated for the extraction well. The difference between the observed T = 0 GWE and the calculated T=0 GWE is the Aquifer Loss.
    iii. Pumping well I-K, NDEP has the following comments:
        1. NDEP noted that the GWE at T=0 data points are nearly equal to T=200 data points. This could possibly mean that insufficient time elapsed for complete water level recovery and/or that other factors have a greater influence on the data points.
        2. TRX should note that at a flow rate of 0.40 gpm in I-K and with the closest observation well was 66.2 ft; extraction at well I-K would likely have had little if any effect on the observation wells.
    iv. Pumping well I-N, NDEP has the following comments:

1. If a linear regression is run for the GWE data for each well versus distance from pumping well at T = 150 minutes the R^2 value (0.3222) indicates that GWE has low relationship to distance from extraction well (i.e. other factors are likely to have greater influence); as opposed TRX's statement that there is "insufficient data to estimate well efficiency." This is at least partially due to the relatively large distance from the extraction well to the observation wells and comparatively low flow rate.
2. NDEP also noted that at T=0 GWE data points are nearly equal to T=150 data points at the observation wells. This could possibly mean that insufficient time elapsed for complete water level recovery and/or that other factors have a greater influence on the data points.

v. Pumping well I-T, based on the well efficiency formula presented above, the well efficiency calculated by TRX is incorrect.

dd. Pumping well I-R, while the NDEP concur that two data points are really not sufficient for analysis, the data suggest that the extraction well may quite inefficient based on the formula presented above.

Tronox Response

8.a. All data and figures referenced in the Revised GW Capture Evaluation will be included in the revised stand-alone document.

8.b. Three-point gradient solutions will be provided.

8.c. TRX submitted a schedule on October 14, 2008.

8.d.i Based on documented upward gradient on both ends of the barrier wall TRX believes that leakage beneath the wall is negligible.

8.d.ii. Data shows that the mound was dissipating until February 2008 when it began to build again as the result of the refurbishment of the recharge trenches. A figure will be provided.

8.d.iii. Hydrographs across the barrier wall show that the immediate upgradient water elevations are higher than the immediate downgradient water elevations. A figure will be provided.

8.d.iv. The density of water relative to vertical gradient measurements has been considered and found to have negligible effect. Data will be provided.

8.d.v. TRX will factor in groundwater density in the calculations for vertical groundwater gradient.

8.e TRX will list the observed change in pumping rates pre- and post-refurbishment.

8.f.i. The data will be reviewed.

8.f.ii The text will be removed.

8.f.iii. The data will be reviewed.

8.f.iv. No further drawdown tests will be performed because the groundwater mounding effect of the barrier wall and pumping effects in adjacent wells precludes obtaining useable data.

8.f.v. The data will be reviewed.

8.g. The average concentration moving around the west end of the barrier wall is 400 mg/L. The data will be reviewed.

8.h Calculations will be made on a mass basis.

8.i Based on documented upward gradient on both ends of the barrier wall TRX believes that leakage beneath the wall is negligible. TRX will install up to eight deep Muddy Creek formation wells in four locations on the plant site to delineate the contaminant plumes and determine vertical gradient.

8.j. Concentration versus time series graphs will be furnished.

8.k. A potentiometric surface map at the scale of 1" = 150' will be provided.

8.l. TRX will discuss flow around the ends of the barrier wall using data from the new wells.

8.m. The text will be revised accordingly.

8.n. TRX will discuss groundwater density as an influencing factor in regards to groundwater head.

8.o. A potentiometric surface map at the scale of 1" = 200' will be provided.

8.p. Calculations will be made on a mass basis.

8.q. The text and calculations will be revised accordingly.

8.r. TRX will discuss the contouring of the plate in the Revised GW Capture Evaluation.

8.s. TRX will review and evaluate the long term trends and revise the text accordingly in the Revised GW Capture Evaluation.

8.t. TRX will review and discuss whether other data gaps exist in the Athens Road area.

8.u. Calculations will be made on a mass basis.

8.v. A potentiometric surface map at the scale of 1" = 150' will be provided.
8.w.i. Calculations will be made on a mass basis.
8.w.ii TRX will revise the text.
8.x. TRX will update this section.
8.y. The relationship of vertical gradients and groundwater density will be discussed.
8.z.i.1 TRX notes that the NDEP recommends ASTM methods for all physical property analyses.
8.z.i.2.a. TRX will clarify the method used.
8.z.i.2.b. TRX will clarify the method used.
8.z.i.2.c. TRX will clarify the method used.
8.z.ii TRX will provide TDS analyses and discuss whether groundwater density affects vertical gradient.
8.z.iii.1. Mass flux calculations will be included.
8.z.iii.2. Data east of I-Z will be included.
8.aa.i. This letter was included in the original GW Capture Evaluation and will again be included in the Revised GW Capture Evaluation.
8.aa.ii TRX will include the requested language.
8.bb. TRX will provide the survey data for wells M-129 and 130 in the Revised GW Capture Evaluation.
8.cc.i TRX notes the NDEP reference.
8.cc.ii Boundary effects from the barrier wall and pumping effects from adjacent pumping recovery wells precluded collection of usable data. TRX will not include this discussion in the Revised GW Capture Evaluation.
8.cc.iii.1 Boundary effects from the barrier wall and pumping effects from adjacent pumping recovery wells precluded collection of usable data. TRX will not include this discussion in the Revised GW Capture Evaluation.
8.cc.iii.2 Boundary effects from the barrier wall and pumping effects from adjacent pumping recovery wells precluded collection of usable data. TRX will not include this discussion in the Revised GW Capture Evaluation.
8.cc.iv.1 Boundary effects from the barrier wall and pumping effects from adjacent pumping recovery wells precluded collection of usable data. TRX will not include this discussion in the Revised GW Capture Evaluation.
8.cc.iv.2 Boundary effects from the barrier wall and pumping effects from adjacent pumping recovery wells precluded collection of usable data. TRX will not include this discussion in the Revised GW Capture Evaluation.
8.cc.v. Boundary effects from the barrier wall and pumping effects from adjacent pumping recovery wells precluded collection of usable data. TRX will not include this discussion in the Revised GW Capture Evaluation.
8.dd. Boundary effects from the barrier wall and pumping effects from adjacent pumping recovery wells precluded collection of usable data. TRX will not include this discussion in the Revised GW Capture Evaluation.

Email from Susan Crowley to Shannon Harbour of NDEP
Dated October 14, 2008
cc – Keith Bailey, Mike Flack

Shannon,

In response to your letter dated October 6, 2008, the following request was made in the comments to the Tronox Annual Remedial Performance Report for Chromium and Perchlorate, Tronox LLC, Henderson, Nevada, July 2007 - 2008 (August 25, 2008):

- Appendix B – Groundwater (GW) Capture Evaluation, TRX should respond to the comments in Attachment A for this appendix in a separate RTC that should be included in a Revised GW Capture Evaluation submitted as a stand-alone document. Please advise the NDEP by October 13, 2008 regarding the schedule for this re-submittal.

and (in conjunction with the above request), the following was also requested:

- NDEP Comment - 8(c), Section 2.0, general comment, TRX should provide a schedule by October 13, 2008, for all additional work proposed in this section to address the identified data gaps.

In response to these requests (and for submittal of a revised Groundwater Capture Evaluation as a stand-alone document), Tronox will provide the revised document by **February 27, 2009**. To meet this date, the schedule for field program events (as proposed in Section 2.0 of the annual report) are summarized as follows:

- Regarding demonstration of barrier integrity (page 2-2, Data Gap No.1) - pumping of wells M-70, M-71, and M-72 was proposed. Tronox is currently working on a power source such that pumping could be performed in these wells. It is anticipated that the power source can be secured and pumping will begin by the end of December 2008.
- Regarding flow around the western end of the barrier (page 2-4, Data Gap No. 3) - This data gap will be addressed through the installation of two additional borings (M-147 and M-148). The borings will be installed in late November or early December 2008.
- Regarding overlapping cones of depression (page 2-4, Data Gap. No 4) - At the present time, Tronox does not intend to shutdown any of the interceptor well field to accommodate additional distance-drawdown testing. Tronox would like to discuss this matter further with NDEP.
- Regarding demonstration of inward flow (section 2.2.3, page 2-11), reconfiguration of the pumping wells, bringing well ART-6 back online was proposed. The engineering to accomplish this has begun and Tronox anticipates that the wells will be online in the later part of December or early January 2008. Significant additional work is required to bring this well back online given the breadth of development that has taken place in the past few years.

- Installation of three wells (PC-138, PC-139 and PC-140) near recovery wells PC-117, PC-118 and PC-133 in the area of the Seep to support the understanding of drawdown in these wells and the delineation of the capture zone. Tronox continues to work to secure an access agreement from BRC for the installation of these wells. The goal is to install these wells within the 4th quarter 2008, pending negotiation of access agreement language.

In consideration of additional wells as noted in NDEP Comment 8 (l), Section 2.1.2, page 2-5, flow budget, it is suggested that TRX install wells within the Muddy Creek formation to address potential underflow issues and to refine the flow budget. Tronox proposed additional nested "deep" wells in the response to the Vertical Delineation of Contaminant Plumes and Hydraulic Gradients (September 2008). Tronox believes that the installation of these wells should be done before consideration of additional wells in the area of the interceptor well field and barrier.

Please feel free to call or e-mail if you have any questions. Thanks.

TRONOX LLC
Susan Crowley
PO Box 55
Henderson, NV 89009
office 702.651.2234
cell 702.592.7727
efax 405.302.4607
email susan.crowley@tronox.com

Meeting Minutes

Project: Tronox (TRX)
Location: Conference Call
Time and Date: 1:30 PM, Monday, October 20, 2008
In Attendance: NDEP – Brian Rakvica, Shannon Harbour
Hackenberry Assoc. – Paul Hackenberry (for NDEP)
Environmental Answers – Keith Bailey (for TRX)
ENSR –Mike Flack (for TRX)

CC: Jim Najima

1. The meeting was held to discuss TRX response-to-comments (RTC) e-mail dated October 14, 2008 in response to NDEP's October 6, 2008 Annual Remedial Performance Report response letter.
2. NDEP's October 6, 2008 letter requested TRX's response to specific comment by October 13, 2008. A complete annotated RTC letter will be included in the next Annual Remedial Performance Report.
3. Keith Bailey for TRX announced that Susan Crowley has been retired from TRX. Susan is expected to be contracted in a similar fashion as Keith for this project. To date, Susan has not been contracted and was therefore not on this call.
4. Keith will determine who the point of contact (POC) for TRX will be and notify NDEP. **ACTION ITEM.**
5. For this call, Keith and Mike Flack represented TRX.
6. TRX stated that TRX has a new AIG technical liaison, Julie Diebenow (pronounced as "D-ben-oh").
7. NDEP and TRX discussed the following comments from TRX's October 14, 2008 e-mail response.
   a. TRX RTC: "In response to these NDEP requests (and for submittal of a revised Groundwater Capture Evaluation as a stand-alone document), Tronox will provide the revised document by **February 27, 2009**."
      i. TRX should note that NDEP is approving the submittal date of February 27, 2009 with the understanding that no extensions will be granted.
      ii. TRX acknowledged NDEP's statement.
   b. TRX RTC: "Regarding demonstration of barrier integrity (page 2-2, Data Gap No.1) - pumping of wells M-70, M-71, and M-72 was proposed. Tronox is currently working on a power source such that pumping could be performed in these wells. It is anticipated that the power source can be secured and pumping will begin by the end of December 2008."
      i. NDEP requested clarification/explanation for the delay in obtaining electrical power. NDEP also noted that failure to obtain power will not be considered as justification for not addressing this data gap in the revised document. This work should be completed in time to include the data in the Revised Groundwater Capture Evaluation by the February 27, 2009 deadline.
      ii. TRX stated that the current electrical panel located at the groundwater treatment system does not have additional capacity for the operation of the pumps for M-70, M-71, and M-72. TRX is looking at options to supply

power to these pumps including solar panels since pumping rates are expected to be low.

c. TRX RTC: "Regarding flow around the western end of the barrier (page 2-4, Data Gap No. 3) - This data gap will be addressed through the installation of two additional borings (M-147 and M-148). The borings will be installed in late November or early December 2008."
   i. NDEP requested clarification/explanation for the delay in the advancement of these borings especially since the delay results in trying to schedule field work during holiday season. NDEP also noted that failure to schedule and complete this work will not be accepted as justification for not addressing this data gap in the revised document. This work should be completed in order to include the data in the Revised Groundwater Capture Evaluation by the February 27, 2009 deadline.
   ii. TRX stated that the schedule for advancement of these borings and the completion of the groundwater wells was being delayed to coordinate with the installation of the seep area wells. The seep wells are in turn being delayed by access agreement issues with BRC. TRX is in the process of reviewing and editing the latest version of the access agreement with BRC. TRX stated that BRC version of the access agreement had items concerning the development of the lower pond area including possible relocation of wells as needed for development.

d. TRX RTC: "Regarding overlapping cones of depression (page 2-4, Data Gap. No 4) - At the present time, Tronox does not intend to shutdown any of the interceptor well field to accommodate additional distance-drawdown testing. Tronox would like to discuss this matter further with NDEP."
   i. TRX stated that the investigation of overlap in the interceptor wells (south of the barrier is a somewhat lower priority than the other data gaps and the Phase B Source Area Investigation since the barrier wall serves to block downgradient flow.
   ii. NDEP stated that a detailed groundwater elevation map would be preferable to a drawdown investigation. NDEP mentioned that a program such as Surfer could be used to draw vectors for groundwater direction analysis.
   iii. TRX stated that the extraction wells are not operated in steady state but are intermittent and shut off when water levels drop. Any groundwater elevation map will only be a "snapshot in time". TRX will provide a draft map to the NDEP for comment prior to the inclusion in the final revised groundwater capture document.

e. TRX RTC: "Regarding demonstration of inward flow (section 2.2.3, page 2-11), reconfiguration of the pumping wells, bringing well ART-6 back online was proposed. The engineering to accomplish this has begun and Tronox anticipates that both ART-6 and ART-9 wells will be online in the later part of December or early January 2008. Significant additional work is required to bring this well back online given the breadth of development that has taken place in the past few years."
   i. NDEP requested clarification/explanation of this comment.

ii. TRX stated that ART-6 has been operated as a "buddy well" to ART-9. This means that only one well is operated as an extraction well at a time, using single power source and flow line back to Lift Station #3 TRX is investigating rewiring or re-designing the power system to the pumps. Additionally, TRX has been delayed by the need to raise the grade of the well completions due to COH construction.

iii. NDEP stated that failure to complete this work will not be accepted as justification for not addressing this data gap in the revised document. This work should be completed in order to include the data in the Revised Groundwater Capture Evaluation by February 27, 2008.

f. TRX RTC: "Installation of three wells (PC-138, PC-139 and PC-140) near recovery wells PC-117, PC-118 and PC-133 in the area of the Seep to support the understanding of drawdown in these wells and the delineation of the capture zone. Tronox continues to work to secure an access agreement from BRC for the installation of these wells. The goal is to install these wells within the 4th quarter 2008, pending negotiation of access agreement language."

i. NDEP responded that the installation of these three wells is acceptable.

ii. Scheduling delays due to access negotiations were discussed above.

g. TRX RTC: "In consideration of additional wells as noted in NDEP Comment 8 (l), Section 2.1.2, page 2-5, flow budget, it is suggested that TRX install wells within the Muddy Creek formation to address potential underflow issues and to refine the flow budget. Tronox proposed additional nested "deep" wells in the response to the Vertical Delineation of Contaminant Plumes and Hydraulic Gradients (September 2008). Tronox believes that the installation of these wells should be done before consideration of additional wells in the area of the interceptor well field and barrier."

i. NDEP stated that the well locations proposed in the Vertical Delineation document area are acceptable to advance and install prior to considering additional wells to address this data gap. NDEP also stated that this work should be completed in time to be included in the Revised Groundwater Capture Evaluation by February 27, 2008.

ii. NDEP stated that comments to the Vertical Delineation document should be issued by the end of the week.

iii. NDEP stated that there has been no resolution to the nomenclature issue.

iv. TRX stated concern with using existing nomenclature that may not be acceptable later.

ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

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

Kenny C. Guinn, Governor
Allen-Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

November 4, 2008

Mike Skromyda
Tronox LLC
PO Box 55
Henderson, NV 89009

Re: **Tronox LLC (TRX)**
NDEP Facility ID #H-000539
Nevada Division of Environmental Protection (NDEP) Response to:
Response to NDEP Comments Vertical Delineation of Contaminant Plumes and Hydraulic Gradients
Dated September 2008 (received September 26, 2008)

Dear Mr. Skromyda,

The NDEP has received and reviewed TRX's report identified above and provides comments in Attachment A. No response is necessary, however, these comments should be considered in the development of future Deliverables. Please advise the NDEP as soon as possible regarding the schedule for the implementation of the proposed scope of work.

Please contact the undersigned with any questions at brakvica@ndep.nv.gov or (702) 486-2850 extension 247.

Sincerely,

Brian A. Rakvica, P.E.
Supervisor
Bureau of Corrective Actions
Special Projects Branch
NDEP-Las Vegas Office

BAR:sh:s

CC: Jim Najima, NDEP, BCA, Carson City
Shannon Harbour, NDEP, BCA, Las Vegas
Keith Bailey, Environmental Answers LLC, 3229 Persimmon Creek Drive, Edmond, OK 73013
Susan Crowley, Crowley Environmental LLC, 366 Esquina Dr, Henderson NV 89014
Sally Bilodeau, ENSR, 1220 Avenida Acaso, Camarillo, CA 93012-8727
Barry Conaty, Holland & Hart LLP, 975 F Street, N.W. Suite 900, Washington, D.C. 20004
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
Ebrahim Juma, DAQEM, 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
Michael Bellotti, Olin Corporation, 3855 North Ocoee Street, Suite 200, Cleveland, TN 37312
Curt Richards, Olin Corporation, 3855 North Ocoee Street, Suite 200, Cleveland, TN 37312
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, NV 89509

Attachment A

1. General comment, groundwater density appears to be calculated by various methods by the various BMI Companies (BMI, Tronox, TIMET and the Pioneer-Olin-Stauffer-Syngenta-Montrose group). In performing these spot checks the NDEP used the online calculator found at http://www.csgnetwork.com/h2odenscalc.html. For example, TIMET used an online calculator found at http://www.earthwardconsulting.com/density. To facilitate comparability of results the NDEP recommends that all the BMI Companies standardize upon a single method, namely the method used at the online calculator found at http://www.earthwardconsulting.com/density. That website lists a reference for its implementation (in the spreadsheet linked at the bottom of the page) as *Handbook of Hydrology, 1993, David R. Maidment.*
2. General comment, there appears to be some disparity in groundwater temperature measurement that may or may not be related to sampling methodology by the BMI Companies. TRX did not present water temperatures and this issue needs clarification. Also, please clarify the sampling methods used.
3. Table 1, it is noted that the NDEP spot check for wells M-74, M-133, and M-132 for Spring 2008 provided comparable results.
4. Table 2, the NDEP has the following comments:
    a. The Spring 2008 data set was evaluated for all TR-Series wells; the data appear acceptable for the Standard Methods quality checks.
    b. Note regarding the Comments column; the NDEP does not approve the use of either anion or cation data from an earlier or later sample to compute the cation-anion balance.
5. Figure 1, NDEP notes that the spacing between wells TR-12 and H-58A is not appropriate for vertical gradient calculations. Based upon data reviewed in the region, it is expected that wells should generally be no further than 50' apart.
6. Plate 1, due to the large distances between the projected wells and the wells used to develop this cross-section, it is noted that the geologic interpretation is not likely to be meaningful. It is requested that the cross-section be redrawn once the new wells are installed.

References Cited

American Public Health Association, American Water Works Association, and Water Environment, 1995. Standard Methods for the Examination of Water and Wastewater, Section 1030 E for Correctness of Analyses. 19th Edition.