UNIVERSITY OF MARYLAND
SHORE MEDICAL CENTER AT CHESTERTOWN

GROUNDWATER REMEDIATION
2015/2016 ACTION PLAN SUMMARY REPORT
CASE NO. 1987-2534-KE

JUNE 6, 2016

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1.0 2015/2016 ACTION PLAN EXECUTIVE SUMMARY

1. The surfactant field screening test used to measure the presence of Ivey-sol® in extraction water indicated that it took an average of three (3) hours and 800 gallons of extraction to eliminate surfactant to limits of detection. It was observed that for every volume of diluted Ivey-sol® solution injected into the wells, three (3) times the volume was extracted before surfactants reached limits of detection.

2. In addition to the extractions, the recovery wells pulled TPH-DRO and surfactant into the pump and treat system. This was evident by the presence of foam in the wet well and elevated vapor smell. The foam was an indication that surfactant and TPH-DRO was removed from the site through multiple pathways which included a combination of the extraction wells and nearby recovery wells.

3. The injection/extraction events which liberated TPH-DRO from the soil resulted in increased biological activity in the groundwater; a favorable outcome which further attenuates residual LPH's. This was evidenced by the significant increase of biofouling on the bag filters which continued during the Ivey-sol® process. Pictures were taken of the biofouling and the frequency of bag filter replacements were recorded in the Weekly Summary Reports.

4. TPH-DRO concentrations continued to trend downward during the twenty-seven (27) week period of injections/extractions. This resulted in measurements at monitoring wells which reached "at or near" limits of detection, defined as less than 1 ppm (1mg/L). See ***Figure 1.0*** for the water quality trend analysis.

5. The presence of TPH-DRO, BTEX, Naphthalene, or surfactant has never been noted at the wells along Campus Avenue (MW-18, MW-23, MW-28, and MW-29). This indicates that residual LPH associated with the original spill have never migrated from the site/property.

6. Even though the hydraulic control system contributed significantly to the fact that petroleum related chemicals/residuals have never migrated offsite, or even to the sentinel wells, now that the residuals are in such trace amounts it is unreasonable to expect that these minute amounts will ever appear in the sentinel wells.

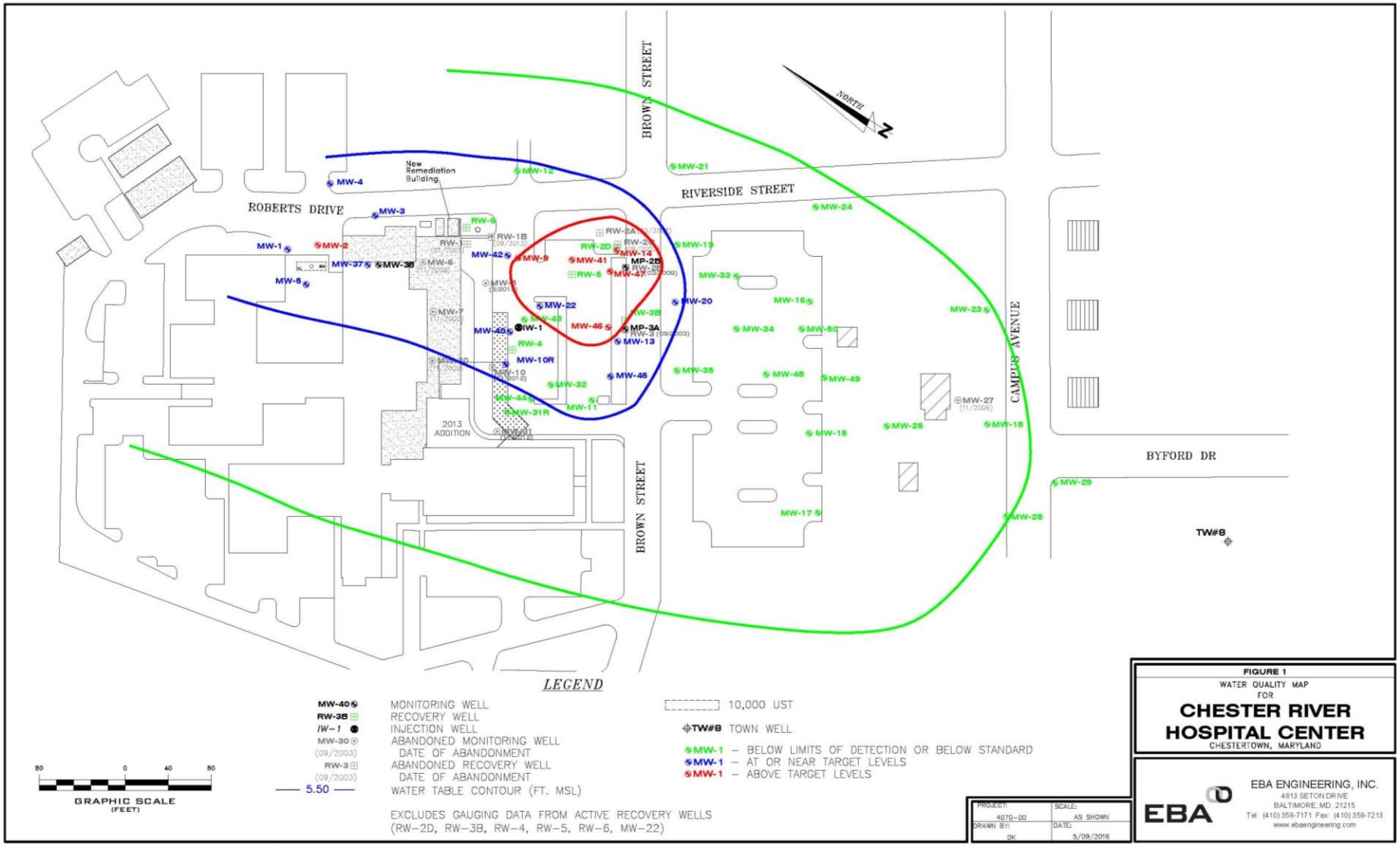
7. An absence of measurable product was noted in all of the Weekly Summary Reports. As the twenty-seven (27) week process continued and these observations were repeated, it became obvious that the likelihood/threat of encountering free product had been significantly diminished.

8. Some of the April, 2016 data show concentrations slightly higher than observed in February, 2016 (monthly) sampling event for TPH-DRO. Appreciating the presence of residual surfactant in the subsurface, the slightly increased TPH-DRO concentrations are likely attributed to the residual Ivey-sol® surfactants making contact with the residual TPH-DRO present within the unsaturated regions. Eliminating all surfactant from the groundwater column removes any possibility of laboratory interface in the testing for TPH-DRO. Once the laboratory test results demonstrate all surfactant has been removed, the TPH-DRO readings should normalize and the target level for case closure consideration will be substantially achieved.

9. Once the target levels had been reached, the injection/extraction events were stopped. The MDE required the pump and treat system remain on and monthly/quarterly sampling continue while they considered what, if any, additional steps would be required as prerequisite to case closure consideration.

10. In further consideration of having achieved case closure, the MDE has required additional subsurface investigations, installation of six (6) new monitoring wells, and associated monitoring/testing be conducted.

Figure 1.0 – Water Quality Map



2.0 2015 ACTION PLAN BACKGROUND AND OVERVIEW

2.1 BACKGROUND:

As reported in the January 19, 2015 Pilot Test Report and 2015 Action Plan, the groundwater remediation effort in 2014 was modified through the Maryland Department of the Environment (MDE) approved 2014 Pilot Study. This plan incorporated, for the first time, the application of surfactants (Ivey-sol®) to liberate product which had been absorbed onto soils in an area known as the "smear zone". The Ivey-sol® patented surfactant and protocols for injections/extractions are included in ***Appendix 1***.

Several years ago, with the hydraulic control system turned off, the Shore Medical Center at Chestertown (SMCC) had pursued a twelve (12) month intensive monitoring program with the MDE for purposes of demonstrating the groundwater had been remediated to a point the enforcement case might be closed. After ten (10) months of favorable sampling, monitoring in months eleven (11) and twelve (12) revealed higher contaminant levels which warranted further investigation. The outcome of these investigations resulted in findings that a portion of the original spill material had absorbed to soil particles in the smear zone. EBA Engineers, Inc. (EBA) was able to perform sufficient hydrogeological analysis to define and prepare cross sections of the smear zone across the site.

With this information, and significant input from Ivey International, Inc. regarding their patented Ivey-sol® process technology, the SMCC Technical Team was able to propose protocols for implementing a Pilot Study which included the MDE conditions regarding number and location of wells to be used for the push-pull process, weekly and monthly gauging events, and obtaining depth-to-water measurements.

The push-pull process using Ivey-sol® was implemented during the months of July/August, 2014 and the ninety (90) day post-injection monitoring occurred in September, October, and November along with the ongoing gauging and reporting. The results of the 2014 Pilot Study, as presented in the Pilot Test Evaluation Report, detailed the successful findings and results from the Ivey-sol® push-pull process. With these successful findings, which included much higher levels of product recovery than had been observed in recent years from the pump and treat system alone, the success of the hydrologic controls to contain the liberated material, no measured impact to down gradient wells, the dissipation and biodegradable nature of the surfactant, and efficient/effective removal of the extracted material; the SMCC proposed, and the MDE approved, a full scale program in June, 2015 to use Ivey-sol® to further remediate the site.

The MDE approved work plan, use of specific protocols, and remediation approach for 2015 built on the results from the 2014 Pilot Study. The plan was to achieve significant liberation of absorbed hydrocarbons from the smear zone, and extraction of residual liquid phase hydrocarbons (LPH) from the groundwater; resulting in laboratory testing measurements at monitoring wells at or near the lower limits of detection for Total Petroleum Hydrocarbons for Diesel Range Organics (TPH-DRO).

2.2 OVERVIEW:

On March 27, 2015 the MDE provided specific comments for the SMCC Technical Team to address. The MDE stated that the Ivey-sol® Pilot Study had demonstrated that implementation of Ivey-sol® technology can be accomplished in a safe manner. The MDE further agreed that additional events should prove effective in expediting the removal of residual LPH. The letter required additional details and clarification be provided to support the proposed 2015 Action Plan.

On April 24, 2015 H&B Solutions, LLC (H&B), on behalf of SMCC, submitted the necessary response letter which both addressed the MDE comments and revised the 2015 Action Plan. As stated in MDE's July 22, 2015 letter

(***Appendix 2***), "the Department hereby approves the proposed plan as revised in the April 24, 2015 letter from the Hospital, through its consultants, for immediate implementation, with the following modifications:

- Upon completion of each priority zone and before moving to the next priority zone, the Hospital must receive the Department's agreement to begin the injection process in the next zone.

- If there are contaminant detections of concern to the Department south of Brown Street during any phase of the injection process, the plan implementation must cease immediately and pumps will be placed in down gradient monitoring wells as directed by the Department to control contaminant migration. In the event that this contingency is necessary, additional engineering evaluation and discussions will take place to determine the next prudent steps.

- During quarterly sampling of the monitoring wells, analysis for surfactants (EPA Method 5540D) must be included. The surfactant analysis is to be included in quarterly sampling events once the injections have ceased and continue until the surfactant is no longer detected by laboratory analysis.

- Following implementation of the entire plan, the Department will require a minimum of one year post-remedial monitoring prior to discussing case closure. The post-remediation monitoring may not begin until, at a minimum, it has been analytically demonstrated that all surfactant has been purged from formation (i.e. through the quarterly sample analysis using EPA Method 5540D). Further, the pump and treat system will be required to remain on until the Department issues written approval that the system may be turned off. The post-remedial monitoring may be extended pending review of data.

- The Wastewater Permits Program, which implements the Underground Injection Control Program, has determined the proposed injection wells will be permitted by rule under its delegated authority from the Environmental Protection Agency. This approval letter serves as documentation of the rule authorization."

On August 27, 2015 the Technical Team established Standard Operating Procedures (SOPs) (***Appendix 3***) at the MDE's suggestion. On August 28, 2015 the Technical Team met onsite to both review the SOPs and confirm each consultant's role in performing the required tasks and services necessary to implement the 2015 Action Plan as approved. In order for the process to be completely transparent the MDE and SMCC agreed the Technical Team would provide Weekly Summary Reports of all activities onsite. This included:

- Overview of Activities/General Observations: Summary of setups/breakdowns; equipment condition and functionality; issues encountered onsite and resolutions; performance of MyCelx® filters; number of bag filter replacements; and visual inspection and observation of the wet well/holding tank for free product.

- Summary of Injection/Extraction Events: Wells used; dates for each event; and quantities of (Ivey-sol®) injections/extractions.

- Summary of Gauging and Sampling Data: Gauging results; field testing results for surfactant; laboratory samples collected; laboratory results received from preceding week; and summary of findings.

- EBA's Technical Assessment of Action Plan Implementation.

- Proposed Schedule of Events for Next Week: Wells to be used for injections/extractions, dates for each proposed event, and priority zone completion status.

As the process continued through each of the three (3) Priority Zone's the TPH-DRO sample results and reported surfactant testing continued to demonstrate the safety of the process and the benefits of removing residual LPH. As reflected in the approved plan, termination of the process would be based on achieving sample results from injection/extraction wells which reach levels at or near lower limits of detection for TPH-DRO and surfactants. On March 1, 2016, in anticipation of suspending the injection/extraction events, EBA and H&B met with the MDE to discuss next steps and actions required to move the remediation case towards a close out process.

In the 2015 Action Plan Weekly Summary Report dated March 4, 2016, the Technical Team reported the following:

- From a process standpoint, the twenty-seventh (27th) week of the 2015 Action Plan Implementation went smoothly and SOPs continue to work as expected. From an overall assessment, based upon the results of Assessment #7 reported last week and the results of MW-20 received this week, a significant and positive reduction of dissolved phase hydrocarbons has been achieved in Priority Zones #1, #2, and #3. At this time, it is recommended to suspend all Ivey-sol® surfactant injection/extraction events.

- All Ivey-sol® injections and extractions were suspended as of March 4, 2016.

- The pump and treat system remains operational until the MDE has provided written confirmation that it can be shut down.

- Monthly and quarterly reporting continues.

The MDE and SMCC have also agreed to enter into a Consent Order which will further clarify the conditions under which case closure can be achieved. More detail on this Order is discussed in Section 6.1 of this report.

On March 23, 2016, as a step towards case closure, the MDE issued a letter (***Appendix 4***) requesting additional subsurface investigations be performed including soil core samples and installation of six (6) new monitoring wells. On April 18, 2016 the Technical Team provided the MDE with a detailed Work Plan (***Appendix 5***) which describes the next phase in the remediation effort and will be the subject of future reports of findings and recommendations. On May 9, 2016 the MDE issued an approval of the Work Plan (***Appendix 6***) and provided written conditions consistent with the detailed scope of work provided by Earth Data, Inc. This additional subsurface investigation is required to be initiated no later than June 1, 2016. Results and findings will be reported to the MDE with copies to the Town of Chestertown consistent with ongoing reporting requirements and specific conditions of this approval letter.

The following sections of this 2015/2016 Action Plan Summary Report provide a more comprehensive analysis of the overall 2015/2016 Action Plan implementation, findings, recommendations, and next steps.

3.0 2015/2016 ACTION PLAN GOALS AND OBJECTIVES

Historically the groundwater remediation effort has been focused on recovering NAPL product from the groundwater table and treating the water through a MyCelx® Filter System prior to discharge at a nearby stormwater management system which eventually flows into receiving waters. The MDE oversees the remediation effort through the issuance of a Groundwater Appropriation Permit (GAP) and accompanying Groundwater Discharge Permit (GWDP). The permits establish the conditions under which groundwater can be pumped from recovery wells treated by the MyCelx® filters and ultimately discharged. Together these permits establish the maximum pumping rates and quality of the effluent which must be met prior to discharge. The overall system is defined in various reports and historic documentation as the "pump and treat" system.

In 2012 the pump and treat system was shut down and monthly/quarterly monitoring was conducted. The outcome resulted in the decision that the groundwater had not been fully remediated. Subsequent investigations and analysis resulted in the finding and determination that the subsurface continued to be contaminated with residual TPH-DRO in an area defined as the smear zone in absorbed form. This led to further investigations into differing technology which would focus on releasing residual absorbed hydrocarbons so they could be removed more easily through the groundwater remediation system.

In 2014 SMCC proposed the use of a surfactant (Ivey-sol®) to release these residuals from the smear zone. The MDE approved a Pilot Study which proved to be successful, and in August, 2015 they further approved the use of this technology for full scale application. The objectives outlined by the MDE and SMCC were to implement various protocols and technical approaches to remediation as defined below to meet the various project objectives.

- To continue with monthly/quarterly sampling and laboratory analysis as a means to evaluate the efficiencies and effectiveness of the ongoing remediation process in order to achieve "end points". The end points were defined as achieving TPH-DRO levels in the groundwater which were at or near levels of detection; later to be defined as having reached concentrations of one part per million (1 ppm) or less.

- In order to achieve end points the pump and treat system would remain on and the Ivey-sol® push-pull process to cleanse the smear zone would be employed.

- A team of consultants with special expertise associated with the ongoing monitoring, pump and treat, Ivey-sol® application process, and geotechnical investigation and analysis would implement the project with defined roles as outlined below.

    - Ivey International, Inc. – Responsible for overseeing the mixture of surfactants, injections, extractions, and field surfactant testing.
    - BrightFields, Inc. – Responsible for the operation and maintenance of the pump and treat system, setups and connections associated with electrical service and pump installations, in addition to ongoing sample collection and gauging.
    - Phase Separation Science, Inc. (PSS) – Responsible for the required laboratory testing using laboratory protocols/procedures defined by the MDE.
    - EBA Engineering, Inc. (EBA) – Responsible for the day-to-day assessment of data collected and performing geotechnical analysis, reporting to the MDE, and development of required engineering assessments to document the project's progress.
    - H&B Solutions, LLC (H&B) – Responsible for the day-to-day management and oversight of the Technical Team, overall remediation project, lead communication with regulatory agencies, permitting, regulatory compliance, and the client representative with regards to submittals to the MDE.

- Through the use of the pump and treat system and the Ivey-sol® push-pull process; execute the approved 2015 Action Plan so as to meet end points in a manner, and with appropriate documentation, that would move the project towards case closure.

4.0 2015/2016 SUMMARY OF WEEKLY REPORTS

During the 2015/2016 Ivey-sol® full scale push-pull remediation effort, the Technical Team prepared detailed Weekly Summary Reports which included a full description of all field work completed and associated findings. This incorporated data interpretation, observations, suggested SOP modifications, and discussion of the following week's schedule of activities. These 2015 Action Plan Weekly Summary Reports have been included in ***Appendix 7***. The supplemental laboratory results corresponding to each week's injection/extraction activities are included in ***Appendix 8***.

An executive summary of these Weekly Summary Reports is provided below which highlights the more significant items reported.

4.1 WEEK ONE (8/28/15-9/4/15):

Wells used for injection/extraction events during the first week were those in Priority Zone 1 and included MW-1, MW-2, MW-3, MW-4, MW-5, MW-14, MW-37, and MW-47. The Technical Team was able to conduct two (2) full injection and extraction (push-pull) events during this week. The mixture of Ivey-sol® used was as described in the SOPs. The Extraction Event #1 volumes ranged from a low of seventy (70) gallons in MW-14 to a high of 955 gallons in MW-1. Extraction Event #2 volumes ranged from a low of 157.5 gallons in MW-14 to a high of 1,100 gallons in MW-2. The average time for extractions was 3.0 hours; indicative of the time required by field conducted surfactant testing to record non-detects. MW-14 was within five feet (5') of extraction well RW-2D and as a result of this close proximity to this pump and treat recovery well, MW-14 was evacuated within five (5) minutes. Observed foaming at the wet well confirmed the evacuated material discharged into the pump and treat system. There were no sample results available from the lab in Week One and no problems encountered.

4.2 WEEK TWO (9/04/15-9/11/15):

Wells used for injection/extraction events during the second week included those in Priority Zone 1. The Technical Team was able to conduct two (2) full injection and extract events during this week. The mixture of Ivey-sol® used was those described in the SOPs. The Extraction Event #3 volumes ranged from a low of 162.5 gallons in MW-14 to a high of 920 gallons in MW-2, MW-3, MW-5, MW-37, and MW-47. Extraction Event #4 volumes ranged from a low of 57.5 gallons in MW-14 to a high of 825 gallons in MW-2, MW-3, MW-5, MW-37, and MW-47. The average time for extractions was 3.0 hours; the time required by field conducted surfactant testing to record non-detects. By Week Two more than 250 field run surfactant tests had been performed. Similar to Week One, and as a result of its close proximity to RW-2D, MW-14 was evacuated within five (5) minutes. There was no recorded measurement of surfactant within thirty (30) minutes of the Extraction Event. Lab results from Extraction #3 range from 0.35 milligrams per liter (mg/L) TPH-DRO to 0.45mg/L TPH-DRO which was significantly less than levels measures after Extraction Event #1 and #2.

4.3 WEEK THREE (9/11/15-9/18/15):

By Week Three the field team had developed a set routine and the SOPs had become second nature. The MyCelx® filter operation, setups and breakdowns, gauging, and lab sampling were unremarkable. Work continued in Priority Zone 1 for Event #5 and Event #6. Again this week foam continued to be observed in the wet well following injections. The Technical Team believed some of the foaming could be attributed to increase in biological activity and the production of CO_2. The Extraction Event #5 volumes ranged from a low of 37.5 gallons in MW-14 to a high of 825 gallons in MW-2, MW-3, MW-5, MW-37, and MW-47. Extraction Event #6 volumes ranged from a low of 112.5

gallons in MW-14 to a high of 875 gallons in MW-2, MW-3, MW-5, MW-37, and MW-47. Further evaluation of the wet well foam resulted in the finding that no surfactant was present. A total of 164 field run surfactant tests were performed. It was further noted that for the first three (3) weeks groundwater elevation remained consistently high and continued to be conducive for the Ivey-sol® solution to interface with the smear zone to the maximum extent possible. Lab results from Extraction #4 ranged from 0.76mg/L TPH-DRO to 1.6mg/L TPH-DRO. Since TPH-DRO continued to drop at the end of each injection/extraction event, it was determined that after Extraction #6 an assessment sample would be conducted to assess the effectiveness of the Priority Zone #1 activities to date.

4.4 WEEK FOUR (9/18/15-9/25/15):

Work continued in Priority Zone 1 for Event #7 and Event #8. The fourth week continued to show similar results with each injections and extractions reporting similar time frames and volumes as those shown in Weeks 1-3. Foam continued to be observed in the wet well. No odors, measurable product, or sheen was detected. Foam is expected to be associated with the Ivey-sol® surfactant, increased biological activity, and production of CO_2. During the first month over 600 field run surfactant tests have been completed. In addition to TPH-DRO sampling of the eight (8) injection/extraction wells, routine monthly sampling in the eleven (11) monitoring wells was also collected and analyzed. Surfactant testing at the down-gradient wells (MW-19, MW-20, MW-21, and MW-35) also continued to show the absence of surfactant which indicated that Priority Zone 1 remains within the area of hydraulic control.

4.5 WEEK FIVE (9/25/15-10/02/15):

As was the routine and protocol for Weeks 1-4, the activities in Week 5 were unchanged with one exception. It was determined that pneumatic plugs would be inserted into all eight (8) wells in order that injected Ivey-sol® solution would saturate the upper soil strata in order to fully achieve the targeted cleansing of the smear zone. The injection volume of Ivey-sol® solution continued to be 275 gallons. Extraction #9 volumes ranged from a low of 37.5 gallons in MW-14 to a high of 875 gallons in MW-2, MW-3, and MW-37. Extraction #10 volumes ranged from a low of 60 gallons in MW-14 to a high of 910 in MW-2. This week 180 field run surfactant tests were performed. Gauging of down-gradient wells (MW-19, MW-20, MW-21, and MW-35) and injection/extraction wells during this period observed no free product. Assessment #1 results showed prior to the implementation of the Action Plan that levels for TPH-DRO (as obtained from the July 30, 2015 sampling event) ranged from limits of detection to a high of 220mg/L. Following the completion of six (6) injection-extraction events, results show levels for TPH-DRO range from 0.65mg/L to 2.3mg/L, a significant and positive reduction in concentrations of dissolved phase hydrocarbons.

4.6 WEEK SIX 9/02/15-10/09/15):

In Week 6, with MDE's approval, it was agreed that the Technical Team would double the volume of injected Ivey-sol® into each of the injection/extraction wells in order to increase injection volumes by using the same Ivey-sol® concentration. The volume of solution increased on October 10, 2015 from 275 gallons to 550 gallons per injection. It was agreed by MDE that this would enhance/facilitate dispersion of Ivey-sol® and subsequently increase the potential for petroleum residual recovery. The volumes extracted during Extraction #11 ranged from a low of 32.5 in MW-14 to a high of 915 gallons in MW-2. During Extraction #12 the volumes ranged from a low of 77.5 gallons in MW-14 to a high of 945 gallons in MW-2 and MW-3. Extraction #13 volumes ranged from a low of 35 gallons in MW-14 to a high of 896 gallons in MW-2. It continued to take approximately 3.0 hours of extractions to reach non-detect levels for field run surfactant test. The SOPs calling for the utilization of pneumatic plugs for addressing the vadose zone continued. Assessment #2 results were reported and except for MW-14 the wells continued to demonstrate a downward trend from original baseline levels reported prior to the Ivey-sol® push-pull process. As reported, the Technical Team continued to report trends which were approaching at or near lower level of detection for TPH-DRO,

it was then expected that only one (1) or two (2) more weeks of injections/extractions would be needed in Priority Zone #1.

4.7 WEEK SEVEN (10/09/15-10/16/15):

Week 7 continued work in Priority Zone 1. In order to enhance dispersion and the overall process for removal of dissolved phase hydrocarbons, injection volumes were increased to 550 gallons per injection while maintaining the same concentration. In general, the Technical Team continued to remove three (3) times the injection volume during the extraction process. There were 206 field run surfactant tests completed this week for a total of 1,120 to date. The pump in MW-47 was sent out for repair and a replacement pump was used during Extraction Event #15. Extraction #14 took 5.5 hours and volumes extracted ranged from a low of 60 gallons at MW-14 to a high of 1,625 gallons at MW-5. Extraction #15 took 5.75 hours and volumes ranged from a low of 42.5 gallons in MW-14 to a high of 1,725 gallons at MW-2 and MW-3. Extraction #16 took 7.25 hours with MW-14 extraction at 25 gallons and MW-2, MW-3, and MW-5 having reported 2,200 gallons of volume extracted. As has been the case throughout the process, no free product was observed during gauging. The groundwater elevations continued to remain high which was conducive to Ivey-sol® interface with the smear zone to the maximum extent practical. The pneumatic plugs continued to enhance the washing effect in the vadose zone since the injections enter at a higher elevation than without. The increase in injection and extraction volumes also provides for enhancement to the dispersion radius.

4.8 WEEK EIGHT (10/16/15-10/23/15):

Week 8 continued to show similar results as reported in Week 7. Extraction #17 included a low of 37.5 gallons at MW-14 to a high of 1,770 gallons at MW-2, MW-3, and MW-5 with extraction time taking approximately 6 hours. Extraction #18 volumes included a low of 47.5 gallons at MW-14 to a high of 2,375 at MW-5. The extraction event took five (5) hours. As per the SOPs, extraction times were based on confirmation of having reached trace amounts of surfactant. This week included 220 field run surfactant test with a total of over 1,300 to date. Surfactant field testing, gauging, and standard olfactory testing indicate water quality at down-gradient wells (MW-19, MW-20, MW-21, and MW-35) were unaffected by Extraction Events #17 and Extraction Events #18. Furthermore, these findings support that all activities within Priority Zone 1 remain within the area of hydraulic control.

The results of Assessment #3 showed a further reduction in dissolved phase hydrocarbons. In addition, the level of dissolved phase hydrocarbons in all of the monitoring wells in Priority Zone 1 (with exception of MW-14) were below 1.0mg/L. The decrease of dissolved phase hydrocarbons reflected in Assessment #3 can be greatly attributed to the implementation of the pneumatic plug protocol during the sixth week followed by the increased injection volumes during the seventh week. Based on the results from Assessment #1 through Assessment #3 the Technical Team requested MDE's approval to begin transitioning from Priority Zone 1 to Priority Zone 2. Based upon the positive reduction of dissolved phase hydrocarbons following the implementation of the pneumatic plugs for addressing the vadose zone and the increased quantity of surfactant solution to enhance the removal of absorbed hydrocarbons, the Technical Team continued this practice in Priority Zone 2.

4.9 WEEK NINE (10/23/15-10/30/15):

Week 9 work remained with Priority Zone 1 and showed similar results as reported in Week 8. Extraction #19 and Extraction #20 were performed with extraction times of 7.25 hours and 6.0 hours respectively. The volume in MW-14 for Extractions #19 and #20 remained low at 30 gallons and 25 gallons respectively. MW-3 extraction was 2,000 gallons for Extraction #19 and a high volume of 2,100 gallons was reported for Extraction #20 at MW-2 and MW-3. Injection #21 did not include surfactant but was instead clear water only for rinsing purposes. Due to the push-pull process there was a possibility that soil particles near the casing and well screen could contain Ivey-sol® and

desorbed TPH-DRO. There were 250 field run surfactant test performed this week with a total of 1,500 performed to date. No free product or odors were reported from the gauging of wells and foam continued to be observed in the wet well. On 10/29/15 MDE clarified that the Technical Team could redirect its efforts to Priority Zone 2 beginning on 11/9/15 with the exception of MW-14 from Priority Zone 1.

4.10 WEEK TEN (10/30/15-11/06/15):

Clean water flush injection/extraction events occurred in Week 10 in preparation for transitioning to Priority Zone 2. However, field run surfactant tests continued with a total to date of approximately 1,600. Surfactant field testing, gauging, and standard olfactory testing indicate water quality at down-gradient wells (MW-19, MW-20, MW-21, and MW-35) were unaffected by Extraction Event #20, Injection Event #21, and Extraction Event #21. Furthermore, these findings supported that all activities within Priority Zone 1 remained within the area hydraulic control.

4.11 WEEK ELEVEN (11/06/15-11/13/15):

Injections/Extractions for Priority Zone #2 started during Week 11, and included MW-40, MW-41, MW-42, MW-43, and MW-46 as well as MW-14 from Priority Zone #1. As had been the case in Priority Zone #1 the volumes extracted from MW-40 and MW-41 were generally three times the injection amount. Volume for monitoring wells MW-14, MW-42, MW-43, and MW-46 was extracted until confirmation of acceptable levels of surfactant was removed. This week 160 field run surfactant tests were completed bring the total to approximately 1,800 to date. The gauging events reported no free product or sheen. There was no measurable product or sheen in the wet well, but foam was observed. Pneumatic plugs were not used for this first week in Priority Zone #2 and concentration of Ivey-sol® was the same as used when the initial work in Priority Zone #1 was completed (5 gallons Ivey-sol® with 270 gallons of water). Injection/Extraction Events #22 and #23 were uneventful and the reported volumes were in the same ratio to injected volumes as was reported in previous events.

4.12 WEEK TWELVE (11/13/15-11/20/15):

Week 12 work remained in Priority Zone 2 as well as MW-14 from Priority Zone #1. Injection/Extraction Events #24 through #26 were conducted during this week. Injection #24 used the same injection quantities and extraction volumes as Event #23. Prior to Injection Event #25 pneumatic plugs were installed; however, the injection volumes remained the same at 5 gallons Ivey-sol® and 270 gallons of water. For Extraction Event #24, MW-14 volumes were at a low of 32.5 gallons with MW-41 at a high of 1,060 gallons. Similar results were obtained from Extraction Event #25 and #26. The time of Extraction Event #24 was 4.5 hours, Extraction Event #25 was 4.25, and Extraction Event #26 was 3.25 hours. Associated with the implementation of pneumatic plugs during Injection Event #25 a minor increase in dissolved phase hydrocarbons was reported. Prior to Assessment #4, pneumatic plugs were accompanied by an increase in the surfactant solution (same concentration but double the volume) in order to maximize dispersion and enhance the removal of dissolved phase hydrocarbons similar to the process used in the later stage of Priority Zone 1.

4.13 WEEK THIRTEEN (11/20/15-11/25/15):

Week 13 fell during the week of Thanksgiving so there was only one (1) injection and extraction. Injection Event #27 continued to use 5 gallons Ivey-sol® and 270 gallons of water. The extraction time took 3 hours with MW-14 volume at 27.5 gallons and MW-41 with the highest volume extracted at 660 gallons. The number of field run surfactant tests completed to date is 2,150. Testing at the down-gradient wells (MW-19, MW-20, MW-21, and MW-35) revealed no surfactants. The lab report for TPH-DRO taken from MW-41 at the end of Extraction Event #26 was reported at

1.13mg/L. As with all of the preceding events, no free product or sheen was observed in the monitoring wells or in the wet well.

4.14 WEEK FOURTEEN (11/30/15-12/04/15):

Week 14 included the addition of Priority Zone #3 wells (MW-9, MW-10R, and MW-13) as well as Priority Zone 1 well (MW-14) and Priority Zone 2 wells. In addition to the use of pneumatic plugs, the volumes were doubled with 10 gallons Ivey-sol® and 540 gallons of water. No free products were observed during daily monitoring prior to the Injection/Extraction Events. The MyCelx® filters were inspected and they continued to perform well and were free or any biofouling due mostly to the increase of bag filter replacement frequency. No free product or sheen was reported as part of the well gauging and sampling procedures. The durations of Extraction Event #28 and Extraction Event #29 were both 5.75 hours. The volumes extracted were generally 3.0 times the injection volumes or until confirmation of acceptable levels of surfactant were removed. The results of Assessment #4 revealed that MW-42 continued to show TPH-DRO less than 1.0mg/L. The Technical Team requested no further injections and extractions should be performed at this location. In addition, it was recommended to cease injections/extractions at MW-14 due to its close proximity of RW-2D and subsequent short circuiting of the groundwater pathway.

4.15 WEEK FIFTEEN (12/04/15-12/11/15):

Week 15 continued in Priority Zone 2 and Priority Zone 3 with double the volume of surfactant solution and the utilization of pneumatic plugs. This week a total of 204 field run surfactant tests were performed bringing the amount to date to 2,530. On 12/04/15 a thorough physical cleaning of the MyCelx® filters were performed to ensure optimal performance. Extraction Events #30, #31, and #32 took 5.25 hours, 5.0 hours, and 6.75 hours respectively. Previous week's laboratory results reported TPH-DRO at MW-41 at 1.0mg/L or less. Water quality at down-gradient wells (MW-19, MW-20, MW-21, and MW-35) was reported as unaffected with no presence of surfactant or TPH-DRO. No free product or sheen was observed in the monitoring wells or wet well. Foam was still present in the wet well.

4.16 WEEK SIXTEEN (12/11/15-12/18/15):

Week 16 remained within Priority Zone #2 and Priority Zone #3. Injection/Extraction Events #33 and #34 were water-flushes only in preparation for the Christmas Holiday. 2,810 field run surfactant tests have been recorded to date. The MW-41 TPH-DRO laboratory results showed under 1.0mg/L. For the holidays injection/extraction events ceased on 12/17/15 and resumed on 1/11/16.

4.17 WEEK SEVENTEEN (12/18/15-12/24/15):

There was no activity onsite during this time. Assessment #5 sampling event; however, was performed on 12/18/15. Routine gauging and sampling was performed at the sentinel wells. BrightFields performed ongoing maintenance of the MyCelx® filters and continued to change the bag filters. No free product or sheen was observed in the wet well.

4.18 WEEK EIGHTEEN (12/28/15-12/31/15):

There was no activity onsite during this time. However, BrightFields continued to perform ongoing maintenance of the MyCelx® filters and continued to change the bag filters. No free product or sheen was observed in the wet well. TPH-DRO results from Assessment #5 were reported as; MW-14 at 0.80mg/L, MW-40, 2.7mg/L, MW-41, 2.0mg/L,

MW-42, 1.3mg/L, MW-46, 2.1mg/L, MW-9, 2.9mg/L, MW-10R, 3.1mg/L, MW-11, 3.3mg/L, MW-13, 2.3mg/L, MW-45, 1.8mg/L. The higher numbers in Priority Zones 2 and 3 were associated with the liberated residual phase hydrocarbons and the fact that no extractions occurred for the past two (2) weeks. It is important to note that because the hydraulic control remained in place, TPH-DRO and surfactants were not reported in the down-gradient wells (MW-19, MW-20, MW-21, and MW-35).

4.19 WEEK NINETEEN (01/01/16-01/08/16):

There was no activity onsite during this time. However, BrightFields continued to perform ongoing maintenance of the MyCelx® filters and continued to change the bag filters. No free product or sheen was observed in the wet well. The Technical Team recommended the addition of MW-20 to Priority Zone 3 efforts. (As part of MDE's condition of approval the residence time for Ivey-sol® in this well had to be limited to 24 hours.)

4.20 WEEK TWENTY (01/11/16-01/15/16):

January 11, 2016 marked the return of the Technical Team and the initiation of Injection/Extraction Events #35 and #36. It was noted in the Weekly Summary Report that weather conditions were a challenge due to subfreezing temperatures. Special efforts were undertaken to prevent lines from freezing. Extractions at MW-35 and MW-41 could not take place because of these freezing conditions. Since RW-2D and RW-5 are so close to these wells it is believed that the surfactant and liberated TPH-DRO was removed through the pump and treat system. No product or sheen was noted from the gauging of monitoring wells or from thee wet well observations. Injections continued at double the rate. Extraction time for Event #35 was 4.0 hours and for Event #36 was 6.5 hours. The average volume extracted was three (3) times the injected amount or the volume was extracted until no surfactant was measured. TPH-DRO measured at MW-46 after Extraction Event #35 was 1.9mg/L. To date over 2,600 field run surfactant tests have been conducted by Ivey personnel.

4.21 WEEK TWENTY-ONE (01/16/16-01/22/16):

Week 21 continued with wells in Priority Zone 2 and Priority Zone 3. The pneumatic plugs remained in place and injection volumes continued at double the original amount. Over 2,900 field run surfactant tests have been performed to date. The gauging of wells and wet well observations continued to show the absence of free product or sheen. Down-gradient wells (MW-19, MW-20, MW-21, and MW-35) continued to be unaffected by Extraction Event #36 and Event #37.

4.22 WEEK TWENTY-TWO (01/2/16-01/29/16):

Work continued in Priority Zone 2 and Priority Zone 3 (MW-9, MW-10R, MW-11, MW-13, MW-45,). The SOPs associated with the pneumatic plugs and double volume injection amounts continued as well. The bag filter replacements and MyCelx® filter performance checks were recorded. Over 3,100 field screening surfactant tests have been performed to date. Field work was extra challenging in Week 22 since severe weather conditions resulted in a State of Emergency declared for Maryland. For this reason only one (1) Injection/Extraction Event could take place on January 29, 2016. No free product or sheen was found in the monitoring wells or wet well. No surfactants were found in the down-gradient wells (MW-19, MW-20, MW-21, and MW-35). The TPH-DRO result from MW-41 Extraction #39 was 0.54mg/L. Results of Assessment #6 were included and every well in Priority Zone 2 and Priority Zone 3 reported TPH-DRO levels of less than 1mg/L. Assessment #6 occurred between Injection/Extraction Event #35 and Event #39. Based on the results from Assessment #6 the Technical Team recommended to cease injection/extraction events at MW-40, MW-41, MW-43, MW-46 of Priority Zone #2 and MW-9, MW-10R, MW-11, MW-

13, and MW-45 of Priority Zone 3 due to its continued absence of sheen, absence of odor, and dissolved phase hydrocarbons levels below 1.0mg/L.

4.23 WEEK TWENTY-THREE (01/29/16-02/05/16):

Work continued in Priority Zone 2 and Priority Zone 3. There was only one (1) injection/extraction event this week; Event #41, which took 7.0 hours. Over 3,300 field screening tests have been performed to date. No free product was observed in any of the monitoring wells or wet well. The down-gradient wells (MW-19, MW-20, MW-21, and MW-35) continued to be free from surfactant. The pneumatic plugs remained in place and the injection continued at double the volume. Water-flushes only were recommended for Priority Zone 2 and Priority Zone 3 with injection/extractions of Ivey-sol® to only occur in MW-20.

4.24 WEEK TWENTY-FOUR (02/05/16-02/12/16):

Injection/Extraction Events #43, #44 and #45 were performed with extraction times reported of 5.5 hours, 9.0 hours, and 11.0 hours respectively. In order to ensure all surfactant had been removed and the previous week's rinsing cycles were effective, Extraction Event #45 was conducted for 11.0 hours to complete the rinsing cycle. In addition to Priority Zone 2 and Priority Zone 3 wells reported in Week 22, MDE approved the addition of injections/extractions for MW-20 into Priority Zone 3. For MW-20 routine injections/extractions occurred using the pneumatic plug and two (2) times the injection volume. For MW-9, MW-10R, MW-11, MW-13, MW-40, MW-41, MW-43, MW-45, and MW-46 only rinsing occurred during the extraction events and without any injection of Ivey-sol®. No surfactants or free product was observed in wet well or monitoring wells. Down-gradient wells (MW-19, MW-20, MW-21, and MW-35) also showed no surfactant.

4.25 WEEK TWENTY-FIVE (02/12/16-02/19/16):

Injection Event #46 involved Ivey-sol® solution, the use of pneumatic plugs, and double the volume for MW-20 only. Extraction Event #46 took 5.5 hours. MW-20 was injected and extracted again during Event #48 and #50 with extraction lasting 3.5 hours and 10.0 hours. Injection/Extraction Events #47 and #49 were water-flush only for MW-1, MW-3, MW-5, and MW-37. Injection/Extraction Event #50 was also a water-flush for the same grouping of wells.

4.26 WEEK TWENTY-SIX (02/19/16-02/26/16):

Injection/Extraction Event #51 took place at only MW-20. The extraction duration was 9.0 hours. There was no activity on any of the other wells in Priority Zone 1, 2, or 3 because the majority of wells after Assessment #7 were reported at or near 1.0mg/L TPH-DRO.

4.27 WEEK TWENTY-SEVEN (02/26/16-03/04/16):

Activities during the final week only included Injection/Extraction Events #52, #53, and #54 at MW-20. The SOPs, volumes, and extraction times were essentially the same as in Week 26. The MyCelx® filters continued to operate well. The bag filters were replaced as needed. There was no free product or sheen in the wet well, no free product observed in the monitoring wells, and no surfactants observed in the down-gradient/sentinel wells. At the end of this reporting period, MDE was advised that the Technical Team had achieved the end points described in the Action Plan, that all injections/extractions would be discontinued, monthly/quarterly monitoring and reporting would continue,

the pump and treat system would remain in operation, and the Technical Team would initiate preparation of the yearly report and submittal of future work plans as directed by MDE in regards to next steps.

5.0 SUMMARY OF TPH-DRO AND SURFACTANT SAMPLING RESULTS

5.1 2015 ACTION PLAN MONITORING/LABORATORY ASSESSMENT RESULTS

In addition to the ongoing monthly/quarterly sampling, gauging, and reporting which is further documented in Section 5.2 below, the Technical Team conducted Assessments #1–7 throughout the duration of the 2015 Action Plan. These Assessments compared baseline numbers (defined as the last sampling event prior to implementation) for TPH-DRO at each well following a series of injections/extraction events in each Priority Zone. The results for Assessments #1–7 were presented in the Weekly Summary Reports and are summarized in the Table 1.0 on the following pages.

Table 1.0 – 2015 Action Plan Summary of Assessments

PZ #1 Well No.	Baseline	Asses. 1 (Events 1-6)	Asses. 2 (Events 7-11)	Asses. 3 (Events 12-16)	Asses. 4 (Events 17-27)	Asses. 5 (Events 28-34)	Jan. Monthly	Asses. 6 (Events 35-39)	Feb. Monthly/ Asses. 7 (Events 40-50)
	7/30/2015	9/21/2015	10/5/2015	10/19/2015	11/30/2015	12/18/2015	1/6/2016	1/25/2016	2/23/2016
MW-1	2.0	1.7	0.62	0.51	NS	NS	2.1	NS	1.0
MW-2	1.4	1.9	5.6	0.63	NS	NS	3.1	NS	0.94
MW-3	0.1	0.81	2.0	0.77	NS	NS	2.3	NS	0.48
MW-4	<0.1	1.0	0.85	0.53	NS	NS	0.85	NS	1.2
MW-5	0.3	0.65	1.6	0.53	NS	NS	2.8	NS	0.90
MW-14	89	2.3	22	3.3	2.0	0.80	2.8	NS	0.91
MW-37	0.35	2.3	1.3	0.76	NS	NS	5.2	NS	1.4
MW-47	220	1.8	1.3	0.92	NS	NS	1.9	NS	1.4

Results for TPH-DRO in mg/L
NS - Not Sampled
NA - Not Applicable

PZ #2 Well No.	Baseline	Asses. 1 (Events 1-6)	Asses. 2 (Events 7-11)	Asses. 3 (Events 12-16)	Asses. 4 (Events 22-27)	Asses. 5 (Events 28-34)	Jan. Monthly	Asses. 6 (Events 35-39)	Feb. Monthly/ Asses. 7 (Events 40-50)
	7/30/2015	9/21/2015	10/5/2015	10/19/2015	11/30/2015	12/18/2015	1/6/2016	1/25/2016	2/23/2016
MW-40	0.47	NA	NA	NA	1.1	2.7	0.69	0.79	0.25
MW-41	1.2	NA	NA	NA	3.0	2.0	3.7	0.40	0.98
MW-42	0.74	NA	NA	NA	0.58	1.3	2.5	NS	1.7
MW-43	<0.1	NA	NA	NA	1.1	1.6	0.67	0.38	0.56
MW-46	15	NA	NA	NA	1.7	2.1	1.6	0.28	1.4

Results for TPH-DRO in mg/L
NS - Not Sampled
NA - Not Applicable

PZ #3 Well No.	Baseline	Asses. 1 (Events 1-6)	Asses. 2 (Events 7-11)	Asses. 3 (Events 12-16)	Asses. 4 (Events 17-27)	Asses. 5 (Events 28-34)	Jan. Monthly	Asses. 6 (Events 35-39)	Feb. Monthly/ Asses. 7 (Events 40-50)
	7/30/2015	9/21/2015	10/5/2015	10/19/2015	11/30/2015	12/18/2015	1/6/2016	1/25/2016	2/23/2016
MW-9	0.26	NA	NA	NA	NA	2.9	7.4	0.55	0.45
MW-10R	2.5	NA	NA	NA	NA	3.1	1.2	0.46	1.9
MW-11	<0.1	NA	NA	NA	NA	3.3	3.0	0.62	2.0
MW-13	0.22	NA	NA	NA	NA	2.3	1.4	0.28	1.2
MW-45	<0.1	NA	NA	NA	NA	1.8	3.2	0.68	3.1
MW-20	<0.1	NS	NS	NS	NS	NS	0.23	NS	1.2

Results for TPH-DRO in mg/L
NS - Not Sampled
NA - Not Applicable

It is important to note that at the beginning of the injection/extraction events, TPH-DRO concentrations were already at exceedingly low levels due to the multi-year groundwater remediation effort and results associated from the pump and treat system. During the entire process there was never any free product or sheen identified in the injection/extraction wells, down-gradient monitoring wells (MW-19, MW-20, MW-21, and MW-35), in the MyCelx® filter system, or in the wet well (which were continuously monitored during the twenty-seven (27) week process and during Assessments #1–7). It was also reported in the Weekly Summary Reports that gauging of the wells during the monthly, quarterly, and special events found no evidence of free product or sheen. The Technical Team field staff also reported that with each Ivey-sol® push-pull event they observed a pungent petroleum smell at the wet-well which indicated liberated TPH-DRO recovery from the smear zone.

As each Assessment was conducted the Technical Team continued to report a decreasing trend in the amount of TPH-DRO found in the monitoring wells used during injection/extraction events. At the end of Assessments #1-7 it became evident that the remediation effort had reached a point where the combination of the MyCelx® filters, pump and treat system, and Ivey-sol® injection/extraction events would unlikely achieve any higher levels of TPH-DRO reduction with the pump and treat system remaining in operation. The concentrations remaining are at or near the end points described in the 2015 Action Plan. It is highly unlikely that continued remediation would be capable of reducing TPH-DRO to levels lower than the exceedingly small amounts of residuals remaining. Notwithstanding the fact that Priority Zone #1, #2, and #3 wells are at or near end points, it is even more noteworthy and important to the remediation outcome that no levels of TPH-DRO or surfactants have been measured at the down-gradient monitoring wells (MW-19, MW-20, MW-21, and MW-35). This demonstrates the remediation effort has been successful and limits of technology have been reached. Based on these results, there is no reasonable expectation further remediation would produce any better results.

As further documented in the following section, the ongoing monthly/quarterly monitoring performed during 2015 and 2016 confirm this finding and support the conclusion that the remediation has been successful.

5.2 MONTHLY AND QUARTERLY MONITORING WELL SAMPLING RESULTS

For ease of data interpretation and to be able to perform a trend analysis, all of the monthly and quarterly results, dating back to June, 2012, have been provided in table form in ***Appendix 9***.

Significant observations made from laboratory test results from each of the monitoring wells and recovery wells over this period of time are highlighted below:

MW-1:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO reduced from an average of 13mg/L recorded in 2012 to an average of 1mg/L recorded in 2015/2016.

MW-2:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, and MTBE.
- Napthalene reduced from an average of 3.5 micrograms per liter (µg/L) for years 2012-2014 to below detection levels in 2015/2016.
- TPH-GRO below detection levels.
- TPH-DRO reduced from an average of 18mg/L recorded in 2012-2014 to an average of 3mg/L recorded in 2015/2016.

MW-3:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, and MTBE.
- Napthalene reduced from an average of 3µg/L for years 2012-2014 to below detection levels in 2015/2016.
- TPH-GRO below detection levels.
- TPH-DRO reduced from a high of 100mg/L recorded in 2012 to an average of 1.5mg/L recorded in 2015/2016.

MW-4:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO has dropped from a high of 11mg/L in 2014 to the current level of 1mg/L or less.

MW-5:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO reduced from a high of 36mg/L recorded in 2014 to an average of 1mg/L recorded in 2015/2016. Following the last injection/extraction event TPH-DRO was recorded at 0.9mg/L on 2/23/16.

MW-9:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, and MTBE.
- Napthalene has continued to average 3µg/L since 2012.
- TPH-GRO below detection levels.
- TPH-DRO reduced from 7.4mg/L recorded on 1/6/16 prior to injection/extraction events to 0.5mg/L on 2/23/16 following injection/extraction events.

MW-10R:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, and MTBE.
- Napthalene in 2014 averaged 1.6µg/L and was reported less than one/below detection levels in 2015/2016.
- TPH-GRO below detection levels.
- TPH-DRO has averaged 1mg/L or less since 2012.

MW-11:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO has averaged at or near detection levels since 2012.

MW-12:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-13:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, and MTBE.
- Napthalene had a high of 1.2µg/L in 2012 and has been below detection levels since.
- TPH-GRO below detection levels.
- TPH-DRO has averaged 9.36mg/L from 2012 to 2013 and has averaged less than 1mg/L since.

MW-14:

- No presence or below detection levels for Toluene and MTBE.
- Benzene reduced from a high of 6.2µg/L in 2012 to a most recent level of 1.2µg/L in 2016. (Cleanup standard is 5µg/L.)
- Ethylbenzene has averaged 25 µg/L from 2012-2016. (Cleanup standard is 700µg/L.)
- Xylenes went from a high of 104µg/L in 2012 to 7µg/L in 2015. (Cleanup standard is 10,000µg/L.)
- Total BTEX of 141µg/L for a high in 2012 to 38µg/L in 2016. (There is no cleanup standard for Total BTEX.)
- Napthalene had a reported high of 250µg/L in 2012 and in 2015/2016 averaged 170µg/L.
- TPH-GRO below detection levels.
- TPH-DRO had a high of 9,700mg/L in 2012 and has averaged 3mg/L in 2015-2016. After injection/extraction events has been reduced to 0.91mg/L.

MW-15:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-16:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-17:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-18: (Sentinel Well)

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-19:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-20:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO averaged 2mg/L from 2012 to 2014 and has been below 1mg/L in 2015/2016.

MW-21:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-22:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, and MTBE.
- Napthalene has averaged 1.5µg/L since 2012.
- TPH-GRO below detection levels.
- TPH-DRO had a high of 200mg/L in 2012 and has been averaging less than 1mg/L ever since.

MW-23: (Sentinel Well)

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-24:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-25:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-28: (Sentinel Well)

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-29: (Sentinel Well)

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-31R:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-32:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-33:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-34:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-35:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-37:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, and Total BTEX.
- Napthalene had a high of 7.4µg/L in 2013 and has averaged below 3µg/L in 2015/2016.
- TPH-GRO below detection levels.
- TPH-DRO was reduced from a high of 100mg/L in 2012 to 1.4mg/L reported after injection/extraction events.

MW-40:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO was reduced from a high of 190mg/L in 2012 to an average of less than 1mg/L in 2015 to 2016.

MW-41:

- No presence or below detection levels for Benzene, Toluene, and MTBE.
- Ethylbenzene averaged 3µg/L in 2012 to 2013 and has been less than 1µg/L since. (Groundwater standard is 700µg/L.)
- Xylenes averaged 9µg/L in 2012 to 2014 and has been below detection levels since. (Groundwater Cleanup Standard is 10,000µg/L.)

- Total BTEX averaged 14µg/L in 2012 to 2014 and has been below detection levels since. (No standard for groundwater.)
- Napthalene averaged 30µg/L in 2012 to 2014 and at or near limits of detection ever since.
- TPH-GRO below detection levels.
- TPH-DRO was reduced from a high of 410mg/L in 2013 and has averaged less than 1mg/L following injection/extraction events.

MW-42:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, and MTBE.
- Napthalene averaged 4.5µg/L from 2012 to 2014 and has been at or below detection levels since.
- TPH-GRO below detection levels.
- TPH-DRO was reduced from a high of 160mg/L in 2012 and has averaged at or below 1mg/L since.

MW-43:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO levels less than 1mg/L.

MW-44:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-45:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO levels in January and February 2016 were 3.2mg/L and 3.1mg/L respectively.

MW-46:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, and MTBE.
- Xylenes has averaged 4.5µg/L from 2012 to present. (Groundwater standard is 10,000.)
- Total BTEX has averaged below 5µg/L from 2012 to 2016. (No groundwater standard.)
- Napthalene has averaged 13µg/L from 2012 to 2016.
- TPH-GRO below detection levels.
- TPH-DRO had a high of 170mg/L in 2012 and is now at 1.4mg/L after injection/extraction events.

MW-47:

- No presence or below detection levels for Toluene and MTBE.
- Benzene averaged 3µg/L from 2012 to 2014 and has been at or below detection levels in 2015/2016.
- Ethylbenzene averaged 8µg/L since 2012. (Groundwater standard is 700.)
- Xylenes was reduced from a high of 78µg/L in 2013 and has averaged below 10µg/L since. (Groundwater standard is 10,000.)
- Total BTEX has averaged 25µg/L from 2012 to 2015 but after the injection/extraction events has been measured at 2.2µg/L. (No groundwater standard.)
- Napthalene was reduced from a high of 180µg/L in 2013 and in 2016 measures 8.8µg/L.

- TPH-GRO below detection levels.
- TPH-DRO had a high of 6,500mg/L in 2013 and has averaged 1.4mg/L in 2015/2016.

MW-48:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-49:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

MW-50:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO below detection levels.

RW-2D:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, Napthalene, TPH-GRO, and TPH-DRO.

RW-3B:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, and Napthalene.
- TPH-GRO below detection levels.
- TPH-DRO had a high of 3,000mg/L in 2012 and has averaged below 1mg/L since.

RW-4:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, Napthalene, TPH-GRO, and TPH-DRO.

RW-5:

- No presence or below detection levels for Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, Napthalene, TPH-GRO, and TPH-DRO.

RW-6:

- No presence or below detection levels of Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, Napthalene, TPH-GRO, and TPH-DRO.

As shown above, the vast majority of the wells were at or below levels of detection and/or action levels for the constituents tested. Based on the results achieved during 2015/2016, the following characterizations provide an overview documenting the remediation efforts have left the site in substantial compliance with Groundwater Cleanup Standards for Type I and Type II aquifers.

- Benzene – Groundwater Cleanup Standard of 5µg/L
    - None of the monitoring wells or recovery wells showed the presence of Benzene above Groundwater Cleanup Standards.

- Toluene – Groundwater Cleanup Standard of 1,000µg/L
    - None of the monitoring wells or recovery wells showed the presence of Toluene above Groundwater Cleanup Standard.

- Ethylbenzene – Groundwater Cleanup Standard of 700µg/L
    - Only MW-14, MW-41, and MW-47 showed minute amounts (all below 25µg/L) which were significantly below Groundwater Cleanup Standard.

- Xylenes – Groundwater Cleanup Standard of 10,000µg/L
    - Only MW-14, MW-41, MW-46, and MW-47 showed minute amounts (all below 10µg/L in 2015/2016) which were significantly below Groundwater Cleanup Standard.

- Total BTEX – No Groundwater Cleanup Standard
    - MW-14 had a high of 141µg/L in 2012 and a low of 38µg/L in 2016, MW-46, and MW-47 averaged less than 5µg/L in 2015 and 2016.
    - All other wells showed no presence of BTEX.

- MTBE – Groundwater Cleanup Standard of 20µg/L
    - None of the monitoring wells or recovery wells showed the presence of MTBE above Groundwater Cleanup Standard.

- Napthalene – Groundwater Cleanup Standard (0.65µg/L)
    - MW-14 reported a high of 240µg/L in 2012 and an average of 170µg/L in 2015 and 2016, and only trace amounts found in MW-37, MW-46, and MW-47.
    - All other wells were below levels of detection.

- TPH-GRO – Groundwater Cleanup Standard of 0.047mg/L
    - None of the monitoring wells or recovery wells showed the presence of TPH-GRO above Groundwater Cleanup Standard.

- TPH-DRO – Groundwater Cleanup Standard of 0.047mg/L
    - In 2012 to 2014 most all groundwater contaminants had been removed to levels below standards or levels of detection with the exception of TPH-DRO which remained above Groundwater Cleanup Standards for approximately forty percent (40%) of the sampled wells.
    - MW-10, MW-11, MW-15, MW-16, MW-17, MW-18, MW-19, MW-21, MW-23, MW-24, MW-25, MW-28, MW-29, MW-31R, MW-32, MW-33, MW-34, MW-35, MW-43, MW-44, MW-45, MW-48, MW-49, MW-50, RW-2D, RW-4, RW-5, and RW-6 do not show levels above the standard or were reported as below levels of detection.
    - Wells with measurable amounts of TPH-DRO in 2012 to 2014 prior to injection/extraction events included MW-1, MW-2, MW-3, MW-5, MW-9, MW-13, MW-14, MW-22, MW-37, MW-40, MW-41, MW-42, MW-46, MW-47, and RW-3B.
    - After the 2015 and 2016 injection/extraction events most all of the wells measured levels of 1mg/L or less with the exception of MW-10R at 1.9mg/L, MW-11 at 2.0mg/L, MW-37 at 1.4mg/L, MW-42 at 1.7mg/L, MW-45 at 3.1mg/L, MW-46 at 1.4mg/L, and MW-47 at 1.4mg/L.

5.3 TPH-DRO AND SURFACTANT TREND ANALYSIS

In the 2015 effort to prepare the Action Plan for implementation of full scale Ivey-sol® application, it became clear based on the above history of monthly/quarterly sampling that only small amounts, if any, of residual LPH remained onsite. As mentioned above, any measurable amounts of Benzene, Toluene, Ethylbenzene, Xylenes, Total BTEX, MTBE, Napthalene, and TPH-GRO were exceedingly small and in trace amounts. The vast majority of sample results were below levels of detection or the measurable levels were significantly below Groundwater Cleanup Standards. The only exception was TPH-DRO, which was not present in approximately sixty percent (60%) of the wells, and where measured, was at exceedingly low levels. These low levels required that a new technology be implemented as it was unlikely the pump and treat system could effectively remediate the site further due to residuals being bound to the soil within the smear zone. For these reasons, the target indicator used to measure the effectiveness of the Ivey-sol® injection/extraction events was TPH-DRO. In addition to the monthly/quarterly sampling, and as reflected in Section 5.1 above, Assessments #1-7 following injection/extraction events focused on TPH-DRO and the ability to test for the presence of surfactant.

With every series of injection/extraction events conducted in each Priority Zone, a representative well was used to collect one (1) sample within thirty (30) minutes following the extraction events for that day. The Weekly Summary Reports documented the actual measurements recorded for each of these extraction events. The findings established a trend which showed the initial injections/extractions did release sorbed hydrocarbons from the smear zone as the TPH-DRO levels after these events increased. Assessments #1-7 were performed by the Technical Team following five (5) or six (6) injection/extraction events. As the injection/extraction events continued for several weeks the measured amount of TPH-DRO was reduced. After twenty-seven (27) weeks and fifty-four (54) injection/extraction events the measured amount of TPH-DRO reached levels which were at or near the target level required by the Maryland Department of the Environment for case closure consideration (1mg/L of less TPH-DRO).

Following Assessment #7 after week twenty-seven (27) the MDE agreed to the cessation of the Ivey-sol® injections with the stipulation that the pump and treat system remain on and the monthly/quarterly sampling continued. As further documentation that the remediation effort had successfully produced lower levels of TPH-DRO which had trended downward and are being sustained, the April quarterly monitoring results were compared to the results from the seventh Assessment. ***Table 2.0*** depicts the comparison of these results.

Table 2.0 - 2015 Action Plan Summary of Assessments with April Sampling Results

PZ #1 Well No.	Baseline	Asses. 1 (Events 1-6)	Asses. 2 (Events 7-11)	Asses. 3 (Events 12-16)	Asses. 4 (Events 17-27)	Asses. 5 (Events 28-34)	Jan. Monthly	Asses. 6 (Events 35-39)	Feb. Monthly/ Asses. 7 (Events 40-50)	Mar. Monthly	Apr. Monthly
	7/30/2015	9/21/2015	10/5/2015	10/19/2015	11/30/2015	12/18/2015	1/6/2016	1/25/2016	2/23/2016	3/16/2016	4/21/2016
MW-1	2.0	1.7	0.62	0.51	NS	NS	2.1	NS	1.0	NS	3.6
MW-2	1.4	1.9	5.6	0.63	NS	NS	3.1	NS	0.94	NS	3.8
MW-3	0.1	0.81	2.0	0.77	NS	NS	2.3	NS	0.48	NS	3.8
MW-4	<0.1	1.0	0.85	0.53	NS	NS	0.85	NS	1.2	NS	5.4
MW-5	0.3	0.65	1.6	0.53	NS	NS	2.8	NS	0.90	NS	3.2
MW-14	89	2.3	22	3.3	2.0	0.80	2.8	NS	0.91	NS	0.97
MW-37	0.35	2.3	1.3	0.76	NS	NS	5.2	NS	1.4	NS	5.2
MW-47	220	1.8	1.3	0.92	NS	NS	1.9	NS	1.4	NS	7.2

Results for TPH-DRO in mg/L
NS-Not Sampled
NA - Not Applicable

PZ #2 Well No.	Baseline	Asses. 1 (Events 1-6)	Asses. 2 (Events 7-11)	Asses. 3 (Events 12-16)	Asses. 4 (Events 22-27)	Asses. 5 (Events 28-34)	Jan. Monthly	Asses. 6 (Events 35-39)	Feb. Monthly/ Asses. 7 (Events 40-50)	Mar. Monthly	Apr. Monthly
	7/30/2015	9/21/2015	10/5/2015	10/19/2015	11/30/2015	12/18/2015	1/6/2016	1/25/2016	2/23/2016	3/16/2016	4/21/2016
MW-40	0.47	NA	NA	NA	1.1	2.7	0.69	0.79	0.25	NS	0.61
MW-41	1.2	NA	NA	NA	3.0	2.0	3.7	0.40	0.98	NS	3.6
MW-42	0.74	NA	NA	NA	0.58	1.3	2.5	NS	1.7	NS	4.2
MW-43	<0.1	NA	NA	NA	1.1	1.6	0.67	0.38	0.56	NS	8.2
MW-46	15	NA	NA	NA	1.7	2.1	1.6	0.28	1.4	NS	5.7

Results for TPH-DRO in mg/L
NS-Not Sampled
NA - Not Applicable

PZ #3 Well No.	Baseline	Asses. 1 (Events 1-6)	Asses. 2 (Events 7-11)	Asses. 3 (Events 12-16)	Asses. 4 (Events 17-27)	Asses. 5 (Events 28-34)	Jan. Monthly	Asses. 6 (Events 35-39)	Feb. Monthly/ Asses. 7 (Events 40-50)	Mar. Monthly	Apr. Monthly
	7/30/2015	9/21/2015	10/5/2015	10/19/2015	11/30/2015	12/18/2015	1/6/2016	1/25/2016	2/23/2016	3/16/2016	4/21/2016
MW-9	0.26	NA	NA	NA	NA	2.9	7.4	0.55	0.45	NS	4.0
MW-10R	2.5	NA	NA	NA	NA	3.1	1.2	0.46	1.9	NS	5.1
MW-11	<0.1	NA	NA	NA	NA	3.3	3.0	0.62	2.0	NS	3.8
MW-13	0.22	NA	NA	NA	NA	2.3	1.4	0.28	1.2	NS	4.7
MW-45	<0.1	NA	NA	NA	NA	1.8	3.2	0.68	3.1	NS	5.9
MW-20	<0.1	NS	NS	NS	NS	NS	0.23	NS	1.2	1.8	7.0

Results for TPH-DRO in mg/L
NS-Not Sampled
NA - Not Applicable

The successful 2014 Pilot Study for Ivey-sol® was implemented to address residual sorbed hydrocarbons in the smear zone, also demonstrated that testing for surfactants using field screening tests achieved a ninety-seven (97%) confidence level as compared to laboratory testing. For this reason field screening tests were performed in great numbers during the 2015 Action Plan. Specifically, over 3,960 field screening tests were performed over the twenty-seven (27) week duration. Once the extraction process started these field screening tests were performed continuously until there was no surfactant measured. At that point the extraction event was declared as having been completed. The MDE had stipulated that case closure could not be considered until TPH-DRO had reached target levels in the identified monitoring wells, and laboratory testing for surfactants revealed the complete absence of surfactants.

Towards the end of the process when the results were at or near the target level for TPH-DRO, it should be noted that there were still a few wells which reported higher levels of TPH-DRO than expected. Further investigation into this matter by EBA and PSS determined that because there were still trace amounts of surfactant in the groundwater that some small amount of liberation was still occurring resulting in slightly higher levels of TPH-DRO. The Technical Team also learned from PSS that trace amounts of surfactant were interfering with the TPH-DRO lab analysis which was resulting in the reporting of TPH-DRO at higher levels. The surfactant interference in the analysis results in a false reading which is higher than actual levels.

In response to these findings the Technical Team conferred with Ivey International. Based on their extensive experience, Ivey International reported that trace amounts of surfactant could be expected for several months after the injection/extraction events were complete. It was further reported that where observed these trace amounts of residual would exhibit a descending concentration over time. They are being removed by two (2) primary mechanisms including groundwater extraction at the existing pump and treat system and natural biological degradation of the biodegradable Ivey-sol® surfactant by the indigenous microbial population observed in the subsurface. It is significant to recognize that between September 1, 2015 and March 31, 2016 the pump and treatment system has extracted and treated over 23 million gallons of groundwater across all three (3) Priority Zones.

- Within Priority Zone 1, a total of 60,231 gallons of diluted Ivey-sol® was injected across eight (8) wells. This was followed by 14,793 gallons of water flushing to help purge remaining Ivey-sol®. The total volume of groundwater extracted at the monitoring well locations within the zone was 165,522.5 gallons, which approximates to 2.7 times the volume of diluted Ivey-sol® injected.

- Within Priority Zone 2, a total of 60,231 gallons of diluted Ivey-sol® was injected across five (5) wells. This was followed by 11,624 gallons of water flushing to purge remaining Ivey-sol®. The total volume of groundwater extracted within Priority Zone #2 was 63,741 gallons, or 1.1 times the volume of diluted Ivey-sol® injected in this Zone. The Priority Zone #2 monitoring well locations were all well within the established hydraulic control of the pump and treatment system.

- Within Priority Zone 3, a total of 31,701 gallons of diluted Ivey-sol® was injected across five (5) wells. This was followed by 13,209 gallons of water flushing to purge remaining Ivey-sol®. The total volume of groundwater extracted within Priority Zone #1 was 50,776 gallons, or 1.6 times the volume of diluted Ivey-sol® injected in this zone. The Priority Zone #3 monitoring well locations were all well within the established hydraulic control of the pump and treatment system.

In summary a total a total of 124,161 gallons of diluted Ivey-sol® was injected across eighteen (18) wells onsite. This was followed by a total combined water flushing volume of 39,626 gallons to purge remaining Ivey-sol®. The total volume of groundwater extracted at the eighteen (18) wells was 280,040 gallons. The extracted groundwater is more than double (2.3 times) the injected volume of diluted Ivey-sol®.

With the pump and treatment system having extracted over 23 million gallons of groundwater across the subject priority zones, the residual levels of surfactant should not pose a significant concern as the pump and treat will continue to extract these residuals. Furthermore, natural biological degradation of the Ivey-sol® will continue. ***Table 3.0*** below documents the volumes associated with the Ivey-sol® push/pull extractions. The quantities treated through the MyCelx® system and extracted during the same period as discussed above, can be found in the Daily Monitoring Reports (DMRs) submitted to the MDE. Although surfactant sampling/testing continues the latest readings for April are included in ***Table 3.0*** below.

Table 3.0 - Push/Pull Extraction Volumes

Location	Ivey-sol® Volume* Injected	Water Flushing Phase	Volume Extracted	Priority Zone	Surfactant Test Results (mg/L)
MW1	7,133 Gal.	2,113 Gal.	19,633 Gal.	1	7.6
MW2	7,133 Gal.	2,113 Gal.	29,164 Gal.	1	9.65
MW3	7,133 Gal.	2,113 Gal.	30,730 Gal.	1	ND
MW4	7,133 Gal.	2,113 Gal.	11,503 Gal.	1	15.2
MW5	7,133 Gal.	2,113 Gal.	25,969 Gal.	1	2.16
MW14	10,303 Gal.	2,113 Gal.	3,124 Gal.**	1	ND
MW37	7,133 Gal.	2,113 Gal.	26,306 Gal.	1	ND
MW47	7,133 Gal.	538 Gal.	19,093 Gal.	1	9.19
Sub-Total	***60,234 Gal.***	***15,329 Gal.***	***165,522 Gal.***		
MW40	7,397 Gal	2,642 Gal.	21,328 Gal.	2	ND
MW41	6,868 Gal.	2,642 Gal.	20,703 Gal.**	2	44.4
MW42	3,170 Gal.	1,057 Gal.	3,627 Gal.**	2	14.4
MW43	7,397 Gal.	2,642 Gal.	9,568 Gal.**	2	7.96
MW46	7,397 Gal.	2,642 Gal.	8,515 Gal.**	2	23.4
Sub-Total	***32,229 Gal***	***11,625 Gal.***	***63,741 Gal.***		
MW9	5,812 Gal.	2,642 Gal.	12,873 Gal.	3	13.4
MW10R	5,812 Gal.	2,642 Gal.	5,201 Gal.	3	8.52
MW11	4,227 Gal.	2,642 Gal.	8,434 Gal.	3	28.4
MW13	5,812 Gal.	2,642 Gal.	3,996 Gal.	3	53.8
Sub-Total	***31,702 Gal.***	***13,210 Gal.***	***50,776 Gal.***		
Totals	***124,165 Gal.***	***40,164 Gal.***	***280,039 Gal.***		

Note: **** Diluted Ivey-sol® concentration in water injected.***
***** MW14 <1000L extracted 26 of 30 extraction events. MW41 Extraction 1 with 0.0 Gal. MW42 5 of 11 Extractions <1000L. MW43 6 of 23 Extractions <1000L MW46 12 of 23 Extractions <1000 L***
Values rounded in volume extracted to nearest Gal.
' - ' Indicates no laboratory sample results.
ND non-detectable.

Regarding the slightly elevated concentrations of TPH-DRO that are being reported by PSS, and are associated with the surfactant interference, we have received written confirmation of same from PSS as noted in ***Appendix 10***. This reported interference can be calculated through direct analysis of the diluted Ivey-sol® which would only result in an interference effect of no more than 1.4mg/L. This means that any TPH-DRO reading which is now above the target levels is more associated with the trace amount of surfactant in the groundwater which, as documented above, will continue to liberate very small amounts of remaining residual phase hydrocarbons and result in a slight increase in TPH-DRO until all of the surfactant has been removed or dissipated. When the monthly and quarterly sampling no longer reports the presence of surfactant, TPH-DRO levels are expected to return to the target. The sentinel wells continue to report no presence of surfactant or TPH-DRO.

6.0 NEXT STEPS AND RECOMMENDATIONS

6.1 MDE/SMCC CONSENT ORDER:

Once the Ivey-sol® process neared completion SMCC and the MDE initiated discussions regarding details associated with case closure requirements. It was deemed appropriate by the parties that they enter into a Consent Order which specified the criteria and target levels that would have to be achieved in monitoring wells to qualify the project for case closure. This Order included but was not limited to, Corrective Action Plan (CAP) requirements, additional work plans, continued monitoring and reporting, requirements for the continued use of pump and treat systems, conditions to be met for case closure, extended monitoring following termination of the pump and treat system, reference to the Oil Control Program's Seven Risk Factors, and other requirements associated with final remediation and case closure.

The Consent Order was completed and executed on May 17, 2016 and is included as ***Appendix 11***.

6.2 TOWN OF CHESTERTOWN AND SMCC AGREEMENT:

The purpose of this Agreement between the Town and SMCC was to establish conditions under which SMCC would be liable for damages should it be documented that residuals from the original oil spill contaminate the Town's water supply. This Agreement included target levels, agreed upon monitoring, determination of sentinel wells, notifications upon discovery of contaminant's, required indemnification, and further actions required.

At the writing of this report SMCC is in final negotiations with the Town of Chestertown.

6.3 ONGOING MONITORING AND REPORTING:

The MDE has required SMCC continue with the long term monthly/quarterly sampling, testing, and reporting using protocols and laboratory methodologies as prescribed. This reporting is required to be shared with all the parties including various representatives from the Town of Chestertown. The information is also posted on the MDE website. It is important to note that the MDE may, at their discretion, modify, amend, or alter the monitoring and reporting as appropriate to be able to efficiently and effectively monitor and assess the remediation effort. As discussed below, the MDE may also require additional monitoring wells, testing, and reporting to demonstrate the remediation case qualifies for case closure.

6.4 SUBSURFACE INVESTIGATIONS AND REPORTING:

On March 23, 2016 the MDE requested SMCC prepare a work plan for subsurface investigations and reporting. This additional work effort will provide the MDE with additional site characterization information which will contribute to their assessment of the effectiveness of the remediation efforts to date. This will provide further evidence as to whether or not the project satisfied the MDE case closure requirements. As noted earlier the MDE March 23, 2016 letter, the SMCC Proposed Work Plan, and the MDE May 9, 2016 approval letter are included in ***Appendix 4, Appendix 5,*** and ***Appendix 6***, respectively.