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Ms. Ruby Crysler
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August 25, 2017

Subject: Response to U.S. Environmental Protection Agency Comments, dated July 25, 2017, on the *2016 Annual Remedy Performance Report*
2040 West River Drive, Davenport, Iowa
Harcros Chemicals EPA ID No. IAD022100671
Docket No. RCRA-07-2012-0013

Dear Ms. Crysler,

On behalf of T H Agriculture & Nutrition, L.L.C. (THAN), Elementis Chemicals, Inc., and Harcros Chemicals Inc. (Respondents), CH2M HILL Engineers, Inc. (CH2M) is submitting responses to U.S. Environmental Protection Agency (EPA)'s comments dated July 25, 2017, on the *2016 Annual Remedy Performance Report* (ARPR) for the above-referenced property (the "site"), which was submitted on February 24, 2017. This letter and its attachments serve as Addendum No. 1 to the 2016 ARPR, as an entirely updated document will not be prepared. Attachment A is a Response to Comments document where EPA's comments are re-stated in bold font and the Respondents' responses are shown in non-bold font. Attachment B contains several replacement pages for the report.

We are currently preparing the 2017 ARPR. Please contact me at (414) 847-0376 or Ms. Anna Kunkel at (913) 538-2349 if you have any questions.

Regards,
CH2M HILL Engineers, Inc.

Paul Rohde

Paul D. Rohde, P.G.
Project Manager

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Attachments
c:
Anna Kunkel/Philips North America
John P. Cleary/ Harcros Chemicals Inc.
Michael Potts/ENVIRON International Corp.

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Attachment A

EPA Comments on the Draft *2016 Annual Remedy Performance Report* (ARPR), Harcros Chemicals, 2040 West River Drive, Davenport, Iowa, EPA ID No. IAD022100671

1. **Table 2-1, *Monitoring Well Construction Data and June 2016 Groundwater Elevations:* Based on a review of Table 2-1 and groundwater level measurement field forms in Appendix A, well screens appear to continue to be occluded (see table below), and these deficiencies apparently have yet to be addressed. Monitoring well occlusion can impact the representativeness of the sampling data as the excessive sediment can promote bacterial activity and produce elevated turbidity levels.**

Well ID	Currently in Sampling Program?	Top of casing (TOC) (ft amsl)	Ground Elevation (ft amsl)	Bottom of Screened Interval, Table 2-1 (ft amsl)	Measured Depth to Bottom – June 2016, Appendix A (ft amsl)	Screen Length (ft)	% Occlusion
MW-05	Yes-ISCO	565.90	562.20	557.20	557.91	2.50	28.4
MW-17	No-GW Elevation only	561.17	561.73	548.73	552.52	5.00	75.8
BW- 05	Yes-ISCO	571.33	568.70	550.20	560.25	10.00	100
BW- 06	Yes-ISCO	567.01	563.97	537.97	544.42	10.00	64.5

amsl = above mean sea level
ft = feet
GW = groundwater
ISCO = in situ chemical oxidation

It is noted that in Table 2-1 of the report that the top of casing elevation and ground elevation listed for bedrock well (BW)-06 appears to be transposed since the table indicates that the ground elevation is at 567.01 feet amsl and the top of casing is at 563.97 feet amsl. This would indicate that the top of casing is approximately three feet below ground surface, which is inconsistent with all other well construction completions at the Facility. The above table assumes that the two elevations are transposed and the calculations were corrected accordingly. Table 2-1 should be revised accordingly.

As previously commented, the report should provide recommendations for re-development of these wells or other corrective measures to re-store the hydraulic connection between the well screens and the aquifer. Additionally, future reports should include the measured total depth of the wells within the well construction and groundwater elevations table for comparisons.

Respondents' Response: Table 2-1 has been updated to revise the construction information for monitoring wells MW-05, MW-17, and BW-06. The updated table is included in Attachment B of this document, and serves as the replacement table for the 2016 ARPR dated February 24, 2017. Additionally, revised monitoring well completion diagrams for MW-17 and BW-06 are also included in Attachment B. Specific responses for the monitoring wells listed Table 2-1 are discussed further in the paragraphs below.

Starting with the 2017 ARPR, total depth information will be included on the monitoring well construction table. Additionally, the need for potential redevelopment at each sampled well will be

evaluated each year. This evaluation will be completed by calculating the percent occlusion of the well. The percent occlusion and the current use of each well (i.e., if it is sampled as part of the long-term monitoring program) will be considered when recommending wells for redevelopment. Due to the unique construction of the Flute monitoring wells, depth to bottom measurements cannot be collected from these locations; therefore, they will not be included in the occlusion evaluation.

MW-05: As discussed in the 2015 ARPR, this monitoring well was repaired in the spring of 2015. The top of casing elevation at this well changed as a result of the repairs, and therefore was re-surveyed. The top of casing elevation provided in Table 2-1 was updated to match this survey; however, the ground surface elevation was inadvertently not revised to match the survey (562.4). Because the length of the monitoring well screen is 3 feet, instead of the 2.5 noted above in Table 2-1, the calculated percent occlusion is 17 percent.

Because MW-05 is part of the long-term monitoring program, and because it appears to be 17 percent occluded, the Respondents recommend redeveloping this well the next time well repairs are performed onsite. The recommendation to redevelop this well will be included in the 2017 ARPR.

MW-17: The historical field forms documenting the installation of MW-17 were reviewed, and the construction information included in Table 2-1 of the 2016 ARPR is erroneous. The bottom of the well screen at MW-17 is 10 feet below ground surface, which corresponds to an elevation of 551.73 feet above mean sea level [amsl]). Using this updated information, the percent occlusion is 7.9. As noted in Table 2-1 above, monitoring well MW-17 is not part of the long-term monitoring program outlined in the EPA-approved *Operation, Monitoring, and Maintenance Plan* (OMMP). Groundwater level measurements are collected from this well to supplement the potentiometric surface map in the unconsolidated bedrock zone. Because this well is not used for sampling, there is not a need to redevelop it.

BW-05: The total depth measurement recorded for BW-05 in June 2016 is believed to be erroneous based on the total depth measurements collected in June 2017. The total depth of this well will be measured when redevelopment occurs for MW-05. If the well is found to be occluded, it will be redeveloped at that time.

BW-06: As discussed in the 2015 ARPR, a new loading dock was constructed in the vicinity of BW-06 since its installation, and as a result of the construction the well's surface completion was converted from a stick-up type to a flush-mount type in 2006. The top of casing elevation and ground surface elevation at this well changed as a result of the construction and was resurveyed in 2015. The top of casing elevation provided in Table 2-1 was updated to match this survey; however, the ground surface elevation, depth to bedrock, and depth to the bottom of the screened intervals were inadvertently not revised. Based on the construction information presented in the revised Table 2-1 (provided in Attachment B), this well is occluded by less than 5 percent and will not be redeveloped at this time.

2. **Table 3-1, *Groundwater Field Parameter Measurements-June 2016:* In the footnotes of Table 3-1 it states that permanganate concentrations were measured in onsite wells using a Hach DR 890 Colorimeter (spectrophotometer). Field forms recording all field parameter measurements should be included in the report, including field spectrophotometer data forms.**

   Respondents' Response: The groundwater sampling forms will be modified to include the spectrophotometer measurements starting with the 2017 ARPR.

3. **Figure 3-2, *Unconsolidated Zone June 2016 Potentiometric Surface:* Groundwater elevation was measured at 565.54 feet amsl at monitoring well (MW)-03, not 567.48 feet amsl, which is a duplicate of the water level measured at MW-04. The figure should be corrected.**

   Respondents' Response: Because EPA is referring to an unconsolidated zone well, the correct figure reference is for Figure 3-1, not Figure 3-2. Figure 3-1 has been updated to revise the groundwater elevation at monitoring well MW-03 to 565.54 feet amsl. The updated figure is included in Attachment B, and serves as the replacement figure for the 2016 ARPR, dated February 24, 2017.

   Additionally, the horizontal gradient and velocity calculations included in Table B-1 of the 2016 ARPR, Appendix B, have been revised for the unconsolidated zone. An updated version of Table B-1 is included in Attachment B of this document, and serves as the replacement table for the 2016 ARPR, dated February 24, 2017.

4. **Figures:**

   a. **The report only includes chlorinated volatile organic compound concentration contours for detections above the EPA Maximum Contaminant Levels in the shallow bedrock unit. By doing so, the evaluation and depiction of the extent of contamination in groundwater is incomplete and potentially misleading. Concentration contour maps of individual CVOCs should be provided for the unconsolidated, intermediate and deep bedrock units, not just the shallow bedrock unit. Also, individual concentration contour maps for benzene, toluene, ethylbenzene and xylene should be included for the unconsolidated, intermediate and deep bedrock units as well.**

      In accordance with the 1999 EPA OSWER Directive 9200.4-17P, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites,* MNA monitoring programs should be designed to verify that plumes are not expanding either downgradient or laterally, but also not expanding vertically. The graphical depiction of this data is helpful in evaluating contaminant migration, recession or stabilization trends both laterally and vertically for both parent/daughter CVOCs and co-metabolized aromatics.

      Respondents' Response: In accordance with EPA's *Performance Monitoring of MNA Remedies for VOCs in Ground Water* (April 2004), there is no standard format for reporting monitoring data. The guidance indicates that contour maps are "helpful for visualizing broad trends" but does not explicitly require that they are submitted. The guidance emphasizes the use of statistical methods and trend analysis for evaluating data results. The Mann-Kendall Trend analysis presented in Section 3.2.3 of the 2016 ARPR includes analysis of monitoring wells in the unconsolidated, shallow, intermediate, and deep bedrock monitoring zones. These data (Appendix F of the 2016 ARPR) are used to support the evaluation of the vertical and horizontal extents over time. Detected concentrations of total and individual VOC compounds at intermediate and deep wells have decreased or are stable. Additionally, detected concentrations of total and individual VOC compounds at side-gradient and downgradient shallow bedrock and unconsolidated zone wells have been reduced or are stable. This suggests the overall vertical and horizontal extent of VOCs is reduced.

      The concentration contour figures requested by USEPA have not been included in previous ARPR reports and will not be prepared for the 2016 or future ARPRs. Extensive statistical analysis, trend data, and time series plots are presented for the purposes for evaluating trends of CVOCs and metabolized aromatics. In the 2016 ARPR, the Respondents provide a combination of figures (9), data tables (12), statistical summary tables (9), plots within the text (8), and trend graphs (273) to document conditions at the site. A complete data set of annual analytical results, necessary to prepare the requested figures, is provided in each ARPR. A row of

information has been added to Table 3-2 that indicates the screened zone of each well, and an updated Table 3-2 is included in Attachment B to this document.

b. **The CVOC concentration contour map for the shallow bedrock unit does not include a depiction of the extent of 1,1,1-trichloroethane, a primary constituent of concern, which should also be included on all maps as applicable.**

   Respondents' Response: Please refer to the response for Comment 4a. Additionally, please note that a concentration contour map for 1,1,1-trichloroethane in the shallow bedrock zone groundwater was included in the *2017 Corrective Measures Performance Evaluation Report* submitted on May 26, 2017.

c. **In accordance with the 1998 EPA guidance EP N600/R-98/128, Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water, Section 2.4.1.6, contour maps should be prepared for electron acceptors consumed (dissolved oxygen, nitrate and sulfate) and metabolic by-products produced (ferrous iron, chloride and methane) during biodegradation. In addition, a contour map should be prepared for alkalinity, Oxidation Reduction Potential and total organic carbon. These contour maps provide evidence of the occurrence and/or potential for biodegradation at a site.**

   Respondents' Response: In accordance with EPA's *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (September 1998) and *Performance Monitoring of MNA Remedies for VOCs in Ground Water* (April 2004), comparison of concentrations upgradient of the site to concentrations at and downgradient of the site provide evidence that reductive dechlorination has occurred and that concentrations are optimal for continued reductive dechlorination. The differences in geochemical concentrations are discussed in the "MNA Performance Monitoring Data" section of the ARPR text (Section 3.5.2) and are summarized on the screening results table (Table 3-10) that was completed in accordance with EPA's *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (September 1998).

   In accordance with the EPA-approved long-term monitoring program, geochemical parameters are not measured in samples from onsite wells due to the influence of ongoing ISCO injections on the aquifer geochemistry (because a highly oxidizing environment is being created). The additional figures EPA is requesting are not expected to provide additional insight into geochemical conditions because of the large separation between the upgradient and downgradient areas where geochemical data are collected. Therefore, no additional contour figures will be completed. A complete data set of annual analytical results, necessary to prepare the requested figures, is provided in each ARPR.

5. **Section ES.2.1, *In Situ Chemical Oxidation and Section* and Section 4.1, *ISCO Effectiveness:* The fourth bullet from the top states that concentration trends for individual CVOC daughter products 1,2-dichloroethene and vinyl chloride in the unconsolidated, shallow, intermediate or deep bedrock groundwater zones are either decreasing, have no trend or are not detected frequently enough to perform statistical trend analysis with the exception of two ISCO locations (BW-27 and BW-37). However, Appendix G, *Evaluation Summary Tables (for wells with increasing trends for CVOC daughter compounds)* indicates that in addition to BW-27 and BW-37, BW-05 has exhibited an increasing trend of vinyl chloride in the past. BW-05 was last sampled in 2010 prior to active ISCO injections. This well has not been sampled since due to permanganate in the well. This should be noted within Section ES.2.1 and Section 4.1 to remain consistent with Appendix G.**

   Respondents' Response: A clarifying statement has been added to Table G-1 of Appendix G indicating that the presence of permanganate in BW-05 during sample events from 2010 through

2016 precludes the determination of a vinyl chloride trend (replacement Table G-1 included in Attachment B to this document). The statements in Sections ES.2.1 and 4.1 are correct.

6. **Section 2.2.2, *Groundwater Level Measurement:* Per Comment #1 above, this section should include a discussion of total depth measurements and possible occlusion of the well screens at BW- 05, BW-06, MW-05 and MW-17.**

   Respondents' Response: Please refer to the response to Comment 1.

7. **Section 3.2.2.2, *VOC Concentration Distribution, CVOCs, CVOC Daughter Compounds:* It is stated within this section that the lateral extent of the detected concentrations of cis 1,2-DCE and vinyl chloride that are greater than Remedial Action Objectives is shown on Figure 3-5. This statement is incorrect. Figure 3-5 only depicts the lateral extent of detected concentrations of CVOC daughter compounds in the shallow bedrock groundwater zone; no information is provided regarding CVOC daughter compounds in the unconsolidated, intermediate or deep bedrock groundwater zones. As stated in Comment #4 above, additional maps depicting the CVOC concentration contours in the all groundwater zones should be included in the report.**

   Respondents' Response: The statement in Section 3.2.2.2 (page 3-4) has been updated to clarify that this statement refers to the shallow bedrock zone. A replacement page containing the revised text is included in Attachment B of this document. In regards to the additional requested figures, please refer to the response to Comment 4a.

8. **Section 3.2.5.1, *MNA Performance Monitoring Data, MNA Performance Monitoring Data Observations:* The last paragraph of this section states that aromatic compounds, which serve as electron donors for anaerobic biodegradation, were detected in several offsite bedrock wells providing a continued fuel source for reductive dechlorination of CVOCs and that periodic flooding of the Mississippi River provides additional organic materials to groundwater. Although the EPA generally agrees with these statements, the contribution of organic materials from Mississippi River flooding appears to be minimal or at least short-lived. Based on Total Organic Carbon concentration data collected during the June 2016 event and in accordance with the 1998 EPA guidance EP N600/R-98/128, *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water,* only one TOC detection fell within the optimal range for TOC (greater than 20 milligrams per liter) at BW-27 located on-site. All remaining TOC detections at off-site MNA monitoring wells were below 20 mg/L indicating, with the exception of the presence of off-site aromatic hydrocarbons, the available source of natural organic carbon may not be sufficient in the long-term. The EPA is not requesting action at this time, but is simply providing an evaluation of the June 2016 TOC concentrations that the report does not include. There are often strong indicators of ongoing, off-site reductive dechlorination beyond elevated TOC concentrations including low or no detections of other alternate electron acceptors and parent CVOC compounds. However, with increasing vinyl chloride concentrations at BW-14, future annual reports should include an evaluation of this MNA parameter and appropriate recommendations for further monitoring or contingency actions.**

   Respondents' Response: As presented in the 2016 ARPR and consistent with over a decade of monitoring results, multiple lines of evidence (decreasing CVOC mass and concentrations, detection of CVOC biodegradation daughter products, detection of geochemical conditions that indicate biodegradation has occurred, and detection of several geochemical parameters that indicate conditions are optimal for continued biodegradation) support ongoing natural attenuation at the facility, which in turn indicates that a sufficient carbon substrate is present at the facility. Under the unique conditions at this site, total organic carbon (TOC) concentrations less than the value (20 milligrams per liter) indicated in EPA's *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (September 1998) are effective for CVOC biodegradation.

Organic carbon sources (or fluxes) continue to enter the system from rainfall infiltration and seasonal and periodic flooding of the Mississippi River. The future availability of organic substrate for CVOC biodegradation will continue to be assessed in future ARPRs through the assessment of CVOC mass, CVOC concentration trends, and geochemical conditions.

9. **Section 3.2.6.4, *ISCO Summary Statement:* The section concludes that onsite well data indicate that the oxidizing chemical persists for ongoing treatment of VOCs in groundwater at five ISCO injection areas. The five areas referred to should be identified within this section. Also, please note that at Area 4, the data indicated low ORP, no observed permanganate and only one elevated detection of chloride (at BW-37), although this is not the highest chloride concentration detected during the June 2017 sampling event.**

   Respondents' Response: The text in Sections 3.2.6.1 (page 3-12) and 3.2.6.4 (page 3-13) has been updated to clarify which ISCO injection areas showed persistence of sodium permanganate in June 2016. Replacement pages containing the revised text for these sections are included in Attachment B of this document.

   The comment regarding ISCO injection Area 4 is noted. As documented in the letter, "Injection Wells Installation," dated July 14, 2017, two new injection wells were installed near existing Injection Area 4 in June 2017. Starting this summer, these new injection wells will be used to supplement the existing ISCO injection well network installed at the site as part of the onsite groundwater remedy selected by EPA in the 2010 *Final Decision Document and Response to Comments* (September 21, 2010).

10. **Section 5.2, *Monitoring Well Network Conditions:* Per Comment #1 above, this section should be revised to include recommendations for re-development of occluded wells or other corrective measures to re-store the hydraulic connection between the affected well screens and aquifer.**

    Respondents' Response: Please refer to the response to Comment 1.

11. **Section 3.2.2.1, *VOC Concentration Distribution, Total VOCs:* This section provides a graph depicting the total VOC planar areas surrounded by the 100,000 microgram per liter concentration line for each of the years starting with 2005. This graph represents the planar areas of the highest concentrations of total VOCs; however, similar graphs were not provided for the planar size of the 10 ug/L, 100 ug/L, 1,000 ug/L or 10,000 ug/L total VOC concentration areas which would also be useful in evaluating the decreasing planar trend of total VOC concentration area on- and off-site. Please include these graphs within this section.**

    Respondents' Response: The planar areas represented by the 10 µg/L, 100 µg /L, 1,000 µg /L, and 10,000 µg /L total VOCs concentrations for 2005 and 2016 are depicted in a graph in Section 3.2.2.1, at the top of Page 3-3. This graph, Figure 3-3, and the Mann-Kendall trend results presented in Table 3-4 are used in evaluation to conclude that the planar areas represented by the different concentration contours are decreasing. As previously stated in response to Comment 4a, the Respondents provide a combination of figures (9), data tables (12), statistical summary tables (9) plots within the text (8), and trend graphs (273) to document conditions at the site in the 2016 ARPR. The additional graphs EPA is requesting are not expected to provide additional insight into site conditions and concentration extent.

12. **Section 5.5, *Onsite Monitoring Well Sampling/Analysis* and Section 5.7, *Work to Be Performed in 2017:* Within the report, and in particular within these sections, there is no mention of the proposed soil investigation activities as outlined in the *Membrane Interface Probe Work Plan,* dated November 2016 to address ongoing, elevated concentrations of CVOCs in groundwater from three northern onsite bedrock monitoring wells (BW-16, BW-27 and BW-28). Please provide**

acknowledgement of this work to be performed and a brief discussion of the results of the investigation within Section 5.5 and Section 5.7 if the work is completed prior to the revision submittal.

Respondents' Response: The ARPRs prepared for the site summarize the status of the implemented/ongoing corrective measures identified in the Administrative Order on Consent (AOC), entered into by the Respondents and EPA Region 7, which was signed and made effective on May 29, 2012 as EPA Docket No. RCRA 07-2012-0013. As outlined in Section 4.2 of the *Membrane Interface Probe Work Plan*, a separate report is being prepared to summarize the membrane interface probe and laboratory analytical data.

13. **Appendix F, *Mann-Kendall Trend Plots and Statistical Analysis of Trend Plots* and Appendix G, *Evaluation Summary Tables:***
    a. **BW-27: Appendix G states that locally weighted scatter plot smoothing curves indicate concentrations are *increasing* for additional CVOC daughter compounds 1,1-DCE and 1,1-DCA at BW-27. The report should include a depiction of these scatter plots within Appendix F and G *to* provide a basis for conclusions made in Appendix G.**
    b. **BW-37: Appendix G indicates that locally weighted scatter plot smoothing curves indicate concentrations are *decreasing* for additional CVOC daughter compounds 1,1-DCE and 1,1-DCA at BW-37. The report should include a depiction of these scatter plots within Appendix F and G to provide a basis for conclusions made in Appendix G.**
    c. **BW-14: It is stated within Appendix G that locally weighted scatter plot smoothing curves indicate concentrations are *stable* for additional CVOC daughter compounds 1,1-DCE and 1,1-DCA at BW-14. The report should include a depiction of these scatter plots within Appendix F and G to provide a basis for conclusions made in Appendix G.**

Respondents' Response: Table G-1 of Appendix G has been updated to include the six requested graphs. Three replacement pages containing the revised Table G-1 are included Attachment B of this document, and serve as the replacement table to the 2016 ARPR, dated February 24, 2017.

Attachment B

August 25, 2017 Replacement Pages for Draft *2016 Annual Remedy Performance Report* (ARPR), Harcros Chemicals, 2040 West River Drive, Davenport, Iowa, EPA ID No. IAD022100671

- Onsite— southern portion of site near former storage area: BW-37 (10,400 µg/L; 1,1,1-TCA dominant)
- Offsite—downgradient from the former storage area in the southeast direction: BW-14 (8,300 µg/L; 1,1,1-TCA dominant). The highest offsite concentration of total parent CVOC concentrations observed at BW-14 is less than the highest onsite concentration (BW-16: 24,382 µg/L).

As shown on Figure 3-5, the detected concentrations of CVOC parent compounds PCE and TCE above RAOs in the shallow bedrock zone are limited to onsite monitoring well locations.

The ratio of CVOC parent compound concentrations versus total CVOC concentrations using 2016 data is summarized on Figure 3-6. Locations where the percentage of detected CVOC parent compounds versus total detected CVOCs exceeds a value of 50 percent (indicating a predominance of parent compounds at that location) are limited to onsite monitoring well locations at MW-04, BW-04, MW-05, MW-06 and BW-31 (orange-colored dots). The highest percentage of detected CVOC parent compounds were observed in samples from onsite unconsolidated monitoring wells.

CVOC Daughter Compounds

CVOC daughter products were detected in the unconsolidated, shallow, intermediate, and deep bedrock zones in June 2016. 1,1-DCA, a biodegradation daughter compound of 1,1,1-TCA, and cis-1,2-DCE, a biodegradation daughter compound of PCE/TCE, are the most frequently detected compounds in sampled wells (detected in 78 percent of wells sampled in 2016; see Table 3-3). Vinyl chloride is also detected more frequently (64 percent) when compared with the detection frequencies of the other compounds.

Consistent with historical sampling, the highest concentrations of total CVOC daughter products detected in the shallow and intermediate bedrock zones in 2016 are as follows:

- Onsite—northern portion of site: BW-16 (92,300 µg/L) and BW-27 (231,690 µg/L). Both of these locations were also identified as areas with highest parent CVOC concentrations.
- Onsite—southern portion of the site: BW-37 (77,270 µg/L). BW-37 was also identified as an area with the highest parent CVOC concentrations.
- Offsite—downgradient from the former product storage area in the southeast direction: BW-14 (154,291 µg/L). BW-14 was also identified as an area with the highest parent CVOC concentrations.

The lateral extents of the detected concentrations of cis-1,2-DCE and vinyl chloride that are greater than RAOs in the shallow bedrock zone is shown on Figure 3-5.

CVOC daughter product concentrations predominate versus parent concentrations at offsite wells (green dots shown on Figure 3-6). At each individual offsite well, either the concentration of CVOC parent compounds comprises less than 6 percent of the total CVOC concentration, or, if individual parent CVOC compounds are detected and comprise more than 6 percent, each is detected at a concentration below its respective RAO.

3.2.2.3 Aromatic Compounds

As shown on Figure 3-7, the lateral extent of aromatic compound detections in 2016 is reduced as compared with the lateral extent of aromatic compound detections in 2005. Furthermore, the magnitude of the aromatic concentrations has decreased as evidenced by smaller planar areas or lack of planar areas for the higher concentration contours (10,000 and 100,000 µg/L; yellow and peach colors, respectively). The lateral extent of BTEX compounds detected above RAOs in June 2016 is shown on Figure 3-8. Concentrations of BTEX compounds above RAOs are limited to two areas of the site, including a northern onsite area and an area within and downgradient from the former storage area in the southern portion of the site.

3.2.5.5 MNA Summary Statement

Natural attenuation via anaerobic biodegradation processes (i.e., reductive dechlorination) is ongoing within the area of CVOC detections as demonstrated by 2016 data, and continues to be an effective remedy for offsite groundwater.

3.2.6 ISCO Operational Data

3.2.6.1 Permanganate

Permanganate was visually observed/noted in eight shallow bedrock monitoring wells in 2016 (observed either during the purging process, at the time of sampling, or during water level measurement process) as summarized in Table 3-11.

The field spectrophotometer was utilized at all onsite wells where groundwater samples were collected in June 2016. Permanganate was detected in three shallow bedrock zone and unconsolidated zone monitoring wells at the time of sampling using this meter as summarized in Table 3-1. Locations where samples were visibly clear (not pink/purple), and had concentrations of permanganate measured of less than 5 mg/L are not believed to be impacted by permanganate at the time of meter use/readings. These measurements are within the range of error of the field spectrophotometer.

Consistent with historical observations, permanganate was not observed in June 2016 in either intermediate or deep bedrock zone monitoring wells, in monitoring wells at ISCO injection Areas 4 or 6 (Figure 2-2), or in offsite monitoring wells. The ROI of permanganate in shallow bedrock wells in June 2016 ranged from 20 to 90 feet, which is similar to the historically observed ROI of 10 to 100 feet. The onsite well data indicate the oxidizing chemical persists for ongoing treatment of VOCs in groundwater at five (Areas 1, 2, 3, 5 and 7) of the seven ISCO injection areas.

Permanganate has persisted in onsite groundwater for at least 6 months since last injection ended in December 2015 and observations were recorded in June 2016.

3.2.6.2 Oxidation Reduction Potential

June 2016 ORP values are provided in Table 3-1. ORP is a relative measure of the groundwater's ability to accept or transfer electrons (EPA, 1998). In general, strongly positive ORP readings in groundwater indicate an ability to oxidize or accept electrons from other substances, and strongly negative ORP readings indicate an ability to reduce or transfer electrons to other substances. When ISCO is used/injected, an oxidant or electron acceptor such as permanganate is added to groundwater to oxidize VOCs. The oxidant's presence in groundwater is evidenced by ORP values that are higher (or more positive) than background conditions. As VOCs are oxidized, the oxidizing ability of groundwater decreases as does the ORP value.

Elevated ORP readings at and downgradient from ISCO injection areas provide evidence of oxidizing conditions due to the presence of permanganate in groundwater (beyond checking for visual evidence of purple color).

Onsite ORP values in June 2016 are generally more oxidizing where permanganate (an oxidant) was observed at the time of sampling. The most oxidizing/highest positive ORP values are observed onsite at unconsolidated zone wells MW-04 (618.9 mV), and shallow bedrock zone monitoring wells BW-04 (579.8 mV), BW-05 (577.9 mV), and PZ-01 (650.7 mV). Elevated ORP values were also measured at unconsolidated zone monitoring well MW-08 (457.6) and shallow bedrock wells BW-01 (440.7) and BW-31 (470.5).

3.2.6.3 Chloride

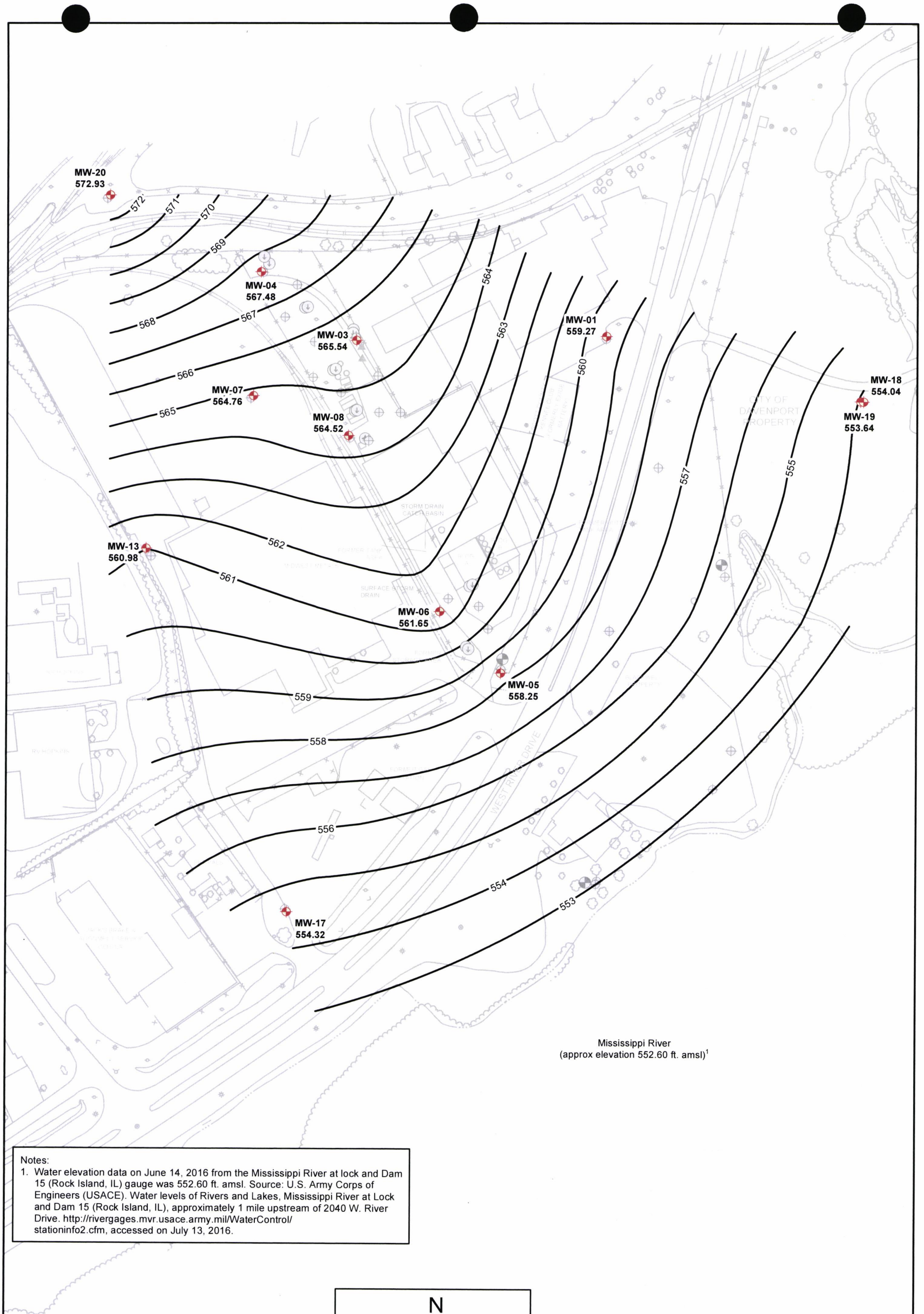
During chemical oxidation of the CVOCs (parent compounds and daughter products) by permanganate, chloride is released into groundwater. Chloride is analyzed as an indicator parameter to evaluate the effectiveness of the ISCO remedy (ITRC, 2005).

The highest chloride concentrations onsite correspond with the highest concentrations of CVOCs detected onsite. Concentrations of chloride detected onsite in the unconsolidated zone and deep bedrock zone are lower than those detected in shallow and intermediate bedrock zones. Elevated concentrations of chloride (2 to 10 times greater than the background concentrations) occur at the following onsite locations:

- Northern portion of site: BW-27 (310 mg/L), BW-28 (180 mg/L), BW-05 (710 mg/L), BW-16 (190 mg/L), and BW-04 (180 mg/L) (BW-27 and BW-38 are located immediately adjacent to ISCO injection Area 1, BW-05 is immediately adjacent to ISCO injection Area 3, BW-16 is within ISCO injection Area 7, and BW-04 is within ISCO injection Area 5.)
- Southern portion of site: BW-37 (180 mg/L) (BW-37 is located downgradient from ISCO injection Area 4.)

3.2.6.4 ISCO Summary Statement

As demonstrated by the 2016 onsite well data, the oxidizing chemical permanganate is being effectively delivered as evidenced by its presence in many onsite monitoring well locations. Permanganate has persisted in onsite groundwater for 6 months since it was injected in December 2015, as it was still observed in many monitoring well locations in June 2016. Elevated chloride concentrations and ORP values both indicate oxidizing conditions are present onsite in the zones affected by permanganate injection (an approximate ROI of 20 to 90 feet). The onsite well data indicate the oxidizing chemical persists for ongoing treatment of VOCs in groundwater at five ISCO injection areas (Areas 1, 2, 3, 5 and 7).



Notes:
1. Water elevation data on June 14, 2016 from the Mississippi River at lock and Dam 15 (Rock Island, IL) gauge was 552.60 ft. amsl. Source: U.S. Army Corps of Engineers (USACE). Water levels of Rivers and Lakes, Mississippi River at Lock and Dam 15 (Rock Island, IL), approximately 1 mile upstream of 2040 W. River Drive. http://rivergages.mvr.usace.army.mil/WaterControl/stationinfo2.cfm, accessed on July 13, 2016.

Figure 3-1
Unconsolidated Zone
June 2016 Potentiometric Surface
2040 West River Drive
Davenport, Iowa

MKE \\LAKEFRONT\PROJ\THAN_DAVENPORT\GIS\MXD\2016\ANNUALREPORT\FIGURE 03-01 - UNCONSOLIDATED ZONE - JUNE 2016.MXD JHANSEN1 8/9/2017 12:32:44 PM

Table 2-1. Monitoring Well Construction Data and June 2016 Groundwater Elevations
THAN Davenport Site, 2040 West River Drive

Location	Well Screen Zone	Northing	Easting	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Bedrock Elevation (ft amsl)	Depth to Bedrock (ft bgs)	Top of Screened Interval (ft bgs)	Bottom of Screened Interval (ft bgs)	June 2016 Depth to Water (ft btoc)	June 2016 GW Elevation (ft amsl)
BW-01	Shallow Bedrock	5039.23	5245.33	570.62	567.60	556.60	11.00	21	31	11.97	558.65
BW-02	Shallow Bedrock	4937.72	4642.48	570.25	567.20	562.20	5.00	11	21	4.89	565.36
BW-03/BW03R[a]	Shallow Bedrock	4479.14	5068.76	565.48	562.50	558.00	4.50	15	25	7.28	558.20
BW-04	Shallow Bedrock	5151.00	4662.94	571.84	569.20	564.20	5.00	21	31	5.34	566.50
BW-05	Shallow Bedrock	4870.19	4810.68	571.33	568.70	563.70	5.00	8.5	18.5	5.57	565.76
BW-06	Shallow Bedrock	4615.99	5057.06	563.97	564.50	561.51	2.99	13.49	23.49	2.66	561.31
BW-09	Shallow Bedrock	4669.60	4474.22	565.52	562.75	549.75	13.00	18	28	3.96	561.56
BW-11	Shallow Bedrock	4071.43	4703.36	561.41	561.70	551.70	10.00	17	27	6.26	555.15
BW-12	Intermediate Bedrock	4866.01	4842.84	572.34	569.44	561.44	8.00	94	104	18.02	554.32
BW-13	Shallow Bedrock	4342.83	5459.16	566.65	563.36	539.36	24.00	27	32	13.80	552.85
BW-14	Shallow Bedrock	4544.55	5252.28	568.24	565.20	556.20	9.00	28	38	13.85	554.39
BW-15	Shallow Bedrock	4821.56	5334.11	567.02	563.94	555.94	8.00	18	28	13.22	553.80
BW-16	Shallow Bedrock	5041.16	4820.72	571.42	568.78	563.78	5.00	22.5	32.5	5.74	565.68
BW-18	Shallow Bedrock	5275.95	4399.23	575.70	575.73	565.73	10.00	32	42	5.00	570.70
BW-19	Shallow Bedrock	4120.61	5232.37	561.93	558.78	533.78	25.00	26.5	36.5	9.39	552.54
BW-21	Intermediate Bedrock	4115.38	5230.37	562.06	559.03	534.03	25.00	140	150	7.88	554.18
BW-22	Intermediate Bedrock	4276.87	5428.65	565.19	562.40	537.40	25.00	139	149	11.16	554.03
BW-23-50'	Shallow Bedrock	4496.61	5070.97	565.74	562.86	--	--	50	60	9.16	556.58
BW-23-90'	Intermediate Bedrock	4496.61	5070.97	565.75	562.86	--	--	90	100	11.50	554.25
BW-23-125'	Intermediate Bedrock	4496.61	5070.97	565.74	562.86	--	--	125	135	11.40	554.34
BW-23-200'	Intermediate Bedrock	4496.61	5070.97	565.76	562.86	--	--	200	210	11.51	554.25
BW-23-290'	Deep Bedrock	4496.61	5070.97	565.77	562.86	--	--	290	300	11.53	554.24
BW-23-390'	Deep Bedrock	4496.61	5070.97	565.78	562.86	--	--	390	400	11.34	554.44
BW-23-Liner	--	4496.61	5070.97	--	--	--	--	--	--	--	--
BW-24-175'	Intermediate Bedrock	4118.22	5212.69	562.63	559.32	--	--	175	185	8.42	554.21
BW-24-230'	Intermediate Bedrock	4118.22	5212.69	562.63	559.32	--	--	230	240	8.33	554.30
BW-24-290'	Deep Bedrock	4118.22	5212.69	562.63	559.32	--	--	290	300	8.29	554.34
BW-24-390'	Deep Bedrock	4118.22	5212.69	562.63	559.32	--	--	390	400	8.43	554.20
BW-24-Liner	--	4118.22	5212.69	--	--	--	--	--	--	--	--
BW-25	Shallow Bedrock	4637.26	5447.90	566.28	564.08	--	--	28	38	15.14	551.14
BW-26-65'[b]	Intermediate Bedrock	4657.67	5442.17	567.08	564.81	538.81	26.00	65	75	13.08	554.00
BW-26-85'[b]	Intermediate Bedrock	4657.67	5442.17	567.13	564.81	538.81	26.00	85	95	13.10	554.03
BW-26-205'[b]	Intermediate Bedrock	4657.67	5442.17	567.28	564.81	538.81	26.00	205	215	13.19	554.09
BW-26-295'[b]	Deep Bedrock	4657.67	5442.17	567.18	564.81	538.81	26.00	295	305	13.12	554.06
BW-26-395'[b]	Deep Bedrock	4657.67	5442.17	567.08	564.81	538.81	26.00	395	405	13.03	554.05
BW-26-Liner[b]	--	4657.67	5442.17	--	--	--	--	--	--	--	--
BW-27[c]	Shallow Bedrock	5129.56	4719.97	570.68	--	--	10.00	15.5	40.5	4.84	565.84
BW-28[c]	Shallow Bedrock	5074.93	4699.76	569.41	--	--	9.00	15.5	40.5	4.05	565.36
BW-29[c]	Shallow Bedrock	5033.18	4750.23	569.50	--	--	8.00	11.5	36.5	3.97	565.53

Table 2-1. Monitoring Well Construction Data and June 2016 Groundwater Elevations
THAN Davenport Site, 2040 West River Drive

Location	Well Screen Zone	Northing	Easting	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Bedrock Elevation (ft amsl)	Depth to Bedrock (ft bgs)	Top of Screened Interval (ft bgs)	Bottom of Screened Interval (ft bgs)	June 2016 Depth to Water (ft btoc)	June 2016 GW Elevation (ft amsl)
BW-30[c]	Shallow Bedrock	4973.09	4747.91	570.17	--	--	8.50	11.5	36.5	4.75	565.42
BW-31[c]	Shallow Bedrock	4947.55	4795.36	571.61	--	--	9.00	12	37	5.40	566.21
BW-32[c]	Shallow Bedrock	4975.52	4857.92	570.13	--	--	8.00	12	37	4.21	565.92
BW-33[c]	Shallow Bedrock	4913.75	4859.60	571.49	--	--	10.50	12	37	5.69	565.80
BW-34[c]	Shallow Bedrock	4913.99	4896.32	570.02	--	--	8.50	12	37	3.66	566.36
BW-35[c]	Shallow Bedrock	4599.13	4978.13	568.05	--	--	7.00	9.5	34.5	3.90	564.15
BW-36[c]	Shallow Bedrock	4586.10	5030.36	567.28	--	--	7.00	9.5	34.5	5.41	561.87
BW-37[c]	Shallow Bedrock	4547.82	5046.31	564.93	--	--	4.50	9.5	34.5	6.24	558.69
ISCO-IW01	Shallow Bedrock	5053.94	4815.66	570.70	--	--	5.50	20.0	30.0	--	--
ISCO-IW02	Shallow Bedrock	5048.20	4817.58	570.77	--	--	5.50	8	18	--	--
ISCO-IW03[d]	Shallow Bedrock	5090.88	4733.75	--	--	--	13.50	29.5	39.5	--	--
ISCO-IW04[d]	Shallow Bedrock	5092.26	4738.26	--	--	--	10.00	16.5	26.5	--	--
ISCO-IW05[d]	Shallow Bedrock	4985.29	4782.28	--	--	--	8.50	24.5	34.5	--	--
ISCO-IW06[d]	Shallow Bedrock	4987.07	4786.27	--	--	--	8.50	12	22	--	--
ISCO-IW07[d]	Shallow Bedrock	4915.92	4819.49	--	--	--	8.50	22	32	--	--
ISCO-IW08[d]	Shallow Bedrock	4917.35	4822.55	--	--	--	9.00	12	22	--	--
ISCO-IW09[d]	Shallow Bedrock	4620.15	5014.89	567.64	--	--	5.50	23.5	33.5	--	--
ISCO-IW10[d]	Shallow Bedrock	4622.55	5019.49	567.33	--	--	6.00	10.5	20.5	--	--
ISCO-IW11	Shallow Bedrock	4525.49	5020.25	566.28	566.60	--	5.00	20	30	--	--
ISCO-IW12	Shallow Bedrock	4523.29	5021.84	565.91	566.20	--	5.00	8	18	--	--
ISCO-IW13	Shallow Bedrock	5165.76	4673.47	570.45	570.60	--	6.50	21.5	31.5	--	--
ISCO-IW14	Shallow Bedrock	5167.85	4670.71	570.36	570.40	--	6.50	9.5	19.5	--	--
ISCO-PZ-01[b]	Shallow Bedrock	5040.33	4793.12	571.34	569.12	563.12	6.00	9	34	5.63	565.71
ISCO-PZ-03	Shallow Bedrock	5026.83	4829.86	570.65	568.42	562.92	5.50	10	35	4.86	565.79
ISCO-PZ-04[b]	Shallow Bedrock	5006.62	4831.17	570.96	569.07	563.57	5.50	10	35	5.14	565.82
MW-01	Unconsolidated	5043.59	5245.56	570.35	567.10	556.10	11.00	4	11	11.08	559.27
MW-03	Unconsolidated	5035.84	4821.48	570.64	568.70	563.70	5.00	2.5	5	5.10	565.54
MW-04	Unconsolidated	5151.67	4659.38	571.36	569.00	564.00	5.00	2.5	5	3.88	567.48
MW-05	Unconsolidated	4474.13	5067.76	565.90	562.40	557.90	4.50	2	5	7.65	558.25
MW-06	Unconsolidated	4576.72	4964.41	570.15	567.50	561.50	6.00	3.5	6	8.50	561.65
MW-07	Unconsolidated	4941.41	4647.23	570.31	567.20	562.20	5.00	2	5	5.55	564.76
MW-08	Unconsolidated	4874.70	4808.19	571.36	568.70	563.70	5.00	2	5	6.84	564.52
MW-13	Unconsolidated	4682.57	4466.12	565.74	563.00	549.00	14.00	9	14	4.76	560.98
MW-17	Unconsolidated	4066.42	4706.18	561.17	561.73	551.73	10.00	6	10	6.85	554.32
MW-18	Unconsolidated	4934.61	5676.34	565.57	562.80	510.80	52.00	42	52	11.53	554.04
MW-19	Unconsolidated	4933.94	5681.49	565.51	562.39	510.39	52.00	5	15	11.87	553.64
MW-20	Unconsolidated	5281.57	4404.09	576.13	576.16	569.36	6.80	5	7	3.20	572.93

Table 2-1. Monitoring Well Construction Data and June 2016 Groundwater Elevations
THAN Davenport Site, 2040 West River Drive

Location	Well Screen Zone	Northing	Easting	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Bedrock Elevation (ft amsl)	Depth to Bedrock (ft bgs)	Top of Screened Interval (ft bgs)	Bottom of Screened Interval (ft bgs)	June 2016 Depth to Water (ft btoc)	June 2016 GW Elevation (ft amsl)
PT-01	Shallow Bedrock	4869.20	4836.66	571.33	569.30	563.80	5.50	--	--	5.73	565.60
PZ-01	Shallow Bedrock	4871.37	4842.89	572.31	569.24	563.74	5.50	40	50	8.42	563.89
PZ-02	Intermediate Bedrock	4871.48	4842.86	572.33	569.24	563.74	5.50	60	70	14.45	557.88

Notes:

[a]Well BW-03 was abandoned on December 4, 2012 due to damage. A replacement well for BW-03 (BW-03R) was installed between December 4 and 6, 2012, approximately 5 feet to the northeast of well BW-03. Survey coordinates presented in this table are for BW-03R.

[b]Monitoring well was installed in December 2004.

[c]Monitoring well was installed in October 2007.

[d]ISCO injection well was installed in October 2007.

[e]ISCO injection well was installed in July 2010.

-- indicates the data is not available

NM = not measured

NA = not accessible

DRY = The monitoring well was dry at the time water level measurements were collected.

ft amsl = feet above mean sea level

ft bgs = feet below ground surface

ft btoc = feet below top of casing

NL = not able to locate

NS = not surveyed

All groundwater level measurements were collected on June 13 and 14, 2016.

Table 3-2. Groundwater Analytical Results – June 2016

THAN Davenport Site, 2040 West River Drive

		Field Sample Location:	MW-03	MW-04	MW-04	MW-05	MW-05	MW-06	MW-07	MW-07	MW-08	MW-08	MW-13	PZ-01
		Monitoring Well Type:	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	MNA	MNA	ISCO	ISCO	MNA	ISCO
		Sample Collection Date:	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/14/2016	6/14/2016	6/15/2016	6/15/2016	6/14/2016	6/16/2016
		Field Sample Identification:	ADDV-002	ADDV-003	ADDV-003-DL	ADDV-004	ADDV-004-DL	ADDV-005	ADDV-006	ADDV-006-DL	ADDV-007	ADDV-007-DL	ADDV-008	ADDV-043
		Well Screen Zone:	Unconsol-idated	Unconsol-idated	Unconsol-idated	Unconsol-idated	Unconsol-idated	Unconsol-idated	Unconsol-idated	Unconsol-idated	Unconsol-idated	Unconsol-idated	Unconsol-idated	Shallow Bedrock
		Matrix:	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
		Laboratory Sample Identification:	280-84538-5	280-84538-11	280-84538-11	280-84538-2	280-84538-2	280-84538-4	280-84495-1	280-84495-1	280-84538-9	280-84538-9	280-84495-4	280-84597-5
Volatile Organic Compounds	**Units**	**RAO (EPA 2009)**												
1,1,1-Trichloroethane	ug/L	200 µg/L	**0.25 J**	**200 =**	NR	**20** =	NR	**16** =	**24** =	NR	20 U	NR	1 U	NR
1,1-Dichloroethane	ug/L	2.4 µg/L*	**4.1 =**	**45 =**	NR	**7.5 =**	NR	**0.88 J**	**44 =**	NR	20 U	NR	1 U	NR
1,1-Dichloroethene	ug/L	7 µg/L	1 U	**3.4 J**	NR	**0.78 J**	NR	1 U	**4.7** =	NR	20 U	NR	1 U	NR
1,2-Dichloroethane	ug/L	5 µg/L	1 U	10 U	NR	1 U	NR	1 U	4 U	NR	20 U	NR	1 U	NR
2-Butanone	ug/L	7100 µg/L*	6 U	60 U	NR	6 U	NR	6 U	24 U	NR	120 U	NR	6 U	NR
Acetone	ug/L	22000 µg/L*	**1.9 J**	100 U	NR	**3.6 J**	NR	**5.4 J**	40 U	NR	200 U	NR	10 U	NR
Benzene	ug/L	5 µg/L	1 U	10 U	NR	1 U	NR	1 U	4 U	NR	20 U	NR	1 U	NR
Chloroethane	ug/L	21000 µg/L*	2 U	20 U	NR	2 U	NR	2 U	8 U	NR	40 U	NR	**0.62 J**	NR
cis-1,2-Dichloroethene	ug/L	70 µg/L	**18** =	**390 =**	NR	**18** =	NR	**2.2** =	NR	**570 =**	NR	**1700 =**	1 U	NR
Ethylbenzene	ug/L	700 µg/L	1 U	10 U	NR	1 U	NR	1 U	4 U	NR	20 U	NR	1 U	NR
Methylene Chloride	ug/L	5 µg/L	0.77 UB	**3.3 J**	NR	0.93 UB	NR	0.95 UB	1.4 UB	NR	**27 J**	NR	0.39 UB	NR
Styrene	ug/L	100 µg/L	1 U	10 U	NR	1 U	NR	1 U	4 U	NR	20 U	NR	1 U	NR
Tetrachloroethene	ug/L	5 µg/L	**7.6 =**	NR	**2000 =**	NR	**130 =**	**43 =**	4 U	NR	NR	**1700 =**	1 U	NR
Toluene	ug/L	1000 µg/L	1 U	10 U	NR	1 U	NR	1 U	4 U	NR	20 U	NR	1 U	NR
trans-1,2-Dichloroethene	ug/L	100 µg/L	**0.54 J**	**2.8 J**	NR	**0.72 J**	NR	**0.27 J**	**1.9 J**	NR	**6.6 J**	NR	1 U	NR
Trichloroethene	ug/L	5 µg/L	**9.9 =**	**180 =**	NR	**13 =**	NR	**21 =**	**2.4 J**	NR	**130 =**	NR	1 U	NR
Vinyl Chloride	ug/L	2 µg/L	**0.91 J**	10 U	NR	1 U	NR	1 U	**140 =**	NR	**460 =**	NR	1 U	NR
Xylenes, Total	ug/L	10000 µg/L	2 U	20 U	NR	2 U	NR	2 U	8 U	NR	40 U	NR	2 U	NR
General Chemistry														
Alkalinity, Total (As CaCO3)	mg/L	NA	NR	NR	NR	NR	NR	NR	**360** =	NR	NR	NR	**520 =**	NR
Chloride (As Cl)	mg/L	NA	**11** =	**78** =	NR	**7.8** =	NR	**4.8** =	**27** =	NR	**7.1** =	NR	**44** =	**95 J**
Ethane	ug/L	NA	NR	NR	NR	NR	NR	NR	**21 J**	NR	NR	NR	**8.2 J**	NR
Ethene	ug/L	NA	NR	NR	NR	NR	NR	NR	**3.4 J**	NR	NR	NR	15 U	NR
Ferrous Iron	mg/L	NA	NR	NR	NR	NR	NR	NR	0.2 UJ	NR	NR	NR	0.2 UJ	NR
Methane	ug/L	NA	NR	NR	NR	NR	NR	NR	**76** =	NR	NR	NR	**27000** =	NR
Nitrogen, Nitrate (As N)	mg/L	NA	NR	NR	NR	NR	NR	NR	0.5 U	NR	NR	NR	0.5 U	NR
Sulfate (As SO4)	mg/L	NA	NR	NR	NR	NR	NR	NR	**190** =	NR	NR	NR	**0.49 J**	NR
Sulfide	mg/L	NA	NR	NR	NR	NR	NR	NR	1 U	NR	NR	NR	1 U	NR
Total Organic Carbon	mg/L	NA	**2** =	**4.7** =	NR	**3.3** =	NR	**1.8** =	**3.4** =	NR	**5.7** =	NR	**9** =	NR

Notes:

NA = Not applicable

NR = Not reported

* RAO = Remedial action objective (If no maximum contaminant level [MCL] was available for the analyte, then the December 2009 EPA regional screening levels [RSLs] [tap water] were used.)

Bold indicates the analyte was detected in the groundwater sample.

Shading indicates the analyte was detected above the MCL.

Validation Codes:

U Undetected. The analyte was analyzed for but not detected at a concentration equal to or greater than the laboratory reporting limit.

J Estimated. The analyte was below the stated reporting limit, but greater than the method detection limit (MDL), or there is an analytical bias.

UB Undetected due to blank contamination. The analyte was detected in the sample and in an associated method, field, or trip blank. The quantity of the analyte is deemed undetected because it falls below the 95-percent confidence interval (five times the blank concentration). The analyte concentration is potentially the result of contamination.

UJ Estimated. The analyte was not detected above the MDL; however, the MDL is approximate, and may or may not represent the actual limit of detection.

Table 3-2. Groundwater Analytical Results – June 2016

THAN Davenport Site, 2040 West River Drive

Field Sample Location:			BW-01	BW-02	BW-02	BW-03R	BW-03R	BW-04	BW-05	BW-06	BW-06	BW-06	BW-06	BW-09	BW-11	BW-13	BW-14	BW-14	BW-14	BW-14	BW-15	BW-15	BW-16	BW-16	BW-18	BW-19	BW-21	BW-23-50'	BW-23-50'	BW-23-125'
Monitoring Well Type:			MNA	MNA	MNA	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	ISCO	ISCO	MNA	MNA	MNA	ISCO	ISCO	ISCO
Sample Collection Date:			6/15/2016	6/14/2016	6/14/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/16/2016	6/16/2016	6/16/2016	6/16/2016	6/14/2016	6/14/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/16/2016	6/14/2016	6/14/2016	6/14/2016	6/14/2016	6/14/2016
Field Sample Identification:			ADDV-009	ADDV-010	ADDV-010-DL	ADDV-011	ADDV-011-DL	ADDV-012	ADDV-013	ADDV-014	ADDV-014-DL	ADDV-015	ADDV-015-DL	ADDV-016	ADDV-017	ADDV-018	ADDV-019	ADDV-019-DL	ADDV-020	ADDV-020-DL	ADDV-021	ADDV-021-DL	ADDV-022	ADDV-022-DL	ADDV-023	ADDV-024	ADDV-025	ADDV-026	ADDV-026-DL	ADDV-027
Well Screen Zone:			Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Intermed. Bedrock	Shallow Bedrock	Shallow Bedrock	Intermed. Bedrock
Matrix:			Water	Water	Water	Water	Water	Water	Water	Water	Water	Water, Dup	Water, Dup	Water	Water	Water	Water	Water	Water, Dup	Water, Dup	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Laboratory Sample Identification:			280-84538-13	280-84495-3	280-84495-3	280-84538-1	280-84538-1	280-84538-12	280-84538-8	280-84597-11	280-84597-11	280-84597-12	280-84597-12	280-84495-2	280-84495-5	280-84538-18	280-84538-17	280-84538-17	280-84538-15	280-84538-15	280-84538-16	280-84538-16	280-84538-10	280-84538-10	280-84597-13	280-84495-7	280-84495-6	280-84495-10	280-84495-10	280-84495-11
Volatile Organic Compounds	**Units**	**RAO (EPA 2009)**																												
1,1,1-Trichloroethane	ug/L	200 µg/L	**0.22 J**	4 U	NR	**2100 =**	NR	NR	NR	**24 =**	NR	**22 =**	NR	1 U	1 U	1 U	NR	**8300 J**	NR	**7900 J**	4 U	NR	**3000 =**	NR	1 U	1 U	1 U	**390 =**	NR	1 U
1,1-Dichloroethane	ug/L	2.4 µg/L*	**0.28 J**	**140 =**	NR	**630 =**	NR	NR	NR	**260 =**	NR	**240 =**	NR	1 U	**0.23 J**	1 U	NR	**12000 J**	NR	**11000 J**	**74 =**	NR	**1200 =**	NR	1 U	1 U	1 U	**2000 =**	NR	**0.98 J**
1,1-Dichloroethene	ug/L	7 µg/L	1 U	**6.4 =**	NR	**150 J**	NR	NR	NR	**5 =**	NR	**5.1 J**	NR	1 U	1 U	1 U	**1200 =**	NR	**1200 =**	NR	**4.1 =**	NR	**390 =**	NR	1 U	1 U	1 U	**290 =**	NR	1 U
1,2-Dichloroethane	ug/L	5 µg/L	1 U	4 U	NR	200 U	NR	NR	NR	5 U	NR	10 U	NR	1 U	1 U	1 U	100 U	NR	100 U	NR	4 U	NR	100 U	NR	1 U	1 U	1 U	100 U	NR	1 U
2-Butanone	ug/L	7100 µg/L*	6 U	24 U	NR	1200 U	NR	NR	NR	30 U	NR	60 U	NR	6 U	6 U	6 U	600 U	NR	600 U	NR	24 U	NR	600 U	NR	6 U	6 U	6 U	600 U	NR	6 U
Acetone	ug/L	22000 µg/L*	5.1 UB	40 U	NR	2000 U	NR	NR	NR	50 U	NR	100 U	NR	**6.7 J**	10 U	3.7 UB	1000 U	NR	1000 U	NR	**30 J**	NR	1000 U	NR	2.4 UB	**7.1 J**	10 U	1000 U	NR	**28 =**
Benzene	ug/L	5 µg/L	1 U	4 U	NR	200 U	NR	NR	NR	**22 =**	NR	**23 =**	NR	1 U	1 U	1 U	**63 J**	NR	**68 J**	NR	**1.4 J**	NR	100 U	NR	1 U	1 U	1 U	**21 J**	NR	**3 =**
Chloroethane	ug/L	21000 µg/L*	2 U	8 U	NR	400 U	NR	NR	NR	**220 =**	NR	**270 =**	NR	**0.94 J**	2 U	2 U	200 U	NR	200 U	NR	8 U	NR	200 U	NR	2 U	2 U	2 U	200 U	NR	**25 =**
cis-1,2-Dichloroethene	ug/L	70 µg/L	**0.3 J**	NR	**410 =**	NR	**15000 =**	NR	NR	NR	**1400 =**	NR	**1300 =**	1 U	**1.1 =**	1 U	NR	**110000 J**	NR	**110000 J**	NR	**320 =**	NR	**89000 =**	1 U	**0.27 J**	1 U	NR	**38000 =**	**1.3 =**
Ethylbenzene	ug/L	700 µg/L	1 U	4 U	NR	**810 =**	NR	NR	NR	**270 =**	NR	**320 =**	NR	1 U	1 U	1 U	**4200 =**	NR	**4600 =**	NR	4 U	NR	100 U	NR	1 U	1 U	1 U	**1100 =**	NR	**0.47 J**
Methylene Chloride	ug/L	5 µg/L	2 U	1.9 UB	NR	**330 J**	NR	NR	NR	**3.6 J**	NR	**5.6 J**	NR	2 U	0.33 UB	2 U	200 U	NR	200 U	NR	2.3 UB	NR	**32 J**	NR	2 U	0.38 UB	0.32 UB	200 U	NR	2 U
Styrene	ug/L	100 µg/L	1 U	4 U	NR	**36 J**	NR	NR	NR	5 U	NR	10 U	NR	1 U	1 U	1 U	100 U	NR	100 U	NR	4 U	NR	100 U	NR	1 U	1 U	1 U	100 U	NR	1 U
Tetrachloroethene	ug/L	5 µg/L	1 U	4 U	NR	**250 =**	NR	NR	NR	5 U	NR	10 U	NR	1 U	**0.46 J**	1 U	100 U	NR	100 U	NR	4 U	NR	NR	**18000 =**	1 U	1 U	1 U	100 U	NR	1 U
Toluene	ug/L	1000 µg/L	**0.25 J**	4 U	NR	**2100 =**	NR	NR	NR	NR	**1300 J**	NR	**2100 J**	1 U	1 U	1 U	NR	**55000 J**	NR	**53000 J**	4 U	NR	**220 =**	NR	1 U	1 U	1 U	**640 =**	NR	**0.46 J**
trans-1,2-Dichloroethene	ug/L	100 µg/L	1 U	**1.6 J**	NR	200 U	NR	NR	NR	**7 =**	NR	**6.5 J**	NR	1 U	1 U	1 U	**91 J**	NR	**92 J**	NR	**0.89 J**	NR	**510 =**	NR	1 U	1 U	1 U	**22 J**	NR	**0.37 J**
Trichloroethene	ug/L	5 µg/L	1 U	4 U	NR	**76 J**	NR	NR	NR	5 U	NR	10 U	NR	1 U	**0.56 J**	1 U	100 U	NR	100 U	NR	4 U	NR	**3800 =**	NR	1 U	1 U	1 U	100 U	NR	1 U
Vinyl Chloride	ug/L	2 µg/L	1 U	**170 =**	NR	**620 =**	NR	NR	NR	NR	**1400 =**	NR	**1300 =**	1 U	1 U	1 U	NR	**31000 J**	NR	**28000 J**	NR	**380 =**	**1200 =**	NR	1 U	1 U	1 U	NR	**13000 =**	**1.1 =**
Xylenes, Total	ug/L	10000 µg/L	2 U	8 U	NR	**2800 =**	NR	NR	NR	**390 J**	NR	**580 J**	NR	2 U	2 U	2 U	**21000 =**	NR	**23000 =**	NR	8 U	NR	**430 =**	NR	2 U	2 U	2 U	**840 =**	NR	2 U
General Chemistry																														
Alkalinity, Total (As CaCO3)	mg/L	NA	**320 =**	**310 =**	NR	NR	NR	NR	NR	NR	NR	NR	NR	**460 =**	**360 =**	**540 =**	**490 =**	NR	**490 =**	NR	**350 =**	NR	NR	NR	**340 =**	**340 =**	**400 =**	NR	NR	NR
Chloride (As Cl)	mg/L	NA	**38 =**	**110 =**	NR	**27 =**	NR	**180 =**	**710 =**	**150 =**	NR	**150 =**	NR	**46 =**	**19 =**	**82 =**	**280 =**	NR	**280 =**	NR	**150 =**	NR	**190 =**	NR	**23 =**	**26 =**	**3.2 =**	**150 =**	NR	**36 =**
Ethane	ug/L	NA	5 U	5 U	NR	NR	NR	NR	NR	NR	NR	NR	NR	**12 J**	5 U	**10 J**	90 U	NR	90 U	NR	**23 =**	NR	NR	NR	5 U	**1.5 J**	5 U	NR	NR	NR
Ethene	ug/L	NA	5 U	**94 =**	NR	NR	NR	NR	NR	NR	NR	NR	NR	10 U	5 U	15 U	**5000 =**	NR	**5000 =**	NR	**37 =**	NR	NR	NR	5 U	5 U	5 U	NR	NR	NR
Ferrous Iron	mg/L	NA	0.2 UJ	0.2 UJ	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.2 UJ	0.2 UJ	0.2 UJ	**1.1 J**	NR	**1.7 J**	NR	**0.028 J**	NR	NR	NR	**0.041 J**	**0.057 J**	**0.096 J**	NR	NR	NR
Methane	ug/L	NA	5 U	**260 =**	NR	NR	NR	NR	NR	NR	NR	NR	NR	**27000 =**	**170 =**	**18000 =**	**240 =**	NR	**250 =**	NR	**390 =**	NR	NR	NR	**4.4 J**	**8500 =**	**120 =**	NR	NR	NR
Nitrogen, Nitrate (As N)	mg/L	NA	**2.4 =**	0.5 U	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.5 U	**0.045 J**	0.5 U	0.5 U	NR	0.5 U	NR	0.5 U	NR	NR	NR	0.5 U	0.5 U	**0.052 J**	NR	NR	NR
Sulfate (As SO4)	mg/L	NA	**73 =**	**52 =**	NR	NR	NR	NR	NR	NR	NR	NR	NR	**0.53 J**	**55 =**	5 U	**21 =**	NR	**21 =**	NR	**110 =**	NR	NR	NR	**120 =**	**0.77 J**	**6.2 =**	NR	NR	NR
Sulfide	mg/L	NA	1 U	1 U	NR	NR	NR	NR	NR	NR	NR	NR	NR	1 U	1 U	1 U	1 U	NR	1 U	NR	1 U	NR	NR	NR	1 U	1 U	1 U	NR	NR	NR
Total Organic Carbon	mg/L	NA	**2.1 =**	**2 =**	NR	**3.7 =**	NR	NR	NR	**5.6 =**	NR	**6.1 =**	NR	**8.8 =**	**3.2 =**	**10 =**	**7.3 =**	NR	**7.5 =**	NR	**2.7 =**	NR	**15 =**	NR	**2.3 =**	**4.3 =**	1.1 UB	**3 =**	NR	**1.8 =**

Notes:

NA = Not applicable

NR = Not reported

* RAO = Remedial action objective (If no maximum contaminant level [MCL] was available for the analyte, then the December 2009 EPA regional screening levels [RSLs] [tap water] were used.)

Bold indicates the analyte was detected in the groundwater sample.

Shading indicates the analyte was detected above the MCL.

Validation Codes:

U Undetected. The analyte was analyzed for but not detected at a concentration equal to or greater than the laboratory reporting limit.

J Estimated. The analyte was below the stated reporting limit, but greater than the method detection limit (MDL), or there is an analytical bias.

UB Undetected due to blank contamination. The analyte was detected in the sample and in an associated method, field, or trip blank. The quantity of the analyte is deemed undetected because it falls below the 95-percent confidence interval (five times the blank concentration). The analyte concentration is potentially the result of contamination.

UJ Estimated. The analyte was not detected above the MDL; however, the MDL is approximate, and may or may not represent the actual limit of detection.

Table 3-2. Groundwater Analytical Results – June 2016

THAN Davenport Site, 2040 West River Drive

Field Sample Location:			BW-23-390'	BW-23-390'	BW-24-390'	BW-24-390'	BW-25	BW-25	BW-26-65'	BW-26-65'	BW-26-85'	BW-26-85'	BW-26-395'	BW-26-395'	BW-27	BW-27	BW-28	BW-28	BW-31	BW-31	BW-33	BW-33	BW-34	BW-35	BW-35	BW-37	BW-37	BW-37	BW-37	MW-01
Monitoring Well Type:			ISCO	ISCO	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	ISCO	MNA
Sample Collection Date:			6/14/2016	6/14/2016	6/14/2016	6/14/2016	6/15/2016	6/15/2016	6/14/2016	6/14/2016	6/14/2016	6/14/2016	6/14/2016	6/14/2016	6/16/2016	6/16/2016	6/16/2016	6/16/2016	6/16/2016	6/16/2016	6/16/2016	6/16/2016	6/16/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016	6/15/2016
Field Sample Identification:			ADDV-028	ADDV-028-DL	ADDV-029	ADDV-030	ADDV-031	ADDV-031-DL	ADDV-032	ADDV-032-DL	ADDV-033	ADDV-033-DL	ADDV-034	ADDV-034-DL	ADDV-035	ADDV-035-DL	ADDV-036	ADDV-036-DL	ADDV-037	ADDV-037-DL	ADDV-038	ADDV-038-DL	ADDV-039	ADDV-040	ADDV-040-DL	ADDV-041	ADDV-041-DL	ADDV-042	ADDV-042-DL	ADDV-001
Well Screen Zone:			Deep Bedrock	Deep Bedrock	Deep Bedrock	Deep Bedrock	Shallow Bedrock	Shallow Bedrock	Intermed. Bedrock	Intermed. Bedrock	Intermed. Bedrock	Intermed. Bedrock	Deep Bedrock	Deep Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Unconsol-idated
Matrix:			Water	Water	Water	Water, Dup	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water, Dup	Water, Dup	Water
Laboratory Sample Identification:			280-84495-12	280-84495-12	280-84495-17	280-84495-16	280-84538-19	280-84538-19	280-84495-13	280-84495-13	280-84495-14	280-84495-14	280-84495-15	280-84495-15	280-84597-8	280-84597-8	280-84597-7	280-84597-7	280-84597-4	280-84597-4	280-84597-2	280-84597-2	280-84597-3	280-84538-3	280-84538-3	280-84538-7	280-84538-7	280-84538-6	280-84538-6	280-84538-14
Volatile Organic Compounds	**Units**	**RAO (EPA 2009)**																												
1,1,1-Trichloroethane	ug/L	200 µg/L	1 U	NR	1 U	1 U	20 UJ	NR	**12 J**	NR	**1.8 J**	NR	2 U	NR	**6600 =**	NR	**3200 =**	NR	NR	**1600 =**	**35 =**	NR	1 U	**45 =**	NR	**8900 =**	NR	**9100 =**	NR	1 U
1,1-Dichloroethane	ug/L	2.4 µg/L*	NR	**94 =**	**0.23 J**	1 U	**5.7 J**	NR	**270 J**	NR	**53 =**	NR	**2.9 =**	NR	**1800 =**	NR	**1200 =**	NR	**120 =**	NR	NR	**220 =**	**3.2 =**	**47 =**	NR	**3500 =**	NR	**3600 =**	NR	1 U
1,1-Dichloroethene	ug/L	7 µg/L	**0.68 J**	NR	1 U	1 U	20 UJ	NR	40 U	NR	4 U	NR	2 U	NR	**740 =**	NR	**310 =**	NR	**77 =**	NR	1 U	NR	1 U	**11 J**	NR	**770 J**	NR	**920 J**	NR	1 U
1,2-Dichloroethane	ug/L	5 µg/L	1 U	NR	1 U	1 U	20 UJ	NR	40 U	NR	4 U	NR	2 U	NR	400 U	NR	200 U	NR	5 U	NR	**1.2 =**	NR	**1.7 =**	20 U	NR	1000 U	NR	1000 U	NR	1 U
2-Butanone	ug/L	7100 µg/L*	6 U	NR	6 U	6 U	120 UJ	NR	240 U	NR	24 U	NR	12 U	NR	2400 U	NR	1200 U	NR	30 U	NR	6 U	NR	6 U	120 U	NR	6000 U	NR	6000 U	NR	6 U
Acetone	ug/L	22000 µg/L*	10 U	NR	**4.8 J**	10 U	200 UJ	NR	400 U	NR	40 U	NR	20 U	NR	4000 U	NR	2000 U	NR	50 U	NR	7.4 UB	NR	3.8 UB	200 U	NR	10000 U	NR	10000 U	NR	2.7 UB
Benzene	ug/L	5 µg/L	**3 =**	NR	1 U	1 U	**60 J**	NR	**43 J**	NR	**21 =**	NR	**19 =**	NR	400 U	NR	200 U	NR	5 U	NR	**1.1 =**	NR	**1 =**	20 U	NR	1000 U	NR	1000 U	NR	1 U
Chloroethane	ug/L	21000 µg/L*	NR	**170 =**	2 U	2 U	NR	**2700 =**	**1700 J**	NR	NR	**1100 =**	NR	**610 =**	800 U	NR	400 U	NR	10 U	NR	**15 =**	NR	**19 =**	40 U	NR	2000 U	NR	2000 U	NR	2 U
cis-1,2-Dichloroethene	ug/L	70 µg/L	NR	**150 =**	1 U	1 U	20 UJ	NR	**32 J**	NR	**13 =**	NR	**0.93 J**	NR	NR	**210000 =**	NR	**49000 =**	NR	**580 =**	NR	**110 =**	**2.8 =**	NR	**1600 =**	NR	**60000 =**	NR	**58000 =**	1 U
Ethylbenzene	ug/L	700 µg/L	**49 =**	NR	1 U	1 U	**260 J**	NR	**650 J**	NR	NR	**410 =**	NR	**190 =**	**1600 =**	NR	200 U	NR	5 U	NR	**8.2 =**	NR	1 U	**94 =**	NR	**1400 =**	NR	**1500 =**	NR	1 U
Methylene Chloride	ug/L	5 µg/L	0.62 UB	NR	2 U	2 U	40 UJ	NR	80 U	NR	1.4 UB	NR	0.98 UB	NR	800 U	NR	**110 J**	NR	**1.7 J**	NR	2 U	NR	2 U	**28 J**	NR	**2000 =**	NR	**2500 =**	NR	2 U
Styrene	ug/L	100 µg/L	1 U	NR	1 U	1 U	20 UJ	NR	40 U	NR	4 U	NR	2 U	NR	400 U	NR	200 U	NR	5 U	NR	1 U	NR	1 U	20 U	NR	1000 U	NR	1000 U	NR	1 U
Tetrachloroethene	ug/L	5 µg/L	1 U	NR	1 U	1 U	20 UJ	NR	40 U	NR	4 U	NR	2 U	NR	400 U	NR	**710 =**	NR	**2.7 J**	NR	**0.42 J**	NR	1 U	**21 =**	NR	1000 U	NR	1000 U	NR	1 U
Toluene	ug/L	1000 µg/L	**4.7 =**	NR	1 U	1 U	NR	**5900 =**	NR	**11000 =**	NR	**5700 =**	**81 =**	NR	**4300 =**	NR	200 U	NR	5 U	NR	**1.4 =**	NR	1 U	**9.8 J**	NR	**4200 =**	NR	**4200 =**	NR	1 U
trans-1,2-Dichloroethene	ug/L	100 µg/L	1 U	NR	1 U	1 U	20 UJ	NR	**7.1 J**	NR	**1.8 J**	NR	2 U	NR	**150 J**	NR	**75 J**	NR	**2.5 J**	NR	**1.1 =**	NR	**0.15 J**	20 U	NR	1000 U	NR	1000 U	NR	1 U
Trichloroethene	ug/L	5 µg/L	1 U	NR	1 U	1 U	20 UJ	NR	40 U	NR	4 U	NR	2 U	NR	**110 J**	NR	**1100 =**	NR	**2 J**	NR	**1.3 =**	NR	1 U	**29 =**	NR	1000 U	NR	1000 U	NR	1 U
Vinyl Chloride	ug/L	2 µg/L	NR	**270 =**	1 U	1 U	**3 J**	NR	**120 J**	NR	**35 =**	NR	**2.3 =**	NR	**19000 =**	NR	**2000 =**	NR	**69 =**	NR	NR	**200 =**	**5.2 =**	**260 =**	NR	**13000 =**	NR	**13000 =**	NR	1 U
Xylenes, Total	ug/L	10000 µg/L	**14 =**	NR	2 U	2 U	**1500 J**	NR	**1900 J**	NR	**880 =**	NR	**820 =**	NR	**11000 =**	NR	400 U	NR	10 U	NR	**13 =**	NR	2 U	**19 J**	NR	**2500 =**	NR	**2600 =**	NR	2 U
General Chemistry																														
Alkalinity, Total (As CaCO3)	mg/L	NA	NR	NR	**470 =**	**470 =**	**580 =**	NR	**540 =**	NR	**490 =**	NR	**510 =**	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**240 =**
Chloride (As Cl)	mg/L	NA	**16 =**	NR	**9.2 =**	**11 =**	**420 =**	NR	**220 =**	NR	**170 =**	NR	**52 =**	NR	**310 =**	NR	**180 =**	NR	**9.4 =**	NR	**80 J**	NR	**37 =**	**30 =**	NR	**180 =**	NR	**180 =**	NR	**46 =**
Ethane	ug/L	NA	NR	NR	**1.6 J**	5 U	**13000 =**	NR	**1700 =**	NR	**2100 =**	NR	**5100 =**	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	5 U
Ethene	ug/L	NA	NR	NR	5 U	5 U	**3800 J**	NR	**12000 =**	NR	**5000 =**	NR	90 U	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	5 U
Ferrous Iron	mg/L	NA	NR	NR	**0.22 J**	**0.17 J**	**3.1 J**	NR	0.2 UJ	NR	**0.31 J**	NR	**0.17 J**	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.2 UJ
Methane	ug/L	NA	NR	NR	**1200 =**	**1300 =**	**18000 =**	NR	**5000 =**	NR	**4300 =**	NR	**12000 =**	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	5 U
Nitrogen, Nitrate (As N)	mg/L	NA	NR	NR	0.5 U	0.5 U	0.5 U	NR	0.5 U	NR	0.5 U	NR	0.5 U	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**6.8 =**
Sulfate (As SO4)	mg/L	NA	NR	NR	**8.6 =**	**9.5 =**	**0.92 J**	NR	**1.2 J**	NR	**0.92 J**	NR	**0.56 J**	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	**44 =**
Sulfide	mg/L	NA	NR	NR	1 U	1 U	1 U	NR	**7 =**	NR	**7 =**	NR	**1.6 =**	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	1 U
Total Organic Carbon	mg/L	NA	**4.8 =**	NR	**6 =**	**5.2 =**	**7.5 =**	NR	**12 =**	NR	**7.8 =**	NR	**3.9 =**	NR	**28 =**	NR	**7.4 =**	NR	**4 =**	NR	**14 =**	NR	**4.2 =**	**3.2 =**	NR	**8.6 =**	NR	**8.5 =**	NR	**1.9 =**

Notes:

NA = Not applicable

NR = Not reported

* RAO = Remedial action objective (If no maximum contaminant level [MCL] was available for the analyte, then the December 2009 EPA regional screening levels [RSLs] [tap water] were used.)

Bold indicates the analyte was detected in the groundwater sample.

Shading indicates the analyte was detected above the MCL.

Validation Codes:

U Undetected. The analyte was analyzed for but not detected at a concentration equal to or greater than the laboratory reporting limit.

J Estimated. The analyte was below the stated reporting limit, but greater than the method detection limit (MDL), or there is an analytical bias.

UB Undetected due to blank contamination. The analyte was detected in the sample and in an associated method, field, or trip blank. The quantity of the analyte is deemed undetected because it falls below the 95-percent confidence interval (five times the blank concentration). The analyte concentration is potentially the result of contamination.

UJ Estimated. The analyte was not detected above the MDL; however, the MDL is approximate, and may or may not represent the actual limit of detection.

Table G-1. CVOC Daughter Products Trend Data Summary for Wells with June 2016 "Increasing" Mann-Kendall Trend Analysis Results

THAN Davenport Site, 2040 West River Drive

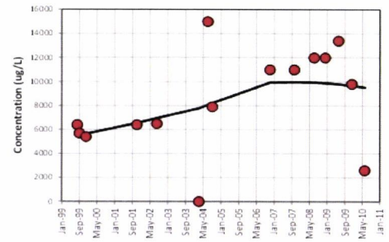
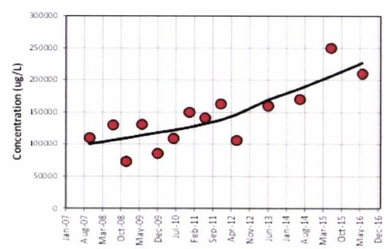
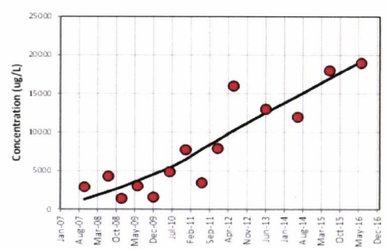
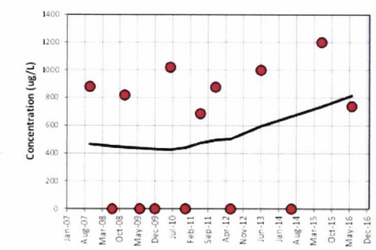
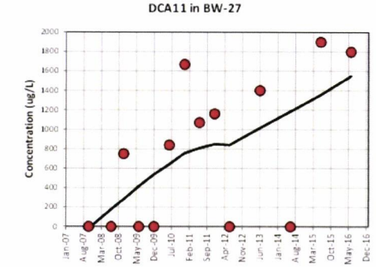
Well ID	Groundwater Monitoring Zone	Location Description[a]	Mann-Kendall Trend Analysis[b]	Trend Plot[c]	Discussion	Trend Plots Supporting Discussion
Onsite Monitoring Wells						
BW-05	Shallow Bedrock Zone	Located in the central portion of the site just north of the main onsite building	Increasing trend for VC	VC in BW-05  	- Locally weighted scatter plot smoothing curve (image in column to the left) for VC at BW-05 is stable between 2006 and June 2010 when it was last sampled. - Active treatment of this area ongoing based on the presence of permanganate noted in this well in December 2010, 2011, 2012, 2013, 2014, 2015, and 2016. - The presence of permanganate in BW-05 during sample events from 2010 through 2016 precluded sampling during this time period and thus precludes an accurate determination of a vinyl chloride trend.	
BW-27	Shallow Bedrock Zone	Northern portion of the site	Increasing trend for DCE12C Increasing trend for VC	DCE12C in BW-27  VC in BW-27  	-CVOC daughter compounds continue to be produced from ongoing reductive dechlorination of CVOC parent compounds. -Locally weighted scatter plot smoothing curves (images at left) for DCE12C and VC indicate increasing concentrations of both daughter products due to reductive dechlorination -BW-27 is located downgradient of ISCO Injection Area 5. -The Mann-Kendall trend analysis result for total VOCs at BW-27 is stable (Table 3-6). -The Mann-Kendall trend analysis results for CVOC parent compounds PCE, TCE, TCA111, and methylene chloride are decreasing (Appendix F). -Locally weighted scatter plot smoothing curves indicate concentrations are increasing for additional CVOC daughter compounds DCE11 and DCA11 (images at right).	DCE11 in BW-27  DCA11 in BW-27 

Table G-1. CVOC Daughter Products Trend Data Summary for Wells with June 2016 "Increasing" Mann-Kendall Trend Analysis Results

THAN Davenport Site, 2040 West River Drive

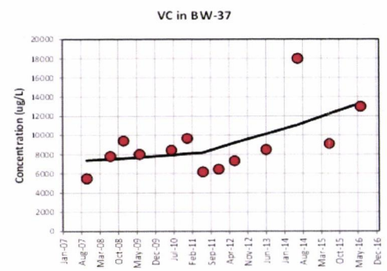
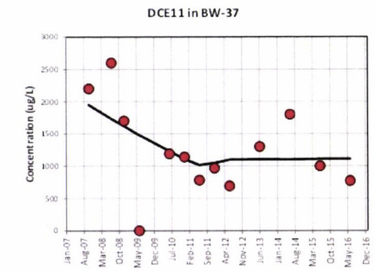
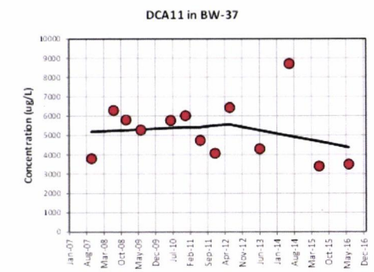
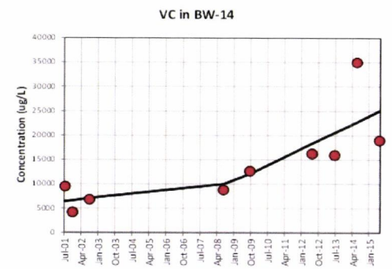
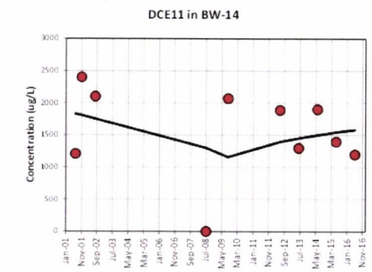
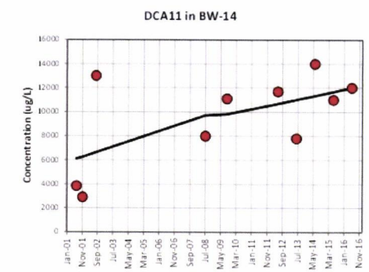
Well ID	Groundwater Monitoring Zone	Location Description[a]	Mann-Kendall Trend Analysis[b]	Trend Plot[c]	Discussion	Trend Plots Supporting Discussion
BW-37	Shallow Bedrock Zone	Southern portion of the site	Increasing trend for VC		- CVOC daughter compounds continue to be produced from ongoing reductive dechlorination of CVOC parent compounds. - Locally weighted scatter plot smoothing curves (image at left) for VC indicate increasing concentrations of this daughter products due to reductive dechlorination. - BW-37 is located downgradient of ISCO Injection Area 4. -The Mann-Kendall trend analysis result for total VOCs at BW-37 is decreasing (Table 3-6). -CVOC parent compounds PCE and TCE have been detected at a frequency less than 50% since monitoring began in 2007 (Appendix F). -The Mann-Kendall trend analysis results for CVOC parent compounds TCA111 and methylene chloride are decreasing (Appendix F). -The Mann-Kendall trend analysis results for CVOC daughter compound DCE12C is decreasing (Appendix F). -Locally weighted scatter plot smoothing curves indicate concentrations are decreasing for additional CVOC daughter compounds DCE11 and DCA11 (images at right).	 

Table G-1. CVOC Daughter Products Trend Data Summary for Wells with June 2016 "Increasing" Mann-Kendall Trend Analysis Results

THAN Davenport Site, 2040 West River Drive

Well ID	Groundwater Monitoring Zone	Location Description[a]	Mann-Kendall Trend Analysis[b]	Trend Plot[c]	Discussion	Trend Plots Supporting Discussion
Offsite Monitoring Wells						
BW-14	Shallow Bedrock Zone	Located in the southeastern portion of the site on the southeastern side of West River Drive	Increasing trend for VC		- CVOC daughter compounds continue to be produced from ongoing reductive dechlorination of CVOC parent compounds. - Locally weighted scatter plot smoothing curve (image at left) for VC in BW-14 indicates increasing concentrations of VC due to reductive dechlorination. - BW-14 is downgradient from the highest onsite groundwater concentrations. - The locally weighted scatter plot smoothing curve (Appendix F) indicates total VOC concentrations at BW-14 are decreasing since 2008. - The Mann-Kendall trend analysis result for TCA111 at BW-14 is decreasing (Appendix F). - CVOC parent compounds PCE, TCE, and methylene chloride have been detected at a frequency less than 50% since monitoring began in 2001 (Appendix F). - The Mann-Kendall Trend analysis results are stable for the additional daughter products of DCE11 (image at right), DCA11 (image at right), and DCE12C (Appendix F). The daughter compounds are also undergoing reductive dechlorination as evidenced by detection of nontoxic end compound of ethene. The geochemistry of groundwater at BW-14 shows strong evidence for continued anaerobic biodegradation of VOCs based upon the following conditions: • Reducing conditions: ORP readings are less than 50 mV (−126.9 mV) • Elevated chloride concentrations compared with other offsite monitoring wells (280 mg/L) • Methane and ethene detected (240 µg/L; 5,000 µg/L) • Nitrate concentrations are less than 1 mg/L (not detected at 0.5 mg/L) • Detection of CVOC daughter compounds: DCE12C, DCE12T, DCE11, DCA11, and VC	 

Notes:

[a] Locations of site wells are presented on Figure 2-2.

[b] Mann-Kendall analysis for VC and DCE12C was completed for the dataset. Tables and graphs of the results are included in Table 3-6 and Appendix F.

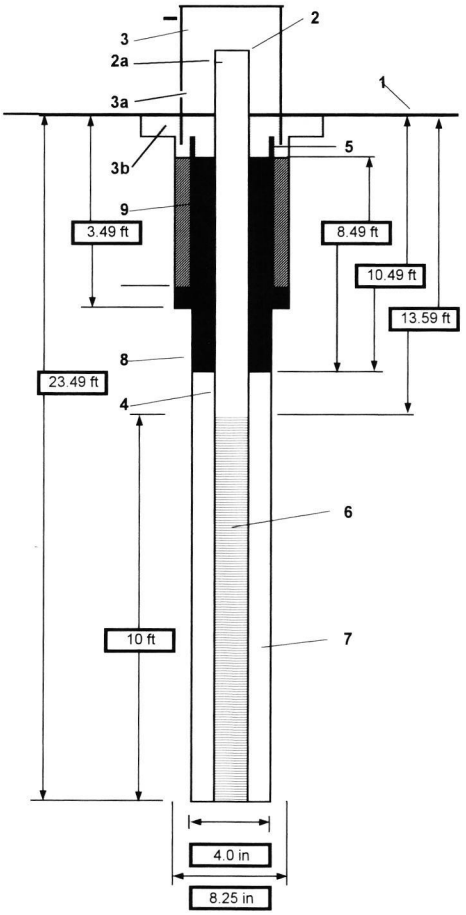
[c] Locally weighted scatter plot with smoothing curve. The trend analysis was completed using all available data for the well, starting when it was installed.

CVOC = chlorinated volatile organic compound
DCE11 = 1,1-Dichloroethene
DCA11 = 1,1-Dichloroethane
DCE12C = cis-1,2-Dichloroethene
DCE12T = trans-1,2-Dichloroethene
ISCO = in situ chemical oxidation
LTMP = long-term groundwater monitoring plan
mg/L = milligrams per liter
mV = millivolts
PCE = tetrachloroethene
TCA111= 1,1,1 trichloroethane
TCE = trichloroethene
VC = vinyl chloride
VOC = volatile organic compound
Total VOCs include 1,1,1-trichloroethane; 1,1-dichloroethane; 1,1-dichloroethene; 1,2-dichloroethane; 2-butanone; acetone; benzene; chloroethane; cis-1,2-dichloroethene; ethylbenzene; methylene chloride; styrene; tetrachloroethene; toluene; trichloroethene; trans-1,2-dichloroethene; vinyl chloride; and xylenes.

PROJECT NUMBER	WELL NUMBER	
158742.DV.FI	BW-06	SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : THAN Davenport
LOCATION : South of Harcros operations building
DRILLING CONTRACTOR : GSI
Revision 1: 08/07/2017 - see comments
DRILLING METHOD AND EQUIPMENT USED : HSA
WATER LEVELS : START : 7-11-01 END : 7-11-01 LOGGER : P. Rohde



1- Ground elevation at well: 564.5 ft

2- Top of casing elevation: 563.97 ft
a) vent hole?

3- Wellhead protection cover type: Flush mount
a) weep hole?
b) concrete pad dimensions: ~2 x 2 ft

4- Dia./type of well casing: 2 in diameter schedule 40 PVC

5- Dia./type of surface casing: 5 in diameter steel

6- Type/slot size of screen: 2 in diameter schedule 40 PVC
0.010 slot

7- Type screen filter: 20/40 sand
a) Quantity used

8- Type of seal: Bentonite (3/8 in chips)
a) Quantity used

9- Grout
a) Grout mix used: Bentonite
b) Method of placement: Tremie
c) Vol. of surface casing grout
d) Vol. of well casing grout

Development method: Pumped

Development time

Estimated purge volume

Comments: 5" surface casing set to 3.49' bgs

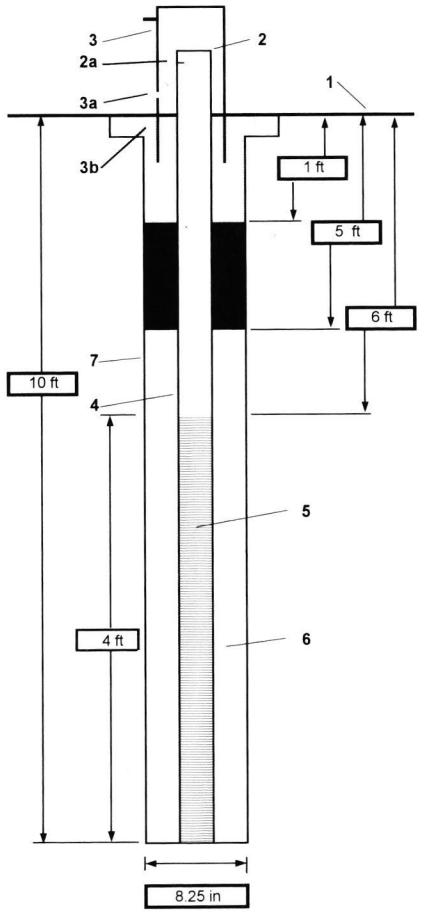
Well converted from a stickup to a flushmount in 2016.

PROJECT NUMBER	WELL NUMBER	
158742.DV.FI	MW-17	SHEET 1 OF 1

CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT : THAN Davenport
LOCATION : SW corner of Citgo property near billboard
DRILLING CONTRACTOR : GSI
Revision 1: 08/07/2017
DRILLING METHOD AND EQUIPMENT USED : HSA
WATER LEVELS : START : 6-9-01 END : 6-9-01 LOGGER : PR



1- Ground elevation at well: 561.73 ft

2- Top of casing elevation: 561.17 ft
a) vent hole?

3- Wellhead protection cover type: Flush mount
a) weep hole?
b) concrete pad dimensions: ~ 2 x 2 ft

4- Dia./type of well casing: 2 in diameter schedule 40 PVC

5- Type/slot size of screen: 2 in diameter schedule 40 PVC
0.010 slot

6- Type screen filter: 20/40 sand
a) Quantity used

7- Type of seal: Bentonite (3/8 in chips)
a) Quantity used

8- Grout
a) Grout mix used: None
b) Method of placement
c) Vol. of well casing grout

Development method

Development time

Estimated purge volume

Comments