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REMEDIATION CLOSURE PLAN FOR LNAPL AND CVOC REMEDIATION – ZONE 3 MERITOR HEAVY VEHICLE BREAKING SYSTEMS

Meritor Heavy Vehicle Braking Systems (HVBS), Cwmbran, Wales

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JULY 2017

Incorporating

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Remediation Closure Plan for LNAPL and CVOC Remediation – Zone 3 Meritor Heavy vehicle Breaking Systems (HVBS)

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Executive Summary

Background

Remediation has been undertaken at the Meritor facility located on Grange Road, Cwmbran, Gwent NP44 3XU, South Wales (the Site) since April 2013 to address the presence of light non-aqueous phase liquid (LNAPL) and dissolved and vapour-phase Chlorinated Volatile Organic Compounds (CVOC), comprising predominantly trichloroethene (TCE), in soil and groundwater beneath the Site.

The works were conducted in support of a planning application (reference Application Number 11/P/00101) which has been submitted to the Local Planning Authority, Torfaen County Borough Council (TCBC), for the refurbishment of the southern zone (Zone 3) of the facility. The objective of this document is to define the end point of active remediation, and to demonstrate that the implemented CVOC and LNAPL remediation has met the remediation objectives and that the project can move to the final stage of the process (the verification phase, to assess post-remediation conditions).

The relevant pollutant linkages, considered potentially active at the Site based on continued use of the Site as a braking system production plant, were previously identified as follows:

- *Risk to water resource receptors through further off-site migration of dissolved phase CVOC beneath the Site;*
- *Risk to commercial workers via inhalation of indoor and outdoor air, originated from CVOC in soil and groundwater beneath the Site; and*
- *Risk to neighbouring commercial workers and users of the adjacent playing field via inhalation of indoor and outdoor air originated from dissolved phase CVOC migrating off-Site.*

Removal of LNAPL was not required for risk management purposes, however it was acknowledged that recovery of LNAPL would be desirable as a form of environmental betterment.

Active remediation of CVOC at the site was undertaken by enhanced reductive dechlorination (ERD) between April 2013 and April 2017 with gas generation managed by two SVE systems. Recovery of LNAPL was undertaken using a Total Fluids Pumping (TFP) system operated between April 2013 and March 2017.

Remediation Validation - CVOC

Remediation is considered to have been implemented successfully when either of the following previously defined criteria have been achieved:

- *Criteria 1 - An updated risk assessment, or a revision of the risk assessment justified by changes in the plume geometry or the conceptual understanding of the Site, indicates that the reduced mass of contaminants does not present an unacceptable risk to the identified receptors; and/or,*
- *Criteria 2 - The improving effect of continued reagent injections has diminished to low or asymptotic levels.*

A number of lines of evidence have been used to assess the performance against the remediation criteria; these included the lateral distribution of CVOC, assessment of natural attenuation parameters, and assessment of biological transformation of CVOC, and a review of groundwater and soil gas quality trends. In addition a review of the detailed quantitative risk assessment (DQRA) was conducted to further assess the risk to water resource receptors.

The lines of evidence review demonstrates that Criteria 1 has been met on the basis that:

- *Concentrations of trichloroethene (TCE), cis-dichloroethene (cis-DCE) and latterly vinyl chloride (VC) in both groundwater and soil gas have significantly reduced and are still decreasing within the IRZ, and corresponding increases in ethene and ethane have been observed indicating destruction of contaminant mass via the ERD process. Overall reductions in key CVOC across the site of up to 86% have been observed.*

The sequential biological dechlorination of CVOC from TCE, to cis-DCE, then VC and subsequently complete dechlorination and reduction to ethene and ethane has been observed throughout the period of active remediation.

- *There has been a significant reduction in the lateral distribution of elevated concentrations of TCE, cis-DCE, and latterly VC across the site with a large reduction plume geometry observed. Corresponding increases in ethene and ethane distribution have been observed indicating destruction of contaminant mass via the ERD process.*
- *Although some exceedances of human health site specific assessment criteria (SSAC) (commercial worker inhalation indoor air) for VC in groundwater are present, these are better assessed using the collected soil gas data, where:*
  - *Within the Production Building based on currently available results the soil gas data does not indicate a unacceptable level of risk is present.*
  - *Within the South Yard, although VC is detected above the SSAC (off site commercial worker inhalation of indoor air) in SG2, concentrations in SG1 (on the site boundary) between this location and the identified off-site receptor are below the SSAC and therefore the risk from the measured concentration in SG2 is not considered significant.*
- *Based on the results of the updated groundwater resource modelling, the risk presented to both the aquifer and Afon Lwyd is not considered to be significant from the residual concentrations of CVOC upon cessation of active remediation.*

Diminishing returns from the active remediation (Criteria 2) are also demonstrated by the following:

- *Where initial concentrations of CVOC were low, lower % reductions in CVOC concentrations have been observed and it is therefore concluded further injections are unlikely to have a significant beneficial effect on further reducing the low levels of CoC in these wells. Where significant initial CVOC mass was present prior to remediation the results show the impact of injections reduces as the number of injections increases. The majority of locations now show relatively low concentrations of CVOC and the impact of the most recent injections are much more limited than those at the start of the remedial programme.*

Remediation Validation - LNAPL

Remediation is considered to have been implemented successfully when either of the following previously defined criteria have been achieved:

- *LNAPL recovery rates have become low or reached asymptotic conditions and dissolved-phase and soil gas concentrations of TPH compounds related to the presence of residual LNAPL are not presenting an unacceptable risk; and/or,*
- *A revision of the risk assessment, justified by changes in the LNAPL plume geometry or the conceptual understanding of the Site, indicates that the reduced mass of contaminants are not presenting an unacceptable risk.*

The lines of evidence reviewed to assess performance against the remediation criteria were groundwater and soil gas data, LNAPL occurrence measurements, and LNAPL removal rates and volumes.

During active remediation 27,700 of LNAPL were recovered by the TFP demonstrating betterment to site conditions; LNAPL extraction rates were approximately 1,100L per month during the first six months of operation and fell throughout the period of operation to approximately 240L per month during the final six months of active remediation. These observations demonstrate LNAPL recovery rates have greatly reduced.

The measurement of stabilised LNAPL thicknesses across the TFP network shows an overall reduction in LNAPL thickness of 60%, and the average LNAPL thicknesses across the extraction well network has reduced during the period of operation from approximately 290mm during the first six months of operation to approximately 90mm during the last six months of operation.

Whilst the removal of a significant volume of LNAPL has resulted in a large reduction in NAPL thicknesses across the extraction well network; the measured thickness of LNAPL in nearby monitoring wells has not been seen to reduce consistently. This observation reinforces the pre-existing conclusions within the CSM for the Site that:

- *The LNAPL is not readily recoverable outside the immediate vicinity of the extraction wells at thicknesses below 500mm. Even at thicknesses above this, results demonstrate LNAPL recovery is hindered due to low mobility in the subsurface.*
- *The LNAPL is of limited mobility and therefore the risk of off-site migration is not considered to be significant.*

Groundwater and soil gas monitoring results continue to demonstrate that concentrations of TPH compounds related to the presence of residual LNAPL are not presenting an unacceptable risk to human health or water resource receptors. The reduction in residual LNAPL volume has provided environmental betterment and further reduces the risk LNAPL mobility and of significant dissolved phase concentrations resulting from the residual LNAPL.

The lines of evidence reviewed indicate that the remediation objectives for the Site have been achieved and that the verification phase, to assess post-remediation conditions should be undertaken.

In addition to the provision of factual data in the Arcadis Annual Monitoring Reports, the Remediation Verification Report will summarise the remediation works carried out and the results and the outcomes of the verification works at Zone 3.

1 Introduction

1.1 Background Information

In February 2017, Arcadis (UK) Limited (Arcadis) was commissioned by Meritor Heavy Vehicle Braking Systems (UK) Limited (Meritor) to produce a Remediation Closure Plan for remedial activities undertaken at the Meritor facility located on Grange Road, Cwmbran, Gwent NP44 3XU, South Wales (the Site) since April 2013. Remediation has been undertaken to address the presence of light non-aqueous phase liquid (LNAPL) and dissolved and vapour-phase Chlorinated Volatile Organic Compounds (CVOC), comprising predominantly trichloroethene (TCE), in groundwater beneath the Site.

Continual review of the remediation progress against the remediation objectives and remediation criteria led to the conclusion in early 2017 that active remediation had been successful. This document presents the results of remediation validation process and proposed amendments to the verification process.

The environmental works were conducted at the request of Meritor as part of a redevelopment of the facility which involved the divestment of the freehold ownership of the northern two thirds of the Site (Zones 1 & 2), for redevelopment. Meritor retained the southern third of the Site (Production Building and South Yard area (Zone 3)), which has been refurbished and modernised to allow expanded production with the aim of ensuring the future global competitiveness of the Cwmbran plant as an important employer in the local and regional area.

A Section 106 agreement exists between Torfaen County Borough Council and Meritor which outlines the planning permission and associated obligations (including the remedial works) for the redevelopment of the overall Meritor site footprint. Zone 1 has subsequently been divested and redeveloped as a food store and petrol filling station, Zone 2 has been divested and is awaiting redevelopment. Meritor are now in the final stages of the process of redeveloping their active manufacturing footprint.

The work was conducted in accordance with the Global Master Services Agreement (2008) between Arcadis and Meritor, Inc. The work was also performed in accordance with Welsh legislation and regulatory guidance for the assessment of land contamination, an overview of which is presented in Appendix A.

The information presented in this report has been obtained during previous phases of assessment (see Section 1.4 below). This report should be read in conjunction with the previous environmental reports as the information contained in those reports forms the basis of the conceptual model for the Site.

1.2 Planning Conditions

A joint planning application by Meritor and Morrisons Supermarkets Plc. (reference Application Number 11/P/00101) has been submitted as part of the Section 106 agreement to the Local Planning Authority, Torfaen County Borough Council (TCBC). The application included for the redevelopment of Zone 1 by Morrisons Supermarkets Plc, and also for the refurbishment of the southern zone (Zone 3) of the facility. Detailed redevelopment plans provided to Arcadis are presented in the planning application and indicated that the main commercial developments for Zone 3 would be as follows:

- Zone 3 – The remainder of the production building (south of building column row M) and the southern yard area and visitors' car park was to be retained as a heavy vehicle braking systems production building with associated employee and visitor car parking areas; an engineering centre; and Meritor's offices.

Refurbishment of this area is now virtually complete. Torfaen County Borough Council imposed environmental planning conditions for the refurbishment of Zone 3, one of which was planning condition #18 which stated:

"A Remediation Verification Plan for Sites 2 and 3 shall be produced in accordance with best practice and submitted to and approved".

To comply with this condition Arcadis produced the following documents:

- Remediation Verification Plan for CVOC Groundwater Remediation, Report Ref. 909363806_04, dated January 2012); and,

- Remediation Verification Plan (LNAPL Recovery), Report Ref. 909364003_04, dated January 2012).

This document supersedes the above verification plans by incorporating remediation performance data collected at the Site between April 2013 and April 2017, and revisiting the verification process based on the success of the remediation implementation. The information contained in this report can be used to assist in the discharge of the environmental planning conditions.

The general Site location and the surrounding area are presented on Figure 1 at a map scale of 1:50,000.

1.3 Report Objectives

The objective of the Remediation Closure Plan is to define the end point of active remediation, and to demonstrate that the implemented CVOC and LNAPL remediation has met the remediation objectives at the Site by successfully reducing contaminant mass and managing the environmental risks and liabilities associated with identified CVOC concentrations beneath the Zone 3 area. The final stage of the process will be the verification phase, to assess post-remediation conditions.

This Remediation Closure Plan is to be submitted to TCBC for their approval under Planning Condition #18.

1.4 Previous Environmental Works

The Site has undergone a series of intrusive Site investigations, risk assessment and remediation since December 2009. The environmental works to date conducted on behalf of Meritor are detailed in Appendix B.

In conducting environmental works at the Site consideration has been given to the document Model Procedures for the Management of Land Contamination (Contaminated Land Report 11, DEFRA and EA, 2004) and Verification of Remediation of Land Contamination (EA, 2009). These guidance documents were published before Natural Resources Wales was formed from the Environment Agency.

1.5 Reliability of Information/ Limitations

This report is only valid when read in its entirety. Any information or advice included in this report should not be relied on unless considered in the context of the whole report. Reference should be made to the notes on study limitations at the end of this report.

A copy of Arcadis' study limitations are presented in Section 9.

1.6 User Reliance

There are neither third party rights nor benefits conferred under this report. Use of this report is strictly limited to Meritor and Meritor, Inc and its direct and indirect subsidiaries, which are the sole parties to whom Arcadis intends to confer any rights. Any reliance on the contents of this report by any other party is the sole responsibility of that party.

2 Site Characteristics

Full details of environmental characteristics of the Meritor Facility are presented in the two Remediation Verification Plans referenced previously in this report. In summary, the Meritor facility is located in an area of mixed land use that includes residential, light industrial and commercial properties. The Site, following divestment of Zones 1 and 2, is bounded by Grange Road to the west, Zone 2 to the north (currently disused), a railway line to the east and a factory to the south. The facility lies on the flood plain of the Afon Lwyd (which is located to the east of the Site) at an elevation of 55 metres Above Ordnance Datum (mAOD). The topography of the facility is generally flat with the immediately surrounding area sloping gently to the south.

The Site is, with the exception of a small area on the western boundary and remote from the area of remediation, completely covered in hardstanding. The hardstanding is underlain by varying thicknesses of Made Ground which in turn is underlain by Alluvium Deposits comprising sandy or gravelly clay and clayey or gravelly sand. The Raglan Marl Formation underlies the superficial geology at the Site.

Groundwater has been observed to rest within both the Alluvium Deposits and Raglan Marl Formation with an inferred flow direction to the south east. Groundwater intercepted in the deeper part of the aquifer system shows a more easterly component of flow than the shallower deposits. The groundwater in the upper part of the Raglan Marl Formation is likely to be directly in continuity with the Afon Lwyd.

The Conceptual Site Model (CSM) in terms of source, pathways and receptors has been developed previously and details of the CSM can be found in the Detailed Quantitative Risk Assessment (DQRA) and subsequent revised and updated DQRAs referenced in Appendix B.

3 Relevant Pollutant Linkages

3.1 Chlorinated VOC

The Updated detailed quantitative risk assessment (DQRA) (April 2012), together with findings from the previous environmental works, assessed and evaluated the potential risks posed to the identified human health and water resource receptors, associated with the measured CVOC beneath the Site. The relevant pollutant linkages, considered potentially active at the Site based on continued use of the Site as a braking system production plant, were identified as follows:

- Risk to water resource receptors through further off-site migration of dissolved phase CVOC beneath the Site;
- Risk to commercial workers via inhalation of indoor and outdoor air, originated from CVOC in soil and groundwater beneath the Site; and
- Risk to neighbouring commercial workers and users of the adjacent playing field via inhalation of indoor and outdoor air originated from dissolved phase CVOC migrating off Site.

The pre-remediation modelled source areas of CVOC in groundwater is presented on Figure 2.

3.2 LNAPL Recovery

The Updated DQRA referenced above and NAPL mobility assessment (August 2011) concluded that, given the LNAPL type (heavy oil), the limited solubility of its constituent compounds and results of groundwater sampling, an extensive dissolved-phase hydrocarbon plume was not present. The data suggested that the removal of LNAPL was not required for risk management purposes. Additionally, near source soil gas data indicated that risks to the occupiers of the main production building (commercial workers) are not presented by the pre-remediation LNAPL condition. However based on discussion with Meritor it was agreed that recovery of LNAPL would be desirable as a form of environmental betterment while other remediation works were on-going.

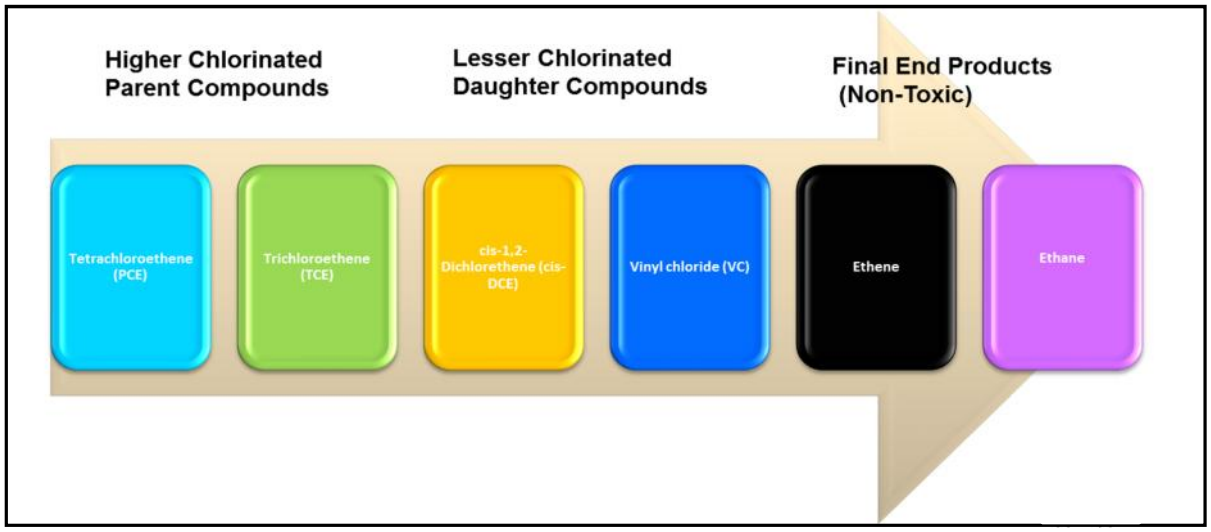
The pre-remediation inferred extent of LNAPL distribution at the site is presented on Figure 3.

4 Site Remediation Summary

This Section provides a brief overview of remediation works undertaken at the Site, full details are presented in the aforementioned Remediation Implementation Plans. The remediation system layout is presented on Figure 4.

4.1 ERD System

Two enhanced reductive dechlorination (ERD) systems are present on site, one within the Production Building and one located on the South Yard, both systems are linked by telemetry to allow the remote monitoring and control. Reductive dechlorination is a biologically mediated reaction which enables the transfer of electrons to chlorinated contaminants from electron donors. In the reduction process, chlorinated solvent molecules replace their chlorine atoms with hydrogen, leading to the sequential dechlorinated pattern as follows:



ERD involves enhancing or inducing the biological transformation of chlorinated compounds through periodic injection of a soluble electron donor solution (in this case molasses) to create an in situ reactive zone (IRZ). The injections of electron donor, at a sufficient rate to exceed the recharge of electron acceptors naturally present within the aquifer such as oxygen and nitrate, will drive the aquifer conditions anaerobic, which promotes aquifer microbial communities into sulphate reduction and methanogenesis, stimulating reductive dechlorination of CVOC dissolved in groundwater. To manage gasses generated as a result of the ERD process two soil vapour extraction (SVE) systems were installed at the Site, one in the South Yard and one in the Production Building.

During ERD higher chlorinated ethenes tetrachloroethene (PCE) and trichloroethene (TCE) are reduced to less chlorinated daughter products cis-dichloroethene (*cis*-DCE) and subsequently vinyl chloride (VC). These daughter products the concentrations of which increase during the initial stages of ERD are transient and are further reduced as the process completes. Vinyl chloride can be degraded under both aerobic and anaerobic conditions, natural attenuation can also occur around the plume fringes and as redox conditions recover to ambient conditions.

Periodic injections of molasses solution have been undertaken between April 2013 and the end of April 2017, injection volumes and strengths were monitored by telemetry and modified in real time to ensure optimal distribution across the treatment area. Periodic monitoring of the condition of the IRZ was completed to inform a flexible and responsive ERD approach with regular review to make sure the process reached its maximum efficiency. In total 16 injection events were completed into the South Yard System and Production Building Systems. Full details on the injection are presented in Appendix C.

4.2 LNAPL Recovery

The recovery of LNAPL has been undertaken using a Total Fluids Pumping (TFP) system, designed to remove LNAPL and groundwater from beneath the Site. The extraction of fluids causes drawdown of the water table at the extraction point, thereby creating a cone of depression. This effectively alters the local hydraulic gradient within the radius of the influence of the extraction well, enhancing LNAPL migration towards the extraction point, and additionally providing a hydraulic barrier, minimising potential for off-Site migration of contaminants in groundwater. Separated groundwater is then treated before discharge under Meritor's permitted trade effluent consent.

Extraction of LNAPL has been undertaken between April 2013 and the end of April 2017.

4.3 Completion of Active Remediation

Following review of data collected to date, the TFP and ERD systems were shut down at the end of April 2017. The IRZ resulting from ERD operation is expected to remain active after cessation of the final injections and is therefore capable of producing methane and other ground gases. To manage this, the SVE systems will remain in operation for three further months, and be switched off one week before the first post-remediation validation visit.

Cessation of remediation activities is justified by demonstrating that the remediation criteria defined for the Site have been met using data collected throughout the period of remediation to date (Sections 5 and 6) and data to be collected during the remediation verification period.

5 CVOC Remediation Validation

5.1 Remediation Criteria

The aim of employing an ERD approach for the remediation of TCE was to achieve the biological transformation of this compound, and its daughter products, to ethene and ethane. The active remediation work at the Site involved the periodic injection of molasses solution between April 2013 and April 2017 to create anaerobic groundwater conditions in order to enhance the reductive de-chlorination process of TCE dissolved in groundwater beneath Zone 3. During the period of injections, Arcadis undertook regular monitoring to assess the progress of the ERD remediation.

The following remediation criteria were defined to help guide the endpoint of remediation, with remediation considered to have been implemented successfully when *either* of the following criteria had been achieved:

- An updated risk assessment, or a revision of the risk assessment justified by changes in the plume geometry or the conceptual understanding of the Site, indicates that the reduced mass of contaminants does not present an unacceptable risk to the identified receptors; and/or,
- The improving effect of continued reagent injections has diminished to low or asymptotic levels.

For either criteria, detailed assessment of the changes in ground conditions would be needed to support the remediation validation process.

5.2 Lines of Evidence

The primary data sources and lines of evidence assessed to provide confidence that the risks from each pollutant linkages have satisfactorily been managed, thus validating the remediation success, are as follows:

Pollutant Linkage	Remediation Performance Data Collected	Lines of Evidence for Remediation Validation
• Inhalation of indoor and outdoor air impacted by a soil, groundwater or NAPL source by on site human health receptors (commercial workers).	• On-site groundwater sampling • On-site soil gas monitoring • On-site indoor and outdoor air monitoring	• Review of groundwater quality trends and lateral distribution • Assessment of biological transformation of CVOC • Assessment of natural attenuation processes • Quantitative risk assessment – soil gas, indoor and outdoor air quality
• Inhalation of indoor and outdoor air, impacted by a groundwater source, by off-site human health receptors (off-site commercial workers) and inhalation of outdoor air, impacted by a groundwater source by off-site human health receptors (rugby player and trespasser).	• On-site and Off-site groundwater sampling • Soil gas monitoring of boundary monitoring points.	• Assessment of soil gas data • Assessment of groundwater quality trends and lateral distribution • Assessment of biological transformation of CVOC • Assessment of natural attenuation processes • Quantitative risk assessment – soil gas quality
• Off-site migration of groundwater impacted by CVOC towards down-gradient surface water resource receptors	• On-site groundwater sampling • Off-site groundwater sampling	• Assessment of groundwater quality trends and lateral distribution • Assessment of biological transformation of CVOC

Pollutant Linkage	Remediation Performance Data Collected	Lines of Evidence for Remediation Validation
		• Assessment of natural attenuation processes • Quantitative risk assessment – groundwater quality

As evidenced within the table, there are a number of lines of evidence pertinent for more than one pollutant linkage:

1. Assessment of CVOC trends
2. Assessment of lateral distribution of CVOCs
3. Assessment of biological transformation of CVOCs
4. Assessment of other indicators for natural attenuation
5. Revised Quantitative risk assessment.

Each of these lines of evidence have been evaluated in detail as part of the remediation validation process, and to support the conclusion that verification of remediation should now take place.

5.3 Assessment of CVOC Trends

CVOC concentrations measured in groundwater samples collected prior to and during the active remediation are presented in Appendix D.1, and detailed remediation trend graphs for groundwater samples collected from wells within the IRZ are presented as Appendix D.2, monitoring well locations are shown on Figure 5.

5.3.1 Groundwater

Alluvium – South Yard

Within the South Yard, with the exception of RSW2006S (where nearly 80% TCE concentration reduction ha been observed), no TCE remains at measured concentrations above the method detection limit (MDL) within the treatment area. Significant reductions in concentrations of *cis*-DCE have also been observed in all monitoring wells. The conversion of TCE, and *cis*-DCE noted above has, as expected by the ERD process, lead to increases in VC concentrations during remediation.

Levels of VC remain present in some locations (e.g. RSW2008S and RSW2011S) but a general trend of reduction to ethene and ethane is observed with large increases in these compounds noted, including in locations where residual levels of VC are still elevated, indicating the ERD process is ongoing. Once VC levels reduce the final process observed in ERD is the reduction in ethene and ethane levels; this process is ongoing and most marked in RSW2012S. Overall the data shows the destruction of CVOC by anaerobic ERD processes is well advanced at the Site. A summary of groundwater trends is presented in the table below:

Monitoring Well	Percentage Change [TCE]	Percentage Change [cis-DCE]	Percentage Change [VC]	Percentage Change [ethene and ethane]
BH204AS*	>-99	-86	73	302**
RSW2006S	-77	-96	-38	179
RSW2007S	Not present	20	52	116
RSW2008S	>-99	-87	341	428

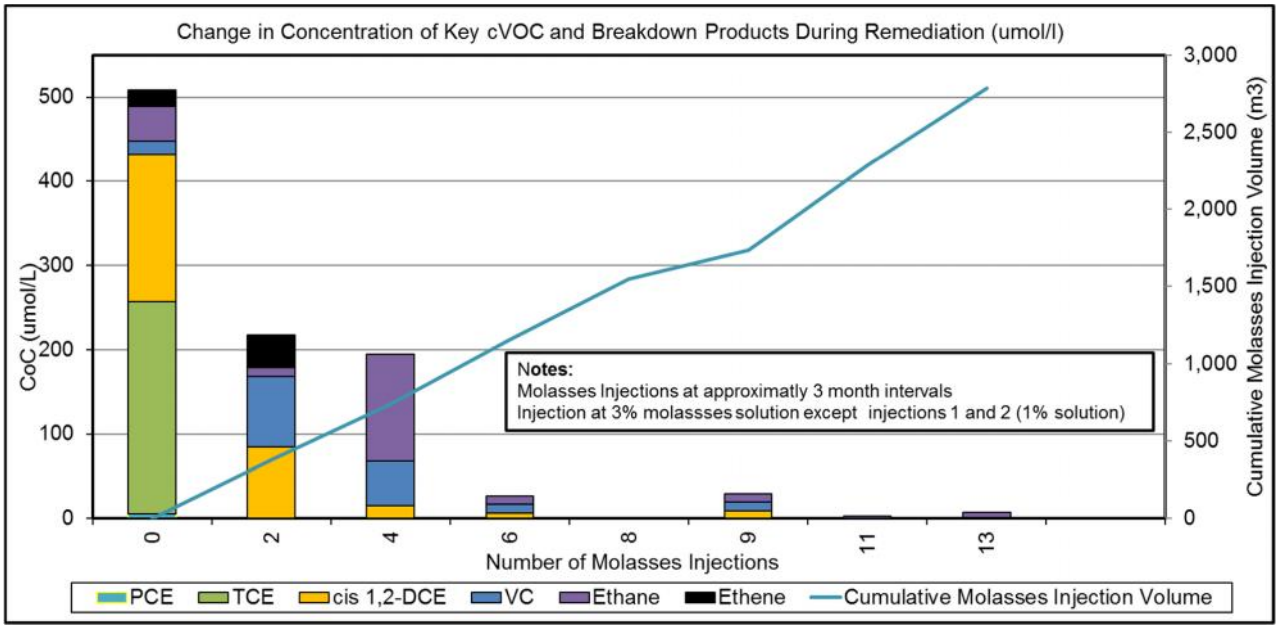
Monitoring Well	Percentage Change [TCE]	Percentage Change [cis-DCE]	Percentage Change [VC]	Percentage Change [ethene and ethane]
RSW2009S	Not present	-99	-99	-74
RSW2010S	>-99	-48	-32	-4
RSW2011S	>-99	-90	>500	>500
RSW2012S	>-99	>-99	>-99	>500

No data BH406 as replacement for BH400 lost during redevelopment

Although not widespread prior to remediation PCE destruction has also been observed

South Yard - Raglan Marl

Concentrations of TCE in the Raglan Marl have been significantly reduced in the South Yard via reductive transformation to *cis*-DCE; which has then been further reduced to VC. Residual *cis*-DCE is present in a number of locations (e.g. RSW2007SD and RSW2012D) but the presence of VC indicates further transformation is ongoing. The conversion of TCE and *cis*-DCE to VC was observed early in the remediation and in the majority of locations VC levels are now observed to be falling as reduction to ethene and ethane occurs, the process is illustrated for RSW2009D below.



Levels of VC remain elevated above baseline in approximately 50% of locations but a strong general trend of ongoing reduction to ethene and ethane is observed across the treatment area. Reduction in ethene and ethane levels, the final stage of the ERD process is ongoing and most marked in RSW2009D and BH304S. Overall the data shows the destruction of CVOC by anaerobic ERD processes is well advanced at the Site. A summary of groundwater trends is presented in the table below:

Monitoring Well	Percentage Change [TCE]	Percentage Change [cis-DCE]	Percentage Change [VC]	Percentage Change [ethene and ethane]
RSW2006D	>-99	-96	-52	161
RSW2007D	>-99	195	>500	-12
RSW2008D	>-99	-85	212	>500
RSW2009D	>-99	>-99	-92	-81
RSW2010D	>-99	-98	7	>500
RSW2011D	>-99	>-99	-96	>500
RSW2012D	>-99	-28	>500	>500
BH204AD*	-99	-75	-61	103**
BH304S	>-99	>-99	-84	-61**
BH304D*	>-99	>-99	-98	>500

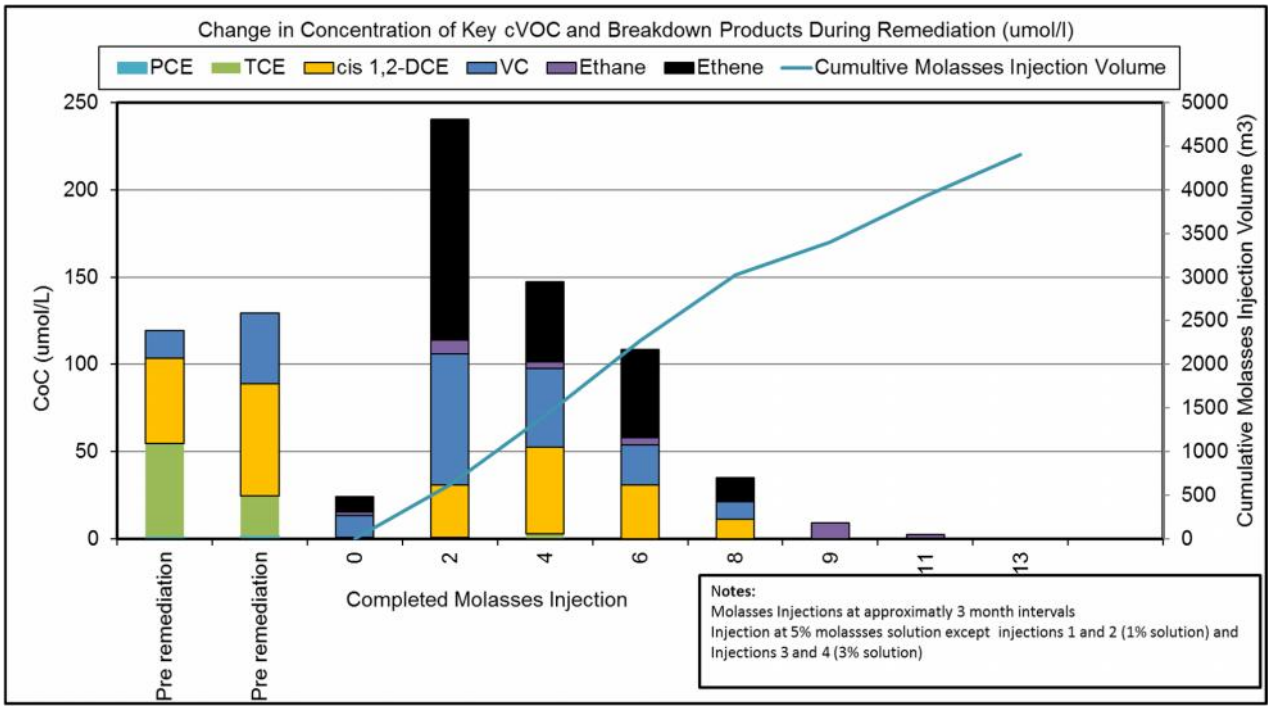
*Average of all pre remediation monitoring visits used as baseline, other wells only 1 baseline data set available

**No baseline data, earliest dataset used

Although not widespread prior to remediation PCE destruction has also been observed

Production Building

Concentrations of TCE have significantly reduced in almost all the locations in the Production Building considered to be within the IRZ. Reduction of TCE to *cis*-DCE was observed early in the remediation as illustrated for BH122 below, followed by further reduction to VC and beyond with corresponding increase in concentration of dissolved gasses ethene and ethane. In many locations (eg.BH108 and BH112) concentrations of dissolved gasses are now falling as part of the final stage in the remediation process.



Elevated concentrations of *cis*-DCE remain in isolated locations in the Production Building (e.g. BH922 and particularly BH919) but concentrations of VC and dissolved gasses are significantly above baseline conditions indicating ongoing anaerobic degradation through the ERD process. Overall the data shows the destruction of CVOC by anaerobic ERD processes is well advanced at the Site. A summary of groundwater trends is presented in the table below:

Monitoring Well	Percentage Change [TCE]	Percentage Change [cis-DCE]	Percentage Change [VC]	Percentage Change [ethene and ethane]
RSW7001S	>-99	>-99	Not present	-39
RSW7002S	>-99	>100	>500	381
RSW7003S	-60	-1	-99	-95
RSW7004S	-28	-98	-99	-97
BH108*	Not present	-81	-94	-85
BH122*	>-99	>-99	>-99	-79
BH909*	>-99	>-99	>-99	-47
BH922*	>-99	-96	322	>500
BH919*	-1	56	>500	>500
RSW7001D	>100	>100	-93	-35
RSW7002D	Not present	-53	53	-12

Monitoring Well	Percentage Change [TCE]	Percentage Change [cis-DCE]	Percentage Change [VC]	Percentage Change [ethene and ethane]
RSW7003D	>100	>100	-85	-91
RSW7004D	-4	-96	-99	-89

*Average of all pre remediation monitoring visits used as baseline, other wells only 1 baseline data set available

No data BH406 as replacement for BH400 lost during redevelopment

Although not widespread prior to remediation PCE destruction has also been observed

For wells screened across the Raglan Marl in the Production Building evidence of ongoing ERD is observed with concentrations of VC, ethene, and ethane being detected, however both TCE and cis DCE levels remain similar or slightly elevated compared to baseline conditions in wells three of the four wells, with RSW7004D the exception. Overall the data shows the destruction of CVOC by anaerobic ERD processes is occurring in the Raglan Marl below the Production Building. It is however noted that the concentrations of CoC within the Raglan marl are significantly lower than those identified in the overlying Alluvium Deposits.

5.3.2 Soil Gas

Soil gas results for CVOC collected prior to and during the active remediation are presented in Appendix D.3, and the sampling locations on Figure 6.

In line with the observations seen in groundwater, soil gas concentrations of TCE within the South Yard have been observed to fall in all three locations (SG1-SG3), and concentrations of *cis* -DCE have also decreased in two of the three locations. Vinyl chloride has been observed to increase in two of the three locations providing further evidence that contaminant mass is being driven through the ERD process. Larger increases are noted in SG2 which is close to the remaining groundwater hotspot in BH204AS where elevated *cis*-DCE and VC are still present. Similar significant reductions in TCE, *cis*-DCE, and VC concentrations are observed in the Production Building. Selected results are summarised in the table below:

Location	Baseline Concentration (µg/m^3)	Most Recent Concentration (µg/m^3)
SG1	TCE - 1,076,693 (April 2010) *cis*-DCE – 178,763 (April 2010) VC – 14,102 (April 2010)	TCE – 318 (February 2017) *cis*-DCE – 6,500 (February 2017) VC – 33,200 (February 2017)
SG2	TCE – 8,574 (May 2012) *cis*-DCE – 6,895 (May 2012) VC – 2,765 (May 2012)	TCE – 1,480 (November 2016) *cis*-DCE – 376,000 (November 2016) VC – 97,900 (November 2016)
SG4	TCE – 32,766,799 (April 2010) *cis*-DCE – 8,978,169 (April 2010) VC – 1,389,808 (April 2010)	TCE – 548,000 (November 2016) *cis*-DCE – 479,000 (November 2016) VC – 22,000 (November 2016)
SG5/RSG05	TCE – 16,910,799 (April 2010)	TCE – 56,400 (February 2017)

Location	Baseline Concentration (µg/m^3)	Most Recent Concentration (µg/m^3)
	cis-DCE – 4,813,110 (April 2010) VC – 913,520 (April 2010)	*cis*-DCE – 53,900 (February 2017) VC – 8,210 (February 2017)
SG9	TCE – 7,590,476 (April 2010) *cis*-DCE – 612,341 (April 2010) VC – 2,030 (April 2010)	TCE – 70,400 (November 2016) *cis*-DCE – 16,900 (November 2016) VC – 241 (November 2016)

The data shows levels of CVOC in all Production Building locations are below the applicable site specific assessment criteria (SSAC) protective of Human Health, one SSAC exceedance remains for VC in SG2 within the South Yard. Overall a clear reduction in CVOC concentrations and by inference contaminant mass has occurred over the period of the active remediation.

Air monitoring was conducted prior to remediation being undertaken (Ground Gas Strategy Report), and none of the measured concentrations exceeded the acceptable indoor or outdoor air concentrations. On the basis of the lower concentrations of CVOC measured in the most recent data the risk from soil gas is not considered to be significant.

Further degradation of VC will occur as the REDOX zone within the aquifer recharges to more neutral conditions over time, and aerobic transformation of VC to non-chlorinated end products become a viable degradation pathway.

5.4 Assessment of Lateral Distribution of CVOCs

5.4.1 Groundwater

South Yard

The distribution of key CVOC and dissolved gasses is presented on Figure 7a and Figure 7b.

The distribution of elevated concentrations of TCE within the Alluvium Deposits and the Raglan Marl has significantly declined during active remediation. Baseline TCE concentrations across the South Yard were generally between >100 µg/l and >10,000 µg/l as indicated by blue, pink, and purple spots on the above referenced figures. By November 2016 only one location (BH205AD – outside the treatment area) remains at these levels with all other locations now showing TCE concentrations <100 µg/l (indicated by green, and grey spots).

A similar reduction in distribution of *cis*-DCE is seen within the Alluvium Deposits with fewer wells recording concentrations >10,000 µg/l (purple spots) and an increasing number wells showing concentrations <10 µg/l (grey spots) in November 2016 compared to baseline levels. Within the Raglan Marl the distribution of concentrations from 5,000 µg/l to <10,000 µg/l (blue and pink spots) has reduced, indicating an overall reduction in the distribution of this CVOC.

The distribution of VC created by the ERD of TCE and cis-DCE is also observed to have reduced across the South Yard during the period of active remediation. Fewer concentrations >100 µg/l are present in the November 2016 data set with the reduction in distribution particularly evident in the Raglan Marl where initial concentrations were higher at the start of the remediation.

Increases in the distribution of dissolved end products ethene and ethane have been noted corresponding to the decreases in CVOC concentrations discussed above. Within the Alluvium deposits the majority of locations now show levels of dissolved gasses >100 µg/l (blue, pink, and purple) compared to baseline where concentrations were generally below this level (green, and grey). In the Raglan marl dissolved gas levels are higher with an increase in the distribution of locations with concentrations >5,000 µg/l (pink) observed.

Production Building

The distribution of key CVOC and dissolved gasses are presented on Figure 7c and Figure 7d.

The distribution of elevated concentrations of TCE within the Alluvium Deposits and the Raglan Marl has significantly declined during active remediation. Baseline TCE concentrations across the Production Building were generally between 101 µg/l and >10,000 µg/l as indicated by blue, pink, and purple spots on the above referenced figures. By November 2016 the majority of locations particularly in the Alluvium Deposits recorded TCE concentrations <100 µg/l (green) or <10 µg/l (grey); less reduction was noted within the Raglan Marl however concentrations were generally lower prior to remediation.

A similar reduction in the distribution of *cis*-DCE is seen with fewer concentrations above 5,000 µg/l (purple and pink spots) observed and an increasing number locations showing levels below <10 µg/l (grey spots) in November 2016 compared to baseline levels. A similar change in the distribution in VC is observed particularly in the Alluvium Deposits with the majority of locations recording levels <10 µg/l in November 2016 compared to 100 µg/l to 5,000 µg/l prior to remediation.

Increases in the distribution of dissolved gases ethene and ethane were noted during active remediation corresponding to the decreases in CVOC concentrations as discussed above. By November 2016 the levels of dissolved gasses had begun to fall in many locations (e.g. BH122) as the final stages of the ERD process occur and only limited residual contaminant mass remains. Where isolated elevated levels of CVOC remain levels of dissolved gasses show increased distribution compared to baseline levels (e.g. BH922, BH919) indicating ongoing ERD.

Off-Site

There has been no significant change in the distribution, there has been isolated fluctuation of CVOC concentrations in off-site monitoring wells although levels have generally remained comparable to baseline conditions at between >10 µg/l and <MDL. The distribution of key CVOC and dissolved gasses are presented on Figure 7e.

5.4.2 Soil Gas

Soil gas results for CVOC collected prior to and during the active remediation are presented in Appendix D.3, and the sampling locations on Figure 6.

Prior to remediation elevated concentrations of TCE, *cis*-DCE, and VC were identified in all three locations in the South Yard (SG1-SG3). The latest sampling shows very little contaminant mass particularly TCE and *cis*-DCE remains and the concentration in SG3 and SG2 is low compared to baseline. The bulk of the CVOC mass is now detected in SG1 in the vicinity of BH204AS.

Within the Production Building there has been a significant reduction in the distribution of TCE, during baseline sampling concentrations over 1,000,000 µg/m^3 were identified in four out of six locations, the most recent data indicated only one location (SG4) now shows levels over 100,000 µg/m^3. There has been a similar reduction in the distribution of cis-DCE now present above 100,000 µg/m^3 in one rather than five locations, and VC no longer present above this concentration compared to three of six baseline samples.

5.5 Assessment of Biological Transformation of CVOCs (groundwater)

To assess the efficiency of the breakdown of CVOC within the well network, the measured concentrations of CVOC and dechlorination end products ethene and ethane are presented in units of µmol / per litre alongside µg / per litre. Units in µmol/l are independent of the molecular weight of the chemical compounds concerned and as such presents a more accurate picture of the contaminant mass changes in groundwater within the aquifer formation. Interconversion of the two concentrations is achieved using the equation below.

[Concentration (µmol/l)] = [Concentration (µg/l)] / [Molecular Weight (g/mol)]

Molecular weights for the compounds concerned are presented in the table below:

Compound	Molecular Weight (g/mol)
PCE	166
TCE	131
Cis-DEC	97
VC	63
Ethene	30
Ethane	28

Both the groundwater quality, and CVOC transformation lines of evidence show a significant improvement throughout the period of remediation. An improvement in groundwater quality is demonstrated by an overall reduction in contaminant concentrations within the aquifer. The transformation of CVOC is demonstrated by changes in the composition of CVOC in groundwater throughout the period of remediation. Initial reductions in TCE concentrations were accompanied by corresponding increases in daughter products cis-dichloroethene (cis-DCE) and vinyl chloride (VC). Subsequently concentrations of daughter products were observed to decrease alongside corresponding increases in ethene and ethane, the final products of the ERD process. Groundwater quality data is presented in Appendix D.1, and sampling location are shown on Figure 5. The overall performance for wells within the IRZ is summarised below:

Percentage Change in COC During Remediation Within the Remediation Area (Molar Mass)		
Location	**Sum Key CVOC**	**End Products**
South Yard Alluvium	-86%	+238%
South Yard Marl	-65%	+285%
Production Building Alluvium	-83%	+96%
Production Building Marl	-24%	+32%

This data demonstrates, as intended by the active remediation strategy that significant reduction in the concentrations of key CVOC (tetrachloroethene (PCE), TCE, cis-DCE, and VC) have occurred alongside corresponding increases in ethene and ethane. The change in concentration of TCE, cis-DCE, VC and end products ethene and ethane over the period of remediation are presented on summary sheets for individual wells as Appendix D.4 and also displayed on Figures 7a-7e.

Conversion of PCE and TCE to cis-DCE was generally observed after 2 injections (six months), with subsequent injections promoting the transformation of cis-DCE to VC and generation of significant amounts of final end products ethene and ethane. This transformation pathway was coupled with an overall reduction in total CVOC contaminant mass.

The conversion of VC to final end products (which is most advanced in the South Yard Alluvium where levels are below baseline) is ongoing and will continue following the cessation of active remediation through natural attenuation processes as discussed in Section 5.6.

No significant changes to groundwater quality are noted in the off-site monitoring wells as a result of the active remediation.

5.6 Assessment of Natural Attenuation Processes

The parameters measured to assess the condition of the aquifers to support natural attenuation of residual contaminant mass are total organic carbon (TOC), pH, methane, nitrate, and sulphate. Data recorded during the active remediation is presented in Appendix D.4 and a summary of the attenuation parameters within the IRZ is given below:

- TOC levels remain high within the IRZ both in the South Yard and the Production Building providing a further carbon (food) source for ongoing microbial transformation of CVOC;
- Groundwater pH is between pH5 and pH9, ideal conditions for microbial degradation of CVOC;
- Methane concentrations are above 1mg/L indicating the strongly reducing anaerobic conditions required for reductive de-chlorination are present; and,
- Nitrate and sulphate concentrations are supressed, these species compete with CVOC as terminal electron acceptors (the process by which the CVOC undergo reduction) in anaerobic aquifers. Their suppression make further reduction of CVOC more likely.

Taken together these results demonstrate that across the IRZ the aquifer is strongly reducing presenting ideal conditions for further significant anaerobic degradation of CVOC. Although the aquifer will eventually recharge the REDOX potential towards more neutral conditions, the data collected throughout the active remediation did not identify any significant drift towards aerobic conditions between injections. Monitoring in the former ERD pilot trial area (BH301S and BH301D) was conducted throughout the active remediation and showed the aquifer conditions remained supportive for continued anaerobic CVOC attenuation for between two to three years following the pilot injections completed in January 2012, similar performance may be expected on the wider Site.

Furthermore, it is noted that the majority of the residual contaminant mass is comprised of VC which not only undergoes dechlorination to ethene via anaerobic pathway but also can be degraded under aerobic conditions. Hence as the REDOX zone within the aquifer recharges to more neutral conditions over time, aerobic transformation of VC to non-chlorinated end products will become a viable degradation pathway.

For all monitoring wells within the IRZ treatment area an assessment of the natural attenuation parameters is included on the ERD performance summary sheets included as Appendix D.2.

5.7 Revised Quantitative Risk Assessment

The Updated DQRA (April 2012) has been revisited for both the human health pathways and the water resource risk assessment. The results of the review are presented in Appendix E.1, with the risk evaluation at the point of remediation cessation presented within the following sections.

5.7.1 Human Health

The most recent groundwater data set (November 2016) indicates the only CoC for which concentrations are found in excess of the human health SSAC is vinyl chloride, this contaminant of concern was also measured above the SSAC in soil gas from SG2 in November 2016.

The following locations have measured concentrations of vinyl chloride which exceed the SSAC based on the vapour inhalation pathway.

Location	Media	Contaminant of Concern	Geology	SSAC
BH919 (Production Building)	Groundwater	Vinyl Chloride	Alluvium Deposits	On site Commercial Worker (indoor air) On site Commercial worker and Playing Field User (indoor and outdoor air)
BH922 (Production Building)	Groundwater	Vinyl Chloride	Alluvium Deposits	On site Commercial Worker (indoor air) On site Commercial worker and Playing Field User (indoor and outdoor air)
BH204AS (South Yard)	Groundwater	Vinyl Chloride	Alluvium Deposits	Off Site Commercial Worker (indoor air)
BH204AD (South Yard)	Groundwater	Vinyl Chloride	Raglan Marl	Off Site Commercial Worker (indoor air)
RSW2007D (South Yard)	Groundwater	Vinyl Chloride	Raglan Marl	Off Site Commercial Worker (indoor air)
RSW2012D (South Yard)	Groundwater	Vinyl Chloride	Raglan Marl	Off Site Commercial Worker (indoor air)
SG2 (South Yard)	Soil Gas	Vinyl Chloride	Alluvium Deposits	Off Site Commercial Worker (indoor air)

Vinyl chloride has been measured in groundwater above the SSAC derived for the protection of off-site commercial workers (BH204AD, RSW2007D and RSW2012D), however these concentrations are within the Raglan Marl formation, which is overlain by Alluvium Deposits. As the pathway of exposure identified by the risk assessment is inhalation of vapour from impacted groundwater it is more appropriate to consider the condition of groundwater within the overlying Alluvium Deposits as there is no active pathway from the Raglan Marl that does not proceed via the Alluvium. Groundwater sampled from the overlying Alluvium Deposits in corresponding wells RSW2007S and RSW2012S shows levels of vinyl chloride below the SSAC; therefore the concentrations from the deeper formation are not considered to present a risk to the identified receptors as no pathway for vapour exposure exists.

Vinyl chloride has been measured in groundwater above the SSAC protective of on-site commercial workers, and on-site commercial workers who use the adjacent playing fields (BH919 and BH922), and also above the SSAC protective of off-site commercial workers (BH204AS). However, the use of soil gas data provides a better indication of the potential risks as it avoids the use of a model to predict the degree of volatilisation from groundwater to soil gas. Therefore, rather than rely on the groundwater assessment for these pathways, soil gas measurements are considered more appropriate than groundwater data.

Two soil gas points SG04 and RSG05 are located close to BH922, and currently do not have measured concentrations of CoC in excess of the applicable SSAC (Appendix D.3). Historically there were no soil gas sampling locations close to BH919, Arcadis has installed a sub slab monitoring point prior to verification sampling in order to collect further data which will be compared to the SSAC reported in Table 1.

Concentrations of VC in BH204AS also exceed the SSAC derived for the protection of off-site commercial workers, however it is noted that

- Although vinyl chloride in the adjacent soil gas point SG2 was also measured above the SSAC there are currently no exceedances of the applicable SSAC in soil gas point SG01 located downgradient of this location between SG2 and the site boundary; and,
- Vinyl chloride concentrations in RSW2012S located downgradient and adjacent to the Site boundary are below the applicable SSAC.

It is therefore considered that the concentrations of VC in groundwater collected from BH204AS and in soil gas collected from SG2 do not present a significant risk to off-Site commercial workers. In addition, it is noted that all locations where VC is currently measured above the human health SSAC in groundwater show strong evidence of ongoing transformation of CVOC to ethene and ethane, and significant further reductions in levels are expected to be observed post remediation. All sample locations discussed in this section will be sampled as part of the verification monitoring.

5.7.2 Water Resources

The ConSim model developed to assess the migration risk to water resource receptors was revised, taking into account the substantially increased dataset collected as part of the remedial works which helps better inform the understanding of the plume behaviours beneath the Site. This includes a review of the extent of degradation, calibrated against pre-remediation conditions and using the down-gradient conditions from 2010-2016, and assessment of the potential for residual concentrations of CVOCs in groundwater to migrate through the aquifer towards the Afon Lwyd. The methodology and findings of the assessment are presented in Appendix E.

As part of the Updated DQRA (April 2012), consideration was given to the development of SSAC based on a compliance point which exceeded 50m – the typical default value when assessing potential risks to water resource receptors. A plume length of 150m from the Site boundary was considered reasonable, on the basis that this was within the shortest distance to the river. However, at the time of assessment, it was recognised that the model assumptions provided a significant over-estimate of the actual plume length, a situation which has been further confirmed through the collection of off-site data throughout the period of remediation. As such, the model was revised (Appendix E) and further calibrated using pre-remediation data.

Using the maximum concentrations of CVOCs identified in November 2016, the re-calibrated model was run and the results of the updated forward prediction are presented in Table 2. This additionally includes Water Quality Standards (WQS) for comparison with predicted concentrations at a 150m distance from the Site.

As a result of the updated modelling, none of the predicted concentrations of CVOC associated with source areas 3R, 5 or 6R (maximum measured concentration) are in excess of the applicable WQS. However, predicted concentrations of TCE and cis-DCE associated with source area 4R and cis-DCE in relation to source area 7R are marginally in excess of the WQS, as summarised in the table below:

Source Area	Compound	IniitalConcentration (mg/L)	Point of Compliance Predicted Concentration(mg/L)	Water Quality Standard (mg/L)
4R	TCE	8.57	0.0068	0.005
	Cis-DCE	73.1	0.155	0.025
7R	Cis-DCE	17.7	0.056	0.025

The cumulative plume output from ConSim for TCE and cis-DCE have been overlaid over the Site layout plan to provide a visual representation of the combined effect of the source areas, as presented on Figures 8 (TCE) and 9 (cis-DCE). What is clear from the figure is that, while the predicted concentrations of CVOC are just in excess of the WQS at a distance of 150m, the predicted concentrations of TCE and cis-DCE at the river Afon Lwyd in the down-gradient direction are below the laboratory MDL for these compounds. Therefore, while there is potential that the residual plume may extend beyond the 150m distance, the plume is expected to attenuate

sufficiently in the remaining distance to the river such that groundwater quality prior to discharge to the river is in compliance with the WQS.

It is noted that several conservatisms are still built into the modelling, as follows:

- Calibration was undertaken assuming the maximum measured concentrations in monitoring well BHOS414 between 2010 and 2016, with average concentrations within the source area assumed as the start concentration. As such, it is possible that the attenuation modelled is lower than what is actually occurring;
- The maximum measured concentration for each source from November 2016 was used for the purpose of forward prediction, which assumes that these concentrations are present throughout the entirety of the source area;
- The source dimensions for 4R in particular are likely to be much smaller than that modelled based on the decrease in dissolved phase CVOC generally observed across the Site as a result of remediation, but has been made conservatively large in the absence of lateral data to prove this; and,
- Predicted concentrations have been assessed based on the 95th percentile.

Given the above, it was considered prudent to further evaluate the risk to water resources. The same model was adopted, with the exception of the source concentrations. The source concentrations of TCE and cis-DCE in relation to source area 4R, and cis-DCE in relation to source area 7R were amended to reflect the current average concentrations of CVOCs identified in the respective source areas, rather than the maximum concentrations. The findings are summarised in the table below:

Source Area	Compound	InitialConcentration (mg/L)*	Point of Compliance Predicted Concentration(mg/L)	Water Quality Standard (mg/L)
4R	TCE	0.943	0.0008	0.005
	Cis-DCE	10.725	0.024	0.025
7R	Cis-DCE	4.278	0.014	0.025

* Average concentrations adopted from groundwater samples collected from monitoring wells located within the revised source area, from groundwater monitoring undertaken in November 2016. Where concentrations of TCE and cis-DCE were below the laboratory MDL, half the value of the MDL was adopted as a concentration for the purpose of deriving an average.

The results of this re-assessment indicate the predicted concentrations will be less than the WQS at a distance of 150m.

Based on the results of the updated water resource modelling, the migration risk presented to both the aquifer and river Afon Lwyd is not considered to be significant from the residual concentrations of CVOC upon cessation of remediation.

5.8 Conclusions

Arcadis believes the evidence provided supports the conclusion that active CVOC remediation should cease, moving the project from an implementation to a verification phase.

5.8.1 Remediation Criterion – Risk to Identified Receptors

The first Remediation Criterion was to demonstrate that the reduced concentrations and contaminant mass does not present an unacceptable risk to the identified receptors (e.g. by completion of an updated risk assessment, changes in plume geometry or the conceptual understanding of the Site).

For the CVOC sources, this is considered to have been met on the basis that:

- The ERD process involves the sequential biological dechlorination of CVOC from TCE, to *cis*-DCE, then VC and subsequently complete dechlorination and reduction to ethene and ethane. This process has been observed throughout the period of active remediation.
- Concentrations of TCE and *cis*-DCE and latterly VC in both groundwater and soil gas have significantly reduced and are still decreasing within the IRZ, corresponding increases in ethene and ethane have been observed indicating destruction of contaminant mass via the ERD process.
-
- There has been a significant reduction in the lateral distribution of elevated concentrations of TCE, *cis*-DCE, and latterly VC across the site with multiple order of magnitude reductions in plume geometry observed. Corresponding increases in ethene and ethane distribution have been observed indicating destruction of contaminant mass via the ERD process.
- Natural attenuation parameters including elevated TOC and suppressed terminal electron acceptors such as nitrate and sulphate indicates transformation of residual contaminant mass to final non-toxic ethene and ethane is occurring will continue to occur after cessation of active remediation.
- Although residual exceedances of human health SSAC based on VC in groundwater are present, these are limited and better assessed using the collected soil gas data, where:
  - Within the Production Building (pending sampling of the new soil gas point adjacent to BH919) the soil gas data does not indicate a significant risk is present.
  - Within the South Yard, although VC is detected above the SSAC in SG2, levels in SG1 between this location and the identified receptor are below the SSAC and therefore the risk from the concentration in SG2 is not considered significant.
- Based on the results of the updated water resource modelling, the migration risk presented to both the aquifer and Afon Lwyd is considered to be low from the residual concentrations of CVOC after cessation of active remediation.

5.8.2 Remediation Criterion – Diminishing Returns

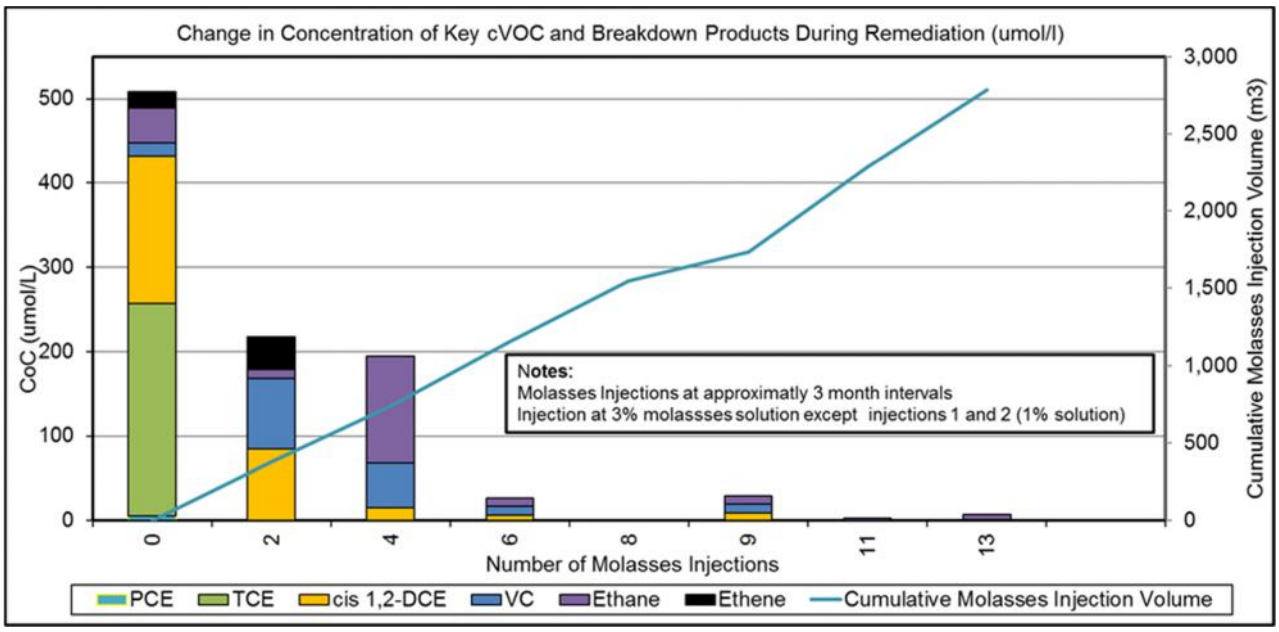
The second (alternative) Remediation Criterion was to demonstrate that the improving effect of continued reagent injections has diminished to low or asymptotic levels.

On average across the Site, greater transformation of CVOC to ethene and ethane has been observed in wells with higher initial concentrations (illustrated for selected wells in the table below). Where initial concentrations were low, lower percentage reductions have been observed. Importantly this is not due to a failure to establish favourable conditions for ERD in these locations as the data shows sufficient TOC, high levels of methane, and suppressed levels of competing species (nitrate and sulphate). It is therefore concluded further injections are unlikely to have a significant beneficial effect on further reducing the low levels of CoC in these wells.

Geology	Location	Initial CVOC Concentration (umol/l)	% Reduction November 2016	%increase in End Products
Alluvium	BH204AS	1,056	-80	304
	BH406	0.237	-5	-32
	RSW2007S	3.9	-27	117
	RSW2010S	3.3	-44	-4
	RSW2012S	590	>-99	>500
	BH922	7,184	-98	>500

Raglan Marl	BH304D	215	>-99	>500
	RSW2010D	460	-98	>500

Where significant initial CVOC mass was present prior to remediation the results show the impact of injections (conducted at approximately quarterly intervals) reduces as the number of injections increases. Conversion of TCE to cis-DCE was generally observed after 2 injections (six months), with subsequent injections promoting the transformation of cis-DCE to VC and generation of significant amounts of final end products ethene and ethane. The majority of locations now show relatively low concentrations of CVOC and the impact of the most recent injections are much more limited than those at the start of the remedial programme. This is illustrated over the four years of active remediation for RSW2009D below, further data is presented in Appendix D.2.



Arcadis believes that these results demonstrate that in line with the remediation criteria the improving effect of continued reagent injections has diminished to low or asymptotic levels, and that further molasses injections are unlikely to result in additional notable reductions in dissolved-phase concentrations.

6 LNAPL Remediation Validation

6.1 Remediation Criteria

It was agreed with the regulatory authorities that the complete removal of the LNAPL in the sub-surface of Zone 3 would be impractical, that the thicknesses, distribution and LNAPL properties present prior to remediation did not pose a significant risk to the identified receptors, and that therefore remediation should focus on betterment at the Site.

The following remediation criteria were defined to help guide the endpoint of remediation, with remediation considered to have been implemented successfully when *either* of the following criteria had been achieved:

- LNAPL recovery rates have become low or reached asymptotic conditions and dissolved-phase and soil gas concentrations of TPH compounds related to the presence of residual LNAPL are not presenting an unacceptable risk; and/or,
- A revision of the risk assessment, justified by changes in the plume geometry or the conceptual understanding of the Site, indicates that the reduced mass of contaminants are not presenting an unacceptable risk.

For either criteria, detailed assessment of the changes in ground conditions would be needed to support the remediation validation process.

6.2 Lines of Evidence

The primary data sources and lines of evidence assessed to as part of the remediation validation process are as follows

- Soil Gas Monitoring Results (trends and comparison against SSAC);
- LNAPL Occurrence;
- LNAPL Removal Rates and Volumes (Including a review of Duty-of-Care Documentation); and
- Groundwater Monitoring Results.

Data collected between April 2013 and March 2017 demonstrates the remediation criteria for LNAPL recovery have been met.

6.3 Soil Gas Monitoring

The following data was collected between April 2013 and November 2016:

Sampling Point (bi-annual sampling)	Laboratory Analyses
SG01 SG02 SG03 SG04 SG05/RSG05^ SG06 SG07 SG08 SG09	• Benzene • Toluene • Ethylbenzene • Sum Xylenes (Indicators for petroleum hydrocarbon volatiles)

Notes:

^ SG05 was destroyed during Zone 3 redevelopment, RSG05 is a replacement next to the location of the original point.

The soil gas results prior to and throughout the period of remediation are reported in Appendix F.1, and sampling locations are presented on Figure 6.

Comparison of the measured concentrations of the LNAPL indicator CoC to the soil gas SSAC demonstrate no exceedances of the SSAC derived for the Site throughout the period of monitoring. Although variation was noted through the period of monitoring no significant changes in concentration are noted in any of the samples.

6.4 LNAPL Occurrence

The LNAPL Assessment Report defined the lower thickness limit for recoverable LNAPL at 500mm. Monthly monitoring of LNAPL levels in accessible extraction and monitoring wells allows the following conclusions to be drawn:

- At cessation of pumping in March 2017 only one extraction well (EX6003) out of 34 contained a thickness of LNAPL greater than 500mm (Figure 10), following Zone 3 redevelopment this well is located within the cage of a production robot and cannot be pumped from with the existing infrastructure.
- Stabilised LNAPL thicknesses within the extraction network were recorded in August 2016 during a shutdown period for system maintenance (Appendix F.2). A total of 19 wells showed reductions in LNAPL thickness compared to baseline levels, a further three wells contained no LNAPL during either visit, seven wells showed an increase on baseline levels. The overall reduction in LNAPL thickness over the entire network was 60%.
- Average LNAPL thicknesses across the extraction well network has reduced during the period of operation from approximately 290mm during the first six months of operation to approximately 90mm during the last six months of operation.
- No LNAPL rebound to thicknesses above 500mm has been noted in wells no longer subject to pumping.
- The monthly monitoring of extraction wells has not identified any significant seasonal influence or dependence on groundwater elevation is observed on LNAPL thicknesses. Plots of groundwater levels against LNAPL thickness for extraction wells are presented in Appendix F.3, no strong correlations are observed.
- Thicknesses of LNAPL were measured in monitoring wells BH103, BH108, BH109, BH110, BH119, BH122, BH136, BH400 (lost during car park redevelopment works), and BH402 throughout the period of remediation (Appendix F.4). The monitoring does not show significant changes have occurred in LNAPL thicknesses within the monitoring well network

The above data demonstrates significant betterment has occurred within the vicinity of the extraction wells with the majority showing significant reductions in LNAPL thickness compared to baseline conditions, and an overall reduction of 60% observed across the extraction well network.

The betterment included the removal of a significant volume of LNAPL (27,700 litres) and has resulted in a significant reduction in NAPL thicknesses across the extraction well network; however this has had no clear effect on the thickness of LNAPL in the majority of the monitoring wells. The removal of LNAPL and the creation of a cone of depression by groundwater abstraction has not caused residual LNAPL outside the immediate vicinity of the extraction wells to become mobilised and migrate towards the abstraction wells. This observation reinforces the pre-existing conclusions within the CSM for the Site that:

- The LNAPL is not readily recoverable outside the immediate vicinity of the extraction wells at thicknesses below 500mm. Even at thicknesses above this, results demonstrate LNAPL recovery is limited due to low mobility in the subsurface.
- The LNAPL is of limited mobility and therefore the risk of off-site migration is not considered significant.

6.5 LNAPL Removal Volumes and Removal Rates

The following data has been recorded during the period of TFP operation between April 2013 and March 2017:

- Total LNAPL recovery during the period was 27,700 litres (Appendix F.5), Duty of Care documentation for the recovered LNAPL is presented in Appendix F.6
- Reduced month on month recovery rates (Appendix F.7) indicating diminishing return based on cost and effort of removal. The average LNAPL recovery across the extraction well network has reduced during the

period of operation from approximately 1,100L per month during the first six months of operation to 240L during the last six months of operation.

- Arcadis has continued to optimise the TFP system throughout operation in an attempt to maximise LNAPL recovery. The latest significant modification took place in April 2016 resulting in an increase in LNAPL recovery although it can be observed that recovery has since diminished.
- As discussed in Section 6.4 reduced removal rates are due to fewer wells being identified as containing recoverable thicknesses of LNAPL.
- It is considered that the molasses injections conducted as part of the CVOC remediation will have aided desorption of LNAPL from soils due to soil flushing and the generation of natural surfactants in the subsurface. Significant interventions are required to maintain current removal rates compared to previous levels, these are:
    - Pumping more aggressively from wells with remaining thicknesses, this is constrained by the 20m^3 day agreed limit on abstraction.
    - Monthly interventions to relocate the majority of pumps compared to isolated movements at the start of the remediation resulting in increased site attendance and operational disturbance. These interventions only impact the immediate extraction well area as noted in Section 6.4 and may not have a significant effect on the overall presence of LNAPL.

6.6 Groundwater Monitoring Results

It is noted that no extensive dissolved phase groundwater plume for petroleum hydrocarbons was identified prior to remediation due to the limited solubility of the LNAPL. The following observations were made during the remediation period:

- Biannual (every six months) groundwater sampling visits were conducted to collect samples from selected monitoring wells for subsequent laboratory analysis for total petroleum hydrocarbons and BTEX (unless LNAPL was present) and assessment against the remediation criteria:
    - Monitoring wells were defined as BH103, BH108, BH109, BH110, BH119, BH122, BH136, BH400, BH402, EX04 EX08, EX10, EX13, EX15, EX17, EX18, EX21, and EX23;
    - BH110, and BH400 were lost during redevelopment of the staff car park;
    - LNAPL was present in most wells for the duration of the April 2013 to March 2017 period therefore no samples were collected, groundwater sampling results are presented as Appendix F.8;
- Groundwater monitoring (Appendix F.9) of down gradient wells in November 2016 did not identify any significant increases in dissolved phase concentrations compared to baseline conditions (March 2011).
- Groundwater monitoring (Appendix F.9) below residual NAPL (November 2016) indicated that dissolved phase concentrations are in line with baseline conditions and comprise hydrocarbons of limited solubility and mobility. The November 2016 and baseline concentrations for the fractions above C16 were generally above the limit of solubility and although linked to the presence of NAPL are considered unlikely to be mobile and therefore of noe significant risk of migration to the water resource receptors is considered present.
- None of the identified dissolved phase concentrations exceeded the SSAC derived for the Site.
- Leaching trials (Appendix F.10) were conducted using four samples of LNAPL from BH109, BH136, BH103, and RSW2009S. The LNAPL was mixed with deionised water and left for 2 weeks, after which the water was drawn off and analysed for VOC. Very low levels of BTEX were identified in the leached samples significantly below the applicable SSAC.
- The reduction in overall LNAPL volume discussed in Section 6.4 further reduces the risk of significant dissolved phase concentrations resulting from the residual LNAPL.

Arcadis Monitoring locations are presented on Figure 10.

6.7 Conclusions

Arcadis believes the evidence provided supports the conclusion that LNAPL remediation should cease, moving the project from an implementation to a verification phase, on the basis that:

- Betterment has been demonstrated through a significant volume of LNAPL being removed from beneath the site reducing the already limited potential for off-site migration and depleting the LNAPL source
- LNAPL recovery rates have become low showing diminishing returns and an increased operational demand for continued operation associated with reduced LNAPL thicknesses within the extraction well network;
- Dissolved-phase and soil gas concentrations of TPH compounds related to the presence of residual LNAPL continue to show that the remaining LNAPL does not present an unacceptable risk.

7 Remediation Verification Plan

7.1 Introduction

As remediation implementation has now been completed, and the remediation works validated against the Remediation Criteria, the final phase of the remediation works is the implementation of the verification plan.

7.2 Changes to Monitoring Requirements

The monitoring requirements during the verification works will be in line with those agreed within the Remediation Verification Plan for CVOC Groundwater Remediation with the following modifications:

- An additional soil gas sampling point has been installed next to BH919 and will be sampled to the current agreed scope.
- BH926 and BH928 can no longer be sampled as they are on land which has been divested by Meritor.
- No sampling of iron (II/III) will be conducted as nitrate and sulphate data are considered to provide an appropriate level of information on aquifer geochemistry

In addition, no further sampling will be undertaken from the following wells as results demonstrate they are not located in areas influenced by the ERD remediation system. They were monitored during the remediation to ensure that the molasses injections did not cause the plume to expand or the geometry to move into areas outside the designed treatment zone. The data collected during the seven performance monitoring events to date demonstrates that conditions within the monitoring wells are stable compared to pre-remediation conditions. The significantly reduced extent of the CVOC plume resulting from active remediation means the risk of any plume expansion is considerably reduced.

- Wells screened across the Alluvium deposits BH107, BH108, BH114A, BH115, BH406, BH205A, BH923, BH925,
- Wells screened across the Raglan Marl BH301S, BH301D, BH303S, and BH303D.

Monitoring well locations are presented on Figure 5:

7.3 Frequency of Sampling

7.3.1 CVOC Remediation Verification

Following cessation of injections in April 2017 further groundwater monitoring will be carried out quarterly for up to 12 months to determine that the observed conditions in performance monitoring remain stable and hence remediation objectives have been achieved at the Site. During the verification monitoring visits the following data will be recorded:

- Depth to water and product in monitoring wells BH406; RSW2006S/D, RSW2007S/D, RSW2008S/D, RSW2009S/D, RSW2010S/D, RSW2011S/D, RSW2012S/D, BH204AS/D, BH304S/D, BH108, BH122, BH909, BH919, BH922, RSW7001S/D, RSW7001S/D, RSW7003S/D, and RSW7004S/D
    - Groundwater samples will be collected in line with established and agreed methodologies;
    - Groundwater samples will be analysed for Volatile Organic Compounds via Gas Chromatography Mass Spectroscopy (GC-MS) methods, and natural attenuation parameters
- Collection of soil gas samples from SG1 to SG4, RSG05, and SG6 to SG10
    - Soil gas samples will be collected in line with established and agreed methodologies;
    - Soil gas samples will be analysed for Volatile Organic Compounds via Gas Chromatography Mass Spectroscopy (GC-MS) methods.

7.3.2 LNAPL Remediation Verification

Three remediation verification monitoring visits will be conducted at quarterly intervals following cessation of active remediation. During the verification monitoring visits the following data will be recorded:

- Depth to water, and product in all extraction wells;

- Depth to water and product in monitoring wells BH103, BH108, BH109, BH118, BH119, BH122, BH132, BH136, BH402, BH406, BH913, BH921, and BH924;
- Collection of soil gas samples from SG1 - SG4, RSG05, and SG6 - SG9
    - Soil gas samples will be collected in line with established and agreed methodologies;
    - Soil gas samples will be analysed for Volatile Organic Compounds via Gas Chromatography – Mass Spectroscopy (GC-MS) methods.
- Collection of groundwater samples from locations down gradient of residual NAPL: BH923, BH924, EX14, BHOS411, BHOS412;
    - Groundwater samples will be collected in line with established and agreed methodologies;
    - Groundwater samples will be analysed for Total Petroleum Hydrocarbons Criteria Working Group via Gas Chromatography - Flame Ionisation Detector (GC-FID) methods.

7.4 Cost-Benefit Analysis

The remediation works in Zone 3 were designed and implemented to effectively manage the potentially active relevant pollutant linkages as far as reasonably practicable using best available technologies and considering costs and benefits. Following completion of the verification monitoring scope outlined in Sections 7.2 and 7.3, and review of the results obtained, further cost benefit analysis may be undertaken if considered appropriate.

7.5 Contingency Plan

7.5.1 CVOC Remediation

Should review of groundwater verification monitoring indicate that further works are required to achieve the remediation criteria outlined in Section 5, additional works may be undertaken in the area of concern. The design of such works will be dictated by the conditions recorded throughout the monitoring however if required, may entail one of the following:

- Additional reagent injections or other remedial intervention to target specific areas if significant localised CVOC concentrations are identified that are deemed to present an unacceptable risk;
- A continuation of process and performance monitoring (for example, if organic carbon concentrations remain sufficiently high for dechlorination processes to continue but CVOC concentrations do not yet satisfy the remediation criteria); or,
- Monitored Natural Attenuation (for example, if active treatment and data trends suggest that additional active remediation will not achieve significant further reduction and monitored natural attenuation is more appropriate to address residual concentrations).

7.5.2 LNAPL Remediation

As outlined in Section 7.3.2 after remediation system shutdown, extraction wells and monitoring wells will be monitored for the presence of LNAPL during the three verification monitoring visits. In the event of a true LNAPL thicknesses measured above 500mm (to be determined by LNAPL bail down testing), localised manual LNAPL removal may be undertaken in these monitoring/ extraction wells. This LNAPL thickness was identified by the NAPL mobility assessment to be the limit of recoverability.

If true LNAPL thicknesses are consistently measured in excess of 500mm following the LNAPL removal events, then the site conditions will be reassessed and the requirement for other potential remediation strategies will then be considered in the context of the side-wide conditions and the overall level of risk presented by the identified LNAPL.

Groundwater concentrations will be assessed throughout the period of the post-remediation monitoring. At the end of the monitoring period a review will be undertaken and a report issued detailing conclusions and, if necessary, recommendation for future works.

8 Statement of Site Completion

In addition to the provision of factual data in the Arcadis Annual Monitoring Reports, the Remediation Verification Report will summarise the remediation works carried out and the results and the outcomes of the verification works at Zone 3.

9 Study Limitations

IMPORTANT. This section should be read before reliance is placed on any of the information, opinions, advice, recommendations or conclusions contained in this report.

1. This report has been prepared by Arcadis (UK) Limited (Arcadis), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with Meritor HVBS (the 'Client'). Arcadis does not accept responsibility for any matters outside the agreed scope.

2. This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing.

3. Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Arcadis are unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have unpublished, more stringent objectives. Further work may be required by these parties.

4. All work carried out in preparing this report has used, and is based on, Arcadis's professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice, pending changes in legislation, of which Arcadis is aware, have been considered. Following delivery of the report, Arcadis have no obligation to advise the Client or any other party of such changes or their repercussions.

5. This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.

6. Whilst this report and the opinions made are correct to the best of Arcadis's belief, Arcadis cannot guarantee the accuracy or completeness of any information provided by third parties.

7. This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have been received.

8. This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of changes in the condition of the site since the time of the investigation.

9. The content of this report represents the professional opinion of experienced environmental consultants. Arcadis does not provide specialist legal or other professional advice. The advice of other professionals may be required.

10. Where intrusive investigation techniques have been employed they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. In some cases the investigation is further limited by site operations, underground obstructions and above ground structures. Unless otherwise stated, areas beyond the boundary of the site have not been investigated.

11. If below ground intrusive investigations have been conducted as part of the scope, service tracing for safe location of exploratory holes has been carried out. The location of underground services shown on any drawing in this report has been determined by visual observations and electromagnetic techniques. No guarantee can be given that all services have been identified. Additional services, structures or other below ground obstructions, not indicated on the drawing, may be present on site.

12. Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issues.

13. Unless otherwise stated, samples from the site (soil, groundwater, building fabric or other samples) have NOT been analysed or assessed for waste classification purposes.

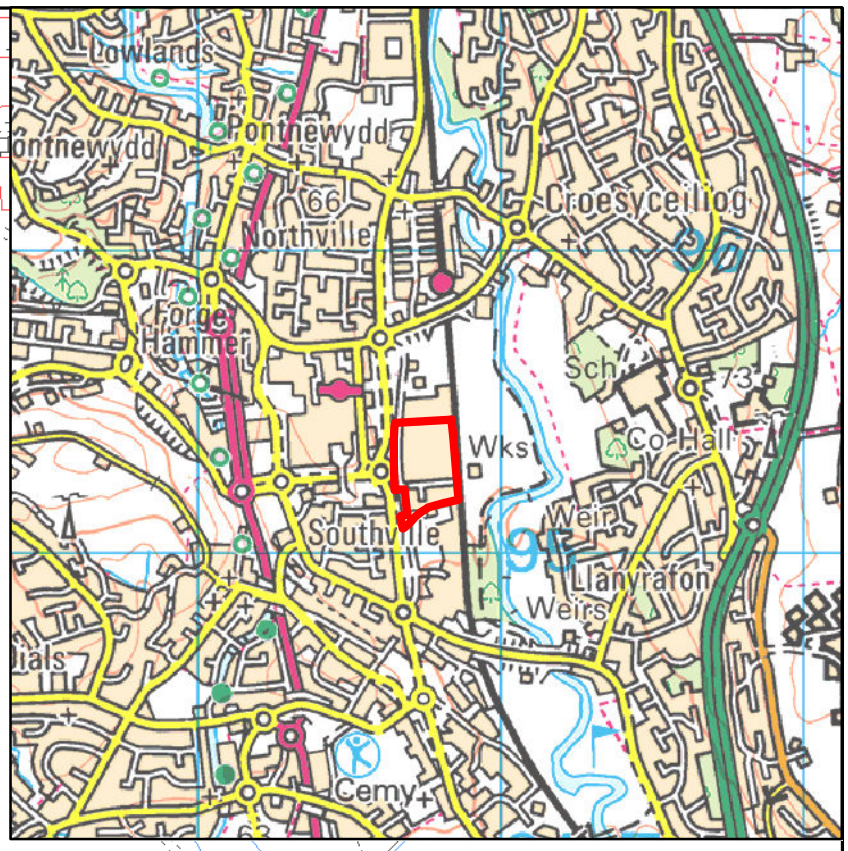
10 References

Model Procedures for the Management of Land Contamination (Contaminated Land Report 11, DEFRA and EA, 2004)

Verification of Remediation of land Contamination (EA, 2009).

Risk References are recorded within Appendix E

Figures



PRODUCTION BUILDING

SOUTH YARD

AFON LWYD

LEGEND

- SITE BOUNDARY
- ZONE 1: REDEVELOPMENT FOR SUPERMARKET AND PETROL FILLING STATION (DIVESTED)
- ZONE 2: REDEVELOPMENT FOR MIXED COMMERCIAL END-USE (DIVESTED)
- ZONE 3: REFURBISHMENT OF MERITOR FACILITY (REDUCED FOOTPRINT)

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

0 10 20 40 60 80 100 Metres

N

TITLE: **SITE LOCATION AND MERITOR ZONING PLAN**

SITE : **CWMBRAN FACILITY**

CLIENT : **MERITOR**

PROJECT :	**27662105**	**FIGURE 1**	
DATE :	01/06/17	DRAWN BY :	BNB
DRG No. :	2766210518 GIS		
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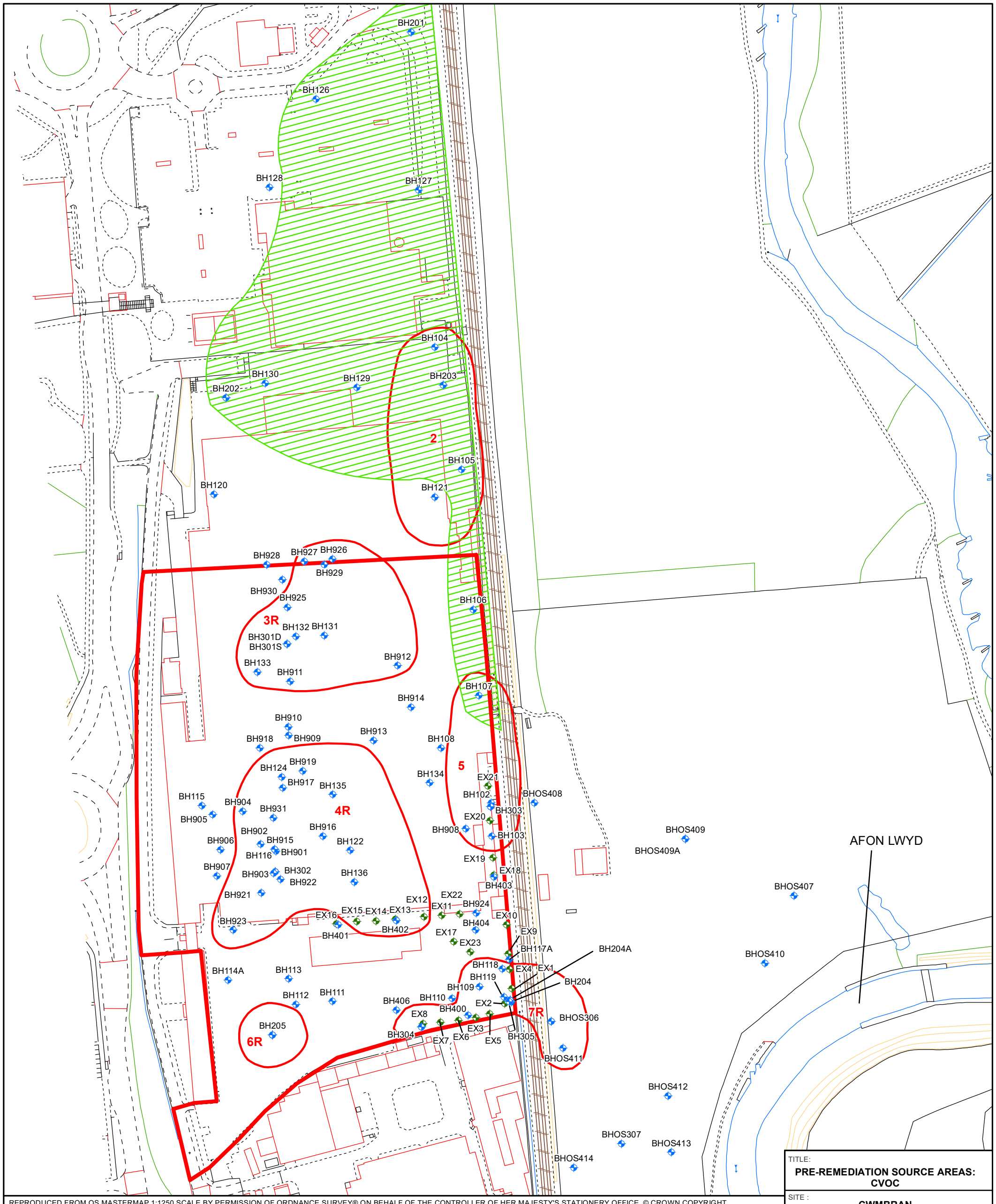
ARCADIS Design & Consultancy for natural and built assets



LEGEND

- MONITORING WELL
- EXTRACTION WELL
- MERITOR SITE BOUNDARY
- NO CLAY RICH DEPOSIT
- PRE-REMEDIATION SOURCE AREAS: CHLORINATED VOLATILE ORGANIC COMPOUNDS (CVOC)

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

GROUNDATER FLOW TO THE SOUTH EAST

0 10 20 40 60 80 100 Metres

N

TITLE:
PRE-REMEDIATION SOURCE AREAS: CVOC

SITE : **CWMBRAN**

CLIENT : **MERITOR**

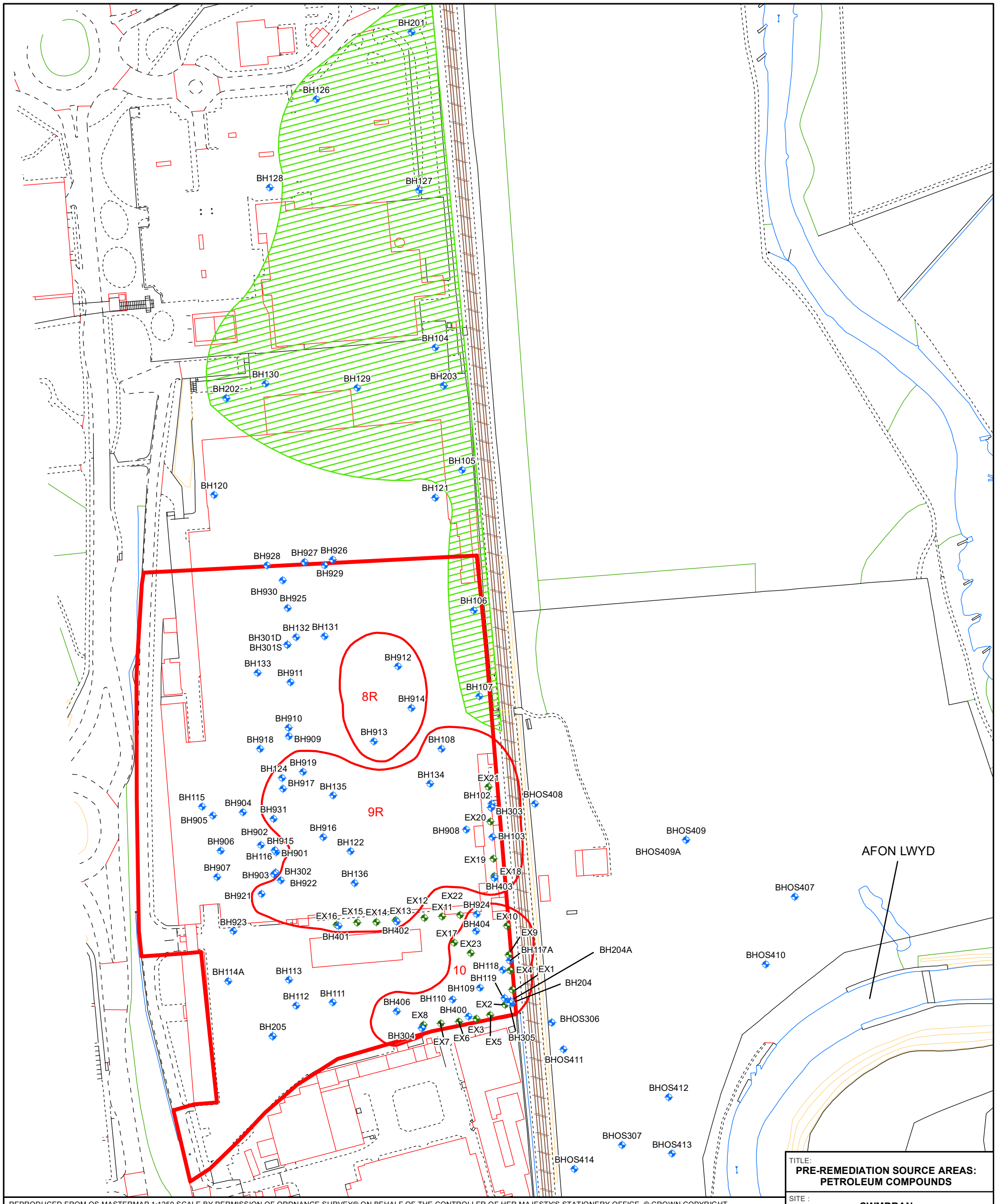
PROJECT : **27662105** | **FIGURE 2**

DATE : 27/03/17 | DRAWN BY : BNB

DRG No. : 2766210508 GIS

SCALE : **1 : 2,000** | PRINT : **A3**

ARCADIS Design & Consultancy for natural and built assets



LEGEND

- MONITORING WELL
- EXTRACTION WELL
- MERITOR SITE BOUNDARY
- NO CLAY RICH DEPOSIT
- PRE-REMEDIATION SOURCE AREAS: PETROLEUM COMPOUNDS

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

GROUNDWATER FLOW TO THE SOUTH EAST

0 10 20 40 60 80 100 Metres

N

TITLE:
PRE-REMEDIATION SOURCE AREAS: PETROLEUM COMPOUNDS

SITE : **CWMBRAN**

CLIENT : **MERITOR**

PROJECT :	**27662105**	**FIGURE 3**	
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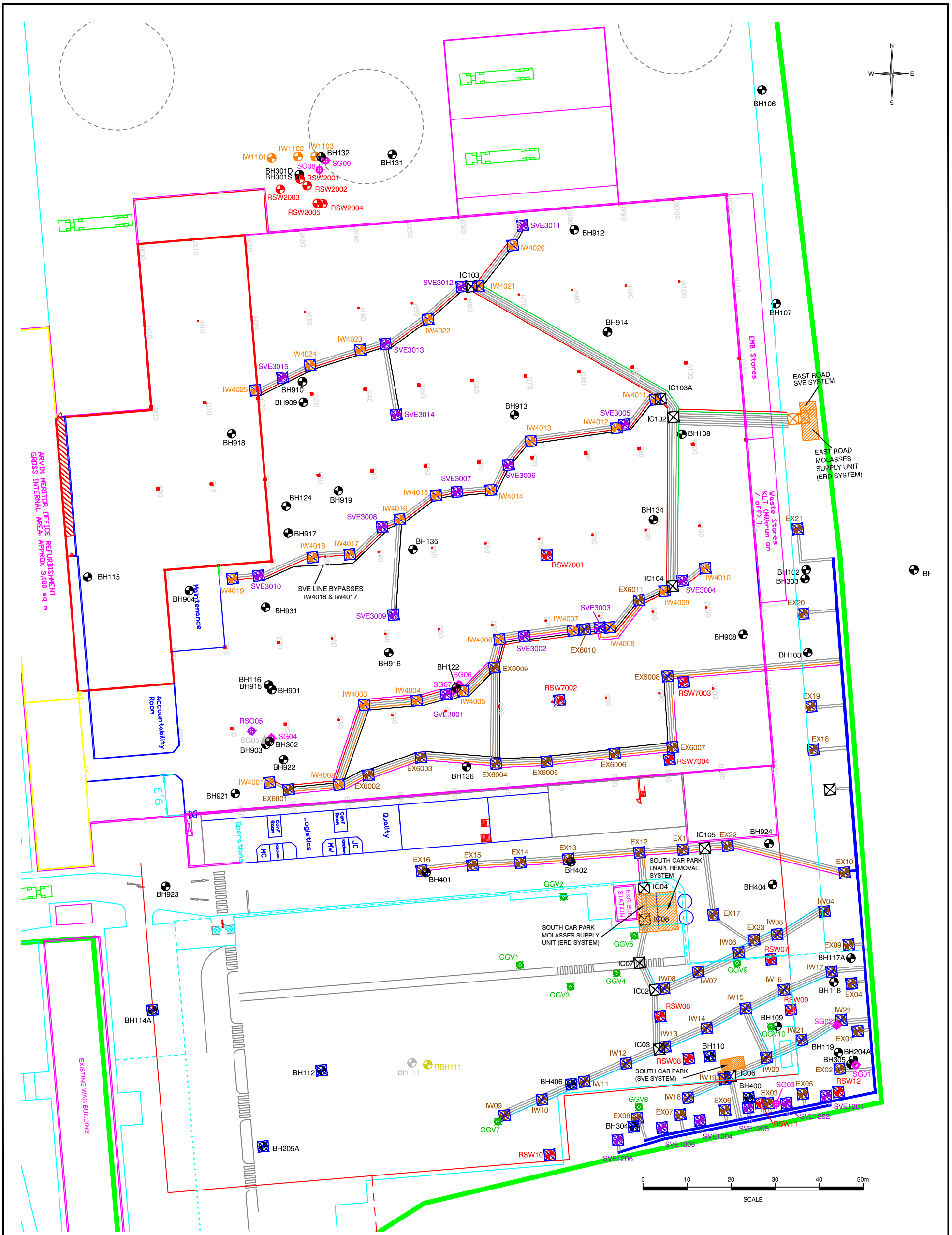

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- CONTACT ARCADIS UK IN CASE OF ANY QUERY

LOCATION RSG05 IS AN APPROXIMATE LOCATION

LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID
SVE = SOIL VAPOUR EXTRACTION
ERD = ENHANCED REDUCTIVE DECHLORINATION

- SOIL GAS MONITORING WELL DESTROYED
- SOIL GAS MONITORING WELL
- REPLACEMENT SOIL GAS MONITORING WELL
- LNAPL EXTRACTION WELL
- SVE EXTRACTION WELL
- ERD INJECTION WELL
- ERD RESPONSE MONITORING WELL
- GROUNDWATER MONITORING WELL
- GROUNDWATER MONITORING WELL DESTROYED
- REPLACEMENT GROUNDWATER MONITORING WELL
- GROUND GAS VENT

KEY

- INSPECTION CHAMBER COVER
- EMPTY INSPECTION CHAMBER
- MERITOR SITE BOUNDARY
- ABOVE GROUND PIPEWORK
- 110mm DUCT
- 32mm AIRLINE
- 110mm HDPE PUMP RETURN
- 50mm HDPE MOLASSES INJECTION
- 110mm SVE
- 110mm HDPE MOLASSES INJECTION
- 150mm HDPE SVE

TITLE: REMEDIATION SYSTEM LAYOUT PLAN

SITE: CWMBRAN

PROJECT: 27662105

CLIENT: MERITOR

FIGURE 4

DATE: 27/03/17

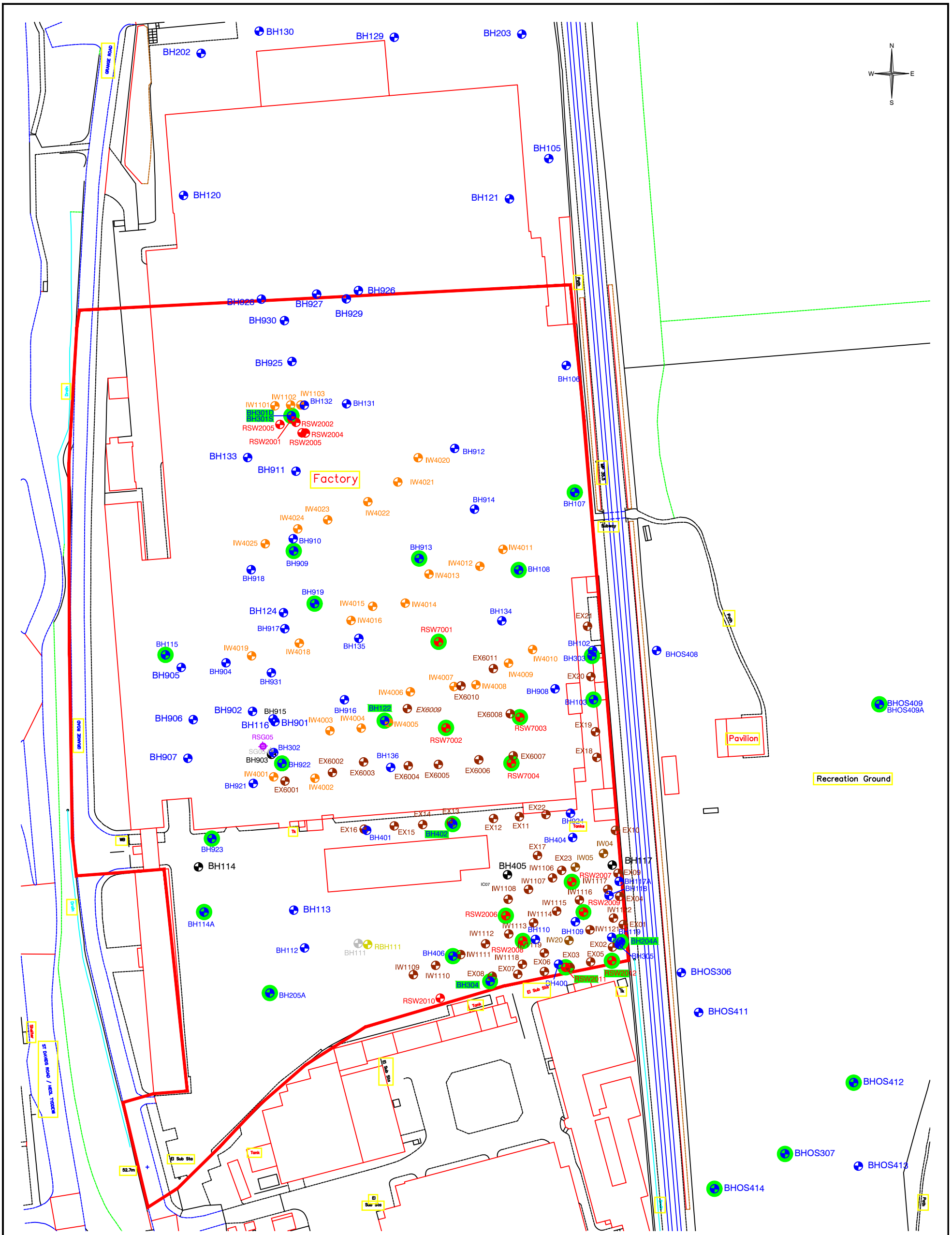
PRINT: A3

DRAWN BY: BNB

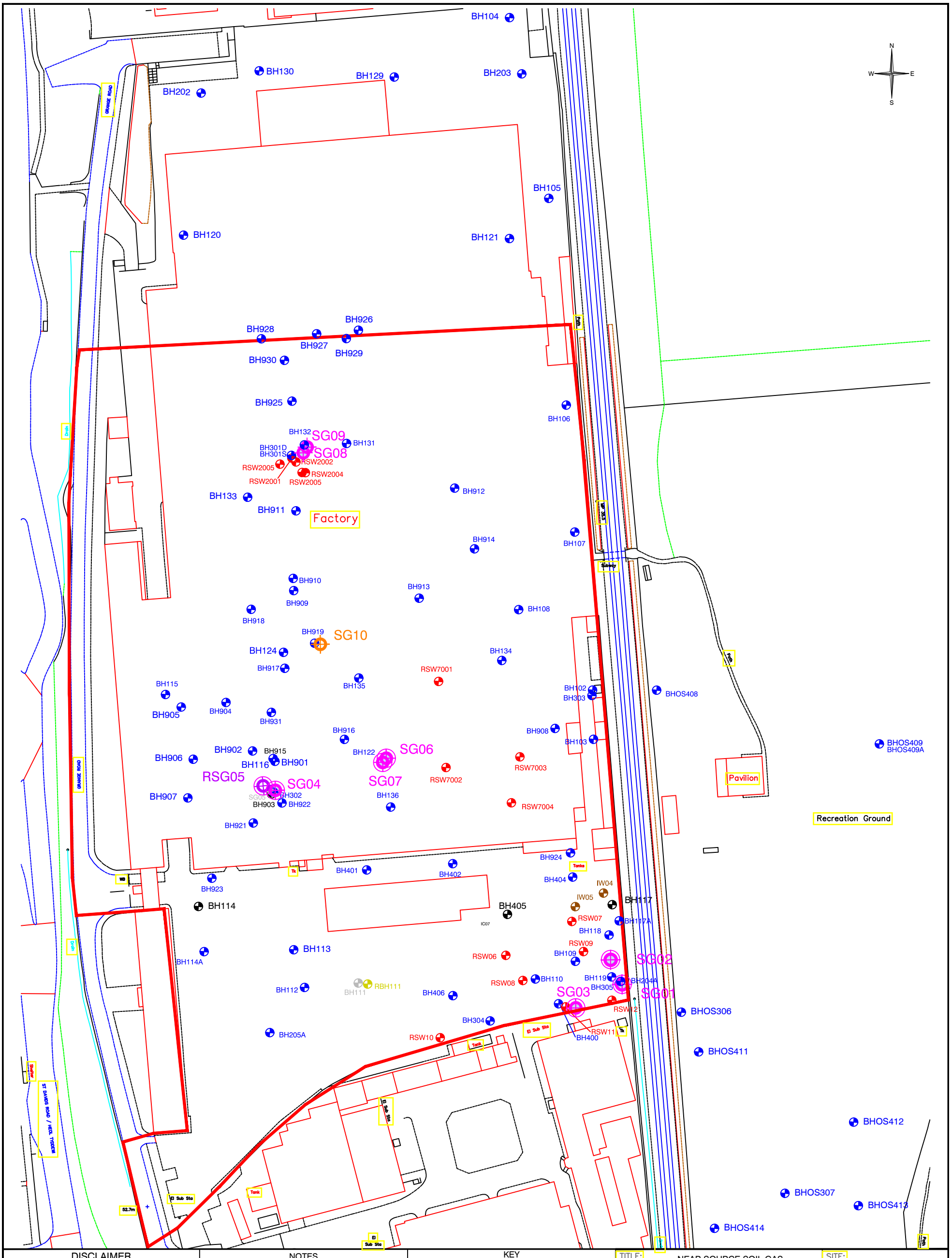
REV: -

DRG.No.: 276210510-CAD

ARCADIS Design & Consultancy for natural and built assets



DISCLAIMER	KEY	KEY		
NOTE: ALL ENTITIES SHOWN ON THIS DRAWING ARE TO BE REGARDED AS APPROXIMATE AND ARE INDICATIVE ONLY. NO MEASUREMENTS TAKEN FROM THIS DRAWING SHOULD BE USED FOR THE LOCATION OF INTRUSIVE INVESTIGATION WORKS ON SITE. SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE. - CONTACT ARCADIS UK IN CASE OF ANY QUERY	LNAPL EXTRACTION WELL ERD INJECTION WELL ERD RESPONSE MONITORING WELL GROUNDWATER MONITORING WELL GROUNDWATER MONITORING WELL DESTROYED REPLACEMENT GROUNDWATER MONITORING WELL BOREHOLE, NO MONITORING WELL INSTALLED SOIL GAS MONITORING WELL DESTROYED REPLACEMENT SOIL GAS MONITORING WELL MERITOR SITE BOUNDARY	PERFORMANCE MONITORING WELL LOCATION NOTES Reproduced from the OS MasterMap by permission of Ordnance Survey® on behalf of The Controller of Her Majesty's Stationery Office. © Crown Copyright. All rights reserved. Licence Number 100021489. **BH912** could not be sampled as has been covered by floor resurfacing works. **RSW2007a/d** and **RSW2009s/d** could not be sampled due to stockpiled material.	TITLE: MONITORING WELL LOCATIONS PROJECT: 27662105 DATE: 25/04/17 PRINT: A3 DRAWN BY: BNB REV: - DRG.No.: 2766210512-CAD	SITE: CWMBRAN CLIENT: MERITOR FIGURE 5 ARCADIS Design & Consultancy for natural and built assets



DISCLAIMER

NOTE: ALL ENTITIES SHOWN ON THIS DRAWING ARE TO BE REGARDED AS APPROXIMATE AND ARE INDICATIVE ONLY. NO MEASUREMENTS TAKEN FROM THIS DRAWING SHOULD BE USED FOR THE LOCATION OF INTRUSIVE INVESTIGATION WORKS ON SITE. SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE. - CONTACT ARCADIS UK IN CASE OF ANY QUERY

NOTES

KEY

- SOIL GAS MONITORING WELL DESTROYED
- SOIL GAS MONITORING WELL
- REPLACEMENT SOIL GAS MONITORING WELL
- SUB SLAB MONITORING POINT

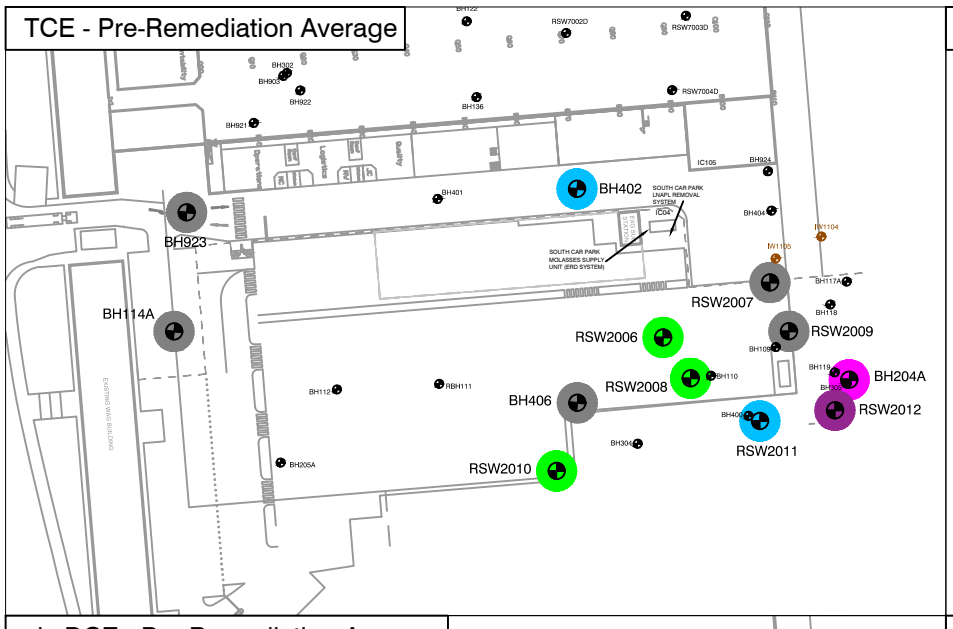
KEY

- ERD RESPONSE MONITORING WELL
- GROUNDWATER MONITORING WELL
- GROUNDWATER MONITORING WELL DESTROYED
- REPLACEMENT GROUNDWATER MONITORING WELL
- BOREHOLE, NO MONITORING WELL INSTALLED
- MERITOR SITE BOUNDARY

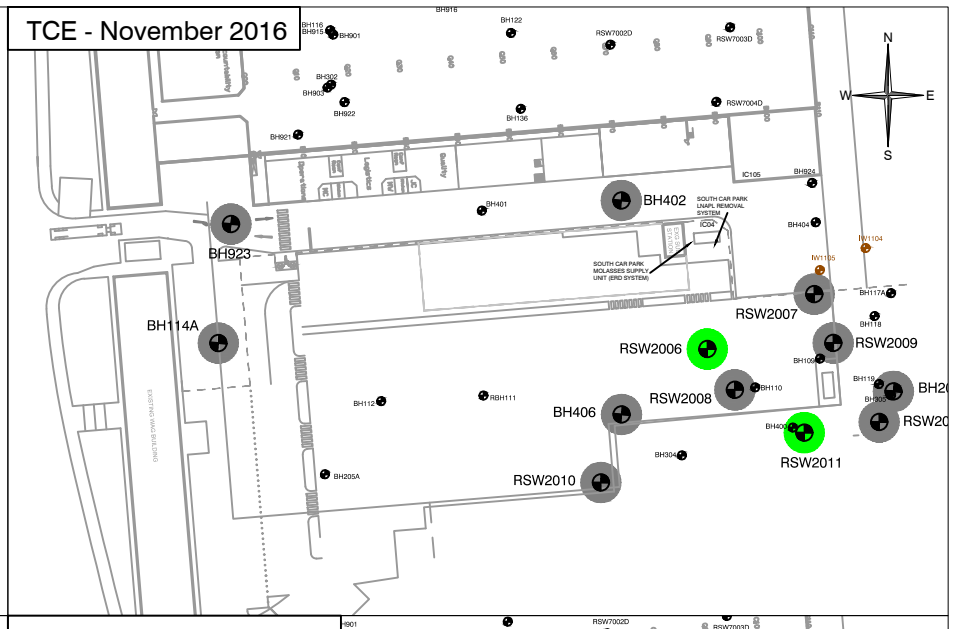
TITLE:	NEAR SOURCE SOIL GAS MONITORING LOCATION PLAN	SITE:	CWMBRAN
PROJECT:	27662105	CLIENT:	MERITOR
			FIGURE 6
DATE:	25/04/17	PRINT:	A3
DRAWN BY:	BNB	REV:	-
DRG.No.:	2766210511-CAD		

ARCADIS Design & Consultancy for natural and built assets

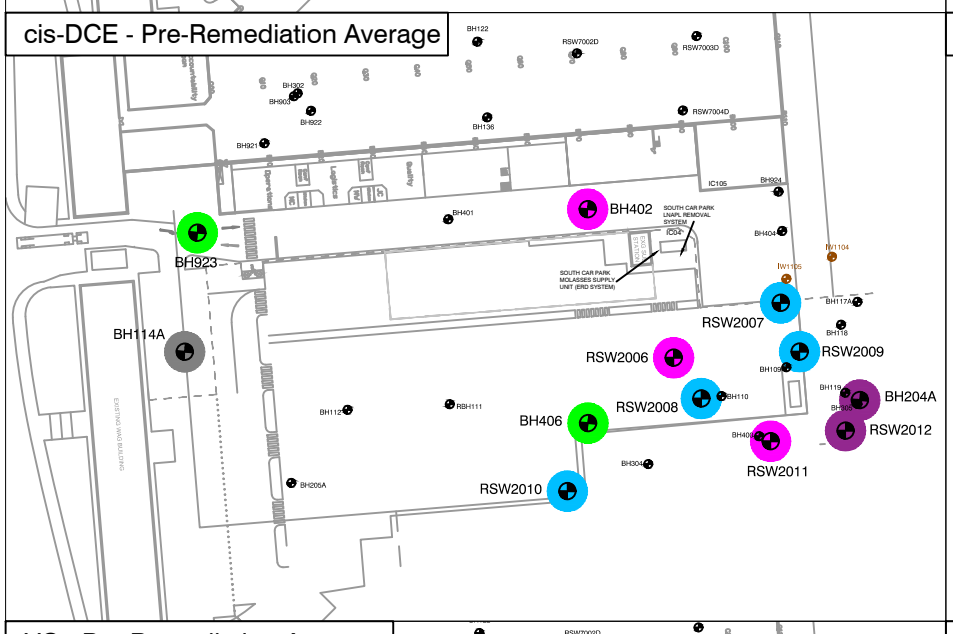
TCE - Pre-Remediation Average



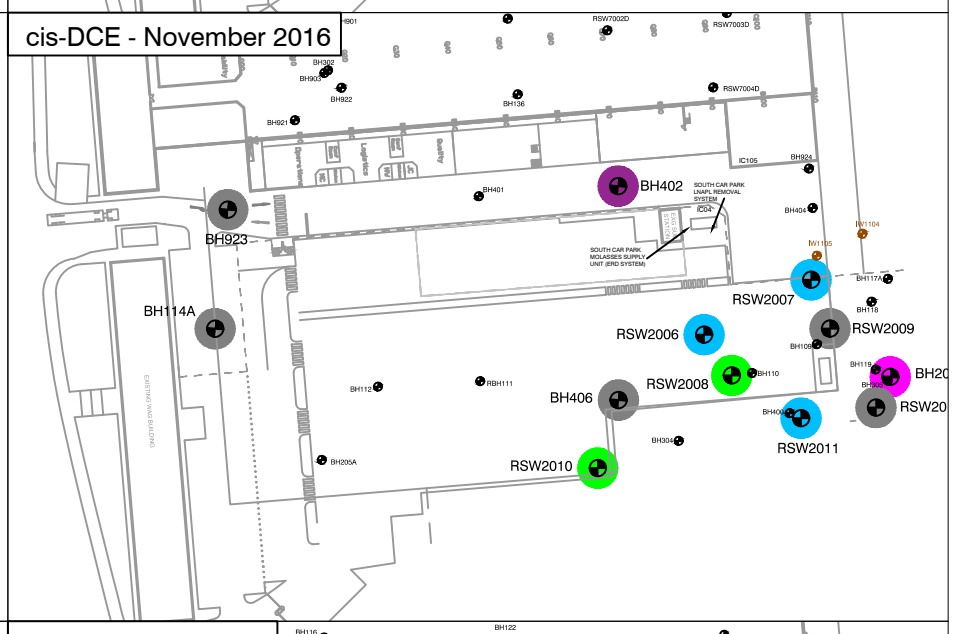
TCE - November 2016



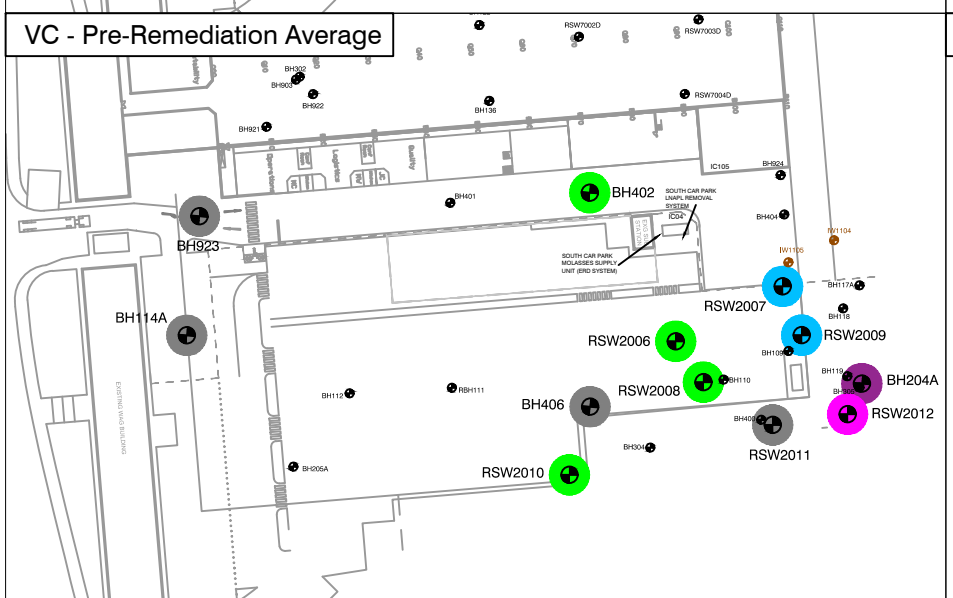
cis-DCE - Pre-Remediation Average



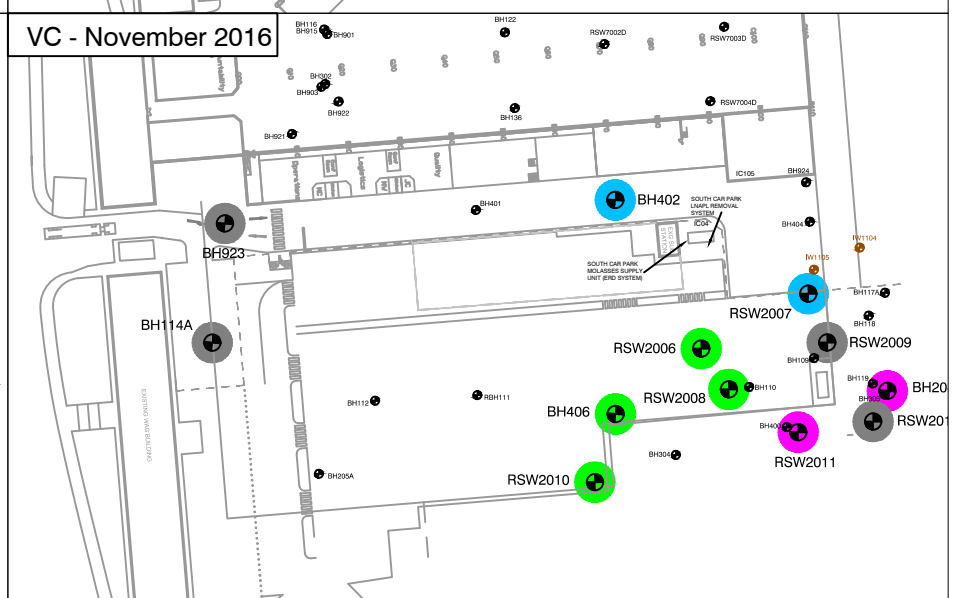
cis-DCE - November 2016



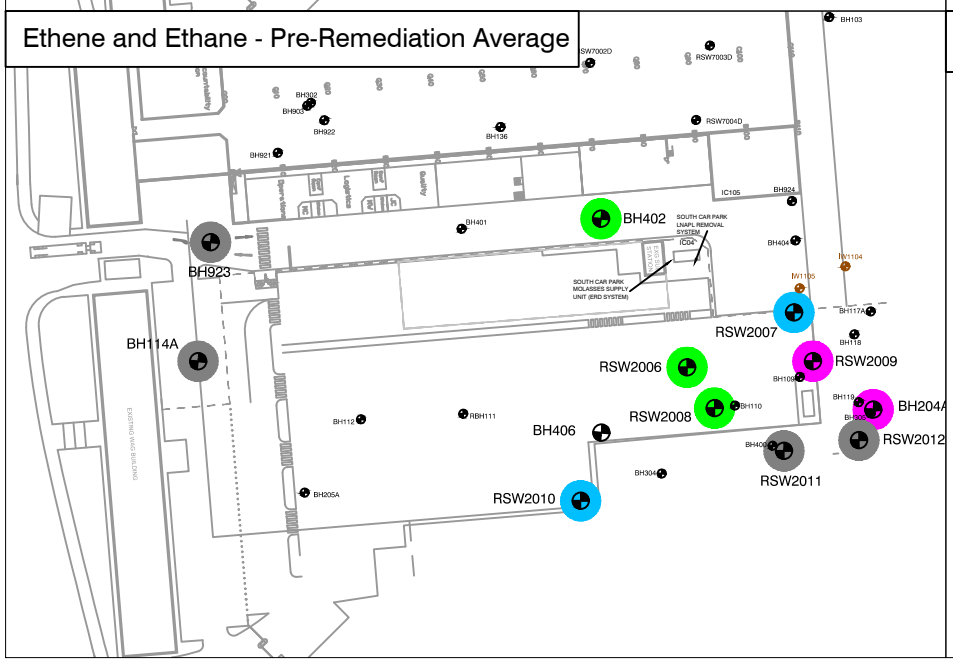
VC - Pre-Remediation Average



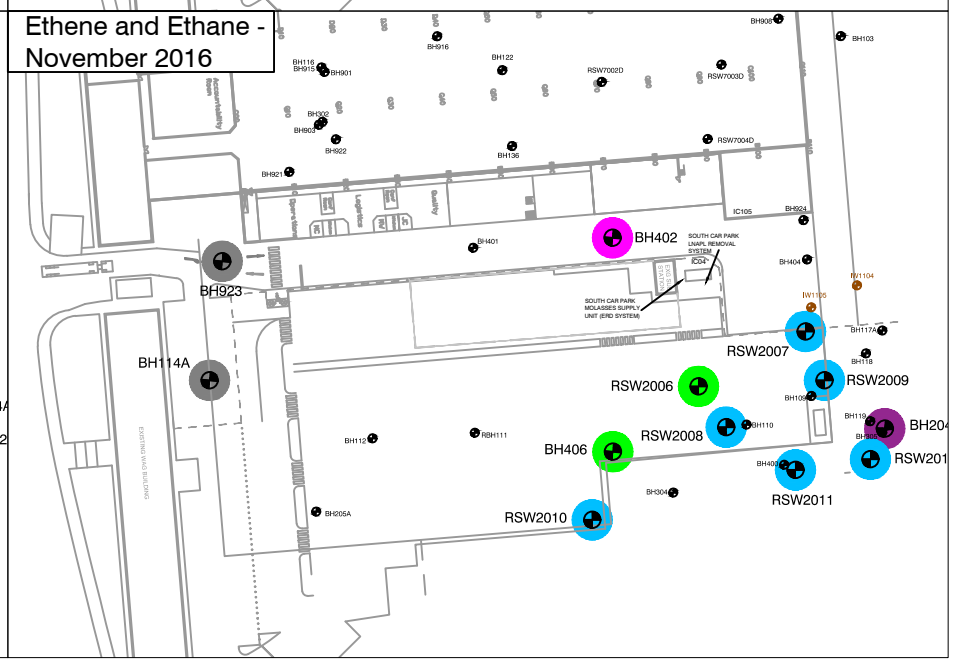
VC - November 2016



Ethene and Ethane - Pre-Remediation Average



Ethene and Ethane - November 2016



NOTES

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LOCATION RSG05 IS AN APPROXIMATE LOCATION

KEY

BOREHOLE LOCATION

- >10,000 µg/l
- <5,000 µg/l
- <1,000 µg/l
- <100 µg/l
- <10 µg/l

TITLE: CHANGE IN CONCENTRATION OF KEY VOC AND DISSOLVED GASSES - SOUTH YARD - ALLUVIUM DEPOSITS

SITE: CWMBRAN

PROJECT: 27662105

CLIENT: MERITOR

FIGURE 7a

DATE: 25/04/17

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REV: -

DRG.No.: 2766210504-CAD

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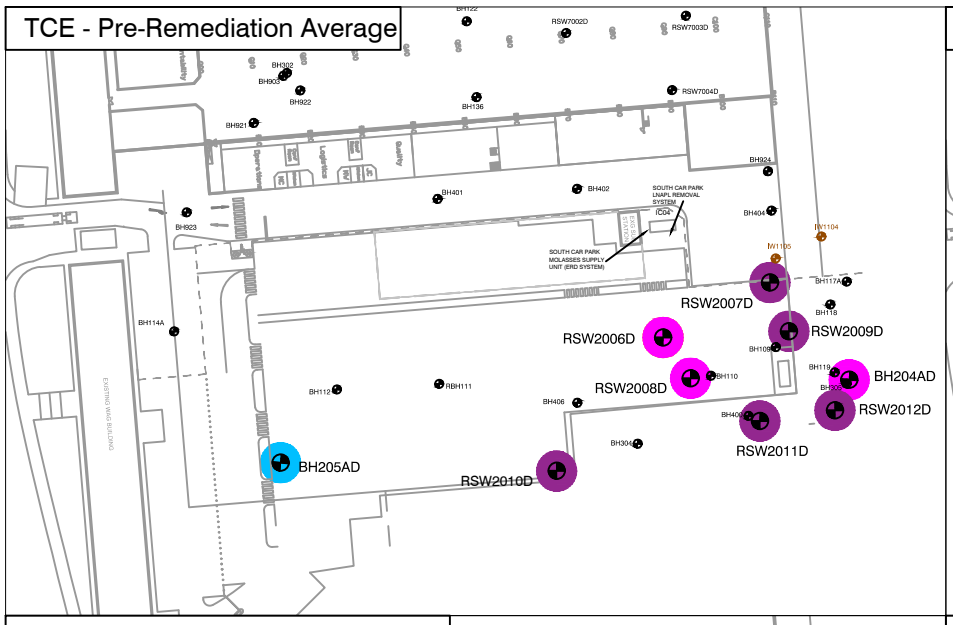
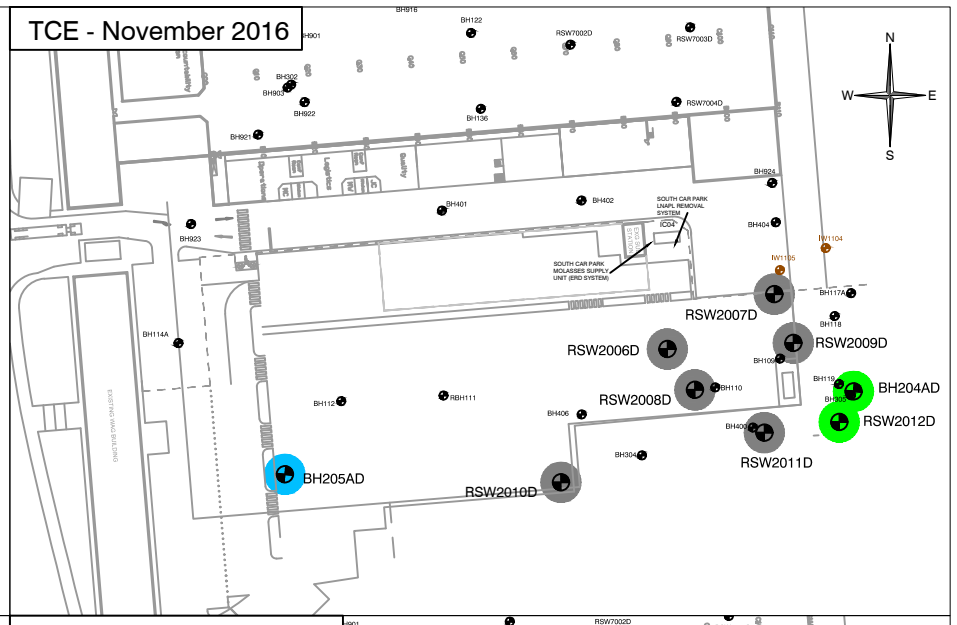
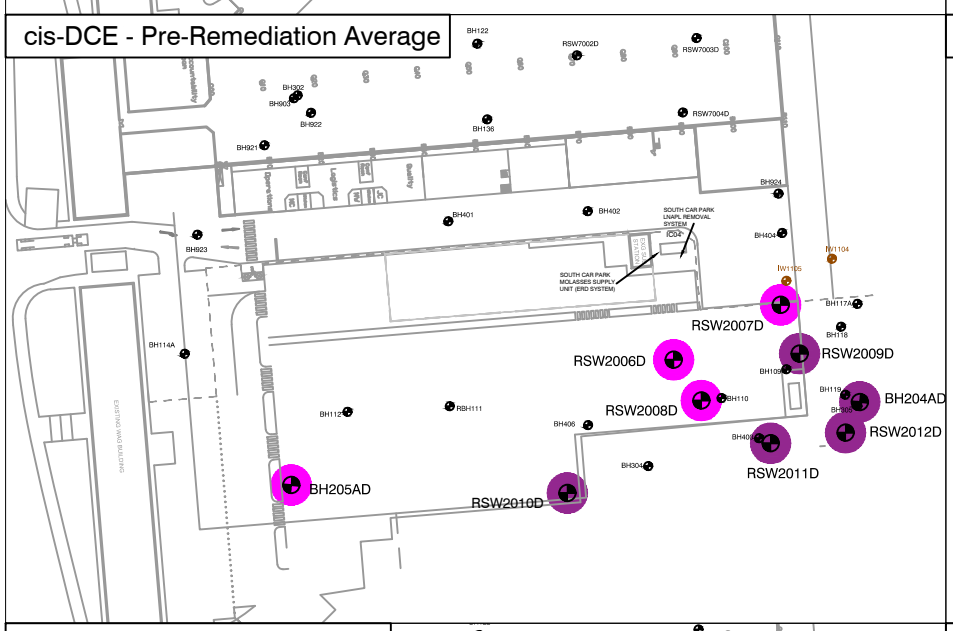
TCE - Pre-Remediation Average



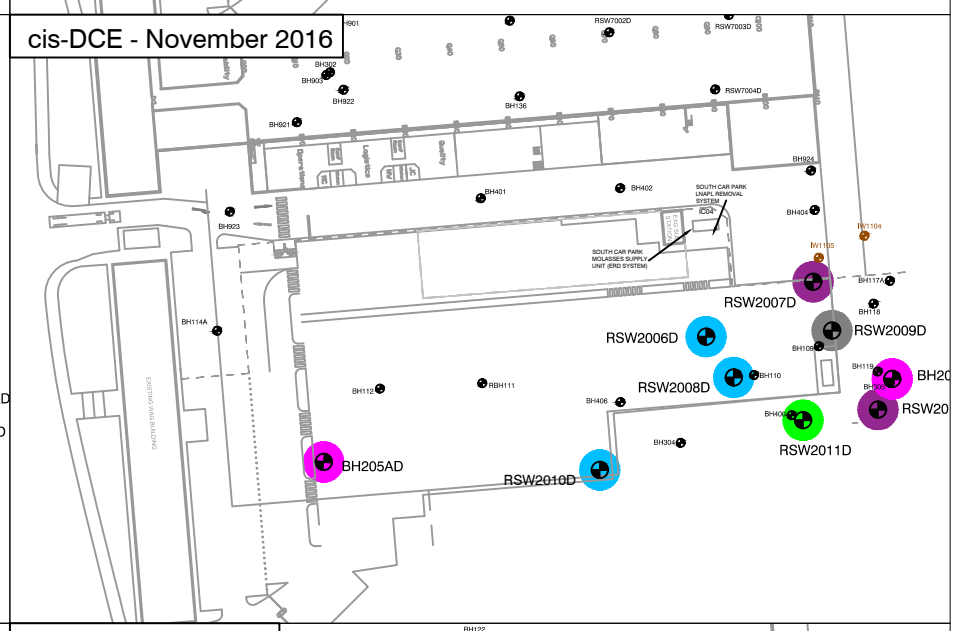
TCE - November 2016



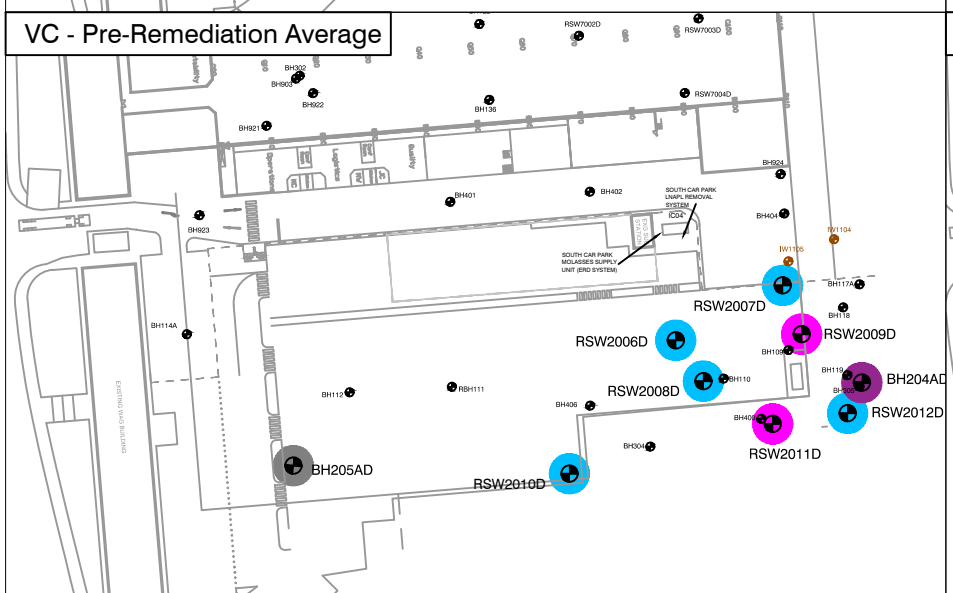
cis-DCE - Pre-Remediation Average



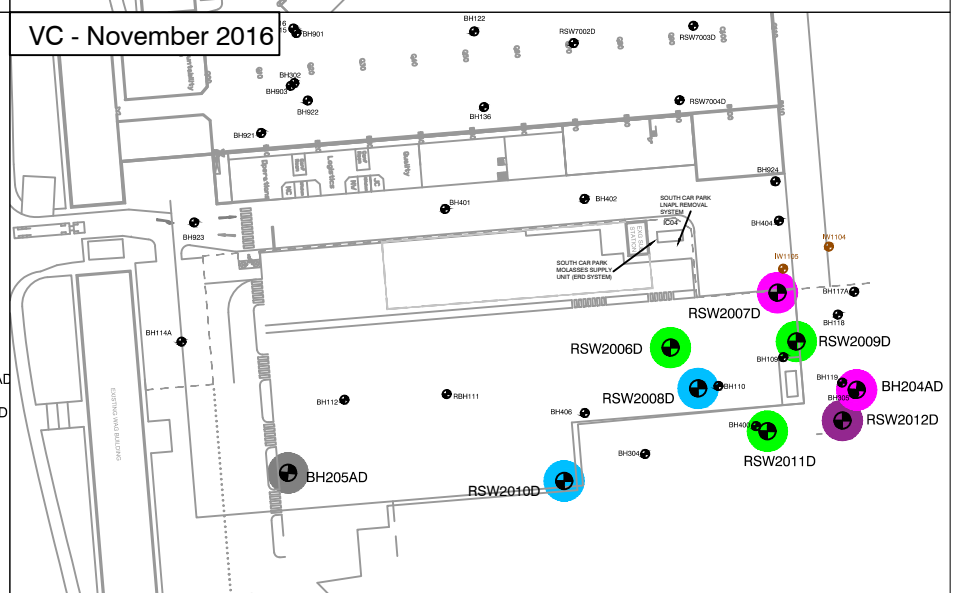
cis-DCE - November 2016



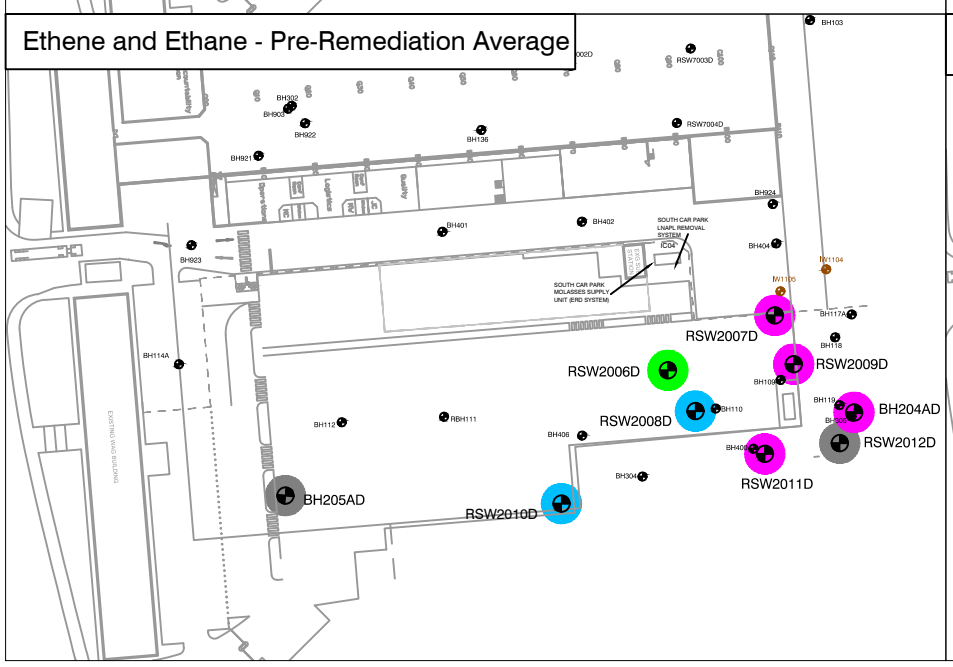
VC - Pre-Remediation Average



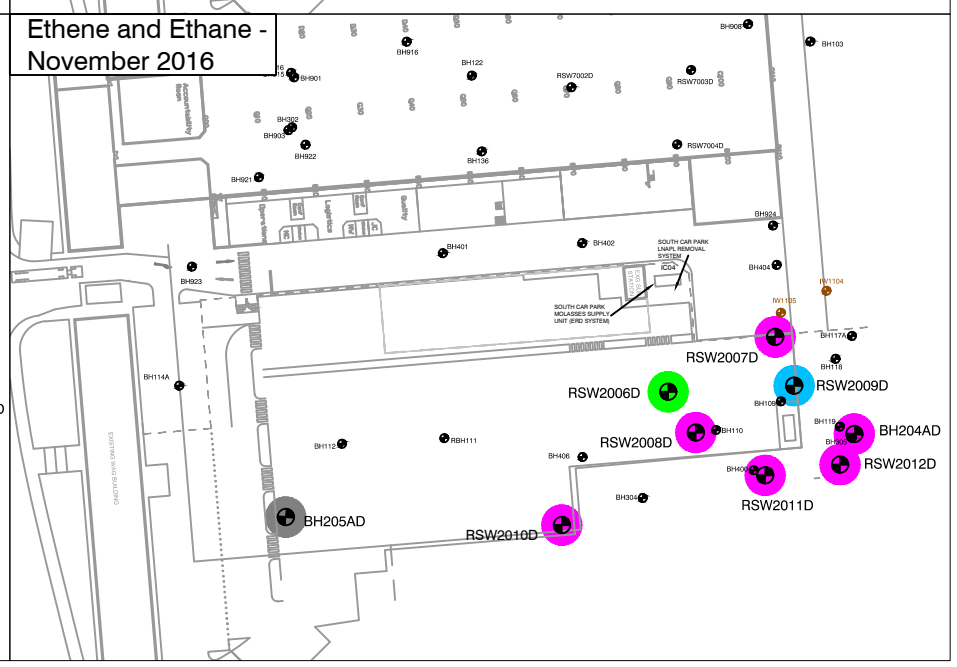
VC - November 2016



Ethene and Ethane - Pre-Remediation Average



Ethene and Ethane - November 2016



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LOCATION RSG05 IS AN APPROXIMATE LOCATION

KEY

BOREHOLE LOCATION

- >10,000 µg/l
- <5,000 µg/l
- <1,000 µg/l
- <100 µg/l
- <10 µg/l

TITLE: CHANGE IN CONCENTRATION OF KEY VOC AND DISSOLVED GASSES - SOUTH YARD - RAGLAN MARL

SITE: CWMBRAN

PROJECT: 27662105

CLIENT: MERITOR

FIGURE 7b

DATE: 25/04/17

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REV: -

DRG.No.: 2766210505-CAD

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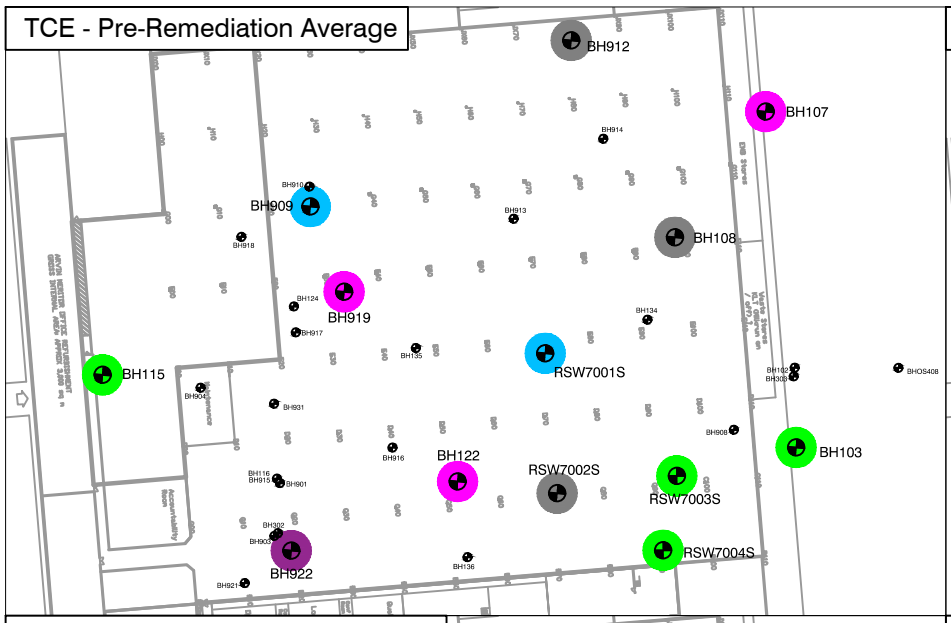
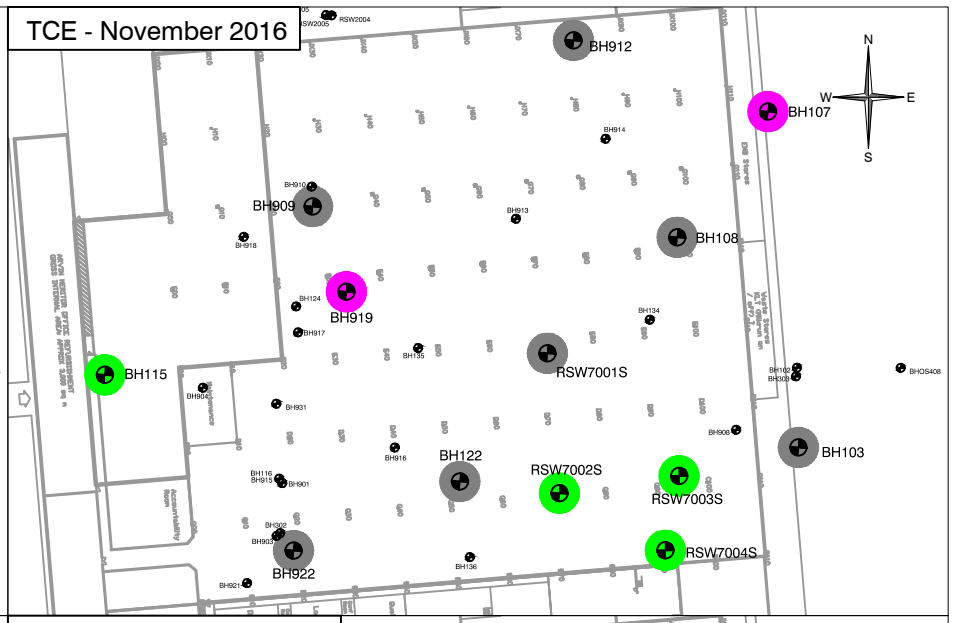


TCE - November 2016



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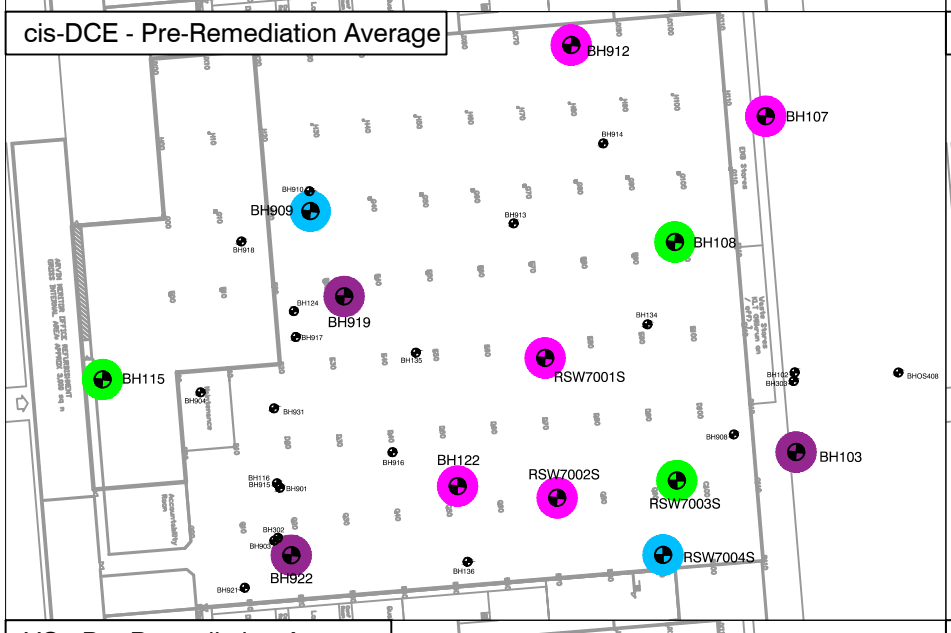
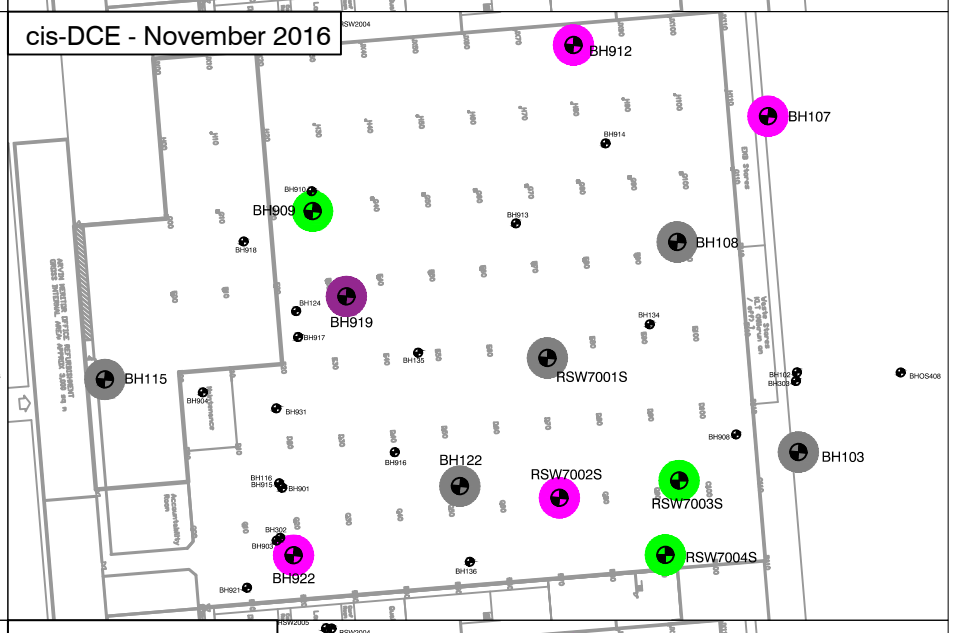
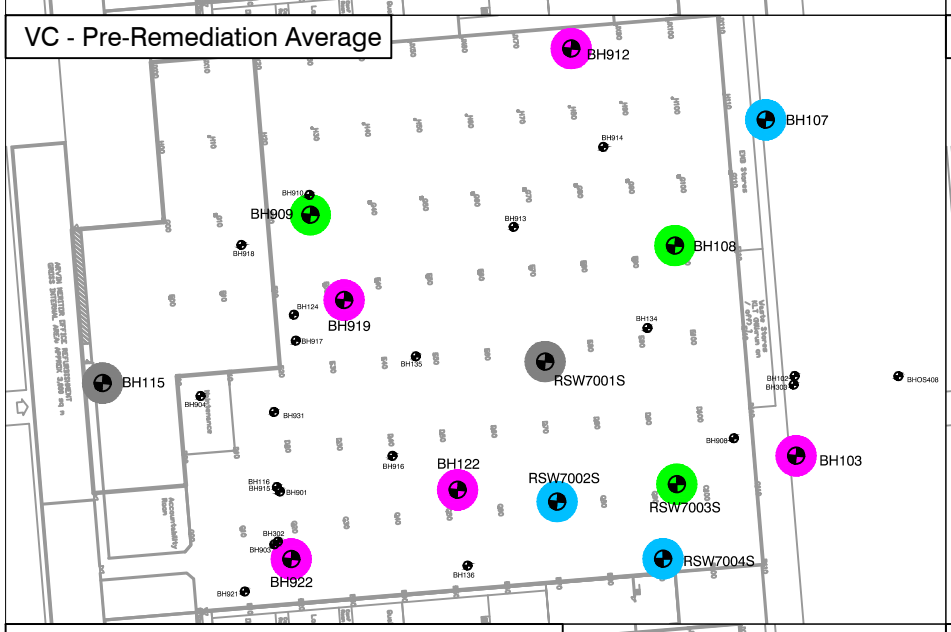


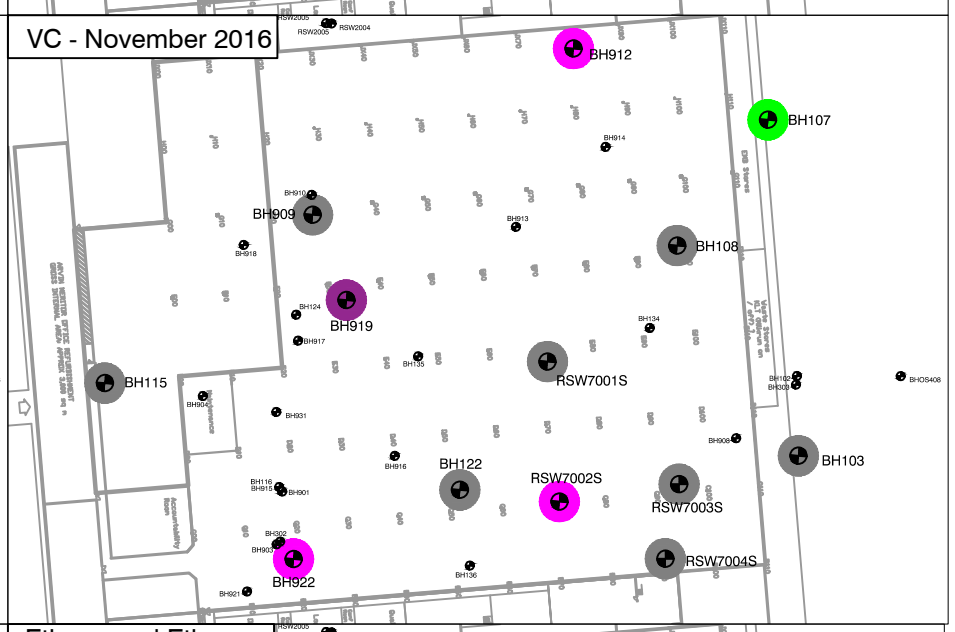
cis-DCE - November 2016



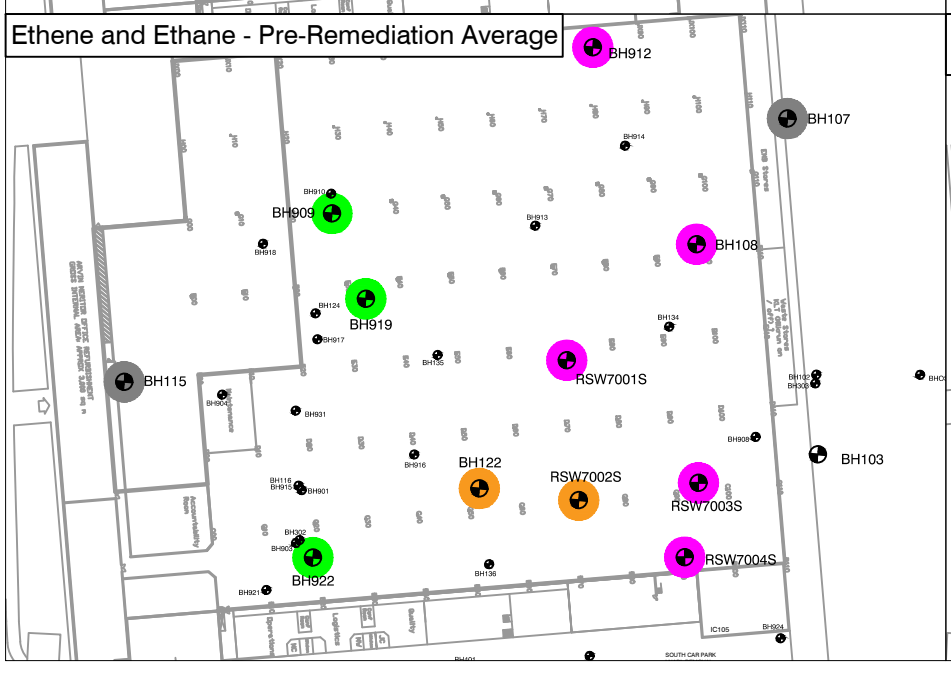
VC - Pre-Remediation Average



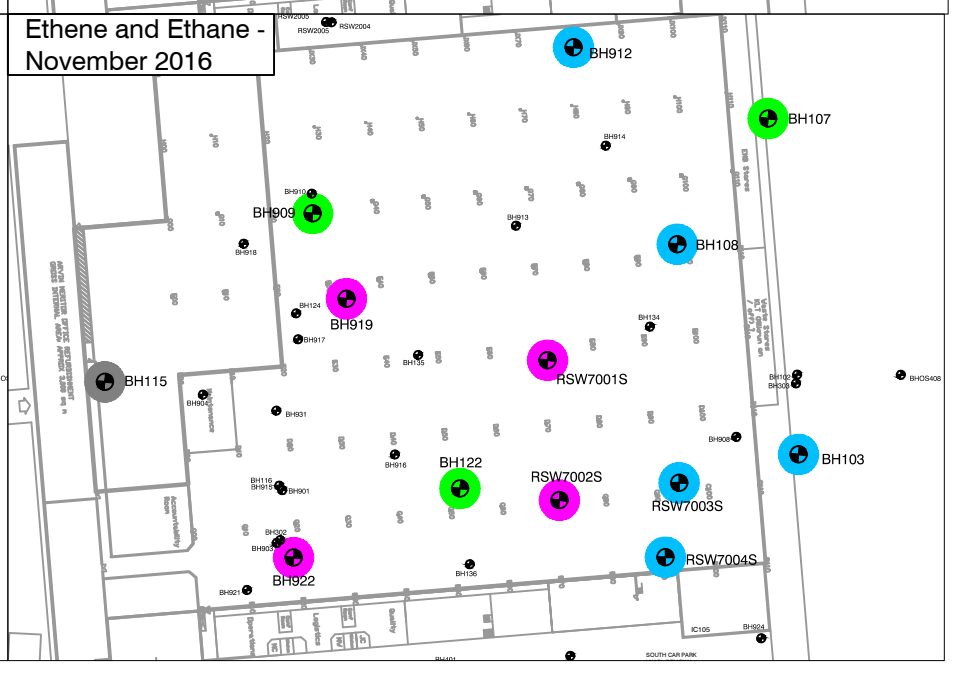
VC - November 2016



Ethene and Ethane - Pre-Remediation Average



Ethene and Ethane - November 2016



NOTES

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LOCATION RSG05 IS AN APPROXIMATE LOCATION

KEY

- BOREHOLE LOCATION
- >10,000 µg/l
- <5,000 uµ/l
- <1,000 µg/l
- <100 µg/l
- <10 µg/l

TITLE: CHANGE IN CONCENTRATION OF KEY VOC AND DISSOLVED GASSES - PRODUCTION BUILDING - ALLUVIUM DEPOSITS

SITE: CWMBRAN

PROJECT: 27662105

CLIENT: MERITOR

FIGURE 7c

DATE: 25/04/17

PRINT: A3

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REV: -

DRG.No.: 2766210502-CAD

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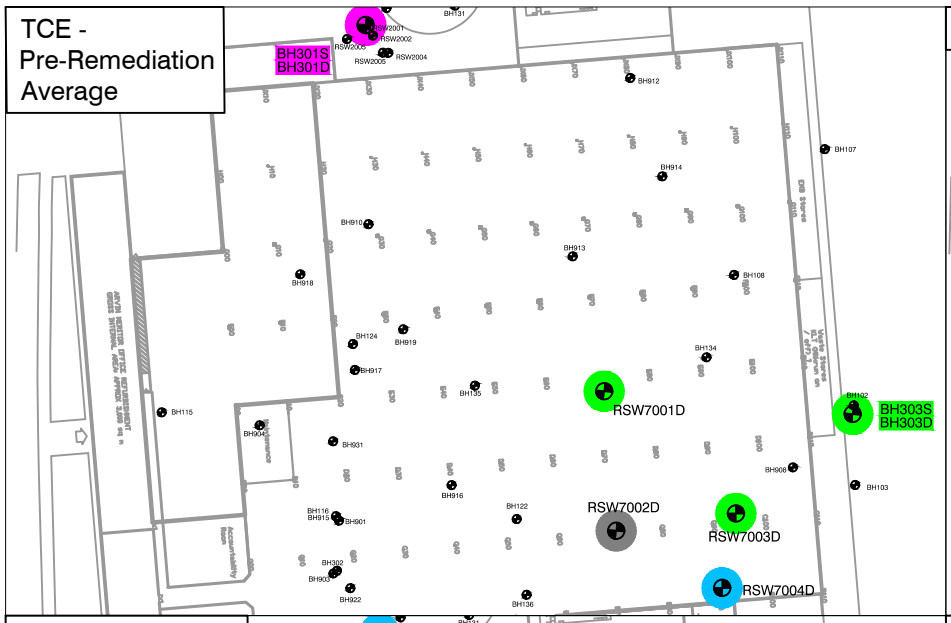
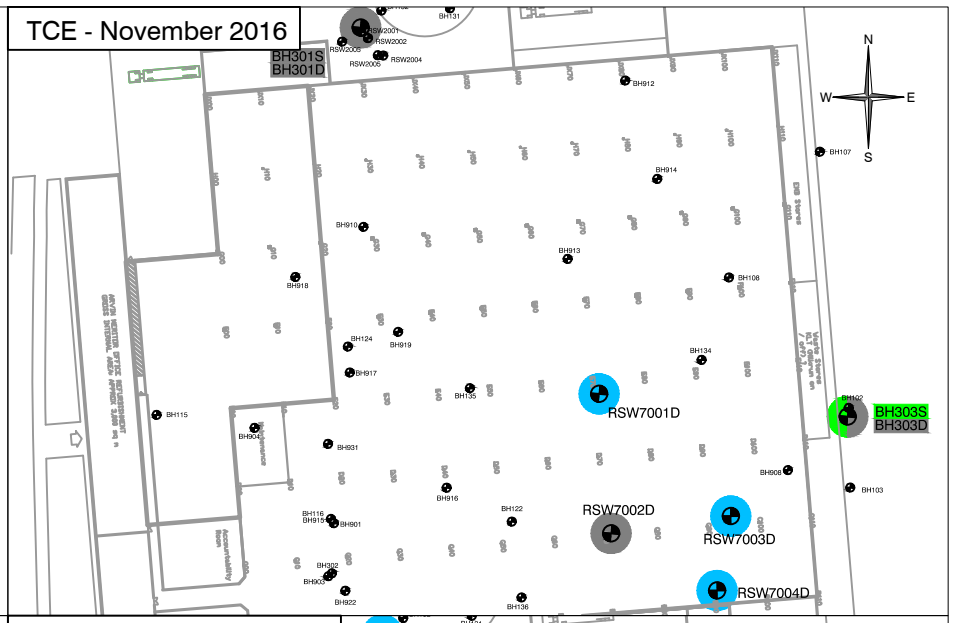
TCE - Pre-Remediation Average



TCE - November 2016



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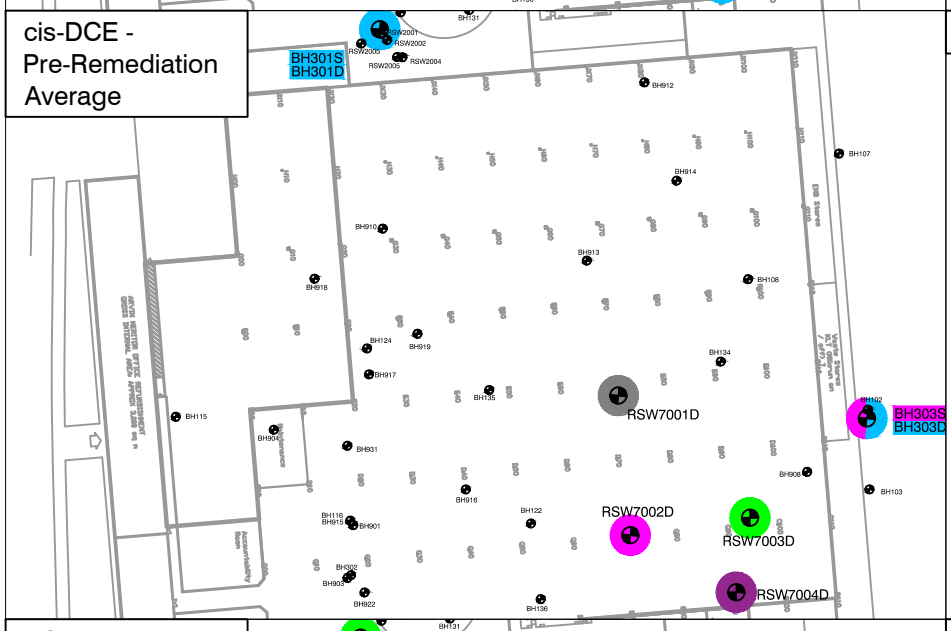
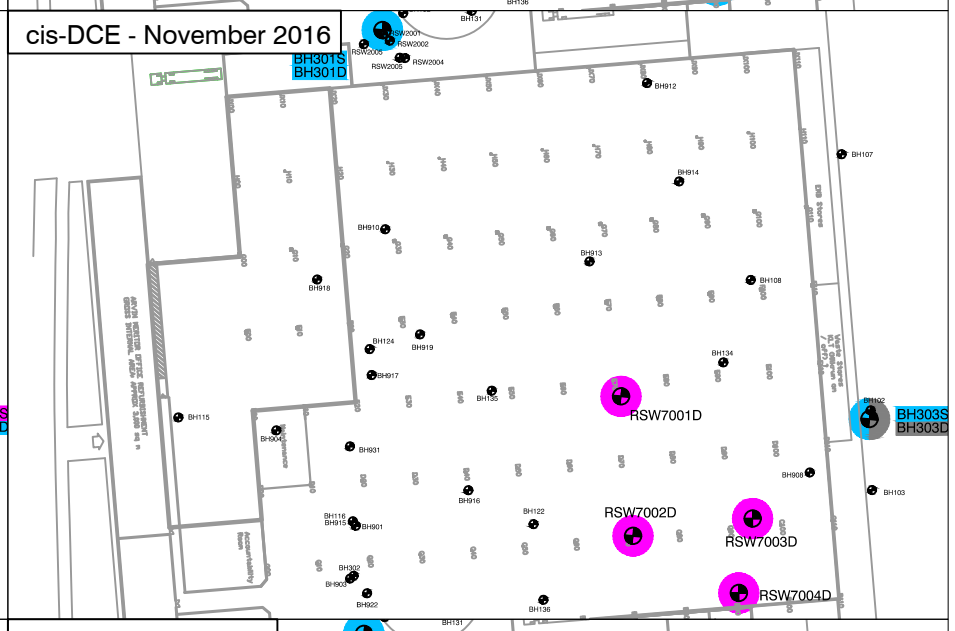
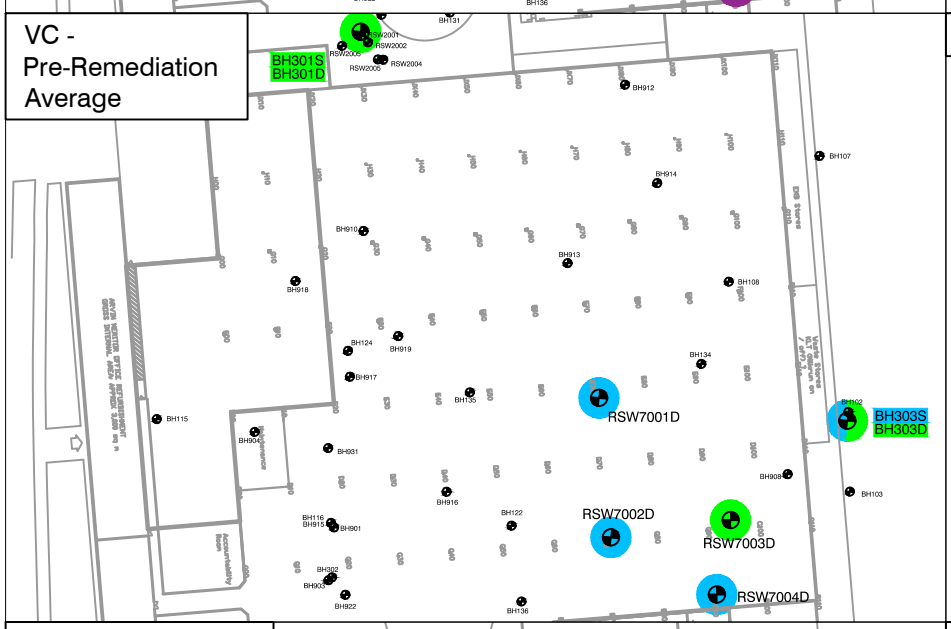


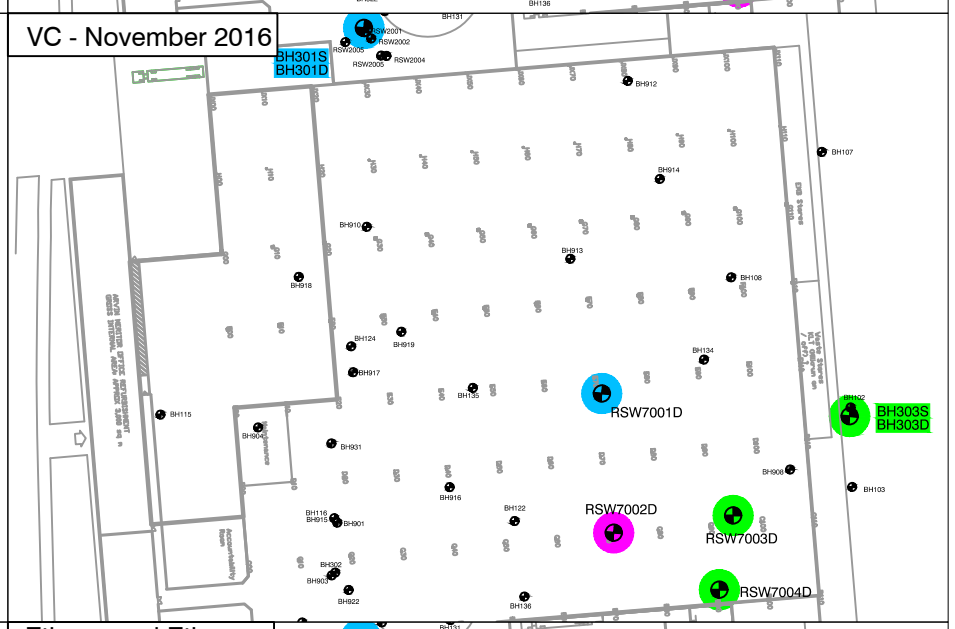
cis-DCE - November 2016



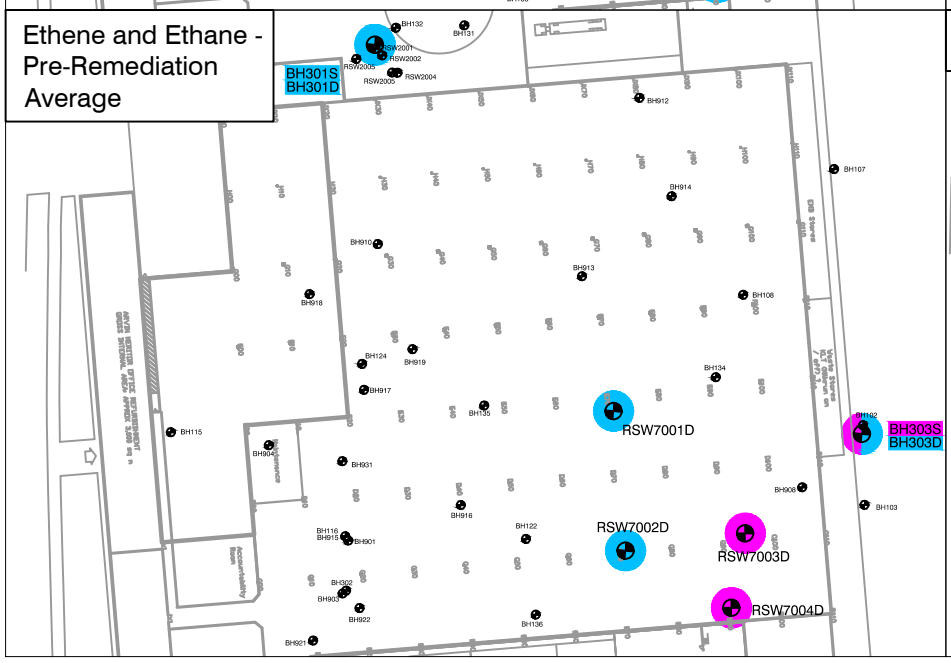
VC - Pre-Remediation Average



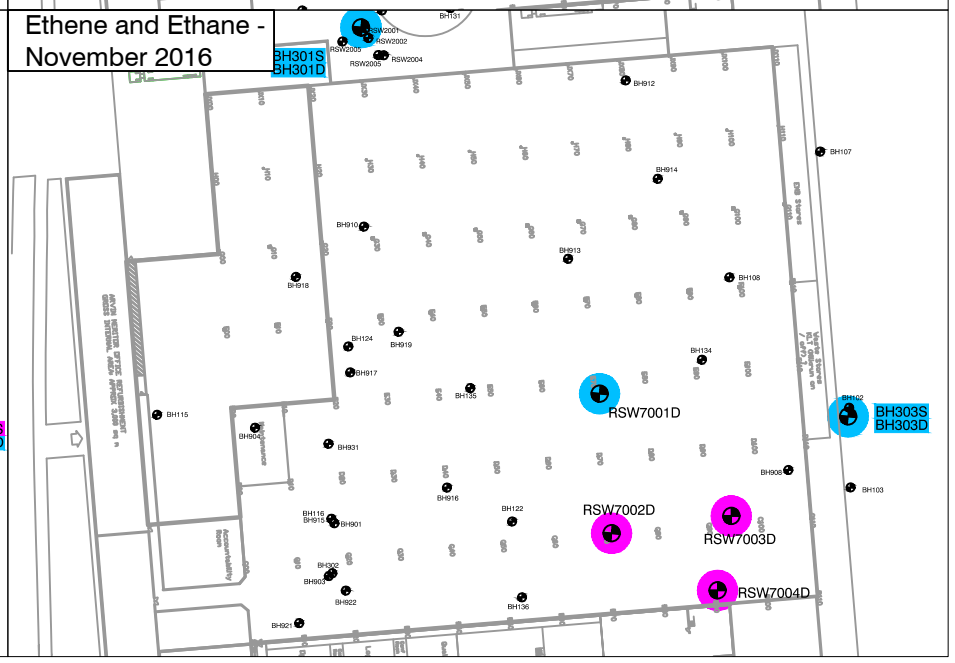
VC - November 2016



Ethene and Ethane - Pre-Remediation Average



Ethene and Ethane - November 2016



NOTES

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LOCATION RSG05 IS AN APPROXIMATE LOCATION

KEY

BOREHOLE LOCATION

- >10,000 µg/l
- <5,000 µg/l
- <1,000 µg/l
- <100 µg/l
- <10 µg/l

TITLE: CHANGE IN CONCENTRATION OF KEY VOC AND DISSOLVED GASSES - PRODUCTION BUILDING - RAGLAN MARL

SITE: CWMBRAN

PROJECT: 27662105

CLIENT: MERITOR

FIGURE 7d

DATE: 25/04/17

PRINT: A3

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REV: -

DRG.No.: 2766210503-CAD

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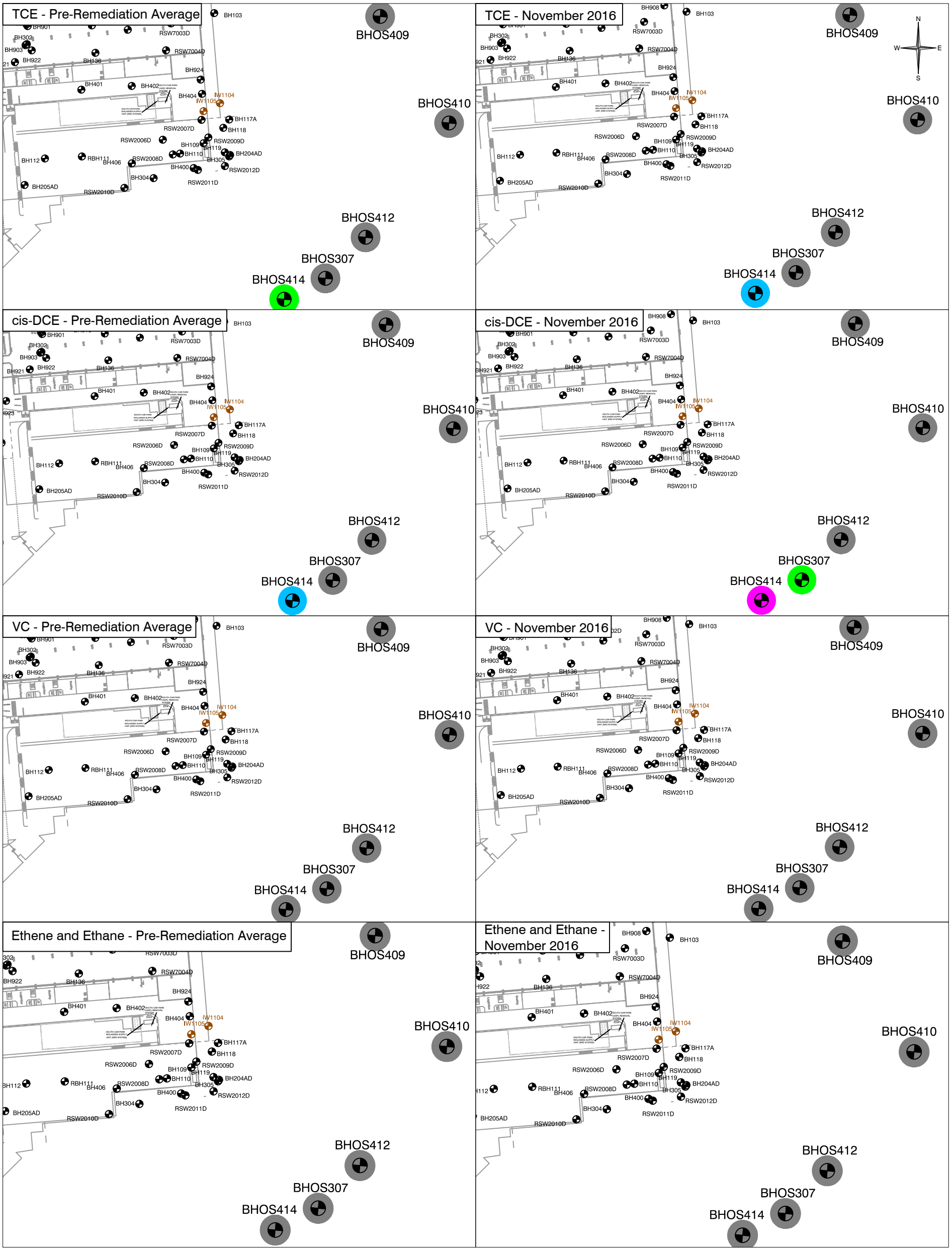

NOTES		KEY	TITLE: CHANGE IN CONCENTRATION OF KEY VOC AND DISSOLVED GASSES - OFF SITE	SITE: CWMBRAN
NOTE: ALL ENTITIES SHOWN ON THIS DRAWING ARE TO BE REGARDED AS APPROXIMATE AND ARE INDICATIVE ONLY. NO MEASUREMENTS TAKEN FROM THIS DRAWING SHOULD BE USED FOR THE LOCATION OF INTRUSIVE INVESTIGATION WORKS ON SITE. SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE. - CONTACT ARCADIS UK IN CASE OF ANY QUERY LOCATION RSG05 IS AN APPROXIMATE LOCATION		BOREHOLE LOCATION >10,000 µg/l <5,000 uµg/l <1,000 µg/l <100 µg/l <10 µg/l	PROJECT: 27662105	CLIENT: MERITOR	FIGURE 7e
			DATE: 25/04/17	PRINT: A3
			DRAWN BY: AP	REV: -
			DRG.No.: 2766210506-CAD	

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NOTES

TCE = TRICHLOROETHENE

TCE CONSIM OUTPUT AT 1,000 YEARS OVERLAID OVER A SITE PLAN. NOTE, CONSIM EXTRAPOLATES THE SOURCE AREA LATERALLY, PARALLEL TO THE DIRECTION OF GROUNDWATER FLOW

MODELLED ON A SAND / GRAVEL AQUIFER - REPRESENTATIVE OF ALLUVIUM AND USING REVISED, POST-REMEDIATION, SOURCE AREAS

KEY

MERITOR SITE BOUNDARY

TITLE: PREDICTED TCE PLUME BASED ON FATE AND TRANSPORT MODELLING

SITE: CWMBRAN

PROJECT: 27662105

CLIENT: MERITOR

FIGURE 8

DATE: 25/04/17

PRINT: A3

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REV: -

DRG.No.: 2766210514-CAD

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NOTES

CIS-DCE = CIS-1,2,-DICHLOROETHENE

CIS-DCE CONSIM OUTPUT AT 1,000 YEARS OVERLAID OVER A SITE PLAN. NOTE, CONSIM EXTRAPOLATES THE SOURCE AREA LATERALLY, PARALLEL TO THE DIRECTION OF GROUNDWATER FLOW

MODELLED ON A SAND / GRAVEL AQUIFER - REPRESENTATIVE OF ALLUVIUM AND USING REVISED, POST-REMEDIATION, SOURCE AREAS

KEY

MERITOR SITE BOUNDARY

TITLE: PREDICTED CIS-DCE PLUME BASED ON FATE AND TRANSPORT MODELLING

SITE: CWMBRAN

PROJECT: 27662105

CLIENT: MERITOR

FIGURE 9

DATE: 25/04/17

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REV: -

DRG.No.: 2766210515-CAD

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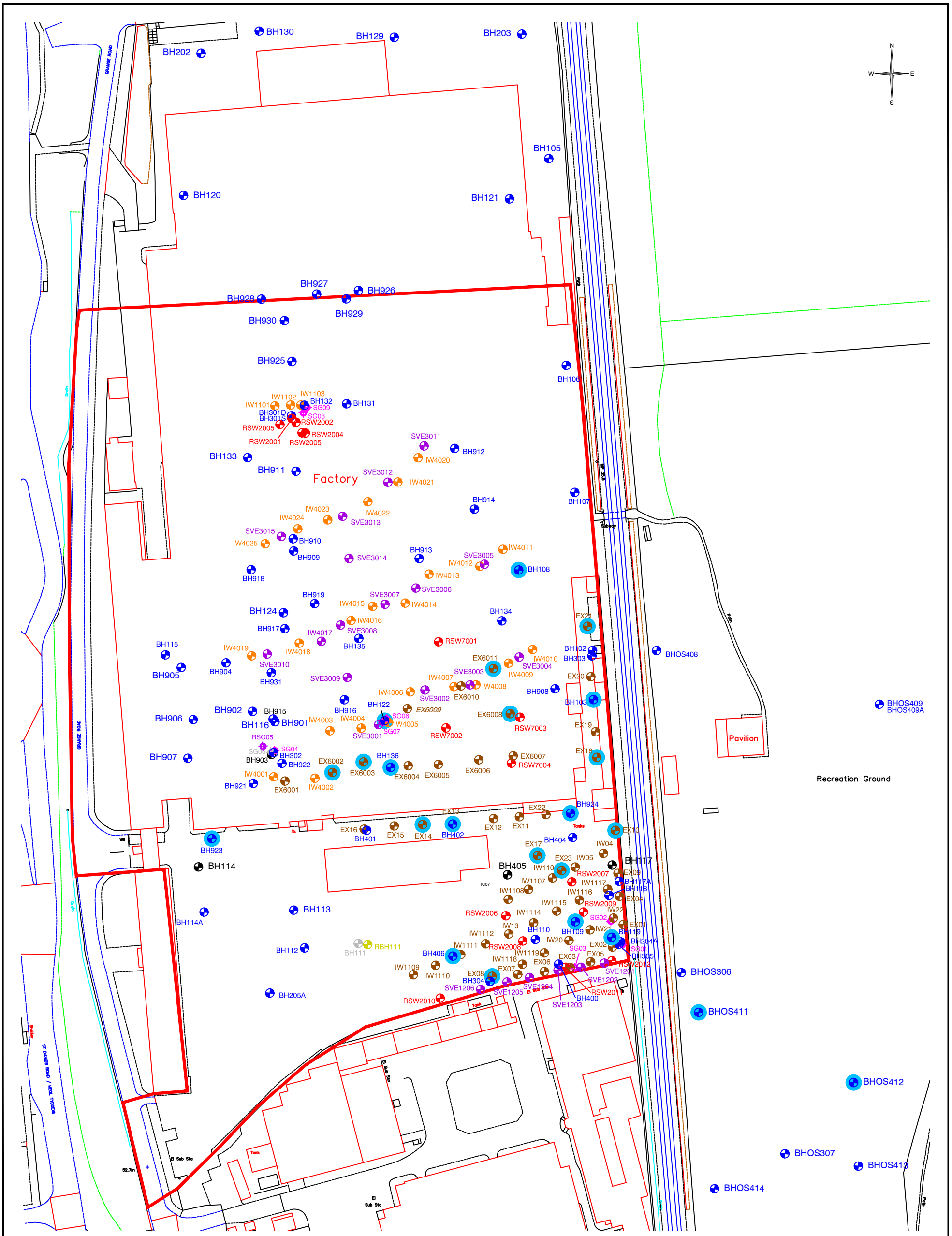

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NOTES

KEY

- SOIL GAS MONITORING WELL DESTROYED
- SOIL GAS MONITORING WELL
- REPLACEMENT SOIL GAS MONITORING WELL
- MERITOR SITE BOUNDARY

KEY

- LNAPL EXTRACTION WELL
- SVE EXTRACTION WELL
- ERD INJECTION WELL
- ERD RESPONSE MONITORING WELL
- GROUNDWATER MONITORING WELL
- GROUNDWATER MONITORING WELL DESTROYED
- REPLACEMENT GROUNDWATER MONITORING WELL
- BOREHOLE, NO MONITORING WELL INSTALLED
- BIANNUAL LNAPL RECOVERY PROGRESS MONITORING - NOVEMBER 2016 - WELL LOCATION

TITLE: BIANNUAL LNAPL RECOVERY PROGRESS GROUNDWATER MONITORING WELL LOCATION PLAN

SITE: CWMBRAN

PROJECT: 27662105

CLIENT: MERITOR

FIGURE 10

DATE: 25/04/17

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DRG.No.: 2766210513-CAD

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Tables

Table 1
Sub Slab Soil Gas SSAC - Area B

Compound	Area B* On-site Commercial Worker - Sub Slab Soil Gas SSAC (ug/m3)		
	Indoor air	Outdoor Air	Combined
Vinyl chloride	291,000	129,000,000	290,000
1,1-Dichloroethene	55,500,000	26,700,000,000	55,400,000
Dichloromethane	5,840,000	2,810,000,000	5,830,000
1,1-Dichloroethane	105,000,000	67,700,000,000	105,000,000
cis-1,2-Dichloroethene	8,490,000	5,540,000,000	8,480,000
Chloroform	117,000	66,400,000	117,000
1,1,1-Trichloroethane	593,000,000	370,000,000,000	592,000,000
Benzene	13,700,000	761,000,000	13,500,000
Trichloroethene	5,130,000	3,140,000,000	5,120,000
1,1,2-Trichloroethane	177,000	107,000,000	177,000
Toluene	13,800,000,000	858,000,000,000	13,600,000,000
Tetrachloroethene	70,500,000	47,800,000,000	70,400,000
Chlorobenzene	14,100,000	8,990,000,000	14,100,000
Ethylbenzene	2,190,000,000	149,000,000,000	2,160,000,000
Sum xylenes	596,000,000	40,700,000,000	587,000,000
1,3,5-Trimethylbenzene	1,690,000	1,200,000,000	1,690,000
1,2,4-Trimethylbenzene	1,990,000	1,410,000,000	1,990,000
Naphthalene	8,550,000	593,000,000	8,430,000
Aliphatic >C5-C6	51,200,000,000	2,520,000,000,000	50,200,000,000
Aliphatic >C6-C8	51,200,000,000	2,520,000,000,000	50,200,000,000
Aliphatic >C8-C10	2,630,000,000	129,000,000,000	2,580,000,000
Aliphatic >C10-C12	2,630,000,000	129,000,000,000	2,580,000,000
Aromatic >EC8-EC10	536,000,000	26,300,000,000	525,000,000
Aromatic >EC10-EC12	536,000,000	26,200,000,000	525,000,000

Notes

*	Soil gas SSAC would also be applicable to Area C, provided that the soil gas point installation was the same as per Area B. Areas as defined by Figure 6
SSAC	Site Specific Assessment Criteria

Table 2
ConSim Results for Non-Petroleum CoC in Groundwater

Source 3R

CoC	Compliance Criteria (mg/l)	Source	Start Concentrations (mg/l)*	Maximum Predicted Concentration - 150m compliance point (mg/l)
Vinyl Chloride	0.0005	WS, 2000	0.376	3.96E-06
Cis-1,2-dichloroethene	0.05	WHO, 2004	0.942	0.0035
Trichloroethene	0.01	WS, 2000	0.004	6.53E-06

Source 4R

CoC	Compliance Criteria (mg/l)	Source	Start Concentrations (mg/l)*	Maximum Predicted Concentration - 150m compliance point (mg/l)
Vinyl Chloride	0.0005	WS, 2000	12.8	4.40E-05
1,1-dichloroethene	0.03	WHO, 2004	0.062	4.90E-06
Trans-1,2-dichloroethene	0.025	WHO, 2011	0.182	2.40E-04
Cis-1,2-dichloroethene	0.025	WHO, 2011	73.1	**0.155**
Trichloroethene	0.005	WS, 2000	8.57	**0.0068**
1,1,2-trichloroethane	0.005	USEPA, 2009	0.009	3.70E-04
Tetrachloroethene	0.005	WS, 2000	0.334	3.90E-06

Source 5

CoC	Compliance Criteria (mg/l)	Source	Start Concentrations (mg/l)*	Maximum Predicted Concentration - 150m compliance point (mg/l)
Vinyl Chloride	0.0005	WS, 2000	0.0232	1.92E-07
1,1-dichloroethene	0.03	WHO, 2004	0.014	2.00E-06
Trans-1,2-dichloroethene	0.025	WHO, 2011	0.018	3.90E-05
Cis-1,2-dichloroethene	0.025	WHO, 2011	2.04	0.007
Trichloroethene	0.01	WS, 2000	7.03	0.01

Source 6R

CoC	Compliance Criteria (mg/l)	Source	Start Concentrations (mg/l)*	Maximum Predicted Concentration - 150m compliance point (mg/l)
Vinyl Chloride	0.0005	WS, 2000	0.0017	1.09E-07
Cis-1,2-dichloroethene	0.05	WHO, 2011	1.39	0.0128
Trichloroethene	0.005	WS, 2000	0.11	0.00049
Tetrachloroethene	0.005	WS, 2000	0.039	5.70E-06

Source 7R

CoC	Compliance Criteria (mg/l)	Source	Start Concentrations (mg/l)*	Maximum Predicted Concentration - 150m compliance point (mg/l)
Vinyl Chloride	0.0005	WS, 2000	29.9	0.00024
1,1-dichloroethene	0.03	WHO, 2004	0.013	1.60E-06
Trans-1,2-dichloroethene	0.025	WHO, 2011	0.027	5.10E-05
Cis-1,2-dichloroethene	0.025	WHO, 2011	17.7	**0.056**
Trichloroethene	0.01	WS, 2000	0.057	7.20E-05
1,1-Dichloroethane	0.003	WHO, 2011	0.01	0.0002
1,1,1-Trichloroethane	0.1	WFD, 2010	0.0015	4.60E-05

Notes:

The compliance criteria of 10µg/l is for sum trichloroethene and tetrachloroethene. Where both compounds are detected, the compliance criteria is split between the two compounds. Where only one compound is detected, a compliance criteria of 10µg/l is selected. Similarly, the compliance criteria for 1,2-dichloroethene of 50µg/l is for cis- and trans- 1,2-dichloroethene. This is split between the two compounds where they are both identified, or a value of 50µg/l is used where only one is identified.

*	Maximum measured concentration for each respective source area during groundwater monitoring in November 2016.
-	Predicted concentration < 1 x 10^{-10} mg/l
np	Compound not present
na	not applicable
1.2	Predicted concentration exceeds adopted EQS

Sources

WHO, 2004	World Health Organisation for Drinking Water Quality. Third Edition, 2004
WHO, 2011	World Health Organisation for Drinking Water Quality. Fourth Edition, 2011
WFD, 2010	The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions, 2010
WS, 2000	Water Supply (Water Quality) Regulations, 2000
US EPA, 2009	United States Environmental Protection Agency, Regional Screening Levels, 2009

APPENDIX A

Legislative Context and Regulatory Guidance

Land contamination is generally dealt with by the following types of regulation:

- Acts of Parliament to investigate and remedy harm caused by land contamination;
- Conditions placed upon Planning Permissions for the redevelopment of land; and,
- Acts of Parliament and Regulations for the control of waste.

In Wales land contamination is identified and dealt with through Acts / Regulations including:

- The Contaminated Land (Wales) Regulations (2006);
- Part 2A of the Environmental Protection Act (1990);
- The Environment Act 1995;
- The Town and Country Planning Act (1990);
- The Environmental Permitting (England and Wales) Regulations (2007);
- The Water Resources Act (1991);
- The Water Act (2003);
- The Environmental Damage (Prevention and Remediation) (Wales) Regulations (2009); and,
- The Groundwater (England and Wales) Regulations (2009).

Part 2A of the Environmental Protection Act 1990

Part 2A of the Environmental Protection Act 1990 (which was inserted by Section 57 of the Environment Act 1995) created a regime for the identification and remediation of contaminated land. Section 78A(2) of the Environmental Protection Act 1990 defines contaminated land for the purposes of Part 2A as:

'*any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that;*
(a) significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) pollution of controlled waters is being, or is likely to be caused.'[1]

Harm is defined under section 78A of the Environmental Protection Act as meaning 'harm to the health of living organisms or other interference with the ecological systems of which they form part and, in the case of man, includes harm to his property'. Types of harm are related to specific receptors in order to determine whether they can be regarded as "significant", as defined in Table A of Part 3 of the Welsh Assembly Government (2006)[2] statutory guidance.

Part 2A sets the definition of contaminated land within the context of the 'suitable for use' approach. The legal definition of contaminated land is also discussed within Statutory Guidance released by DEFRA (2008)[3], although this is currently only applicable for England the paper was prepared in consultation with the other UK countries.

The 'suitable for use' approach underlies the assessment process, and is based on the principles of risk assessment, including the concept of the 'pollutant linkage'.

In the event that there are unacceptable levels of risk posed by a Site, a remediation notice can be served under the contaminated land regime introduced under Part 2A of the Environmental Protection Act 1990.

Regulation of Development on Land Affected by Contamination

Management of risks from contamination in development of land is also regulated in Wales under the Town and Country Planning Act 1990. Land contamination is a material planning consideration within this planning

[1] Definition to be amended to "significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused" under the Water Act 2003
[2] Part 2A. Statutory Guidance on Contaminated Land. Welsh Assembly Government, December 2006
[3] Guidance on the legal definition of contaminated land. DEFRA July 2008

regime. The Local Planning Authority may impose conditions on the development during planning that include preliminary risk assessment, Site investigation, risk assessment and remediation. The Environment Agency may use its role as a statutory consultee to provide the Local Planning Authority with advice.

Assessment of risk is again based on the pollutant linkage concept. The aim of risk management in the development should be to render the land suitable for the proposed use and, therefore, to prevent consideration of the Site under Part 2A.

The Welsh Assembly Government document Planning Policy Wales (March 2002) provides guidance on the relationship between development and the management of risks from land contamination caused by historical use. The Building Regulations 2000, made under the Building Act 1984, also require measures to be taken to protect new buildings and their occupants from the effects of contamination.

Voluntary Remediation Action

Voluntary remediation action on contamination resulting from historical activities can often anticipate future remediation requirements, such as through the Planning regime, and is encouraged, especially where the Site is not being assessed under Part 2A.

Environmental Damage

The Environmental Damage (Prevention and Remediation) Regulations 2009 came into force on 1st March 2009 to implement EC Directive 2004/35 on environmental liability with regard to the prevention and remedying of environmental damage.

These Regulations do not apply retrospectively; environmental damage that took place before the Regulations came into force (1st March 2009), or damage that takes place (or is likely to take place) after that date but is caused by an incident, event or emission that occurred before that date are exempt from the requirements of the Regulations.

The Regulation is concerned with preventing environmental damage. It requires that all operators of activities that cause an imminent threat of environmental damage to take all reasonably practical steps to prevent the damage. Where damage has already been caused, the operator must take all reasonably practical steps to prevent further damage from occurring.

Non-statutory regulatory technical guidance Documents

The UK non-statutory regulatory technical guidance on the assessment of land contamination, primarily released as part of the Contaminated Land Exposure Assessment (CLEA) methodology (DEFRA and EA) has recently been updated. New guidance has been released by the EA, for use in England and Wales. The following documents currently present guiding principles in investigating and assessing potentially contaminated land, which are generally adopted in considering Sites within any of the legal frameworks discussed above, or when considering voluntary remediation action:

- *Investigation of potentially contaminated Sites – Code of Practice* (British Standard 10175: 2001).
- Contaminated Land Report CLR11 *Model Procedures for the Management of Land Contamination.* (DEFRA and EA, 2004).
- *Human health toxicological assessment of contaminants in soil* Environment Agency Science Report SC050021/SR2 (EA, 2009)
- *Updated technical background to the CLEA model* Environment Agency Science Report SC050021/SR3 (EA, 2009)
- *Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* Environment Agency Science Report SC050021/SR7 (EA, 2008)
- *An ecological risk assessment framework for contaminants in soil.* Environment Agency Science

Report SC070009/SR1 and related reports S2a-e
- *Groundwater Protection: Policy and Practice*, Environment Agency GP3 Parts 1-4
- *Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination* (EA of England and Wales, 2006) developed in consultation with the Scottish Environment Protection Agency (SEPA) and the Northern Ireland Heritage and Environment Service.
- *Assessing risks posed by hazardous ground gases to buildings* Report C665 (CIRIA, 2007)
- *BS 8485:2007 Code of practice for the characterization and remediation from ground gas in affected developments(British Standards Institution, 2007)*
- *Risk Based Corrective Action (RBCA) Methodology* (ASTM designation E1739-95, E2081-00).
- *DoE Industry Profiles*

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- *DoE Industry Profiles*

APPENDIX B

Previous Environmental Works

Arcadis have completed the following environmental works at the Meritor facility.

- Phase I Environmental Site Assessment, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, ARCADIS report reference 909361804_03, January 2010.
- Phase II Environmental Site Assessment Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran. ARCADIS report ref: 909361904_02, February 2010.
- Phase IIB Environmental Site Assessment Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran. ARCADIS report reference 909362203_02, May 2010.
- Detailed Quantitative Risk Assessment (DQRA), Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, ARCADIS report reference 909362002_01, May 2010.
- Remediation Options Appraisal (ROA) Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, ARCADIS report reference 909362302_01, August 2010.
- Revised Detailed Quantitative Risk Assessment Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, ARCADIS report reference 909362802_01, January 2011.
- Remediation Method Statement, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, ARCADIS report reference 909362819_03, January 2011.
- Supplementary Environmental Site Investigation Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran. ARCADIS report reference 909362509_01, April 2011.
- Remediation Pilot Testing (Oil Recovery) Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran 909362711_01, June 2011.
- Updated Detailed Quantitative Risk Assessment, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran 909363202_02, April 2012.
- Baseline Site-Wide Groundwater Monitoring Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran 909362902_02, September 2011.
- Location of Historic Abstraction Well Letter Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, ARCADIS report reference 909363603_01, January 2012.
- Quarterly Groundwater Monitoring – November 2011 Update Letter Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, ARCADIS report reference 909363603_01, January 2012.
- Interim Enhanced Reductive Dechlorination Pilot Trial Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909363415_01, January 2012.
- Remediation Implementation Plan – Chlorinated Volatile Organic Compound Groundwater Remediation, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909363805_04, January 2012.
- Ground Gas Strategy Report, Zone 2 and Zone 3, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909364202_04, January 2012.
- Remediation Verification Plan for Chlorinated Volatile Organic Compounds Groundwater Remediation, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909363806_04, January 2012.
- Remediation Verification Plan (LNAPL Recovery), Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909364003_04, January 2012.
- Remediation Implementation Plan (LNAPL Recovery), Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909363022_06, February 2012.
    - Remediation Method Statement, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, ARCADIS report reference 909362819_03, January 2011.
- Ground Gas Strategy Report, Zone 2 & Zone 3, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909364202_04, January 2012.
- Quarterly Groundwater Monitoring – February 2012 Update Letter Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, ARCADIS report reference 909363707_01, March 2012.
- Remediation of Chlorinated Volatile Organic Compounds (CVOCs) – Raglan Mudstone Formation Aquifer Letter Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909363825_02, April 2012
    - Remediation Infrastructure Installation Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909363909_01, March 2012.

- Enhanced Reductive Dechlorination Pilot Trial Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909363429_02, June 2012.
- Annual Groundwater Monitoring Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909363716_01, October 2012
- Remediation system Commissioning Report, Meritor Heavy Vehicle Braking Systems (UK) Limited, Cwmbran, 909364502_04, March 2013
- Year 1 Remediation Update Letter Reports May 2013 to April 2014;
- Year 2 Remediation Update Letter Reports May 2014 to April 2015;
- Year 3 Remediation Update Letter Reports May 2015 to April 2016;
- Year 4 Remediation Update Letter Report May 2016 (Arcadis Ref: 2766210401_01, August 2016);
- Year 4 Remediation Update Letter Report, June to August 2016 (Arcadis Ref: 2766210403_01, December 2016);
- Year 4 Remediation Update Letter Report, September 2016 (Arcadis Ref: 2766210404_01, December 2016);
- Year 4 Remediation Update Letter Report, October 2016 (Arcadis Ref: 2766210409_01, December 2016);
- Year 4 Remediation Update Letter Report, November 2016 (Arcadis Ref: 2766210409_01, January 2017); and,
- Year 4 Remediation Update Report, December 2016 (Arcadis Ref 2766210417_01, January 2017.

APPENDIX C

Injection Summary Data

Injection	System	Dates	Solution concentration	Volume of solution injected
First injection	South Yard	15th April – 3rd May 2013	1% (by volume)	186 m^3
	Main Production Building			315 m^3
Second injection	South Yard	12th August – 2nd September 2013	1% (by volume)	194 m^3
	Main Production Building			306 m^3
Third injection	South Yard	18th November – 17th December 2013	3% (by volume)	149 m^3
	Main Production Building			313 m^3
Fourth injection	South Yard	11th February – 7th March 2014	3% (by volume)	206 m^3
	Main Production Building			477 m^3
Fifth injection	South Yard	16th April – 5th May 2014	3% (by volume)	208 m^3
	Main Production Building	16th April – 31st May 2014	5% (by volume)	409 m^3
Sixth injection	South Yard	17th July – 14th August 2014	3% (by volume)	213 m^3
	Main Production Building	16th July – 15th September 2014	5% (by volume)	458 m^3
Seventh injection	South Yard	31st October – 18th November 2014	3% (by volume)	189 m^3
	Main Production Building	31st October – 19th December 2014	5% (by volume)	222 m^3
Eighth injection	South Yard	13th February – 18th March 2015	3% (by volume)	201 m^3
	Main Production Building	13th February – 16th April 2015	5% (by volume)	526 m^3
Ninth injection	South Yard	18th June – 8th July 2015	3% (by volume)	188 m^3
	Main Production Building	18th June – 13st July 2015	5% (by volume)	373 m^3
Tenth injection	South Yard	29th October – 29th November 2015	3% (by volume)	194 m^3
	Main Production Building	28th October – 23rd December 2015	5% (by volume)	369 m^3
Eleventh injection	South Yard	9th February – 26th February 2016	3% (by volume)	183 m^3
	Main Production Building	4th February – 26th February 2016	5% (by volume)	157 m^3

Injection	System	Dates	Solution concentration	Volume of solution injected
Twelfth injection	South Yard	6th May -12th June 2016	3% (by volume)	241 m^3
	Main Production Building	6th May -12th June 2016	5% (by volume)	287 m^3
Thirteenth injection	South Yard	19th August 30th September 2016	3% (by volume)	257 m^3
	Main Production Building	19th August - 21st October 2016	5% (by volume)	194 m^3
Fourteenth injection	South Yard	16th October - 1st December 2016	3% (by volume)	189 m^3
	Main Production Building	16th October-1st December 2016	5% (by volume)	113 m^3
Fifteenth injection	South Yard	5th January 2017 - 16th January 2017	3% (by volume)	66 m^3
	Main Production Building	5th January 2017 - 8th February 2017	5% (by volume)	50 m^3
Sixteenth Injection	South Yard	8th March 2017 – 11th April 2017	3% (by volume)	263 m^3
	Main Production Building	8th March 2017 – 4th May 2017	5% (by volume)	174 m^3

APPENDIX D

D.1 - Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

D.2 – Remediation Summary Sheets

D.3 – Measured Concentrations of CVOC in Soil Gas (ug/m^3) – Baseline and Remedial Period

D.4 – Natural Attenuation Parameters

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Human Health SSAC			Alluvium - Production Building										
					BH103 - Source Zone 5										
Monitoring date		Commercial Worker	Playing Field	Off Site Commercial Worker	Mar-10	Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2				-	-	-	Only NAPL Present in Well	Only NAPL Present in Well	Only NAPL Present in Well	Only NAPL Present in Well	-	-	-	-
Methyl Tertiary Butyl Ether	<1				-	-	-					-	-	-	-
Chloromethane	<3				-	-	-					-	-	-	-
Vinyl Chloride	<<2	3,500	2,800	1,300	3,259	3,885	590					1.9	39.9	-	-
Bromomethane	<1				-	-	-					-	-	-	-
Chloroethane	<3				-	-	-					-	-	-	-
Trichlorofluoromethane	<3				-	-	-					-	-	-	-
1,1-Dichloroethene	<3	580,000	470,000	220,000	15	22	4					-	-	-	-
Dichloromethane	<3				-	-	-					-	-	-	-
trans-1-2-Dichloroethene	<3	1,900,000	1,200,000	290,000	8	10	-					-	-	-	-
1,1-Dichloroethane	<3	2,500,000	ND	580,000	-	-	-					-	-	-	-
cis- DCE	<3	180,000	130,000	42,000	6,146	41,451	767					-	27	-	-
2,2-Dichloropropane	<1				-	-	-					-	-	-	-
Bromochloromethane	<2				-	-	-					-	-	-	-
Chloroform	<2				-	-	-					-	-	-	-
1,1,1-Trichloroethane	<2	ND	ND	ND	-	-	-					-	-	-	-
1,1-Dichloropropene	<3				-	-	-					-	-	-	-
Carbon tetrachloride	<2				-	-	-					-	-	-	-
1,2-Dichloroethane	<2				-	-	-					-	-	-	-
Benzene	<1	270,000	170,000	36,000	-	-	-					-	-	-	-
TCE	<3	120,000	93,000	37,000	32	93	-					-	-	-	-
1,2-Dichloropropane	<2				-	-	-					-	-	-	-
Dibromomethane	<3				-	-	-					-	-	-	-
Bromodichloromethane	<2				-	-	-					-	-	-	-
cis-1-3-Dichloropropene	<2				-	-	-					-	-	-	-
Toluene	<2	ND	ND	ND	-	-	-					-	-	-	-
trans-1-3-Dichloropropene	<2				-	-	-					-	-	-	-
1,1,2-Trichloroethane	<2	21,000	13,000	3,000	-	-	-					-	-	-	-
PCE	<3	ND	ND	ND	-	-	-					-	-	-	-
1,3-Dichloropropane	<2				-	-	-					-	-	-	-
Dibromochloromethane	<2				-	-	-					-	-	-	-
1,2-Dibromoethane	<2				-	-	-					-	-	-	-
Chlorobenzene	<2				-	-	-					-	-	-	-
1,1,1,2-Tetrachloroethane	<2				-	-	-					-	-	-	-
Ethylbenzene	<2	ND	ND	ND	-	-	-					-	-	-	0.7
p/m-Xylene	<3	ND	ND	ND	-	-	4					-	-	-	2
o-Xylene	<2	ND	ND	ND	-	-	-					-	-	-	0.8
Styrene	<2				-	-	-					-	-	-	-
Bromoform	<2				-	-	-					-	-	-	-
Isopropylbenzene	<3				-	-	-					-	-	-	-
1,1,2,2-Tetrachloroethane	<4				-	-	-					-	-	-	-
Bromobenzene	<2				-	-	-					-	-	-	-
1,2,3-Trichloropropane	<3				-	-	-					-	-	-	-
Propylbenzene	<3				-	-	-					-	-	-	-
2-Chlorotoluene	<3				-	-	-					-	-	-	-
1,3,5-Trimethylbenzene	<3				-	-	-					-	-	-	-
4-Chlorotoluene	<3				-	-	-					-	-	-	-
tert-Butylbenzene	<3				-	-	-					-	-	-	-
1,2,4-Trimethylbenzene	<3				-	-	-					-	-	-	-
sec-Butylbenzene	<3				-	-	-					-	-	-	-
4-Isopropyltoluene	<3				-	-	-					-	-	-	-
1,3-Dichlorobenzene	<3				-	-	-					-	-	-	-
1,4-Dichlorobenzene	<3				-	-	-					-	-	-	-
n-Butylbenzene	<3				-	-	-					-	-	-	-
1,2-Dichlorobenzene	<3				-	-	-					-	-	-	-
1,2-Dibromo-3-chloropropane	<2				-	-	-					-	-	-	-
1,2,4-Trichlorobenzene	<3				-	-	-					-	-	-	-
Hexachlorobutadiene	<3				-	-	-					-	-	-	-
Naphthalene	<2	ND	ND	ND	-	-	-					-	-	-	-
1,2,3-Trichlorobenzene	<3				-	-	-					-	-	-	-
Total VOCs	**				9,460	45,461	1,365					2	67	-	4

Notes:

	Pre -Remediation Sample
-	Below MDL
MDL : Method detection lir	Method Detection Limit
VOC	Volatile Organic Compounds
underline	Exceeds SSAC off site Commercial Worker (applies South Yard only)
Bold	Exceeds SSAC on site Commercial Worker
Italic	Exceeds SSAC on site Commercial Worker / Playing Field User

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building										
		BH107 - Source Zone 5										
Monitoring date		Mar-10	Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	116	1,329	117	33	56	11	61.7	42.6	33.4	43.3	23.2
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	13	27	14	19	24	10	26	17	16	17	14
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	14	30	16	24	39	13	28	17	16	14	18
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	2,499	7,481	2,285	1,000	2,345	2,003	1,340	2,000	1,560	2,040	2,040
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-	-	-
TCE	<3	2,100	5,577	3,337	3,000	16	4,462	5,270	3,650	1,970	2,450	7,030
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	4,742	14,444	5,769	4,076	2,480	6,499	6,726	5,727	3,595	4,564	9,125

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSA(
Bold	Exceeds SSA(
Italic	Exceeds SSA(

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building									
		BH108 - Source Zone 5*									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	-	22	7	16	8	23.2	-	-	0.4	1.3
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	-	22	50	36	33	72	-	-	-	4
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-	-
TCE	<3	-	-	-	13	6	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-		-	-	-	-	-
Total VOCs	**	-	44	57	65	47	95	-	-	0.4	5.3

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building								
		BH115 - Source Zone 4R*								
Monitoring date		Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	-	-	-	-	-	-	-	3.3	0.1
Bromomethane	<1	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-
cis- DCE	<3	25	5	-	-	8	-	-	53	-
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-
Chloroform	<2	22	16	8	5	8	11	11	7	6
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-
TCE	<3	160	5	-	-	-	-	-	-	18
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Total VOCs	**	207	26	8	5	16	11	11	63	24

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building									
		BH122 - Source Zone 4R									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	985	2,542	791	4,712	2,820	1,440	616	-	3.3	4
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	37	24	10	10	20	20	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	29	32	15	6	9	4	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	4,726	6,214	-	2,912	4,833	2,980	1,090	-	6	7
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-	-
TCE	<3	7,033	3,006	-	91	348	6	4	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	455	14,200	86
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
PCE	<3	186	287	92	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2		-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	1.5	0.6
p/m-Xylene	<3	-	-	-	-	-	-	-	-	2	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	-	12,105	908	7,731	8,030	4,450	1,710	455	14,213	98

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building								
		BH909 - Source Zone 4R*								
Monitoring date		Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	40	146	40	56	133	-	1.3	5.5	3.7
Bromomethane	<1	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-
cis- DCE	<3	48	235	370	54	574	-	-	67	26
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-
TCE	<3	250	4	51	-	60	4	-	5	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	6.6	1	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-
PCE	<3	17	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Total VOCs	**	355	385	461	110	767	11	2.3	78	30

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building								
		BH912 - Source Zone 3R						BH913		BH912
Monitoring date		Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Baseline Monitoring August 2012	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-		-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-		-	-	-
Chloromethane	<3	-	-	-	-	-		-	-	-
Vinyl Chloride	<<2	**3,024**	1,000	3,481	1,613	1,610		46	0.7	1,300
Bromomethane	<1	-	-	-	-	-		-	-	-
Chloroethane	<3	-	-	-	-	-		-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-		-	-	-
1,1-Dichloroethene	<3	29	27	20	-	25		6	-	17
Dichloromethane	<3	-	-	-	-	-		-	-	-
trans-1-2-Dichloroethene	<3	21	19	17	-	23		-	-	12
1,1-Dichloroethane	<3	-	-	-	-	-		-	-	-
cis- DCE	<3	8,049	3,000	9,385	5,077	4,930		688	-	6,780
2,2-Dichloropropane	<1	-	-	-	-	-		-	-	-
Bromochloromethane	<2	-	-	-	-	-		-	-	-
Chloroform	<2	-	-	-	-	-		-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-		-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-		-	-	-
Carbon tetrachloride	<2	-	-	-	-	-		-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-		-	-	-
Benzene	<1	-	-	-	-	-		-	-	-
TCE	<3	3	-	-	10	13		165	-	6
1,2-Dichloropropane	<2	-	-	-	-	-		-	-	-
Dibromomethane	<3	-	-	-	-	-		-	-	-
Bromodichloromethane	<2	-	-	-	-	-		-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-		-	-	-
Toluene	<2	-	-	-	-	-		-	175	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-		-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-		-	-	-
PCE	<3	-	-	-	-	-		-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-		-	-	-
Dibromochloromethane	<2	-	-	-	-	-		-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-		-	-	-
Chlorobenzene	<2	-	-	-	-	-		-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-		-	-	-
Ethylbenzene	<2	-	-	-	-	-		-	-	-
p/m-Xylene	<3	-	-	-	-	-		-	-	-
o-Xylene	<2	-	-	-	-	0.7		-	-	-
Styrene	<2	-	-	-	-	-		-	-	-
Bromoform	<2	-	-	-	-	-		-	-	-
Isopropylbenzene	<3	-	-	-	-	-		-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-		-	-	-
Bromobenzene	<2	-	-	-	-	-		-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-		-	-	-
Propylbenzene	<3	-	-	-	-	-		-	-	-
2-Chlorotoluene	<3	-	-	-	-	-		-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-		-	-	-
4-Chlorotoluene	<3	-	-	-	-	-		-	-	-
tert-Butylbenzene	<3	-	-	-	-	-		-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-		-	-	-
sec-Butylbenzene	<3	-	-	-	-	-		-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-		-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-		-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-		-	-	-
n-Butylbenzene	<3	-	-	-	-	-		-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-		-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-		-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-		-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-		-	-	-
Naphthalene	<2	-	-	-	-	-		-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-		-	-	-
Total VOCs	**	11,126	4,046	12,903	6,700	6,602		905	176	8,115

Thought to have been lost beneath new floor and until relocated replaced by BH913

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building								
		BH919 - Source Zone 4R								
Monitoring date		Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	**3,460**	172	429.8	906	874	1,550	***6,920***	***7,700***	***12,800***
Bromomethane	<1	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	52	7	21	56	64	62	35	81	62
Dichloromethane	<3	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	280	35	129	358	261	194	76	173	182
1,1-Dichloroethane	<3	-	-	-	3	-	-	-	-	-
cis- DCE	<3	93,333	-	45,838	98,162	67,400	101,000	99,100	107,000	73,100
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-
Chloroform	<2	11	-	-	7	5	5	-	2	3
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	0.9	1
TCE	<3	17,296	-	4,728	5,834	8,210	2,540	4,920	5,800	8,570
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
Toluene	<2	9	-	2	4	6	3.6	2.4	-	6
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	10	11	-	3	8	9
PCE	<3	12	6	5	4	4	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	14	-	1	3	4.1	1.7	-	1.6	1.2
p/m-Xylene	<3	13	-	-	5	4	2	-	2	2
o-Xylene	<2	16	3	3	10	13.1	6.5	2.3	6.7	5.3
Styrene	<2	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	10	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	4	-	-	8	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	6	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Total VOCs	**	114,500	223	51,157	105,376	76,866	105,365	111,059	120,775	94,742

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building								
		BH922 - Source Zone 4R								
Monitoring date		Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	1,380	741	799.1	823	***5,200***	***27,100***	***78,500***	***10,000***	***4,480***
Bromomethane	<1	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	486	187	240	187	365	207	36	23	4
Dichloromethane	<3	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	1,068	491	635	517	843	525	74	4	-
1,1-Dichloroethane	<3	24	13	13	9	17	18	13	6	-
cis- DCE	<3	36,637	***153,000***	29,628	84,244	***150,000***	***185,000***	98,300	9,480	3720
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-
Chloroform	<2	8	-	3	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	18	-	-	6	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-
Benzene	<1	3	1	-	1	1.8	-	1.4	1.4	0.5
TCE	<3	19,067	***735,000***	***116,207***	33,973	282	15	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
Toluene	<2	5	5	5	3	3.4	5.1	14.2	-	59
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	20	20	21	8	-	-	-	-	-
PCE	<3	22	17	30	9	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Total VOCs	**	58,738	889,475	147,581	119,780	156,712	212,870	176,939	19,514	8,264

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building							
		BH925 - Source Zone 3R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	Unable to Access Currently Within Demolition Area	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-		-	-
Chloromethane	<3	-	-	-	-	-		-	-
Vinyl Chloride	<<2	51	11	4	12	6		10	8.9
Bromomethane	<1	-	-	-	-	-		-	-
Chloroethane	<3	-	-	-	-	-		-	-
Trichlorofluoromethane	<3	-	-	-	-	-		-	-
1,1-Dichloroethene	<3	13	4	3	5	4		7	6
Dichloromethane	<3	-	-	-	-	-		-	-
trans-1-2-Dichloroethene	<3	36	8	9	11	11		32	22
1,1-Dichloroethane	<3	-	-	-	-	-		-	-
cis- DCE	<3	7,000	4,052	4,438	1,580	3,180		10,800	5,670
2,2-Dichloropropane	<1	-	-	-	-	-		-	-
Bromochloromethane	<2	-	-	-	-	-		-	-
Chloroform	<2	7	2	3	-	-		11	6
1,1,1-Trichloroethane	<2	-	-	-	-	-		-	-
1,1-Dichloropropene	<3	-	-	-	-	-		-	-
Carbon tetrachloride	<2	-	-	-	-	-		-	-
1,2-Dichloroethane	<2	-	-	-	-	-		-	-
Benzene	<1	-	-	-	-	-		1	0.7
TCE	<3	4,000	3,157	4,281	3,170	2,800		12,700	9,530
1,2-Dichloropropane	<2	-	-	-	-	-		-	-
Dibromomethane	<3	-	-	-	-	-		-	-
Bromodichloromethane	<2	-	-	-	-	-		-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-		-	-
Toluene	<2	-	-	-	-	-		-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-		-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-		-	-
PCE	<3	7	6	5	10	6		9	8
1,3-Dichloropropane	<2	-	-	-	-	-		-	-
Dibromochloromethane	<2	-	-	-	-	-		-	-
1,2-Dibromoethane	<2	-	-	-	-	-		-	-
Chlorobenzene	<2	-	-	-	-	-		-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-		-	-
Ethylbenzene	<2	-	-	-	-	-		-	-
p/m-Xylene	<3	-	-	-	-	-		-	-
o-Xylene	<2	-	-	-	-	-		-	-
Styrene	<2	-	-	-	-	-		-	-
Bromoform	<2	-	-	-	-	-		-	-
Isopropylbenzene	<3	-	-	-	-	-		-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-		-	-
Bromobenzene	<2	-	-	-	-	-		-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-		-	-
Propylbenzene	<3	-	-	-	-	-		-	-
2-Chlorotoluene	<3	-	-	-	-	-		-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-		-	-
4-Chlorotoluene	<3	-	-	-	-	-		-	-
tert-Butylbenzene	<3	-	-	-	-	-		-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-		-	-
sec-Butylbenzene	<3	-	-	-	-	-		-	-
4-Isopropyltoluene	<3	-	-	-	-	-		-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-		-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-		-	-
n-Butylbenzene	<3	-	-	-	-	-		-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-		-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-		-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-		-	-
Hexachlorobutadiene	<3	-	-	-	-	-		-	-
Naphthalene	<2	-	-	-	-	-		-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-		-	-
Total VOCs	**	11,114	7,240	8,743	4,788	6,007		23,570	15,252

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building							
		RSW7001S - Source Zone 4R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	-	***11,892***	1,073	21.1	237	-	0.5	-
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	20	23	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	28	17	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	7,000	16,548	948	84	-	-	3	-
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	102	15	-	4	-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	2.6	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	0.5	-	-	-	-
p/m-Xylene	<3	-	-	-	1	-	-	-	-
o-Xylene	<2	-	-	-	0.9	-	-	0.7	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	7,150	28,495	2,021	114	237	-	4	-

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building							
		RSW7002S - Source Zone 4R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	278	2,308	2,501	***3,450***	***3,510***	2,040	2,730	1,930
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	14	32	31	44	54	54	59	35
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	18	50	38	40	26	15	10	6
1,1-Dichloroethane	<3	-	-	-	-	-	3	-	-
cis- DCE	<3	2,000	9,725	10,653	11,700	11,000	6,950	7,070	4,220
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	-	890	621	533	80	11	27	29
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	46	9	-	11	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	3	-	-	-	-	-
p/m-Xylene	<3	-	-	13	-	-	-	-	-
o-Xylene	<2	-	-	10	-	-	-	0.6	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	2,356	13,014	13,871	15,778	14,670	9,073	9,897	6,220

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building							
		RSW7003S - Source Zone 4R* and 5*							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	91	240	6	-	-	-	-	2
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	33	82	10	-	-	-	-	57
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	50	14	-	-	-	-	-	25
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	174	336	16	-	-	-	-	84

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Production Building							
		RSW7004S - Source Zone 4R*							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	523	603	1,322	35.6	6.5	40.2	3.2	8.5
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	4	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	834	399	1,188	182	-	85	-	22
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	11	15	-	-	-	-	-	10
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	4
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	1,372	1,017	2,510	218	7	125	3	

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard										
		BH114A - Source Zone 4R* and 6R*										
Monitoring date		Mar-10	Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	-	-	-	-	-	7	17.9	-	-	0.2	0.4
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	-	-	-	-	-	48	15	-	-	-	-
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-	-	-
TCE	<3	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	-	-	-	-	-	55	33	-	-	-	0.4

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard										
		BH204AS - Source Zone 7R										
Monitoring date		Mar-10	Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-		-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-		-	-	-	-
Chloromethane	<3	-	-	-	-	-	-		-	-	-	-
Vinyl Chloride	<<2	**27,729**	**24,408**	**23,108**	**20,000**	**89,795**	**30,011**		**20,300**	**18,300**	**5,980**	**9,160**
Bromomethane	<1	-	-	-	-	-	-		-	-	-	-
Chloroethane	<3	-	-	-	-	-	-		-	-	-	3
Trichlorofluoromethane	<3	-	-	-	-	-	-		-	-	-	-
1,1-Dichloroethene	<3	97	194	108	68	56	64		35	21	9	7
Dichloromethane	<3	-	-	-	-	-	-		-	-	-	-
trans-1-2-Dichloroethene	<3	298	510	352	138	122	121		40	17	4	5
1,1-Dichloroethane	<3	-	-	31	24	34	29		17	12	12	10
cis- DCE	<3	63,259	**45,588**	-	71,000	96,085	54,054		29,300	10,500	7,380	6,100
2,2-Dichloropropane	<1	-	-	-	-	-	-		-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-		-	-	-	-
Chloroform	<2	-	-	-	-	-	-		-	-	-	-
1,1,1-Trichloroethane	<2	-	-	11	-	7	-		-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-		-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-		-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-		-	-	-	-
Benzene	<1	4	8	5	2	4	5		4	2.9	2.8	3
TCE	<3	4,424	28,615	993	509	-	26		-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-		-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-		-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-		-	-	-	-
cis-1-3-Dichloropropene	<2	-	8	-	-	-	-		-	-	-	-
Toluene	<2	-	-	5	4	5	8		7.7	5.1	11	7
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-		-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-		-	-	-	-
PCE	<3	15	34	10	10	-	-		-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-		-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-		-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-		-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-		-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-		-	-	-	-
Ethylbenzene	<2	-	9	4	4	3	6		4.4	9.2	28.2	33
p/m-Xylene	<3	**5**	19	-	4	6	9		8	7	8	7
o-Xylene	<2	-	8	2	3	4	4		3.7	2.9	3.8	2.3
Styrene	<2	-	-	-	-	-	-		-	-	-	-
Bromoform	<2	-	-	-	-	-	-		-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-		-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-		-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-		-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-		-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-		-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-		-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-		-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-		-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-		-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	3		-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-		-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-		-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-		-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-		-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-		-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-		-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-		-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-		-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-		-	-	-	-
Naphthalene	<2	-	-	-	-	-	-		-	-	5	-
1,2,3-Trichlorobenzene	<3	-		-	-	-	-		-	-	-	-
Total VOCs	**	95,831	99,401	24,629	91,766	186,122	84,339		49,720	28,877	13,444	15,337

Sample contained NAPL, unable to analyse

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard									
		BH402 - Source Zone 4R									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	57	24	-	**17,919**	**8,733**	**6,960**	2,070	1,340	1,580	505
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	16	4	12	13	7	8	9	-	10	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	12	98	31	11	6	7	-	9	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	438	6,169	3,000	31,676	18,160	11,300	5,030	1,900	6,720	19,900
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-	-
TCE	<3	637	1,415	149	-	9	23	329	-	91	5
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
PCE	<3	10,255	8,591	356	5	11	570	5,700	4	352	18
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	11,403	16,215	3,615	49,644	26,931	18,867	13,145	3,244	8,762	20,428

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard								
		BH406 - Source Zone 6								
Monitoring date		Apr-10	Baseline Monitoring March 2011	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	7	9	9.1	29	-	2.6	2.4	2	14
Bromomethane	<1	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-
cis- DCE	<3	12	9	14	24	-	-	4	5	5
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-
TCE	<3	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-
PCE	<3	21	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Total VOCs	**	40	18	23	53	-	3	6	7	19

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

March 2011 baseline data used for BH406. BH406 was added to the selected monitoring well set after BH400, part of the original baseline well set, was lost during the South Yard car park redevelopment works.

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard								
		BH923 - Source Zone 4R								
Monitoring date		Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	9	-	-	28	11.1	-	-	-	0.3
Bromomethane	<1	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-
cis- DCE	<3	42	5	-	106	41	-	-	-	-
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-
TCE	<3	-	-	72	-	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-
Total VOCs	**	51	5	72	134	52	-	-	-	-

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSA(
Bold	Exceeds SSA(
Italic	Exceeds SSA(

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard							
		RSW2006S - Source Zone 7R*							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	83	157	-	136	88.7	60.5	58.4	51.4
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	7	3	-	3	3	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	6,000	850	1,149	723	709	312	297	243
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	56	18	13	14	23	11	18	13
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	6,146	1,028	1,162	876	824	384	373	307

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard							
		RSW2007S - Source Zone 7R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	120	55	4	15.9	13.3	25.7	24.9	183
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	197	66	4	25	74	152	45	236
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	-	-	-	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	3.1	-	8	186
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	317	121	8	41	90	-	78	605

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard							
		RSW2008S - Source Zone 7R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	12	2	162	**4,870**	37.9	102	35.1	53
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	4	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	4	18	-	13	-	4	3	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	143	6,248	401	2,840	73	154	70	18
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	57	4	-	-	-	6	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	3	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	0.7	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	219	6,276	563	7,724	111	266	108	71

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard							
		RSW2009S - Source Zone 7R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	Not Accessible due to construction works	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-		-	-	-
Chloromethane	<3	-	-	-	-		-	-	-
Vinyl Chloride	<<2	430	78	1,041	419		6.5	8.5	0.4
Bromomethane	<1	-	-	-	-		-	-	-
Chloroethane	<3	-	-	-	-		-	-	6
Trichlorofluoromethane	<3	-	-	-	-		-	-	-
1,1-Dichloroethene	<3	-	-	-	-		-	-	-
Dichloromethane	<3	-	-	-	-		-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-		-	-	-
1,1-Dichloroethane	<3	6	15	10	-		-	-	-
cis- DCE	<3	409	220	778	2,460		19	19	3
2,2-Dichloropropane	<1	-	-	-	-		-	-	-
Bromochloromethane	<2	-	-	-	-		-	-	-
Chloroform	<2	-	-	-	-		-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-		-	-	-
1,1-Dichloropropene	<3	-	-	-	-		-	-	-
Carbon tetrachloride	<2	-	-	-	-		-	-	-
1,2-Dichloroethane	<2	-	-	-	-		-	-	-
Benzene	<1	-	-	-	59		-	-	-
TCE	<3	4	-	-	-		-	-	-
1,2-Dichloropropane	<2	-	-	-	-		-	-	-
Dibromomethane	<3	-	-	-	-		-	-	-
Bromodichloromethane	<2	-	-	-	-		-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-		-	-	-
Toluene	<2	-	-	14	2,390		602	417	201
trans-1-3-Dichloropropene	<2	-	-	-	-		-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-		-	-	-
PCE	<3	-	-	-	-		-	-	-
1,3-Dichloropropane	<2	-	-	-	-		-	-	-
Dibromochloromethane	<2	-	-	-	-		-	-	-
1,2-Dibromoethane	<2	-	-	-	-		-	-	-
Chlorobenzene	<2	-	-	-	-		-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-		-	-	-
Ethylbenzene	<2	-	-	-	329		-	1.1	-
p/m-Xylene	<3	-	-	-	1,240		2	3	1
o-Xylene	<2	-	-	-	1,080		1.5	2	0.9
Styrene	<2	-	-	-	-		-	-	-
Bromoform	<2	-	-	-	-		-	-	-
Isopropylbenzene	<3	-	-	-	263		-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-		-	-	-
Bromobenzene	<2	-	-	-	-		-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-		-	-	-
Propylbenzene	<3	-	-	-	372		-	-	-
2-Chlorotoluene	<3	-	-	-	-		-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	1,070		-	-	-
4-Chlorotoluene	<3	-	-	-	-		-	-	-
tert-Butylbenzene	<3	-	-	-	-		-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	1,330		-	-	-
sec-Butylbenzene	<3	-	-	-	542		-	-	-
4-Isopropyltoluene	<3	-	-	-	204		-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-		-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-		-	-	-
n-Butylbenzene	<3	-	-	-	721		-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-		-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-		-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-		-	-	-
Hexachlorobutadiene	<3	-	-	-	-		-	-	-
Naphthalene	<2	-	-	-	-		-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-		-	-	-
Total VOCs	**	849	313	1,843	12,479		631	451	212

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard							
		RSW2010S - Source Zone 7R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	80	-	46.4	13.8	40	18.1	68.5	54.2
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	179	-	19	10	20	18	39	93
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	0.8
TCE	<3	18	-	-	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	277	-	65	24	60	36	108	148

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard							
		RSW2011S - Source Zone 7R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<<2	3.0	36.9	10.0	36.0	2,740	767	323	1,150
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-	-	10	3	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	4	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	1,438	798	461	477	337	296	110	149
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	770	27	10	5	-	-	-	15
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	21	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	2,236	862	481	518	3,087	1,066	433	1,314

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - South Yard							
		RSW2012S - Source Zone 7R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-		-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-		-	-	-	-	-	-
Chloromethane	<3	-		-	-	-	-	-	-
Vinyl Chloride	<<2	**5,000**		253	175	10.3	9.9	406	6.9
Bromomethane	<1	-		-	-	-	-	-	-
Chloroethane	<3	-		-	-	-	-	-	-
Trichlorofluoromethane	<3	-		-	-	-	-	-	-
1,1-Dichloroethene	<3	28		-	-	-	-	-	-
Dichloromethane	<3	-		-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	48		-	-	-	-	-	-
1,1-Dichloroethane	<3	4		-	-	-	-	-	-
cis- DCE	<3	31,000		228	195	21	37	847	-
2,2-Dichloropropane	<1	-		-	-	-	-	-	-
Bromochloromethane	<2	-		-	-	-	-	-	-
Chloroform	<2	2		-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-		-	-	-	-	-	-
1,1-Dichloropropene	<3	-		-	-	-	-	-	-
Carbon tetrachloride	<2	-		-	-	-	-	-	-
1,2-Dichloroethane	<2	-		-	-	-	-	-	-
Benzene	<1	-		-	-	-	-	-	-
TCE	<3	25,000		-	-	-	-	-	6
1,2-Dichloropropane	<2	-		-	-	-	-	-	-
Dibromomethane	<3	-		-	-	-	-	-	-
Bromodichloromethane	<2	-		-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-		-	-	-	-	-	-
Toluene	<2	-		2.3	174	917	468	133	10
trans-1-3-Dichloropropene	<2	-		-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-		-	-	-	-	-	-
PCE	<3	5	LNAPL only in well, no groundwater sample collection possible	-	-	-	-	-	-
1,3-Dichloropropane	<2	-		-	-	-	-	-	-
Dibromochloromethane	<2	-		-	-	-	-	-	-
1,2-Dibromoethane	<2	-		-	-	-	-	-	-
Chlorobenzene	<2	-		-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-		-	-	-	-	-	-
Ethylbenzene	<2	-		-	-	-	-	1.4	-
p/m-Xylene	<3	-		-	-	-	-	3	-
o-Xylene	<2	-		-	-	-	-	1.8	-
Styrene	<2	-		-	-	-	-	-	-
Bromoform	<2	-		-	-	-	-	-	-
Isopropylbenzene	<3	-		-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-		-	-	-	-	-	-
Bromobenzene	<2	-		-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-		-	-	-	-	-	-
Propylbenzene	<3	-		-	-	-	-	-	-
2-Chlorotoluene	<3	-		-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-		-	-	-	-	-	-
4-Chlorotoluene	<3	-		-	-	-	-	-	-
tert-Butylbenzene	<3	-		-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-		-	-	-	-	-	-
sec-Butylbenzene	<3	-		-	-	-	-	-	-
4-Isopropyltoluene	<3	-		-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-		-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-		-	-	-	-	-	-
n-Butylbenzene	<3	-		-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-		-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-		-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-		-	-	-	-	-	-
Hexachlorobutadiene	<3	-		-	-	-	-	-	-
Naphthalene	<2	-		-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-		-	-	-	-		-
Total VOCs	**	61,087		483	544	948	515	1,392	23

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Off site wells									
		BHOS409 - Source 7*									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-		-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-		-	-	-	-	-	-
Chloromethane	<3	-	-	-		-	-	-	-	-	-
Vinyl Chloride	<<2	-	-	-		-	-	-	-	-	-
Bromomethane	<1	-	-	-		-	-	-	-	-	-
Chloroethane	<3	-	-	-		-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-		-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-		-	-	-	-	-	-
Dichloromethane	<3	-	-	-		-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-		-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-		-	-	-	-	-	-
cis- DCE	<3	-	3	4		-	-	-	-	-	-
2,2-Dichloropropane	<1	-	-	-		-	-	-	-	-	-
Bromochloromethane	<2	-	-	-		-	-	-	-	-	-
Chloroform	<2	-	-	-		-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-		-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-		-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-		-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-		-	-	-	-	-	-
Benzene	<1	-	-	-		-	-	-	-	-	-
TCE	<3	-	3	4		-	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-		-	-	-	-	-	-
Dibromomethane	<3	-	-	-		-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-		-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-		-	-	-	-	-	-
Toluene	<2	-	-	-		-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-		-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-		-	-	-	-	-	-
PCE	<3	-	-	-		-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-		-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	Not Sampled	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-		-	-	-	-	-	-
Chlorobenzene	<2	-	-	-		-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-		-	-	-	-	-	-
Ethylbenzene	<2	-	-	-		-	-	-	-	-	-
p/m-Xylene	<3	-	-	-		-	-	-	-	-	-
o-Xylene	<2	-	-	-		-	-	-	-	-	-
Styrene	<2	-	-	-		-	-	-	-	-	-
Bromoform	<2	-	-	-		-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-		-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-		-	-	-	-	-	-
Bromobenzene	<2	-	-	-		-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-		-	-	-	-	-	-
Propylbenzene	<3	-	-	-		-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-		-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-		-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-		-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-		-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-		-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-		-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-		-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-		-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-		-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-		-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-		-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-		-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-		-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-		-	-	-	-	-	-
Naphthalene	<2	-	-	-		-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-		-	-	-	-	-	-
Total VOCs	**	-	6	8		-	-	-	-	-	-

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Off site wells									
		BHOS410									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-		-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-		-	-	-	-	-	-
Chloromethane	<3	-	-	-		-	-	-	-	-	-
Vinyl Chloride	<<2	-	-	-		0.4	-	-	-	-	-
Bromomethane	<1	-	-	-		-	-	-	-	-	-
Chloroethane	<3	-	-	-		-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-		-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-		-	-	-	-	-	-
Dichloromethane	<3	-	-	-		-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-		-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-		-	-	-	-	-	-
cis- DCE	<3	-	20	-		3	-	-	-	-	-
2,2-Dichloropropane	<1	-	-	-		-	-	-	-	-	-
Bromochloromethane	<2	-	-	-		-	-	-	-	-	-
Chloroform	<2	-	-	-		-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-		-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-		-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-		-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-		-	-	-	-	-	-
Benzene	<1	-	-	-		-	-	-	-	-	-
TCE	<3	-	5	-		-	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-		-	-	-	-	-	-
Dibromomethane	<3	-	-	-		-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-		-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-		-	-	-	-	-	-
Toluene	<2	-	-	-		-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-		-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-		-	-	-	-	-	-
PCE	<3	-	-	-		-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-		-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	Not Sampled	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-		-	-	-	-	-	-
Chlorobenzene	<2	-	-	-		-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-		-	-	-	-	-	-
Ethylbenzene	<2	-	-	-		-	-	-	-	-	-
p/m-Xylene	<3	-	-	-		-	-	-	-	-	-
o-Xylene	<2	-	-	-		-	-	-	-	-	-
Styrene	<2	-	-	-		-	-	-	-	-	-
Bromoform	<2	-	-	-		-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-		-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-		-	-	-	-	-	-
Bromobenzene	<2	-	-	-		-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-		-	-	-	-	-	-
Propylbenzene	<3	-	-	-		-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-		-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-		-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-		-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-		-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-		-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-		-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-		-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-		-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-		-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-		-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-		-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-		-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-		-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-		-	-	-	-	-	-
Naphthalene	<2	-	-	-		-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-		-	-	-	-	-	-
Total VOCs	**	-	25	-		3	-	-	-	-	

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Off site wells									
		BHOS412 - Source 7*									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-		-		-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-		-		-	-	-	-
Chloromethane	<3	-	-	-		-		-	-	-	-
Vinyl Chloride	<<2	-	-	-		-		-	-	-	-
Bromomethane	<1	-	-	-		-		-	-	-	-
Chloroethane	<3	-	-	-		-		-	-	-	-
Trichlorofluoromethane	<3	-	-	-		-		-	-	-	-
1,1-Dichloroethene	<3	-	-	-		-		-	-	-	-
Dichloromethane	<3	-	-	-		-		-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-		-		-	-	-	-
1,1-Dichloroethane	<3	-	-	-		-		-	-	-	-
cis- DCE	<3	-	4	-		-		-	-	-	-
2,2-Dichloropropane	<1	-	-	-		-		-	-	-	-
Bromochloromethane	<2	-	-	-		-		-	-	-	-
Chloroform	<2	-	-	-		-		-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-		-		-	-	-	-
1,1-Dichloropropene	<3	-	-	-		-		-	-	-	-
Carbon tetrachloride	<2	-	-	-		-		-	-	-	-
1,2-Dichloroethane	<2	-	-	-		-		-	-	-	-
Benzene	<1	-	-	-		-		-	-	-	-
TCE	<3	-	-	-		-		-	-	-	-
1,2-Dichloropropane	<2	-	-	-		-		-	-	-	-
Dibromomethane	<3	-	-	-		-		-	-	-	-
Bromodichloromethane	<2	-	-	-		-		-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-		-		-	-	-	-
Toluene	<2	-	-	-		-		-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-		-		-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-		-		-	-	-	-
PCE	<3	-	-	-		-		-	-	-	-
1,3-Dichloropropane	<2	-	-	-		-		-	-	-	-
Dibromochloromethane	<2	-	-	-	Not Sampled	-	Well could not be located	-	-	-	-
1,2-Dibromoethane	<2	-	-	-		-		-	-	-	-
Chlorobenzene	<2	-	-	-		-		-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-		-		-	-	-	-
Ethylbenzene	<2	-	-	-		-		-	-	-	-
p/m-Xylene	<3	-	-	-		-		-	-	-	-
o-Xylene	<2	-	-	-		-		-	-	-	-
Styrene	<2	-	-	-		-		-	-	-	-
Bromoform	<2	-	-	-		-		-	-	-	-
Isopropylbenzene	<3	-	-	-		-		-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-	-		-		-	-	-	-
Bromobenzene	<2	-	-	-		-		-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-		-		-	-	-	-
Propylbenzene	<3	-	-	-		-		-	-	-	-
2-Chlorotoluene	<3	-	-	-		-		-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-		-		-	-	-	-
4-Chlorotoluene	<3	-	-	-		-		-	-	-	-
tert-Butylbenzene	<3	-	-	-		-		-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-		-		-	-	-	-
sec-Butylbenzene	<3	-	-	-		-		-	-	-	-
4-Isopropyltoluene	<3	-	-	-		-		-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-		-		-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-		-		-	-	-	-
n-Butylbenzene	<3	-	-	-		-		-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-		-		-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-		-		-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-		-		-	-	-	-
Hexachlorobutadiene	<3	-	-	-		-		-	-	-	-
Naphthalene	<2	-	-	-		-		-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-		-		-	-	-	-
Total VOCs	**	-	4	-		-		-	-	-	-

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)

Sample Identity	Laboratory Method Detection Limit	Alluvium - Off site wells								
		BHOS414 - Source 7*								
Monitoring date		Apr-10	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-		-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-		-	-	-	-	-	-
Chloromethane	<3	-	-		-	-	-	-	-	-
Vinyl Chloride	<<2	-	-		0.6	1.1	-	1.1	1	0.6
Bromomethane	<1	-	-		-	-	-	-	-	-
Chloroethane	<3	-	-		-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-		-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-		-	-	-	-	-	-
Dichloromethane	<3	-	-		-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-		3	-	-	-	-	-
1,1-Dichloroethane	<3	-	-		-	-	-	-	-	-
cis- DCE	<3	28	789		494	561	570	705	766	1,160
2,2-Dichloropropane	<1	-	-		-	-	-	-	-	-
Bromochloromethane	<2	-	-		-	-	-	-	-	-
Chloroform	<2	-	-		-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-		-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-		-	-	-	-	-	-
Carbon tetrachloride	<2	-	-		-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-		-	-	-	-	-	-
Benzene	<1	-	-		-	-	-	-	-	-
TCE	<3	13	174		191	358	323	333	266	131
1,2-Dichloropropane	<2	-	-		-	-	-	-	-	-
Dibromomethane	<3	-	-		-	-	-	-	-	-
Bromodichloromethane	<2	-	-		-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-		-	-	-	-	-	-
Toluene	<2	-	-		-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-		-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-		-	-	-	-	-	-
PCE	<3	-	-		-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-		-	-	-	-	-	-
Dibromochloromethane	<2	-	-	Not Sampled	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-		-	-	-	-	-	-
Chlorobenzene	<2	-	-		-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-		-	-	-	-	-	-
Ethylbenzene	<2	-	-		-	-	-	-	-	-
p/m-Xylene	<3	-	-		-	-	-	-	-	-
o-Xylene	<2	-	-		-	-	-	-	-	-
Styrene	<2	-	-		-	-	-	-	-	-
Bromoform	<2	-	-		-	-	-	-	-	-
Isopropylbenzene	<3	-	-		-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	<4	-	-		-	-	-	-	-	-
Bromobenzene	<2	-	-		-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-		-	-	-	-	-	-
Propylbenzene	<3	-	-		-	-	-	-	-	-
2-Chlorotoluene	<3	-	-		-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-		-	-	-	-	-	-
4-Chlorotoluene	<3	-	-		-	-	-	-	-	-
tert-Butylbenzene	<3	-	-		-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-		-	-	-	-	-	-
sec-Butylbenzene	<3	-	-		-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-		-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-		-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-		-	-	-	-	-	-
n-Butylbenzene	<3	-	-		-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-		-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-		-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-		-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-		-	-	-	-	-	-
Naphthalene	<2	-	-		-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-		-	-	-	-	-	-
Total VOCs	**	41	963		689	920	893	1,039	1,033	1,292

Notes:

	Pre -Remediat
-	Below MDL
MDL : Method detection lir	Method Detect
VOC	Volatile Organi
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Human Health SSAC			Raglan Mudstone Formation - Production Building									
					BH301S - Source Zone 3R									
Monitoring date		Commercial Worker	Playing Field	Off Site Commercial Worker	Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2				-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1				-	-	-	-	-	-	-	-	-	-
Chloromethane	<3				-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	3,500	2,800	1,300	7	7	141	503	10	65.4	153	247	210	376
Bromomethane	<1				-	-	-	-	-	-	-	-	-	-
Chloroethane	<3				-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3				-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	580,000	470,000	220,000	19	-	-	-	-	-	-	-	-	-
Dichloromethane	<3				-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	1,900,000	1,200,000	290,000	4	3	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	2,500,000	ND	580,000	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	180,000	130,000	42,000	758	614	172	323	12	46	275	527	125	244
2,2-Dichloropropane	<1				-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2				-	-	-	-	-	-	-	-	-	-
Chloroform	<2				-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	ND	ND	ND	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3				-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2				-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2				-	-	-	-	-	-	-	-	-	-
Benzene	<1	270,000	170,000	36,000	-	-	-	-	-	-	-	-	-	-
TCE	<3	120,000	93,000	37,000	3566	2650	-	-	4	39	11	12	3	4
1,2-Dichloropropane	<2					-	-	-	-	-	-	-	-	-
Dibromomethane	<3					-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2				-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2				-	-	-	-	-	-	-	-	-	-
Toluene	<2	ND	ND	ND	-	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2				-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	21,000	13,000	3,000	-	-	-	-	-	-	-	-	-	-
PCE	<3	ND	ND	ND	9	8	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2				-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2					-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2				-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2				-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2				-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	ND	ND	ND	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	ND	ND	ND	-	-	-	-	-	-	-	-	-	-
o-Xylene	<2	ND	ND	ND	-	-	-	-	-	-	-	-	-	-
Styrene	<2				-	-	-	-	-	-	-	-	-	-
Bromoform	<2				-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3				-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4				-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2				-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3				-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3				-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3				-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3				-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3				-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3				-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3				-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3				-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3				-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3				-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3				-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3				-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3				-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2				-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3				-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3				-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	ND	ND	ND	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3				-	-	-	-	-	-	-	-	-	-
Total VOCs	**				4,363	3,282	313	826	26	150	439	786	338	624

Notes:

	Pre -Remediation Sample
-	Below MDL
MDL : Method detection limit	Method Detection Limit
VOC	Volatile Organic Compounds
underline	Exceeds SSAC off site Commercial Worker (applies South Yard only)
Bold	Exceeds SSAC on site Commercial Worker
Italic	Exceeds SSAC on site Commercial Worker / Playing Field User

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - Production Building									
		BH301D - Source Zone 3R									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	**3**	10	55	485	57.7	105	83.2	113	173	212
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	18	-	-	-	-	5	5	11	6	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	4	3	-	-	4	6	7	8	8	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	653	611	943	370	1,197	972	914	988	1,730	942
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-	-
TCE	<3	2,890	4,068	-	-	157	1,350	1,020	1,090	35	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3		-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
PCE	<3	8	6	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2		-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	3,576	4,698	998	855	1,416	2,438	2,029	2,210	1,952	1,154

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detecti
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - Production Building									
		BH303S - Source Zone 5									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	228	163	225	132	211	262	126	150	95.3	98.7
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	23	6	7	10	8	7	9	7	10	3
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	8	-	-	-	-	-	-	-	3	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	2,855	613	971	903	869	641	906	621	1,160	733
2,2-Dichloropropane	<1		-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-	-
TCE	<3	243	4	-	35	16	-	31	10	86	72
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
Toluene	<2	9	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	3,366	786	1,203	1,080	1,104	910	1,072	788	1,354	907

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detecti
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - Production Building									
		BH303D - Source Zone 5									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	50	140	49	321	154	346	104	150	67.2	12.4
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	17	3	-	4	4	7	-	3	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	804	442	47	629	712	549	155	117	68	6
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	4	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-	-
TCE	<3	66	-	-	-	6	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	941	585	96	954	876	902	259	270	135	18

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - Production Building							
		RSW7001D - Source Zone 4R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	798	429	280	172	70.1	83.3	1,060	158
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	21	20	19	34	29	38	34	24
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	38	32	28	41	27	29	21	11
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	-	11,245	11,571	8,730	11,500	12,200	8,680	6,840
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	79	1,539	1,608	989	1,720	1,060	18	896
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	1.1	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	936	13,265	13,506	9,967	13,346	13,410	9,813	7,929

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
<u>underline</u>	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - Production Building							
		RSW7002D - Source Zone 4R							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	480	***3,883***	2,242	***3,530***	***3,300***	2,580	1,970	1,950
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	14	13	8	20	38	57	23	16
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	22	20	-	6	7	9	-	-
1,1-Dichloroethane	<3	-	-	-	-	3	-	-	-
cis- DCE	<3	3,000	4,710	4,114	6,580	10,100	8,800	3,370	2,410
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	-	40	-	6	5	3	-	7
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	24	6.1	5.5	-	7	7
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	2	-	-	1	-
o-Xylene	<2	-	-	-	3.4	2	-	1.2	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	3,516	8,666	6,388	10,154	13,461	11,449	5,372	4,390

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
<u>underline</u>	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - Production Building							
		RSW7003D - Source Zone 4R* and 5R*							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	92	67	52	36.8	33.5	26.6	62.8	34.8
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	-	16	12	16	15	17	15	10
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	10	7	8	8	7	6	5
1,1-Dichloroethane	<3	-	3	-	-	-	-	3	-
cis- DCE	<3	30	2,175	2,305	1,630	1,770	1,460	1,050	1,540
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	20	465	618	725	792	957	679	616
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	142	2,736	2,994	2,416	2,619	2,468	1,816	2,206

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
<u>underline</u>	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - Production Building							
		RSW7004D - Source Zone 4R* and 5R*							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	782	113	104	40.6	46.1	21.8	106	18.8
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	11	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	10	10	8	7	8	8	12	4
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	10	6	5	4	4	3	5	-
1,1-Dichloroethane	<3	5	4	-	3	3	-	4	-
cis- DCE	<3	17,000	1,650	1,827	919	1,390	1,030	1,330	1110
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	390	466	484	373	420	411	465	471
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	-	67	58	137	289	253	394	334
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	18,208	2,316	2,486	1,484	2,160	1,727	2,316	1,938

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard										
		BH204AD - Source Zone 7										
Monitoring date		Mar-10	Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	**20,882**	8,079	**14,625**	**10,000**	**13,663**	**9,657**	**5,690**	**9,460**	**7,990**	**5,240**	**5,170**
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	6	-	-	-	8	8	7	10	9
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	107	99	107	52	39	25	27	51	23	22	13
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	340	87	114	55	44	27	30	64	30	17	13
1,1-Dichloroethane	<3	-	-	20	16	19	13	11	17	12	14	9
cis- DCE	<3	39,708	25,112	-	48,000	57,357	25,483	31,800	48,400	23,500	17,000	7,070
2,2-Dichloropropane	<1	-		-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	12	9	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
Benzene	<1	4	-	-	-	1	-	0.8	1.4	0.8	1.1	0.8
TCE	<3	4,683	8,724	-	7,000	1,695	988	88	2,520	414	43	57
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-	-
Toluene	<2	3	-	-	-	-	-	0.7	1.3	1.2	6	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	7	-	-	-	-	-	-	-	-
PCE	<3	18	56	70	26	11	8	-	20	5	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	6	-	-	-	-	-	-	-	-	2	-
o-Xylene	<2	4	-	3	-	-	-	1.2	1.8	-	2.4	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	65,755	42,157	14,952	65,161	72,838	36,201	37,657	60,545	31,983	22,358	12,342

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard									
		BH205AD - Source Zone 6									
Monitoring date		Mar-10	Apr-10	Baseline Monitoring February 2011	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-		-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-		-	-	-	-	-	-
Chloromethane	<3	-	-	-		-	-	-	-	-	-
Vinyl Chloride	<2	10	-	-		0.4	39.8	3.9	4.2	2.2	1.7
Bromomethane	<1	-	-	-		-	-	-	-	-	-
Chloroethane	<3	-	-	-		-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-		-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-	-		3	4	6	3	3	-
Dichloromethane	<3	-	-	-		-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-	-		-	4	5	-	-	-
1,1-Dichloroethane	<3	-	-	-		-	-	-	-	-	-
cis- DCE	<3	2,084	-	1,515		1,435	2,700	2,220	1,150	996	1,390
2,2-Dichloropropane	<1	-	-	-		-	-	-	-	-	-
Bromochloromethane	<2	-	-	-		-	-	-	-	-	-
Chloroform	<2	-	-	-		-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-		-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-		-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-		-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-		-	-	-	-	-	-
Benzene	<1	-	-	-		-	-	-	-	-	-
TCE	<3	152	-	154		227	315	333	211	171	110
1,2-Dichloropropane	<2	-	-	-		-	-	-	-	-	-
Dibromomethane	<3	-	-	-		-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-		-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-		-	-	-	-	-	-
Toluene	<2	-	-	-		-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-		-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-		-	-	-	-	-	-
PCE	<3	67	-	69		59	99	92	71	54	39
1,3-Dichloropropane	<2	-	-	-		-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	Not Sampled	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-		-	-	-	-	-	-
Chlorobenzene	<2	-	-	-		-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-		-	-	-	-	-	-
Ethylbenzene	<2	-	-	-		-	-	-	-	0.7	-
p/m-Xylene	<3	-	-	-		-	-	-	-	-	-
o-Xylene	<2	-	-	-		-	-	-	-	-	-
Styrene	<2	-	-	-		-	-	-	-	-	-
Bromoform	<2	-	-	-		-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-		-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-		-	-	-	-	-	-
Bromobenzene	<2	-	-	-		-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-		-	-	-	-	-	-
Propylbenzene	<3	-	-	-		-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-		-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-		-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-		-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-		-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-		-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-		-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-		-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-		-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-		-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-		-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-		-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-		-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-		-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-		-	-	-	-	-	-
Naphthalene	<2	-	-	-		-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-		-	-	-	-	-	-
Total VOCs	**	2,313	-	1,738		1,724	3,162	2,660	1,439	1,227	1,541

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detecti
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard								
		BH304S - Source Zone 7								
Monitoring date		Apr-10	Baseline Monitoring February 2011	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-		-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-		-	-	-	-	-	-
Chloromethane	<3	-	-		-	-	-	-	-	-
Vinyl Chloride	<2	494	1,451		37	484	496	184	319	234
Bromomethane	<1	-	-		-	-	-	-	-	-
Chloroethane	<3	-	-		-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-		-	-	-	-	-	-
1,1-Dichloroethene	<3	32	30		-	5	4	-	4	4
Dichloromethane	<3	-	83		-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	22	61		-	9	5	-	5	-
1,1-Dichloroethane	<3	-	-		-	-	-	-	-	-
cis- DCE	<3	4,621	20,995		85	2,520	1,590	507	1,020	97
2,2-Dichloropropane	<1	-	-		-	-	-	-	-	-
Bromochloromethane	<2	-	-		-	-	-	-	-	-
Chloroform	<2	-	-		-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-		-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-		-	-	-	-	-	-
Carbon tetrachloride	<2	-	-		-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-		-	-	-	-	-	-
Benzene	<1	-	-		-	-	-	-	-	-
TCE	<3	7,849	14,868		39	47	13	4	21	4
1,2-Dichloropropane	<2	-	-		-	-	-	-	-	-
Dibromomethane	<3	-	-		-	-	-	-	-	-
Bromodichloromethane	<2	-	-		-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-		-	-	-	-	-	-
Toluene	<2	-	-		-	-	-	-	-	55
trans-1-3-Dichloropropene	<2	-	-		-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-		-	-	-	-	-	-
PCE	<3	2,547	2,547		33	14	-	-	4	-
1,3-Dichloropropane	<2	-	-		-	-	-	-	-	-
Dibromochloromethane	<2	-	-	Not Sampled	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-		-	-	-	-	-	-
Chlorobenzene	<2	-	-		-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-		-	-	-	-	-	-
Ethylbenzene	<2	-	-		-	-	-	-	-	-
p/m-Xylene	<3	-	-		-	-	-	-	-	-
o-Xylene	<2	-	-		-	-	-	-	-	-
Styrene	<2	-	-		-	-	-	-	-	-
Bromoform	<2	-	-		-	-	-	-	-	-
Isopropylbenzene	<3	-	-		-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-		-	-	-	-	-	-
Bromobenzene	<2	-	-		-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-		-	-	-	-	-	-
Propylbenzene	<3	-	-		-	-	-	-	-	-
2-Chlorotoluene	<3	-	-		-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-		-	-	-	-	-	-
4-Chlorotoluene	<3	-	-		-	-	-	-	-	-
tert-Butylbenzene	<3	-	-		-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-		-	-	-	-	-	-
sec-Butylbenzene	<3	-	-		-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-		-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-		-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-		-	-	-	-	-	-
n-Butylbenzene	<3	-	-		-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-		-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-		-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-		-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-		-	-	-	-	-	-
Naphthalene	<2	-	-		-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-		-	-	-	-	-	-
Total VOCs	**	15,565	40,035		194	3,079	2,108	695	1,373	394

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detecti
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard									
		BH304D - Source Zone 7									
Monitoring date		Apr-10	Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	564	1,417	484	1,008	97	92.3	8.4	118	352	15.2
Bromomethane	<1	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	35	30	18	6	5	-	13	10	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	23	60	35	21	8	5	12	13	5	4
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	5,236	15,240	12,550	7,732	1,778	104	2,310	2,190	896	10
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	4	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-	-	-
TCE	<3	9,154	9,299	9,075	-	26	-	912	215	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-	-	12
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	20	-	-	-	-	-	-	-
PCE	<3	4,090	3,177	1,488	-	-	-	136	30	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	19,102	29,227	23,670	8,767	1,914	201	3,391	2,576	1,253	41

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detecti
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard							
		RSW2006D - Source Zone 7*							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	161	-	186	172	92.7	86.5	81.9	76.4
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	5	-	-	-	-	-	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	8	8	-	3	-	-	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	-	-	-
cis- DCE	<3	6,000	1,484	814	782	623	223	396	235
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	7,000	-	-	3	10	-	5	5
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	446	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	-	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	13,620	1,492	1,000	960	726	310	483	

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard							
		RSW2007D - Source Zone 7*							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	416	**9,762**	**11,994**	**13,900**	**8,290**	**7,300**	**3,490**	**9,910**
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	13	19	15	10	14	17	7	6
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	16	83	40	37	45	79	35	27
1,1-Dichloroethane	<3	-	8	6	9	11	11	-	4
cis- DCE	<3	6,000	55,856	50,361	51,700	33,600	43,800	23,200	17,700
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	5	-	-	-	2	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	1	-	1	-	-	-	0.9
TCE	<3	17,000	14	86	5	4	3	-	3
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	1.2	16.9	49.5	109	131
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	1,803	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	2	1	4.9	5.4	5.5	2.3	3.3
p/m-Xylene	<3	-	6	6	14	18	17	6	9
o-Xylene	<2	6	13	14	21.4	26.2	24.3	9.4	8.7
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	25,254	65,764	62,528	65,704	42,031	51,306	26,861	27,803

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard							
		RSW2008D - Source Zone 7							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	226	18	**13,142**	217	270	**7,420**	**9,710**	706
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	11	16	11	-	-	8	3	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	11	70	15	5	5	22	13	18
1,1-Dichloroethane	<3	-	-	-	-	-	-	5	-
cis- DCE	<3	4,000	24,238	4,721	302	351	10,900	6,180	589
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	9,000	-	51	-	-	-	-	4
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	6.2	5	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-	-	-	-	-
PCE	<3	280	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	-	-	-	-	-	1.5	-	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	13,528	24,342	17,940	524	626	18,358	15,916	1,317

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard								Raglan Mudstone Formation - South Yard							
		RSW2009D - Source Zone 7								RSW2010D - Source Zone 7*							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	1,000	**5,245**	**3,300**	659		660	14.4	72.4	256	8	**2,687**	**4,300**	1,410	127	74	275
Bromomethane	<1	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-		-	-	3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	28	-	-	-		-	-	-	11	12	4	7	13	-	-	-
Dichloromethane	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	31	24	5	-		8	-	-	10	16	8	4	17	-	-	-
1,1-Dichloroethane	<3	4	4	7	8		8	-	-	-	-	-	-	-	-	-	-
cis- DCE	<3	17,000	8,176	1,464	605		837	19	-	17,000	11,757	2,389	4,370	3,810	205	186	285
2,2-Dichloropropane	<1	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	0.6		-	-	0.5	-	-	-	-	-	-	-	-
TCE	<3	33,000	-	-	-		-	-	-	34,000	5	18	8	-	-	4	-
1,2-Dichloropropane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	1.7		14.1	28	34	-	-	-	-	-	-	-	11
trans-1-3-Dichloropropene	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
PCE	<3	931	-	-	-		-	-	-	3,636	5	34	12	-	-	5	-
1,3-Dichloropropane	<2	-	-	-	-	Not accessible due to stockpiled aggregate	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-		-	0.8	0.6	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-		2	3	1	-	-	-	-	-	-	-	1
o-Xylene	<2	7	-	-	0.9		4.3	3.5	2.2	-	-	-	-	-	-	-	0.9
Styrene	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Total VOCs	**	52,001	13,449	4,776	1,275		1,533	69	114	54,913	11,803	5,140	8,701	5,250	332	269	573

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detecti
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard							
		RSW2011D - Source Zone 7							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	1,213	-	**2,830**	**4,700**	411	**27,700**	**3,760**	53
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	-	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	29	-	6	-	-	5	-	-
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	48	-	23	7	6	17	-	-
1,1-Dichloroethane	<3	-	-	-	-	-	3	-	-
cis- DCE	<3	18,478	212	9,638	5,420	1,870	15,900	1,400	18
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	4	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	13,704	155	-	-	-	-	-	-
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	2.7	6	-
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	17	-	-	-	-	-	-	-
PCE	<3	831	14	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	-	-
p/m-Xylene	<3	-	-	-	-	-	-	-	-
o-Xylene	<2	5	-	-	1.4	-	2.2	2	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	34,329	381	12,497	10,128	2,287	43,630	5,168	71

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
<u>underline</u>	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

Sample Identity	Laboratory Method Detection Limit	Raglan Mudstone Formation - South Yard							
		RSW2012D - Source Zone 7							
Monitoring date		Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-	-	-	-	-	-	-
Chloromethane	<3	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	915	**11,454**	**5,891**	944	808	481	257	**29,900**
Bromomethane	<1	-	-	-	-	-	-	-	-
Chloroethane	<3	3	-	-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-	-	-	-	-	-	-
1,1-Dichloroethene	<3	26	49	7	-	-	-	-	10
Dichloromethane	<3	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	25	45	8	4	17	6	-	8
1,1-Dichloroethane	<3	-	-	7	-	-	-	-	-
cis- DCE	<3	16,000	33,994	3,264	2,820	2,110	845	304	11,500
2,2-Dichloropropane	<1	-	-	-	-	-	-	-	-
Bromochloromethane	<2	-	-	-	-	-	-	-	-
Chloroform	<2	14	-	-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-	-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-	-	-	-	-	-	-
Carbon tetrachloride	<2	-	-	-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-	-	-	-	-	-	-
Benzene	<1	-	-	-	-	-	-	-	-
TCE	<3	15,000	478	8	5	-	-	-	10
1,2-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromomethane	<3	-	-	-	-	-	-	-	-
Bromodichloromethane	<2	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
Toluene	<2	-	-	-	-	-	2.8	345	13
trans-1-3-Dichloropropene	<2	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	<2	9	-	-	-	-	-	-	-
PCE	<3	-	-	-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-	-	-	-	-	-	-
Dibromochloromethane	<2	-	-	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-	-	-	-	-	-	-
Chlorobenzene	<2	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-	-	-	-	-	-	-
Ethylbenzene	<2	-	-	-	-	-	-	0.8	-
p/m-Xylene	<3	-	-	-	-	-	-	3	-
o-Xylene	<2	-	-	-	-	-	-	1.4	-
Styrene	<2	-	-	-	-	-	-	-	-
Bromoform	<2	-	-	-	-	-	-	-	-
Isopropylbenzene	<3	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-	-	-	-	-	-	-
Bromobenzene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-	-	-	-	-	-	-
Propylbenzene	<3	-	-	-	-	-	-	-	-
2-Chlorotoluene	<3	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
4-Chlorotoluene	<3	-	-	-	-	-	-	-	-
tert-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-	-	-	-	-	-	-
sec-Butylbenzene	<3	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
n-Butylbenzene	<3	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-	-	-	-	-	-	-
Naphthalene	<2	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-	-	-	-	-	-	-
Total VOCs	**	31,992	46,020	9,185	3,773	-	1,335	911	

Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detectic
VOC	Volatile Organic
<u>underline</u>	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

Appendix D.1

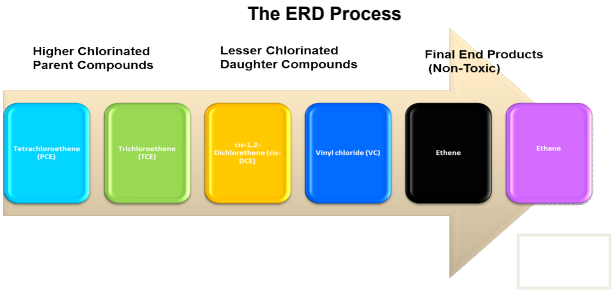
Concentrations of Volatile Organic Compounds Pre and During Remedial Measures (µg/l)
Zone 3 Raglan Marl Wells

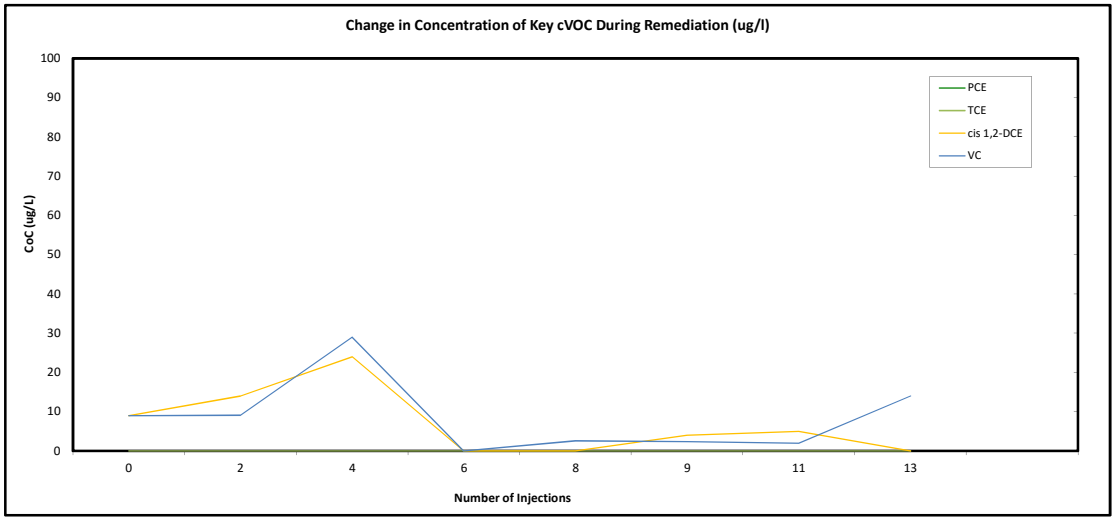
Sample Identity	Laboratory Method Detection Limit	Off Site Wells								
		BHOS307 - Source Zone 7*								
Monitoring date		Mar-11	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Dichlorodifluoromethane	<2	-	-		-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<1	-	-		-	-	-	-	-	-
Chloromethane	<3	-	-		-	-	-	-	-	-
Vinyl Chloride	<2	-	-		-	1.2	-	-	-	1.1
Bromomethane	<1	-	-		-	-	-	-	-	-
Chloroethane	<3	-	-		-	-	-	-	-	-
Trichlorofluoromethane	<3	-	-		-	-	-	-	-	-
1,1-Dichloroethene	<3	-	-		-	-	-	-	-	-
Dichloromethane	<3	-	-		-	-	-	-	-	-
trans-1-2-Dichloroethene	<3	-	-		-	-	-	-	-	-
1,1-Dichloroethane	<3	-	-		-	-	-	-	-	-
cis- DCE	<3	-	-		-	533	-	-	-	10
2,2-Dichloropropane	<1	-	-		-	-	-	-	-	-
Bromochloromethane	<2	-	-		-	-	-	-	-	-
Chloroform	<2	-	-		-	-	-	-	-	-
1,1,1-Trichloroethane	<2	-	-		-	-	-	-	-	-
1,1-Dichloropropene	<3	-	-		-	-	-	-	-	-
Carbon tetrachloride	<2	-	-		-	-	-	-	-	-
1,2-Dichloroethane	<2	-	-		-	-	-	-	-	-
Benzene	<1	-	-		-	-	-	-	-	-
TCE	<3	-	-		-	383	-	-	3	4
1,2-Dichloropropane	<2	-	-		-	-	-	-	-	-
Dibromomethane	<3	-	-		-	-	-	-	-	-
Bromodichloromethane	<2	-	-		-	-	-	-	-	-
cis-1-3-Dichloropropene	<2	-	-		-	-	-	-	-	-
Toluene	<2	-	-		-	-	-	-	-	-
trans-1-3-Dichloropropene	<2	-	-		-	-	-	-	-	-
1,1,2-Trichloroethane	<2	-	-		-	-	-	-	-	-
PCE	<3	-	-		-	-	-	-	-	-
1,3-Dichloropropane	<2	-	-		-	-	-	-	-	-
Dibromochloromethane	<2	-	-	Not Sampled	-	-	-	-	-	-
1,2-Dibromoethane	<2	-	-		-	-	-	-	-	-
Chlorobenzene	<2	-	-		-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	<2	-	-		-	-	-	-	-	-
Ethylbenzene	<2	-	-		-	-	-	-	-	-
p/m-Xylene	<3	-	-		-	-	-	-	-	-
o-Xylene	<2	-	-		-	-	-	-	-	-
Styrene	<2	-	-		-	-	-	-	-	-
Bromoform	<2	-	-		-	-	-	-	-	-
Isopropylbenzene	<3	-	-		-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	4	-	-		-	-	-	-	-	-
Bromobenzene	<2	-	-		-	-	-	-	-	-
1,2,3-Trichloropropane	<3	-	-		-	-	-	-	-	-
Propylbenzene	<3	-	-		-	-	-	-	-	-
2-Chlorotoluene	<3	-	-		-	-	-	-	-	-
1,3,5-Trimethylbenzene	<3	-	-		-	-	-	-	-	-
4-Chlorotoluene	<3	-	-		-	-	-	-	-	-
tert-Butylbenzene	<3	-	-		-	-	-	-	-	-
1,2,4-Trimethylbenzene	<3	-	-		-	-	-	-	-	-
sec-Butylbenzene	<3	-	-		-	-	-	-	-	-
4-Isopropyltoluene	<3	-	-		-	-	-	-	-	-
1,3-Dichlorobenzene	<3	-	-		-	-	-	-	-	-
1,4-Dichlorobenzene	<3	-	-		-	-	-	-	-	-
n-Butylbenzene	<3	-	-		-	-	-	-	-	-
1,2-Dichlorobenzene	<3	-	-		-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	<2	-	-		-	-	-	-	-	-
1,2,4-Trichlorobenzene	<3	-	-		-	-	-	-	-	-
Hexachlorobutadiene	<3	-	-		-	-	-	-	-	-
Naphthalene	<2	-	-		-	-	-	-	-	-
1,2,3-Trichlorobenzene	<3	-	-		-	-	-	-	-	-
Total VOCs	**	-	-		-	917	-	-	3	15

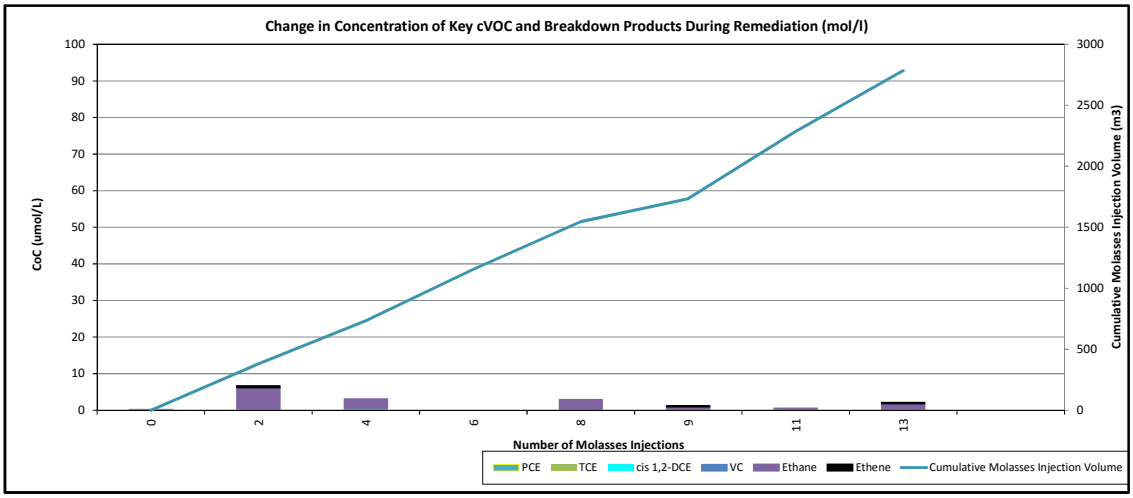
Notes:

	Pre -Remediatic
-	Below MDL
MDL : Method detection limit	Method Detecti
VOC	Volatile Organic
underline	Exceeds SSAC
Bold	Exceeds SSAC
Italic	Exceeds SSAC

BH406 Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-5%
	Percentage Increase Ethene and Ethane	-32%

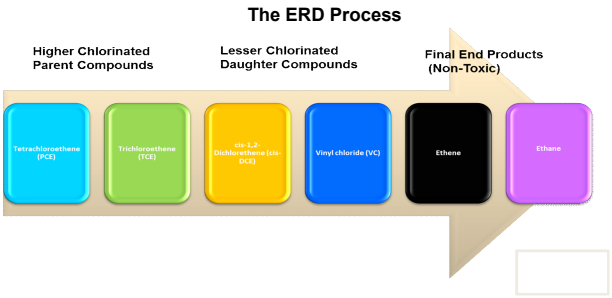


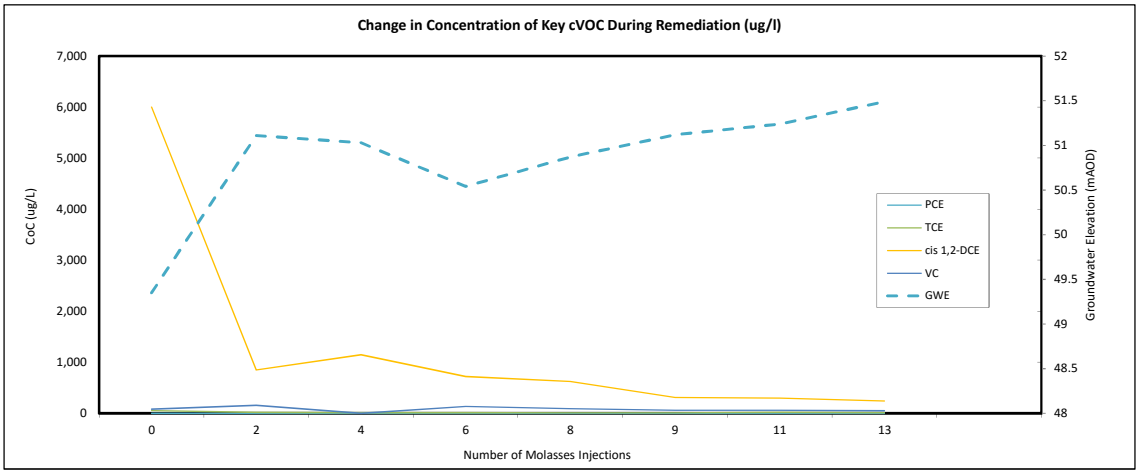


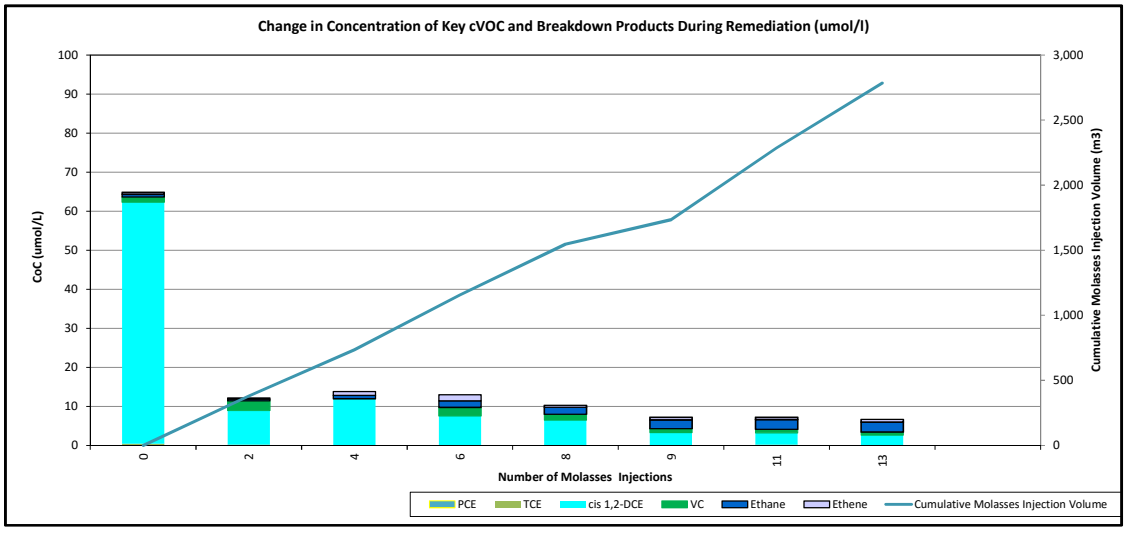


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2006S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-96%
	Percentage Increase Ethene and Ethane	179%

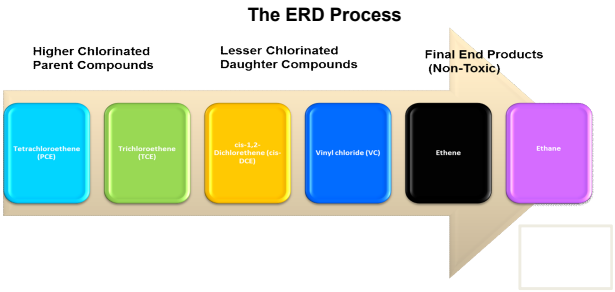


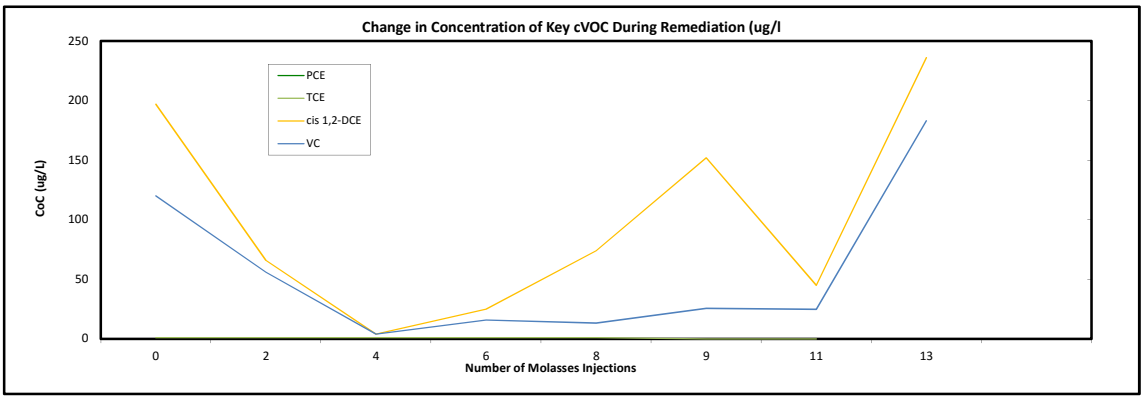


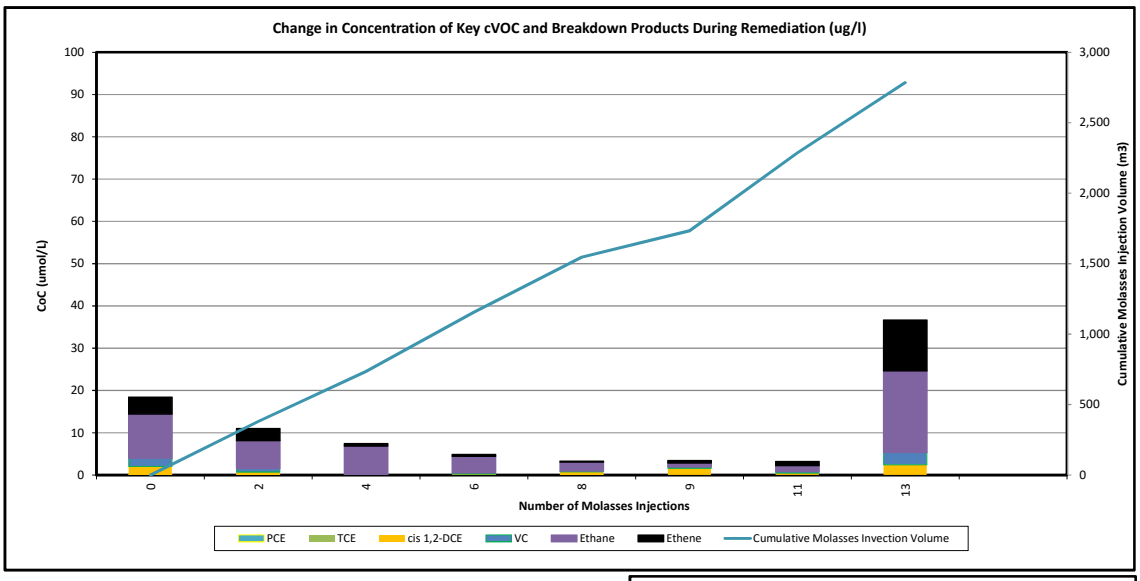


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2007S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-27%
	Percentage Increase Ethene and Ethane	117%

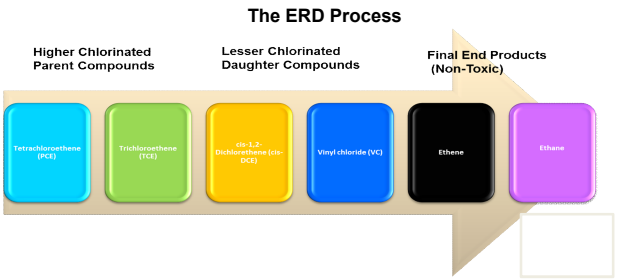


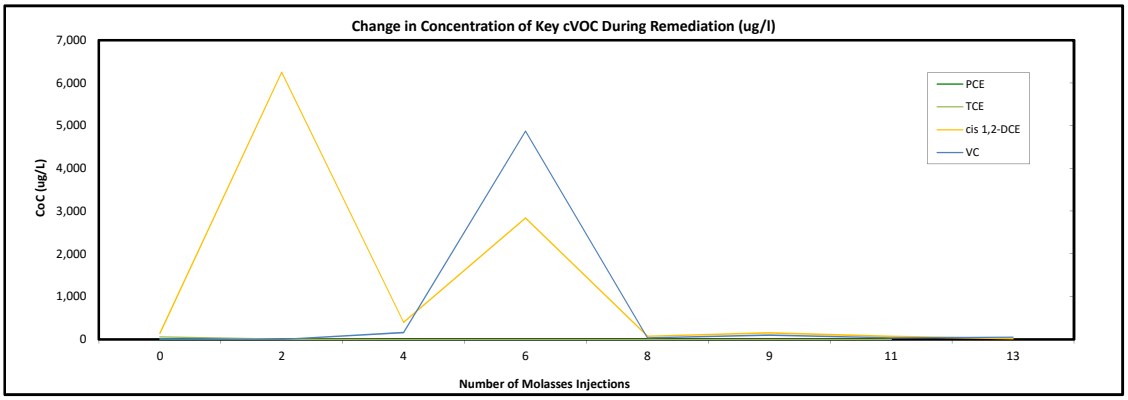


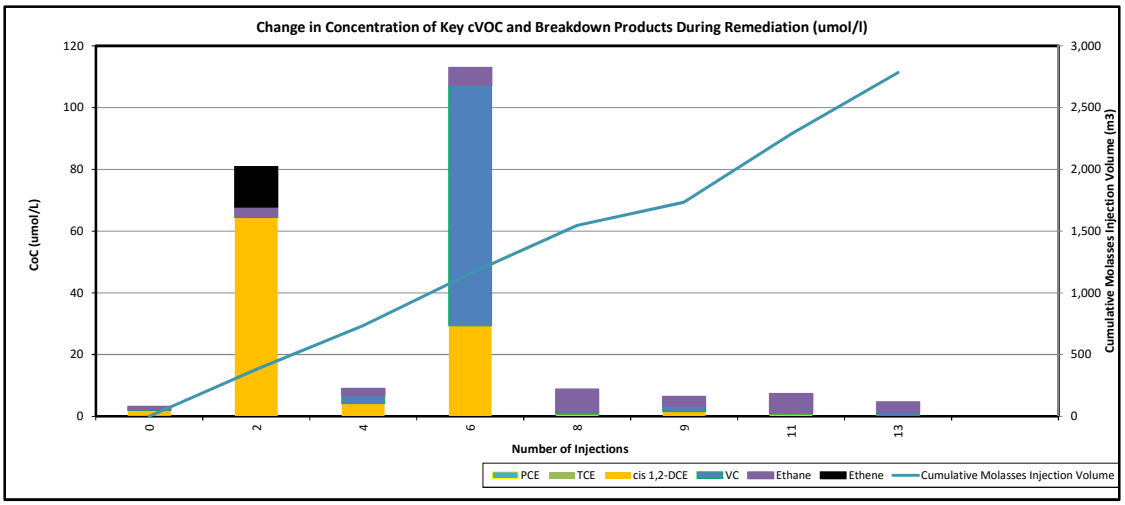


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2008S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-51%
	Percentage Increase Ethene and Ethane	428%

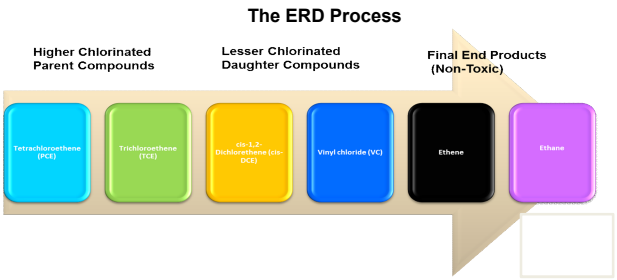


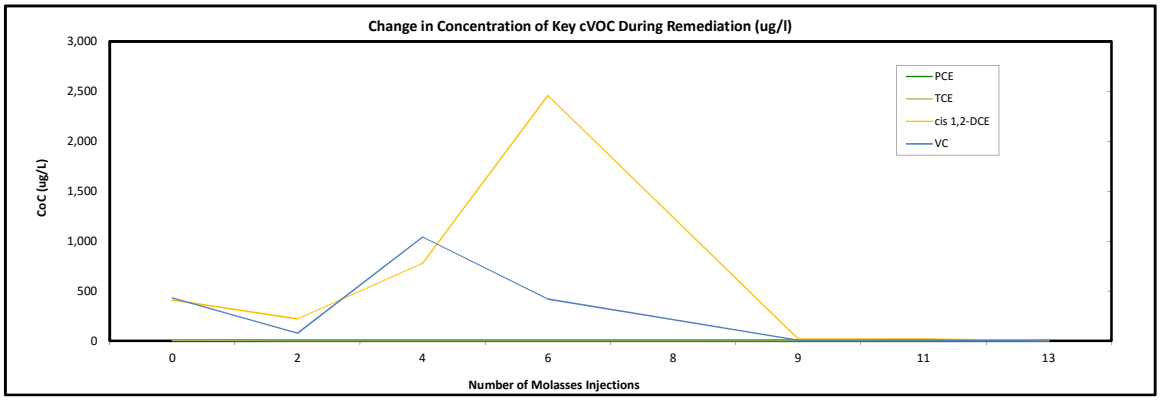


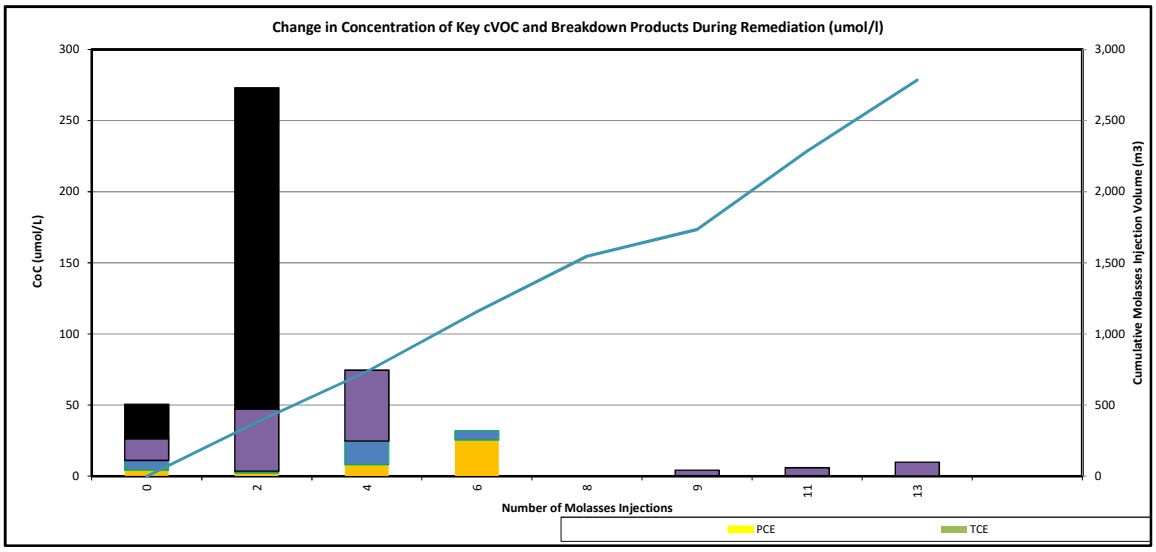


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2009S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-100%
	Percentage Increase Ethene and Ethane	-75%

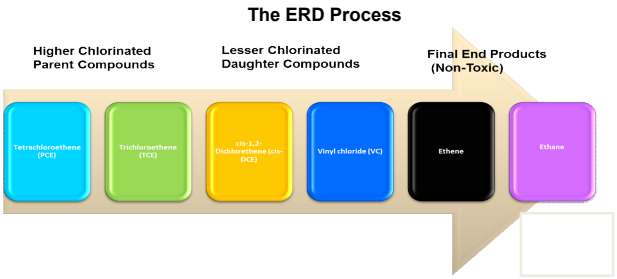


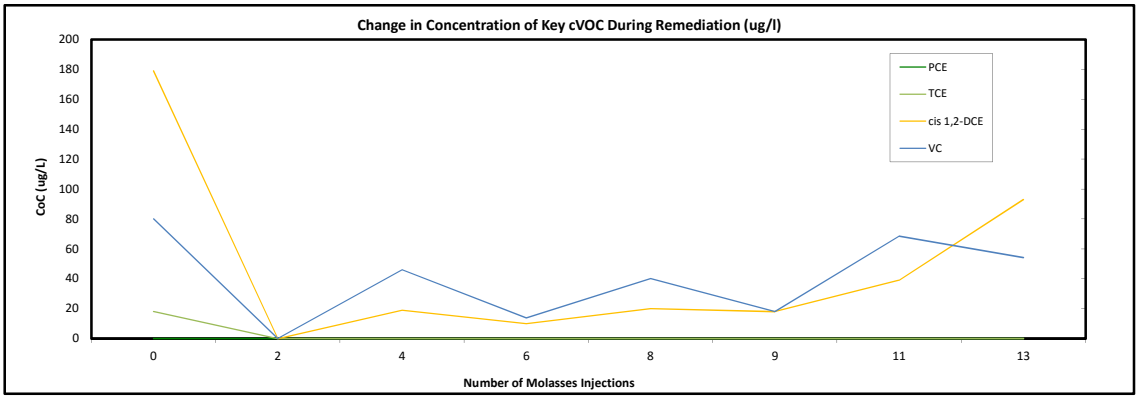


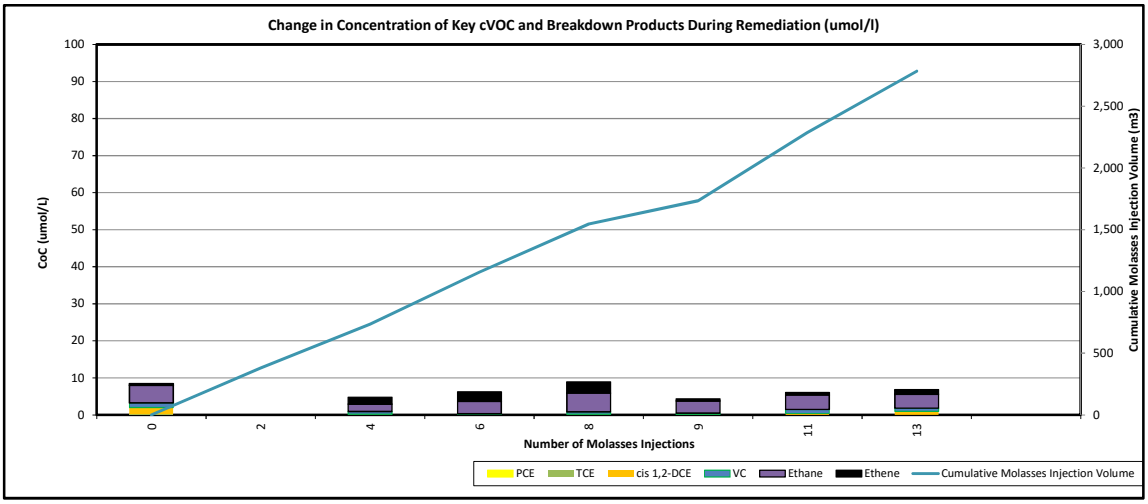


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2010S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-44%
	Percentage Increase Ethene and Ethane	-4%

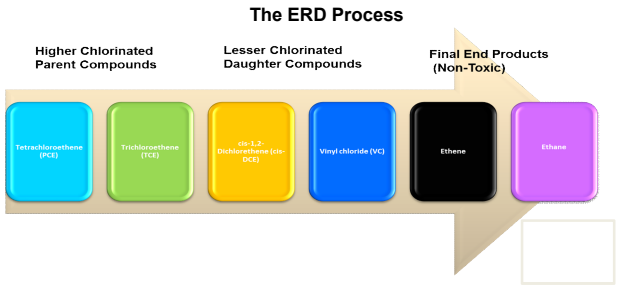


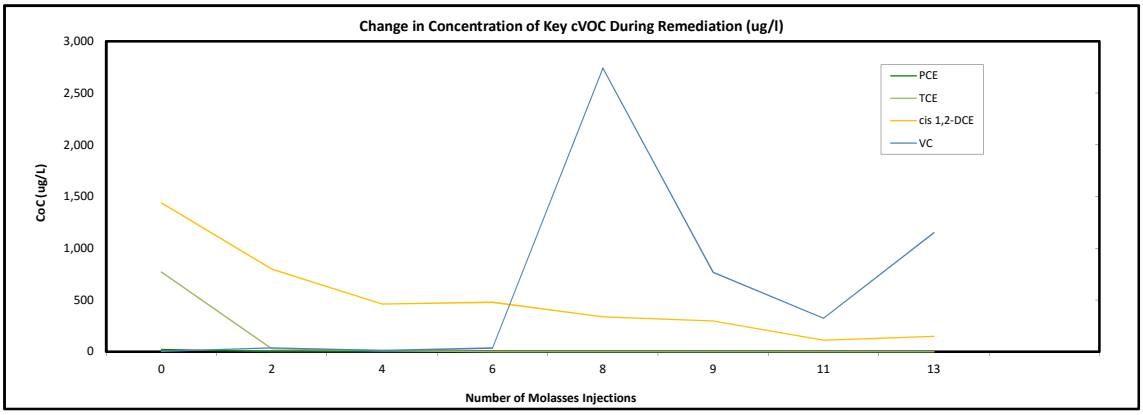


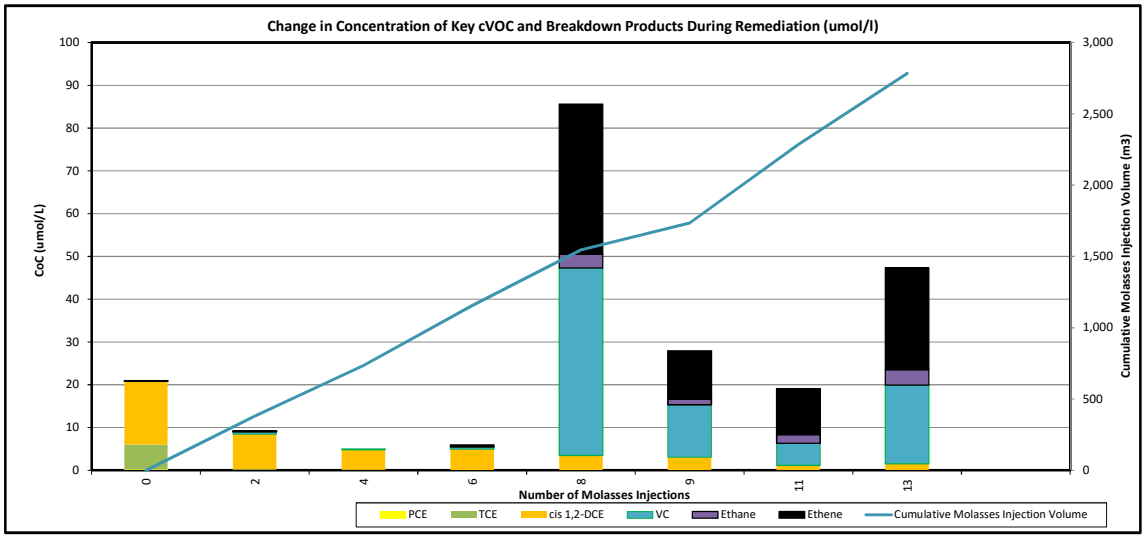


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2011S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-4%
	Percentage Increase Ethene and Ethane	>500%

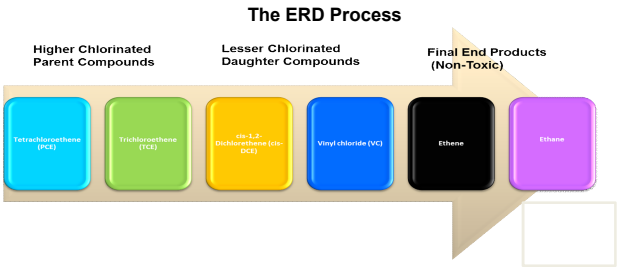


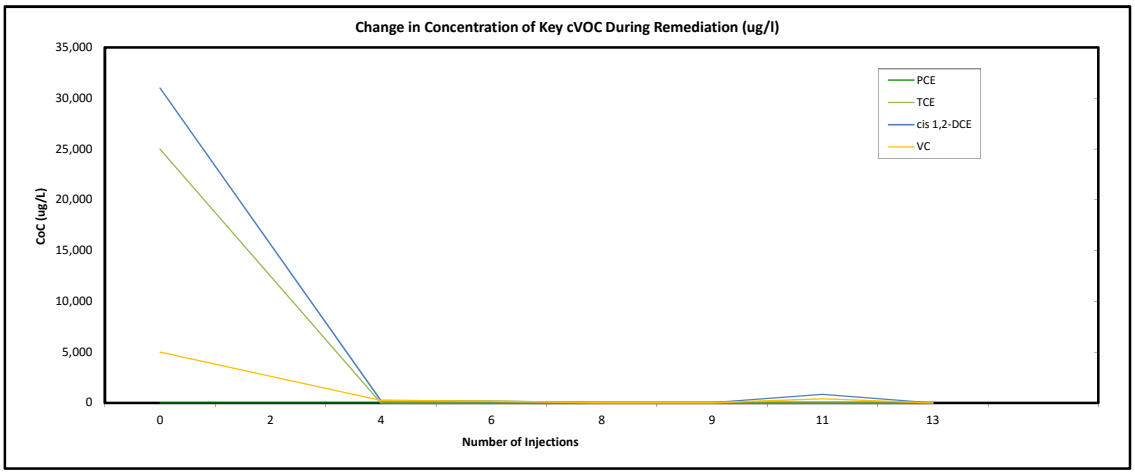


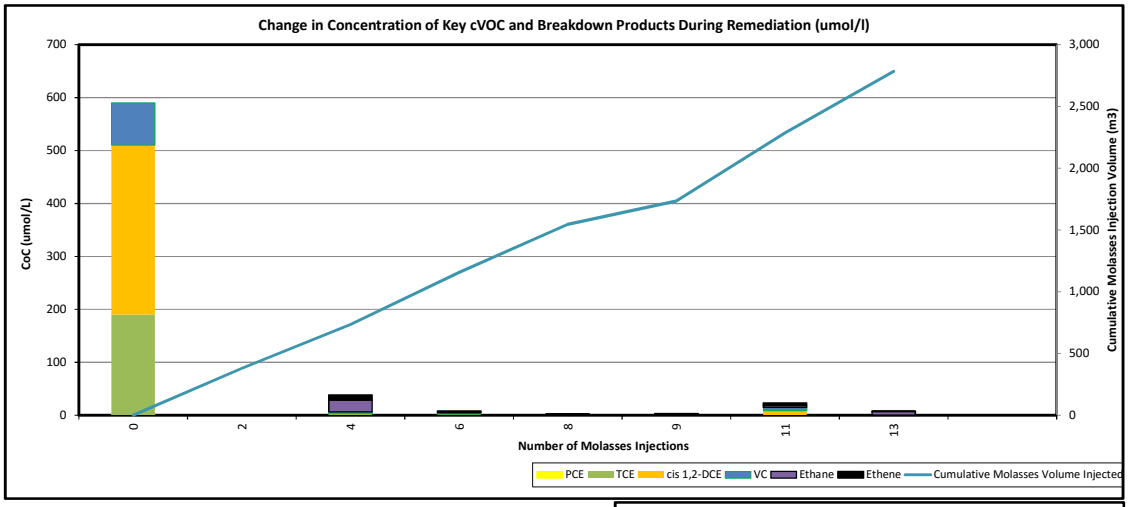


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2012S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-100%
	Percentage Increase Ethene and Ethane	>500%

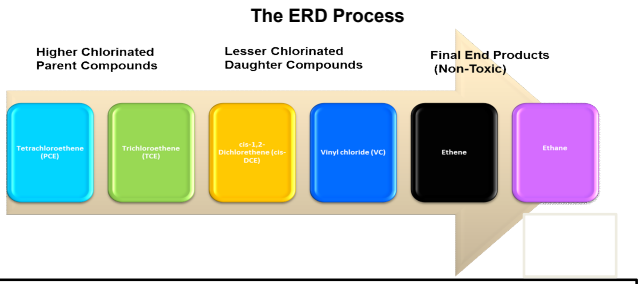


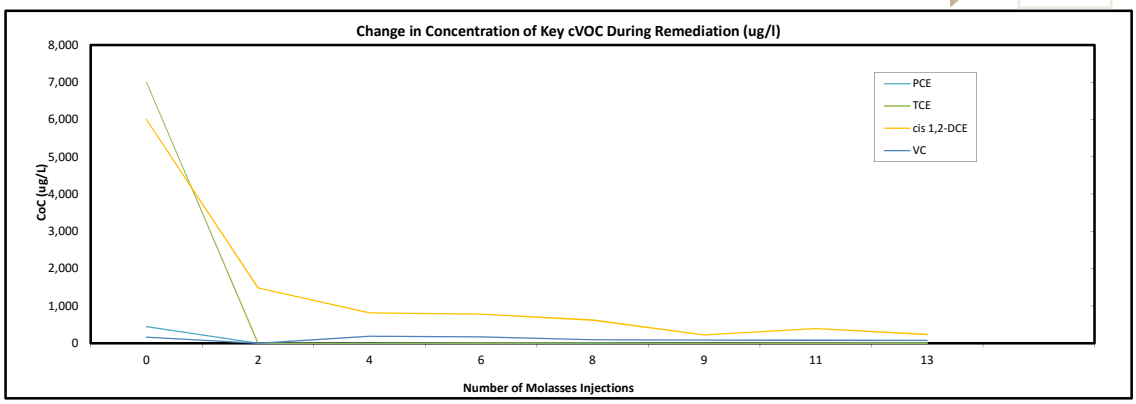


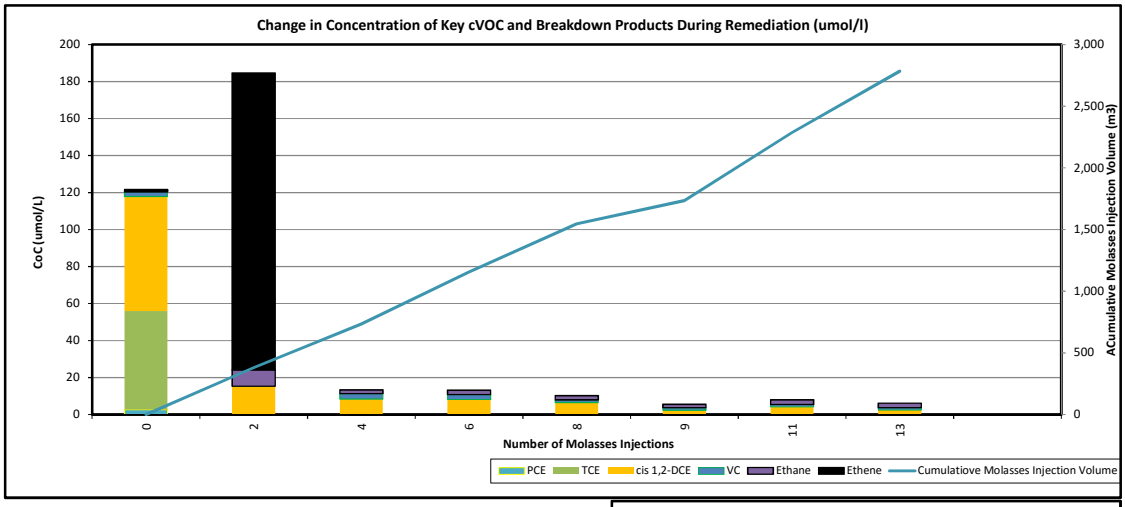


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2006D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-97%
	Percentage Increase Ethene and Ethane	161%



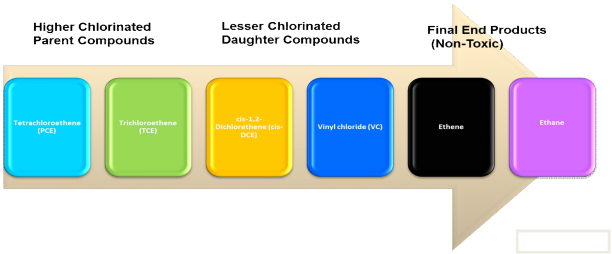


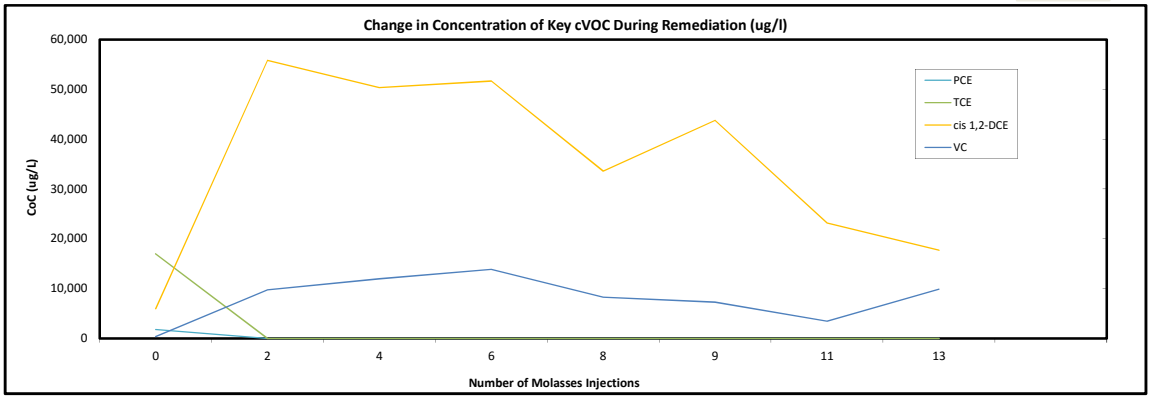


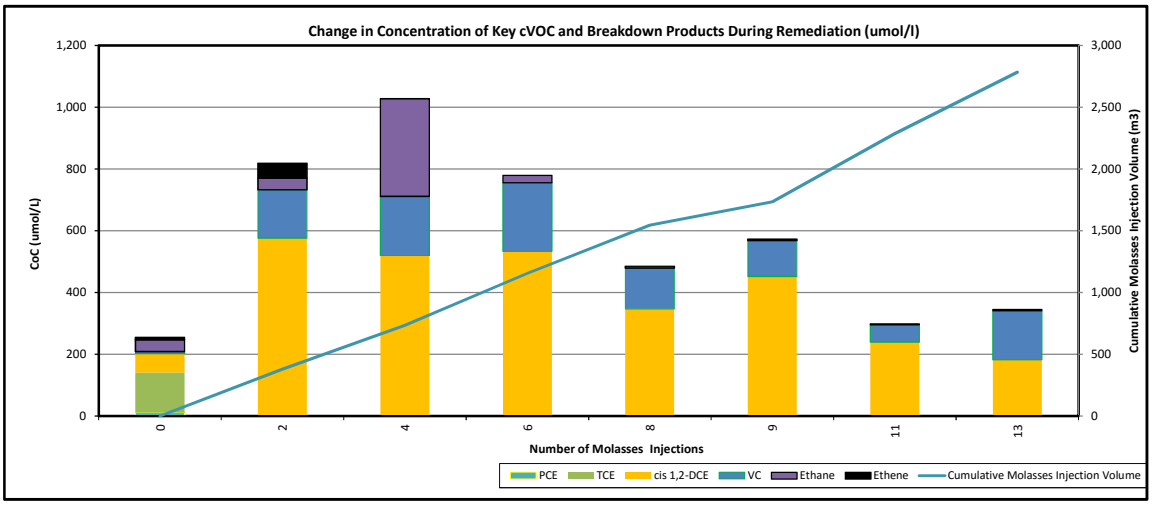
Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

The ERD Process

RSW2007D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	63%
	Percentage Increase Ethene and Ethane	-13%

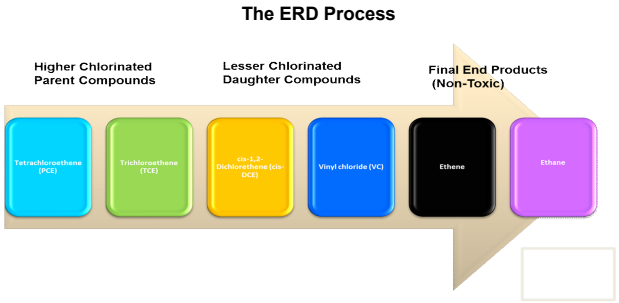


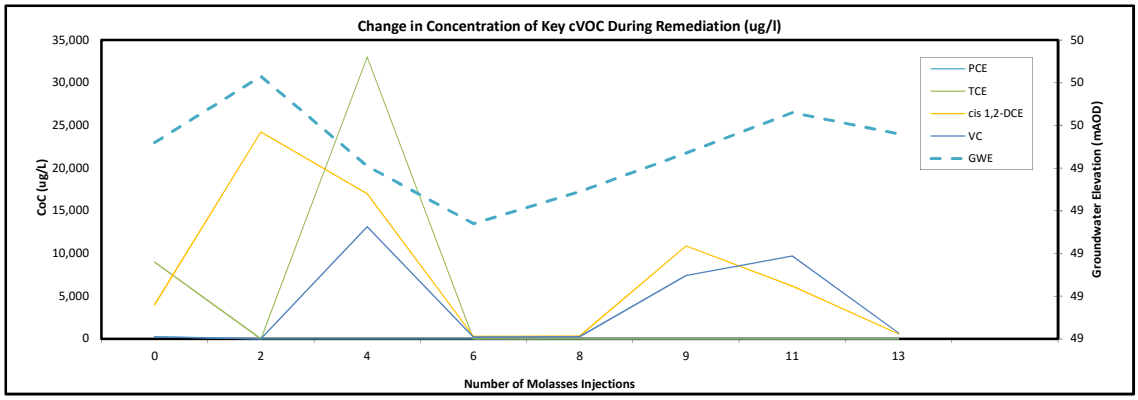


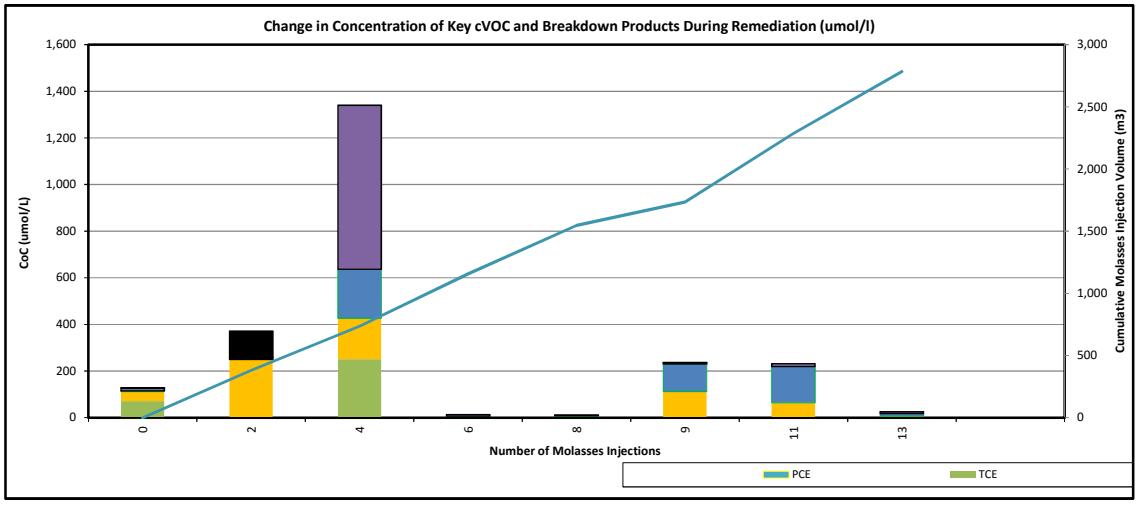


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2008D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-85%
	Percentage Increase Ethene and Ethane	>500%



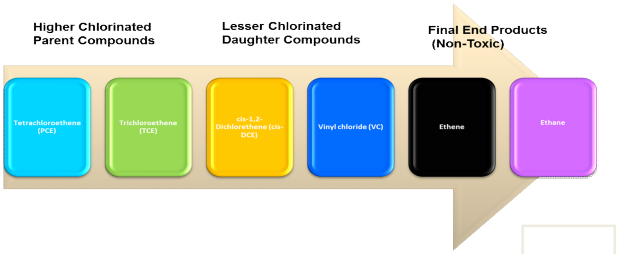


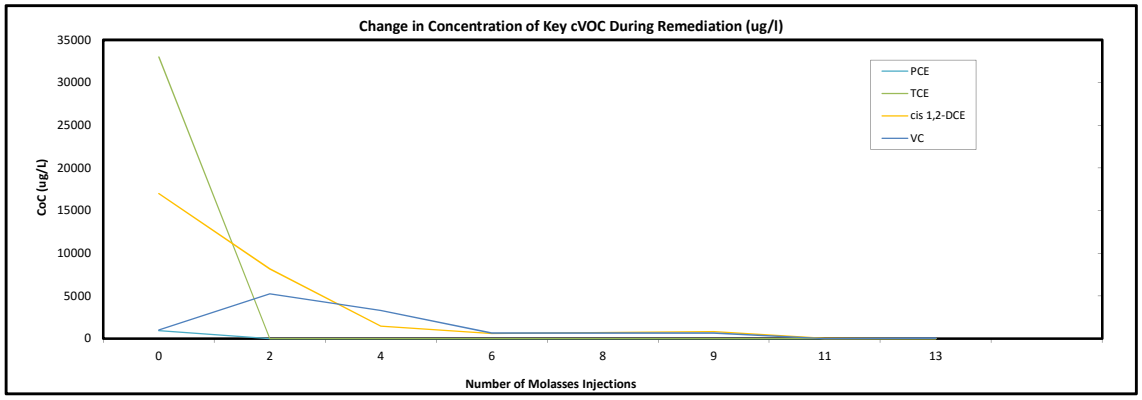


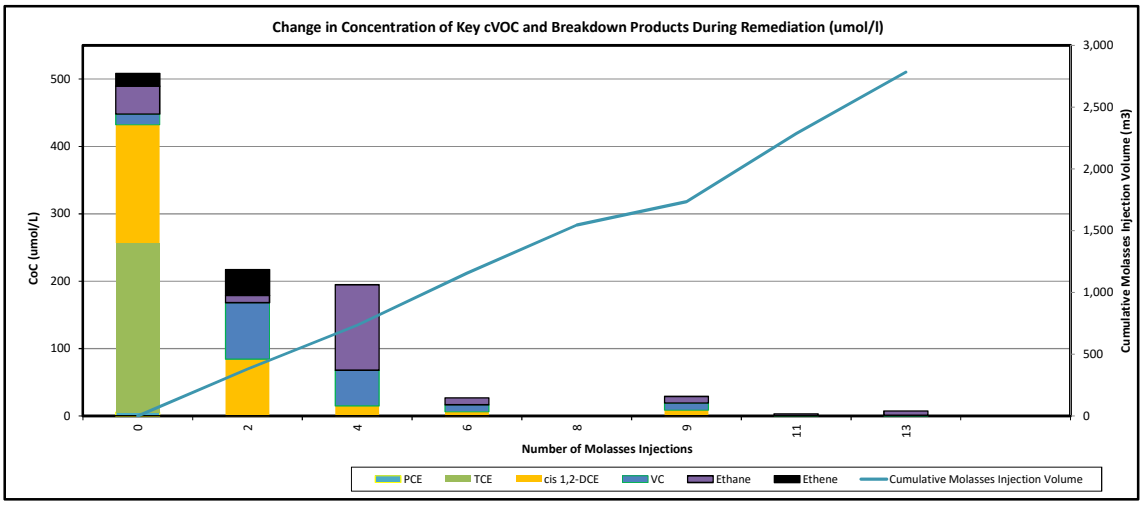
Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2009D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-100%
	Percentage Increase Ethene and Ethane	-81%

The ERD Process

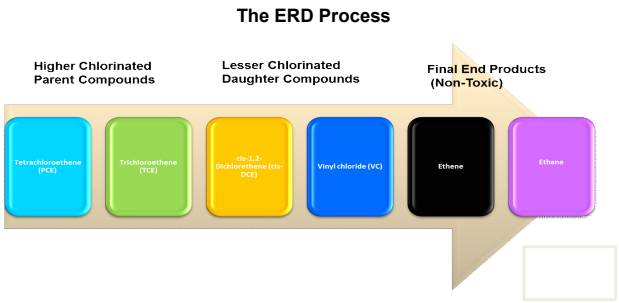


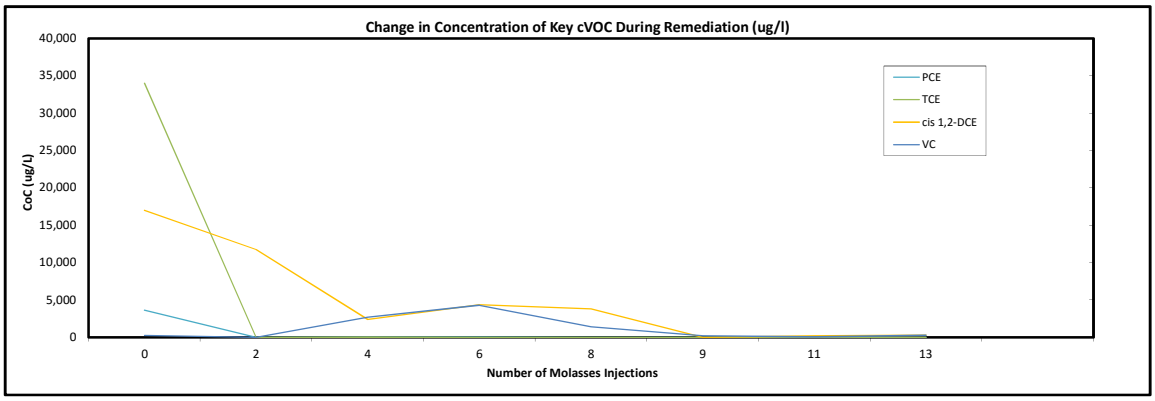


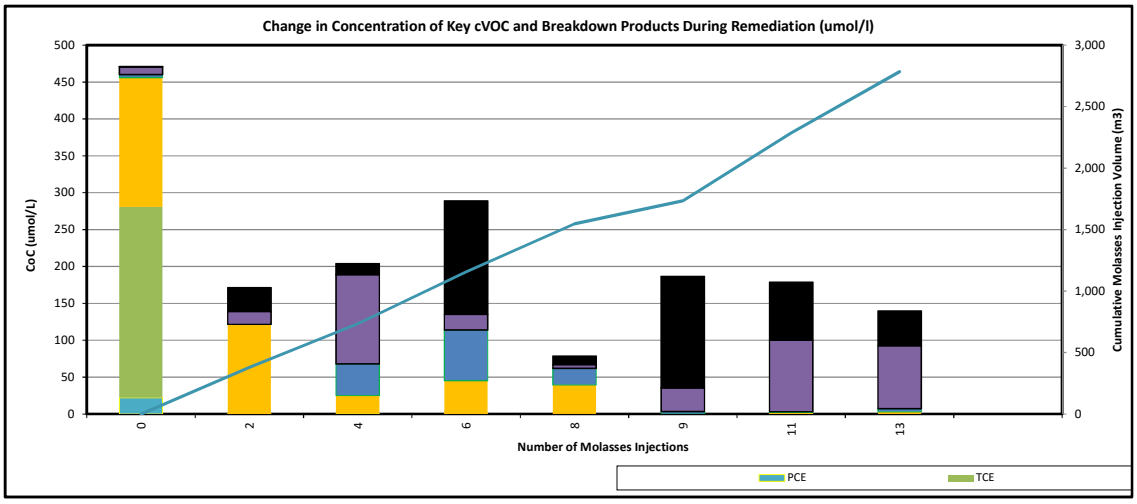


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2010D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-98%
	Percentage Increase Ethene and Ethane	>500%



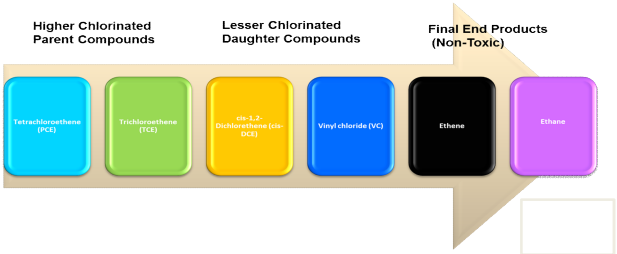


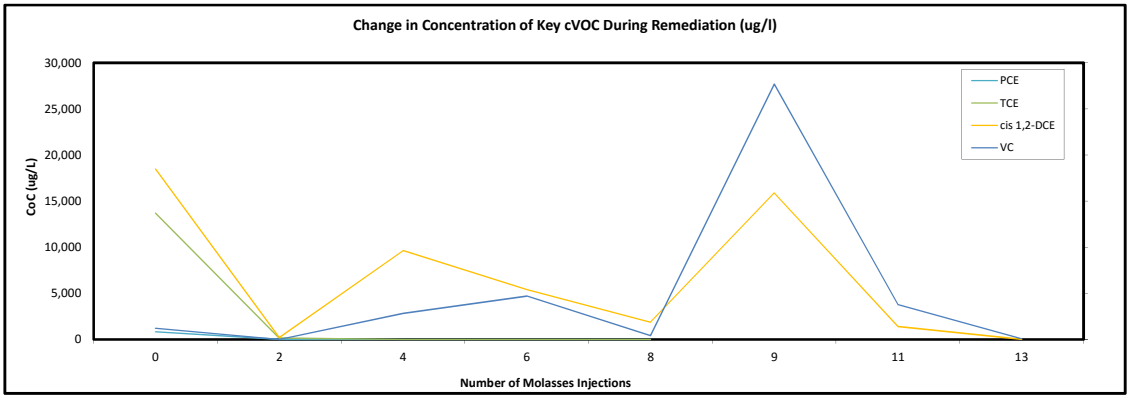


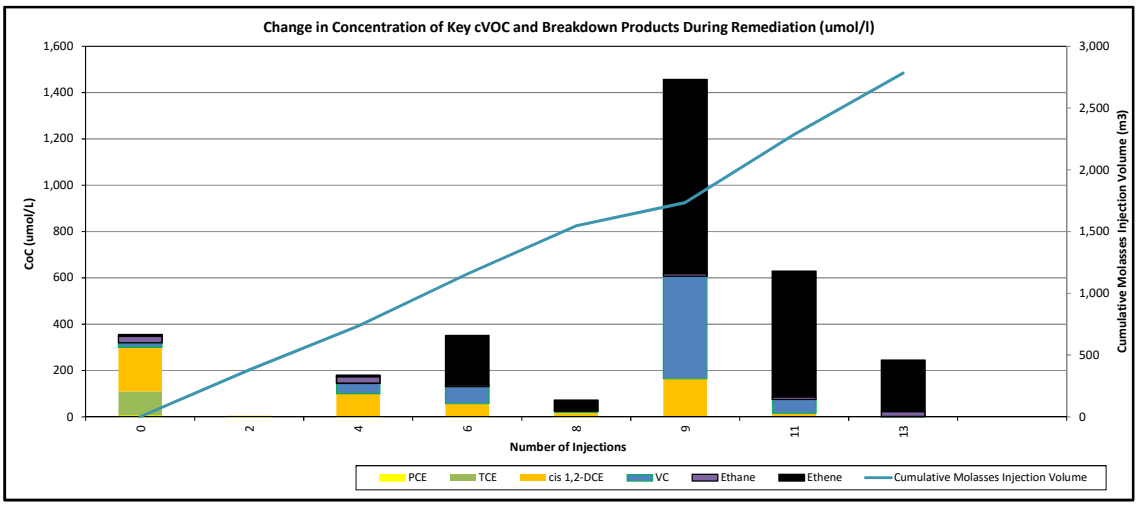
Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

RSW2011D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-100%
	Percentage Increase Ethene and Ethane	>500%

The ERD Process



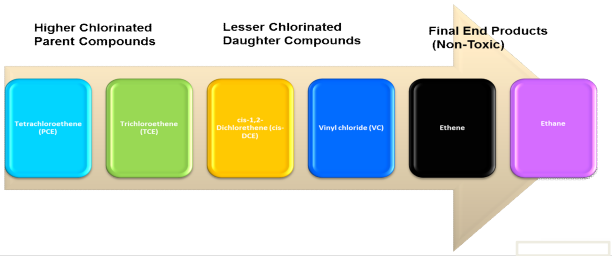


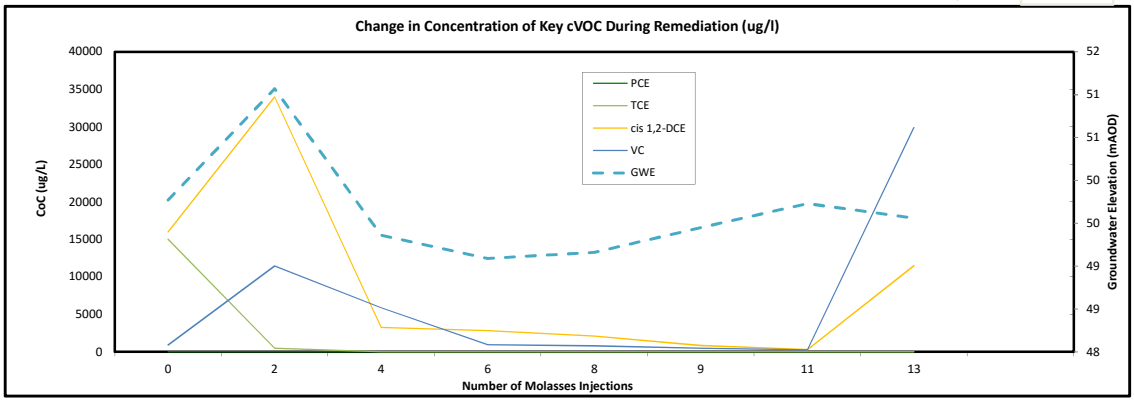


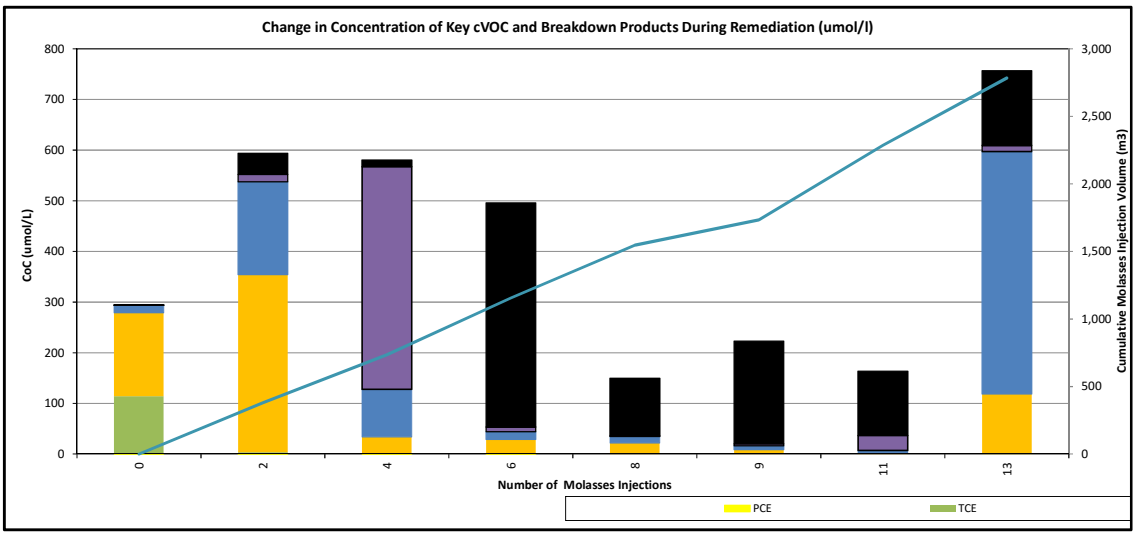
Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

The ERD Process

RSW2012D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	103%
	Percentage Increase Ethene and Ethane	>500%

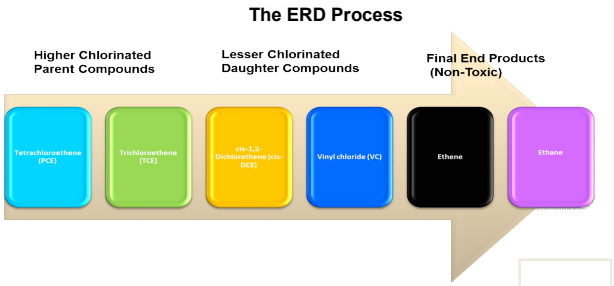


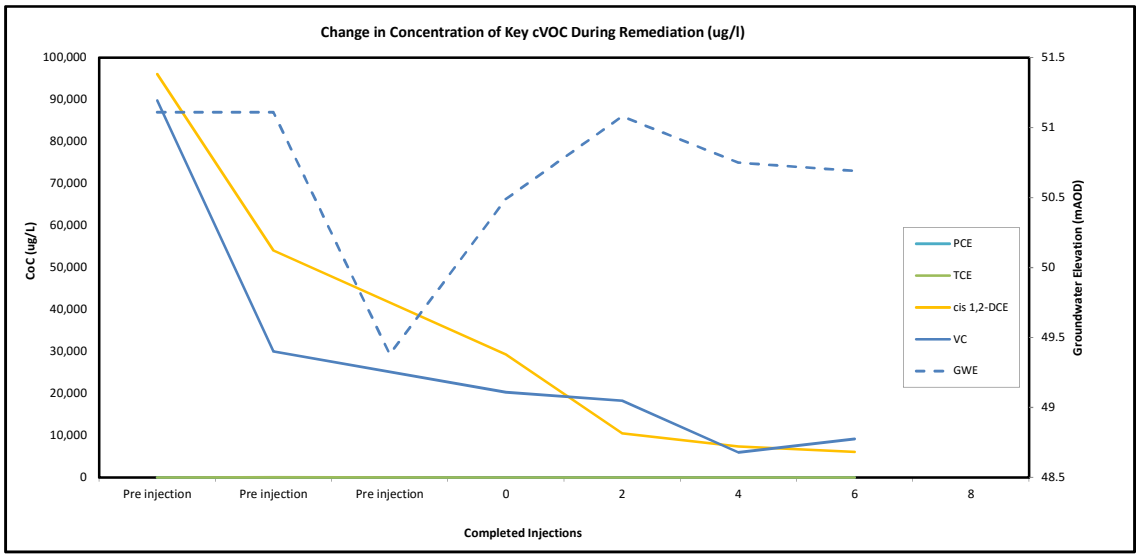


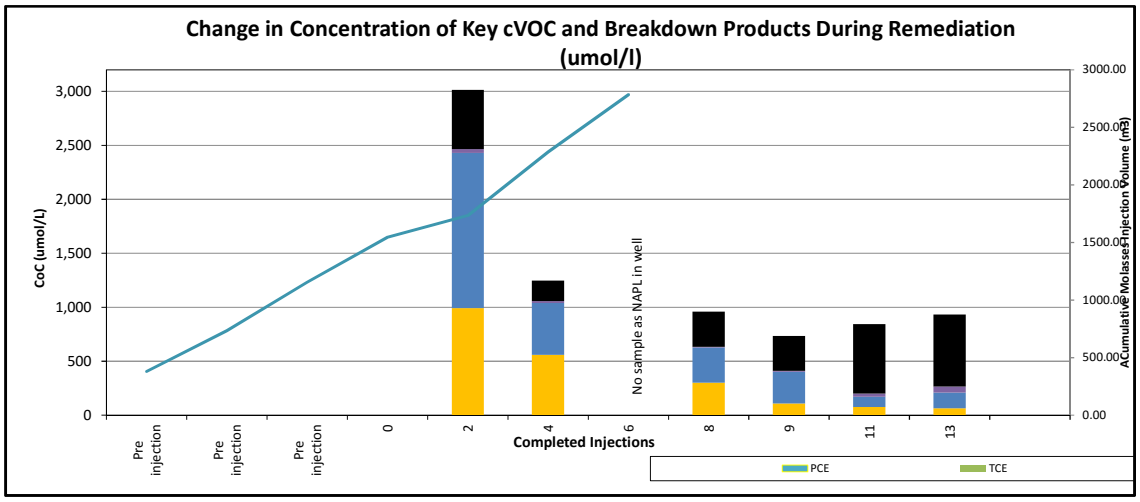


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

BH204AS Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-80%
	Percentage Increase Ethene and Ethane	302%

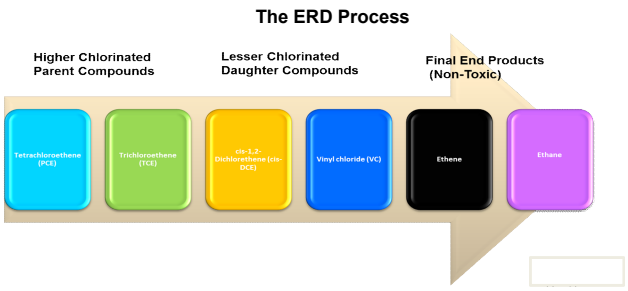


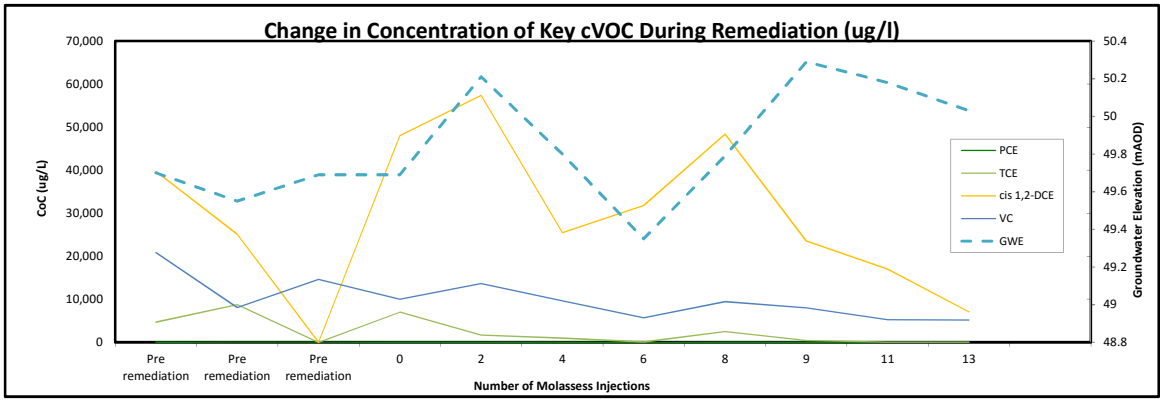


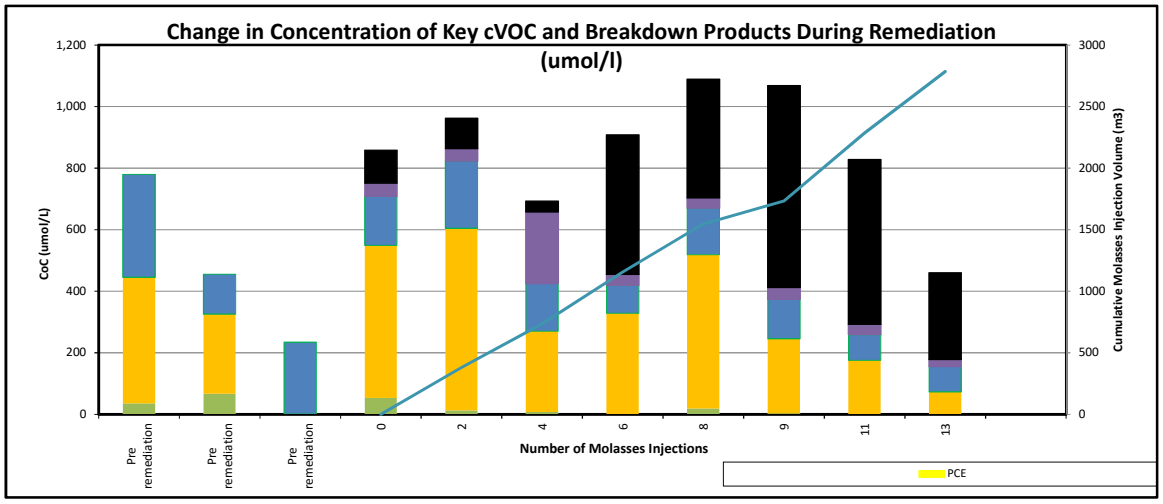


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

BH204AD Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-78%
	Percentage Increase Ethene and Ethane	103%

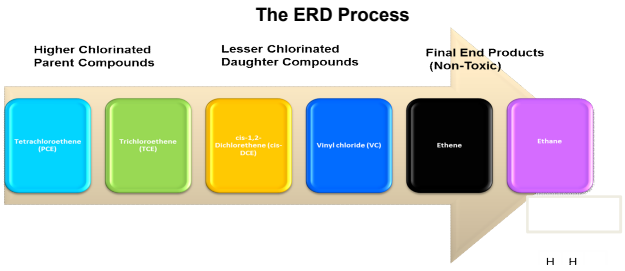


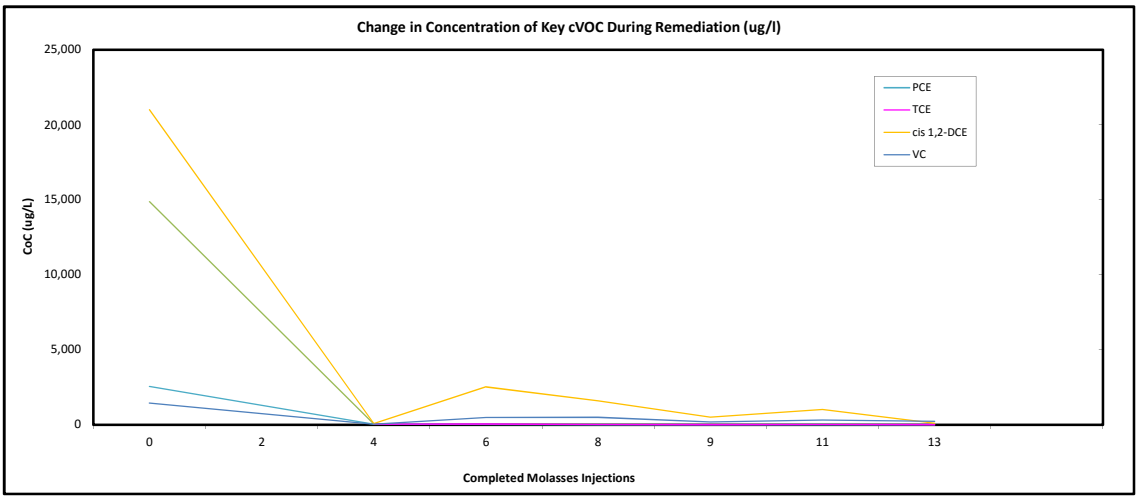


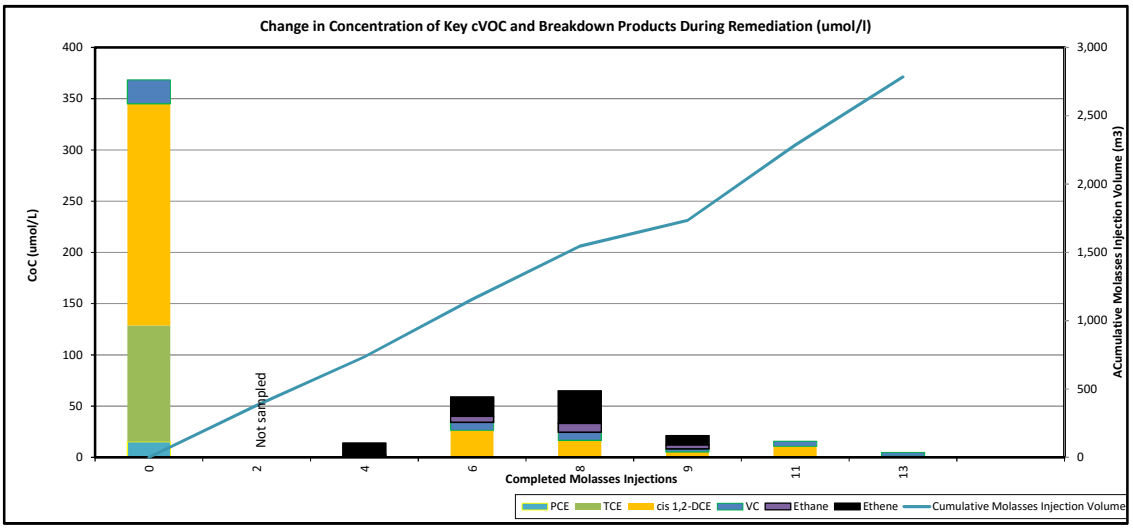


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

BH304S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-99%
	Percentage Increase Ethene and Ethane	-75%

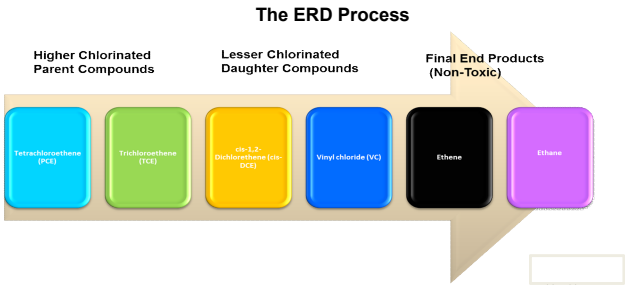


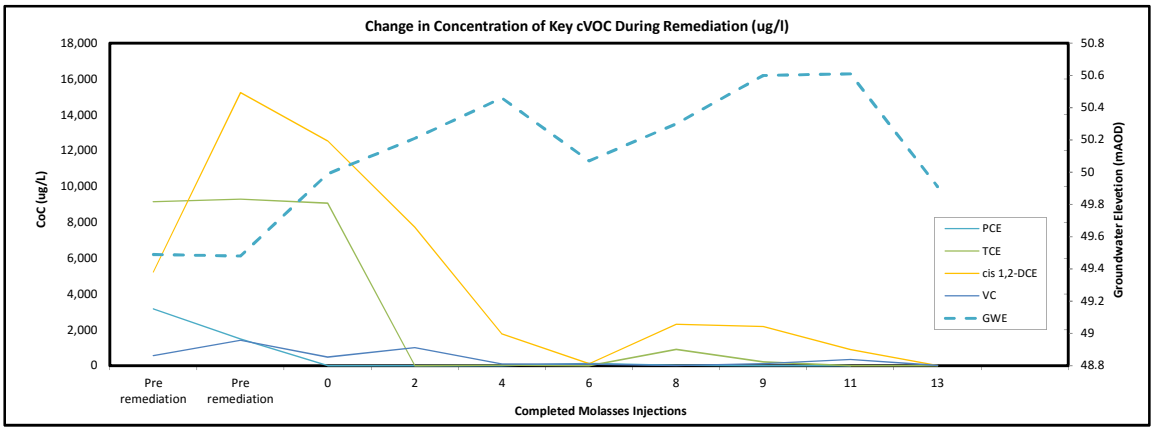


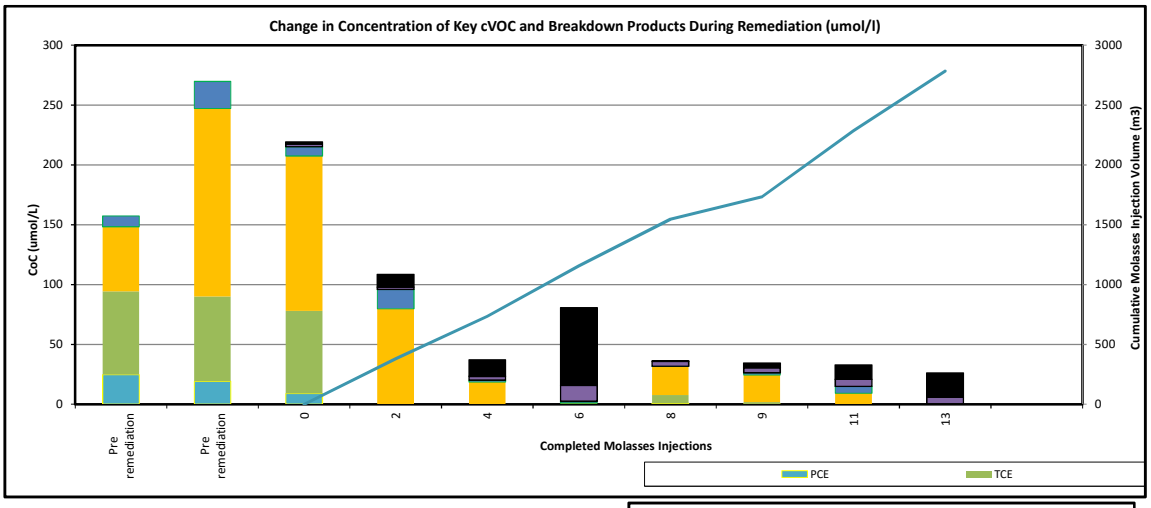


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

BH304D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-100%
	Percentage Increase Ethene and Ethane	>500%

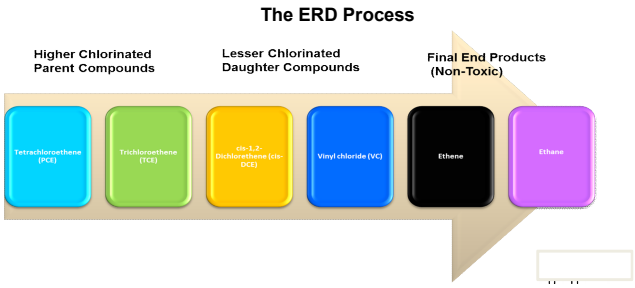


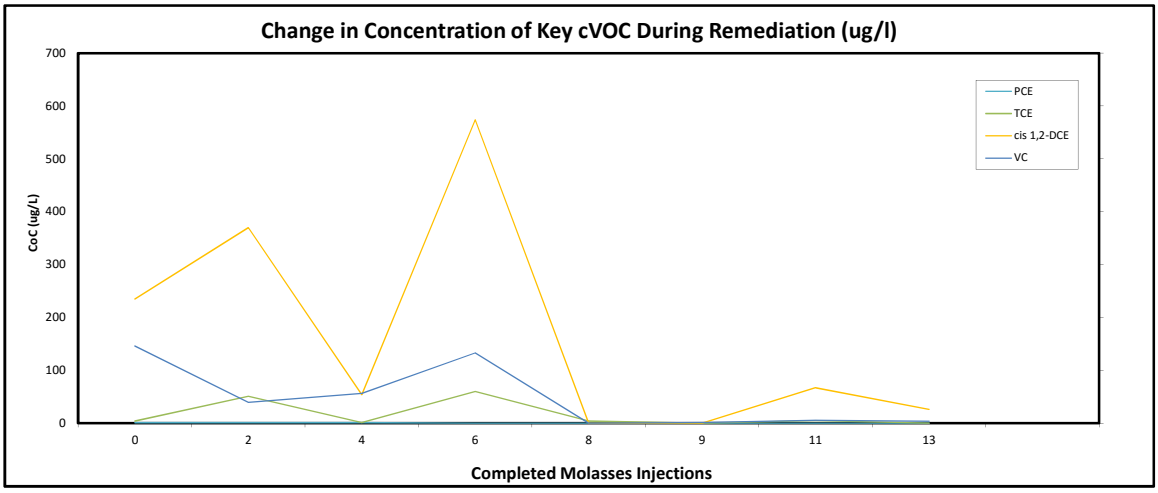


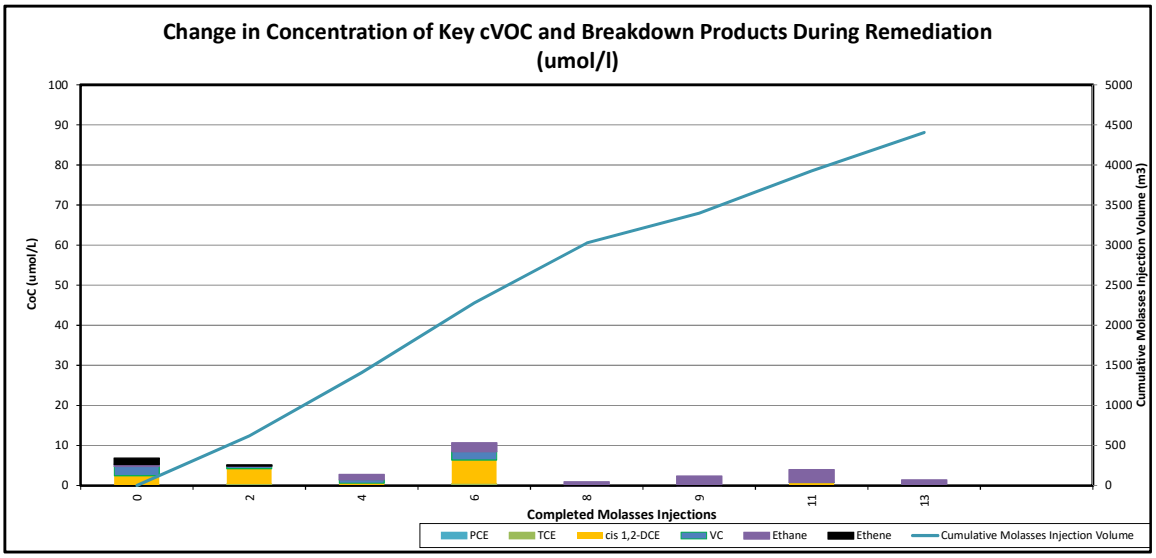


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 3% molassses solution except injections 1 and 2 (1% solution)

BH909 Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-93%
	Percentage Increase Ethene and Ethane	-47%

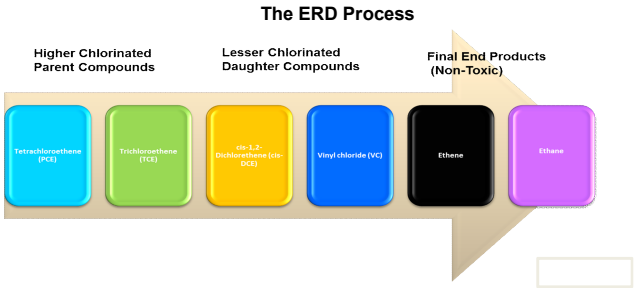


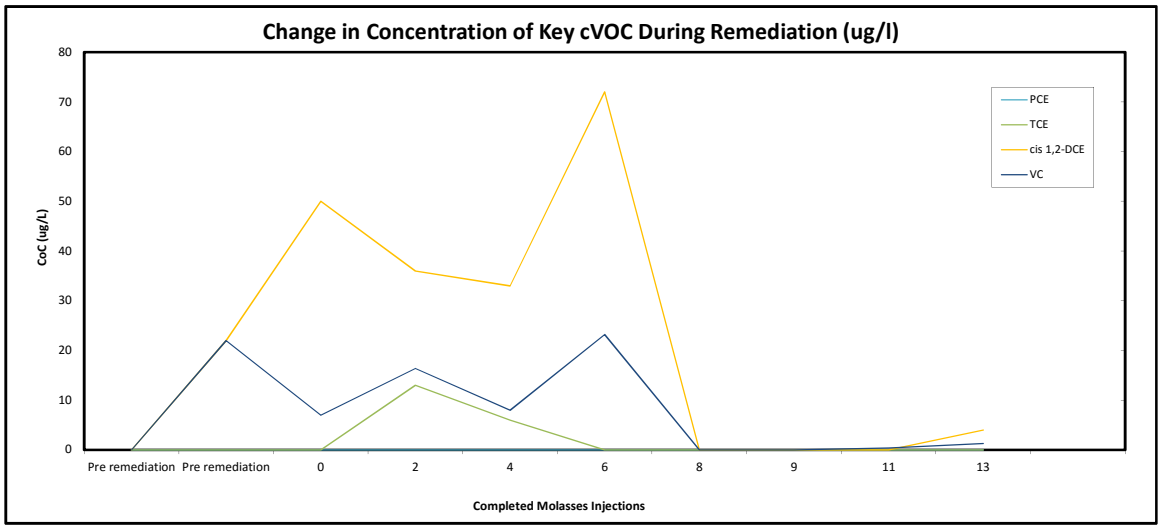


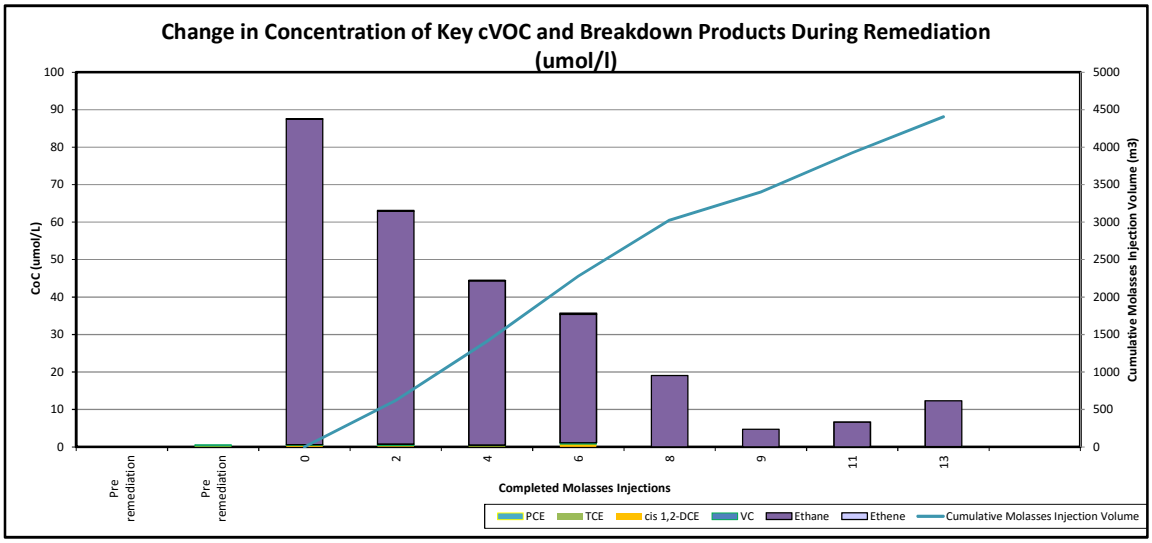


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

BH108 Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	0%
	Percentage Increase Ethene and Ethane	-86%

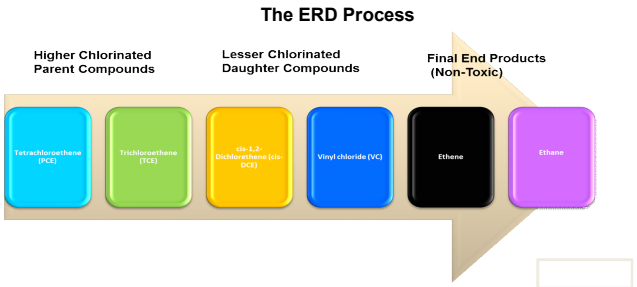


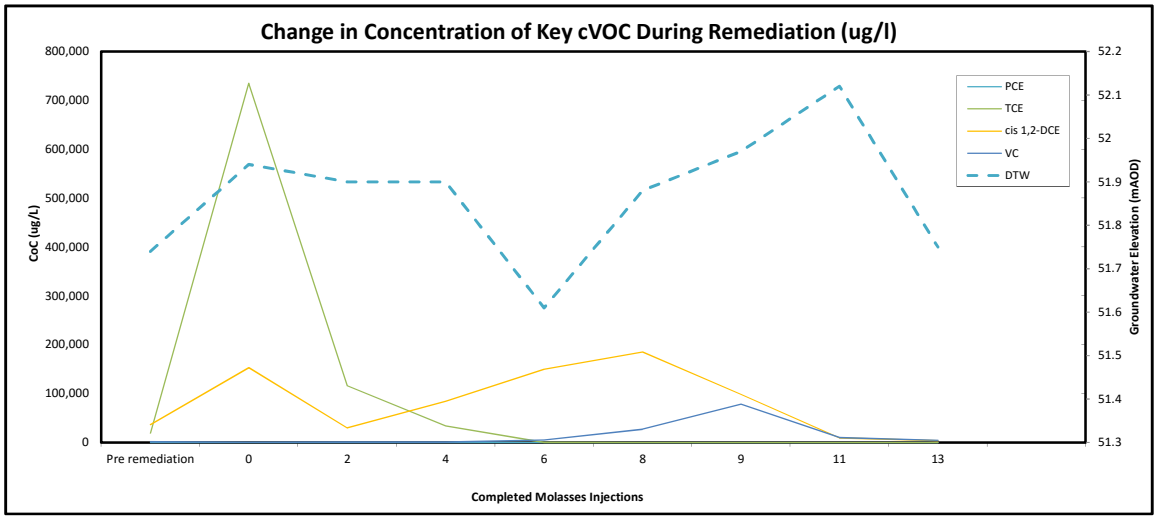


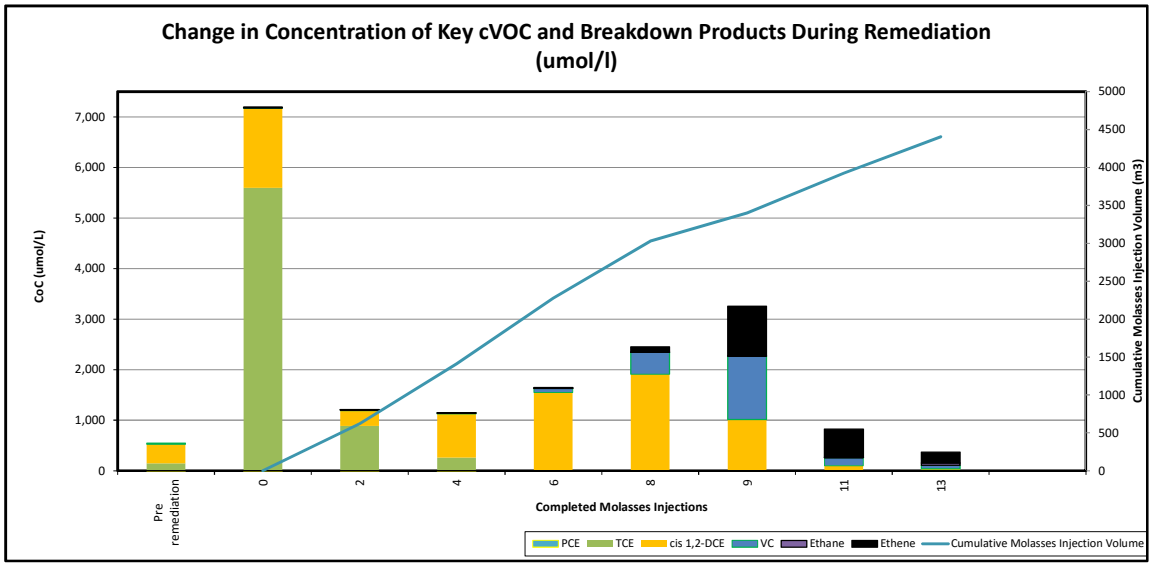


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

BH922 Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-98%
	Percentage Increase Ethene and Ethane	>500%

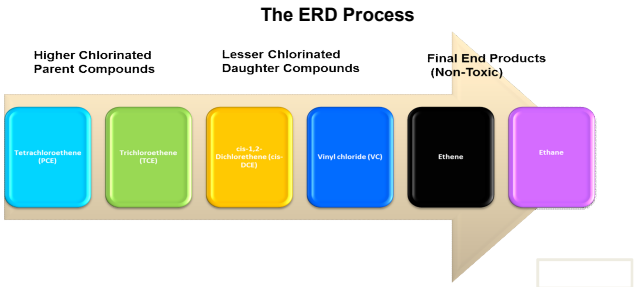


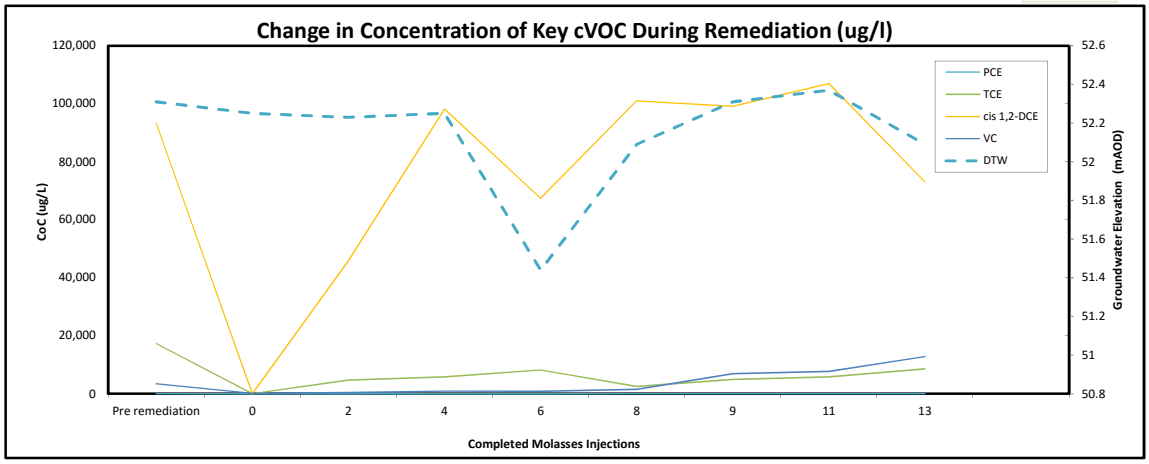


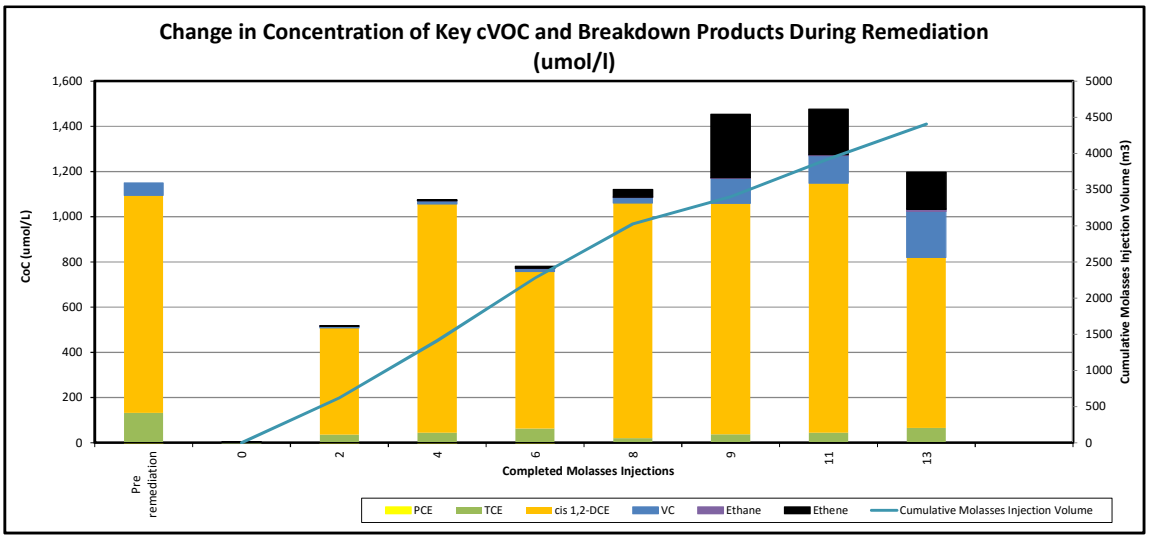


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

BH919 Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	>500%
	Percentage Increase Ethene and Ethane	>500%

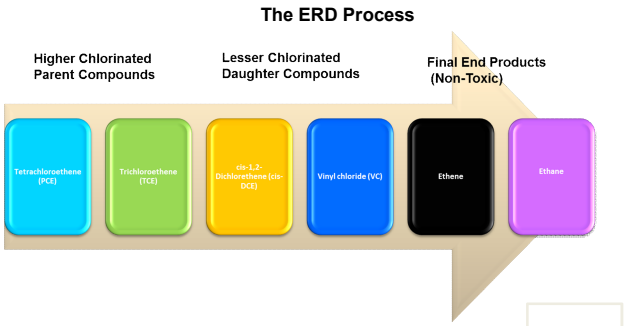


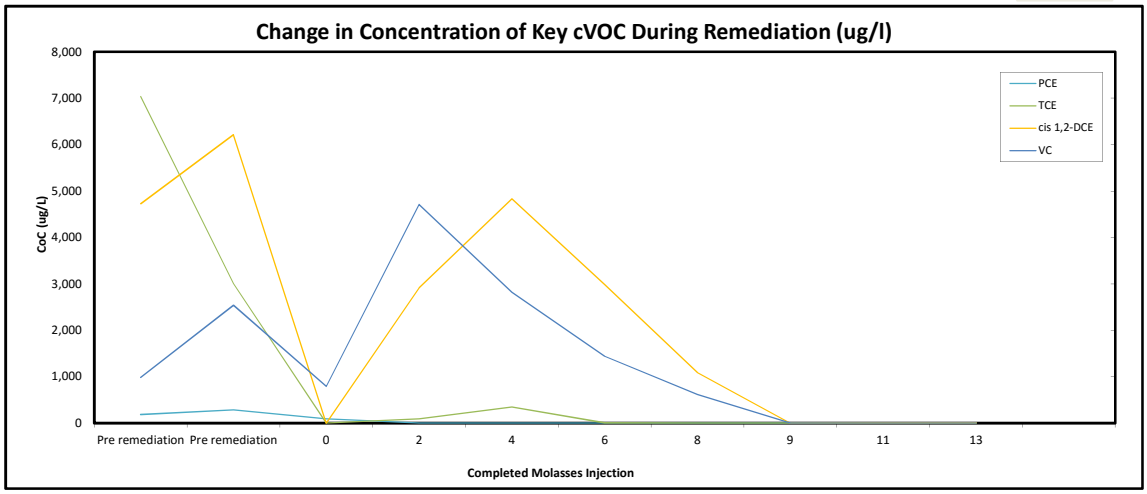


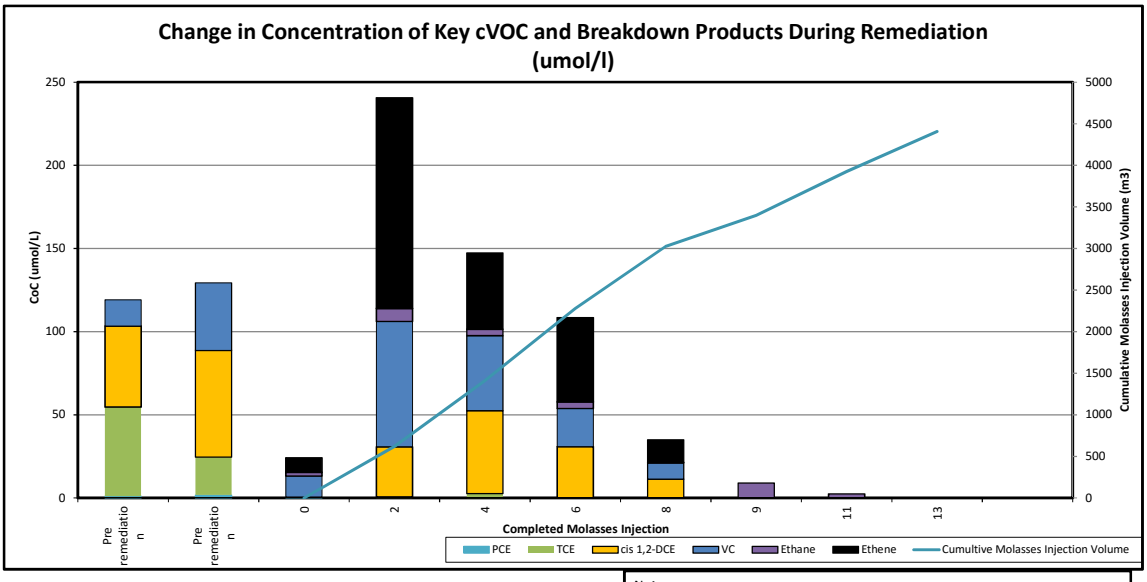


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

BH122 Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-99%
	Percentage Increase Ethene and Ethane	-79%

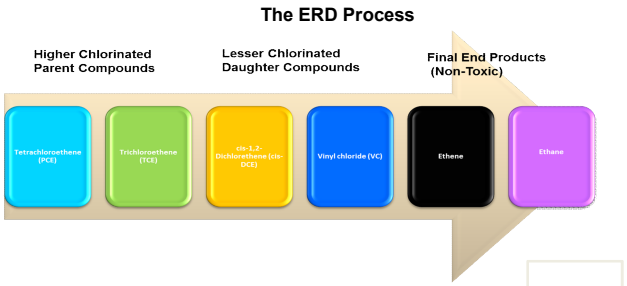


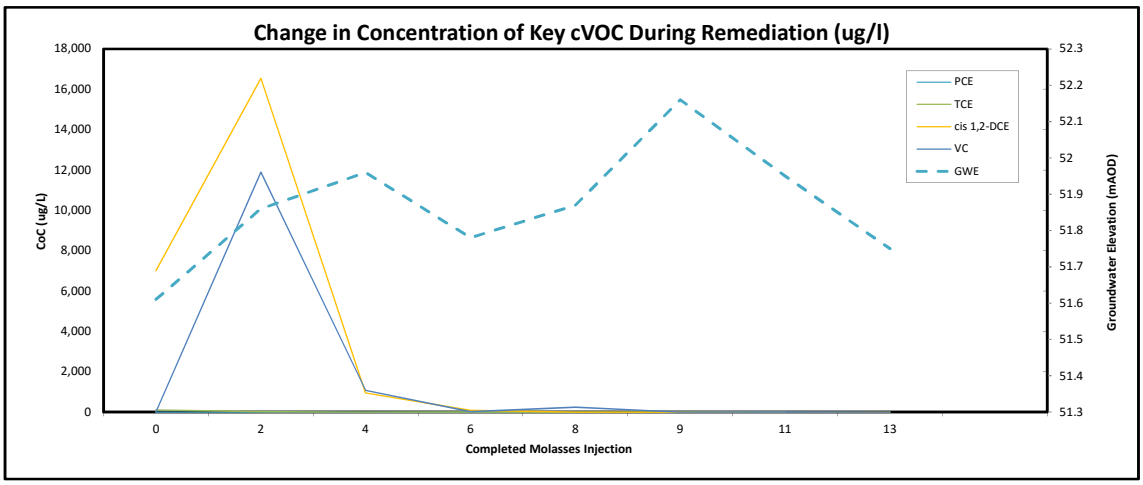


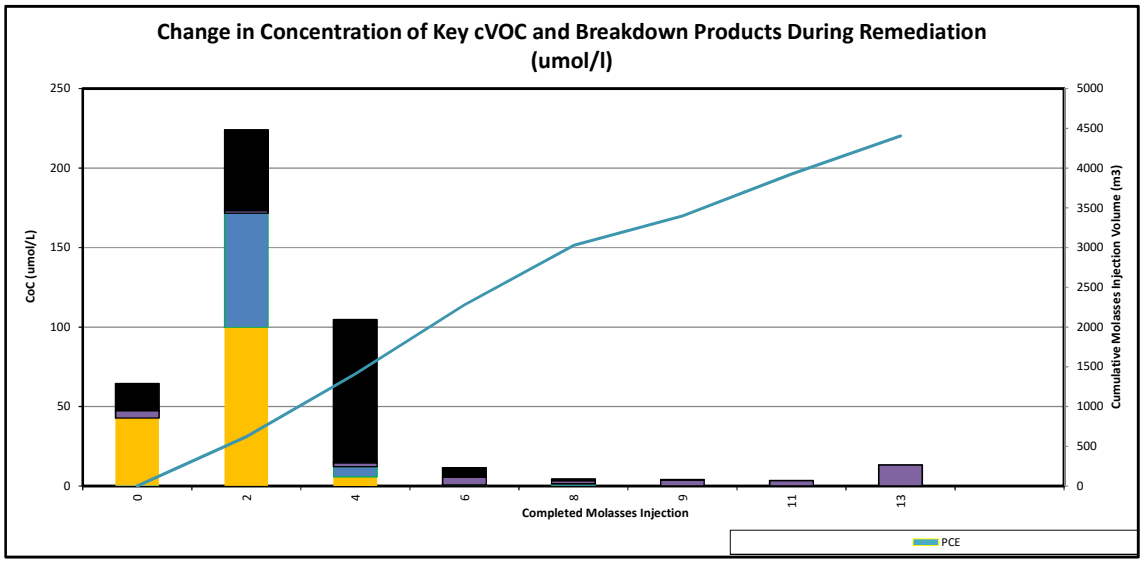


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

RSW7001S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-100%
	Percentage Increase Ethene and Ethane	-42%

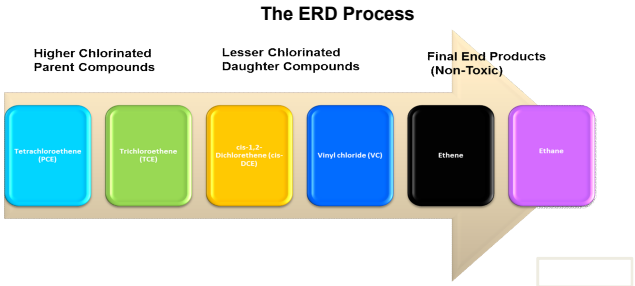


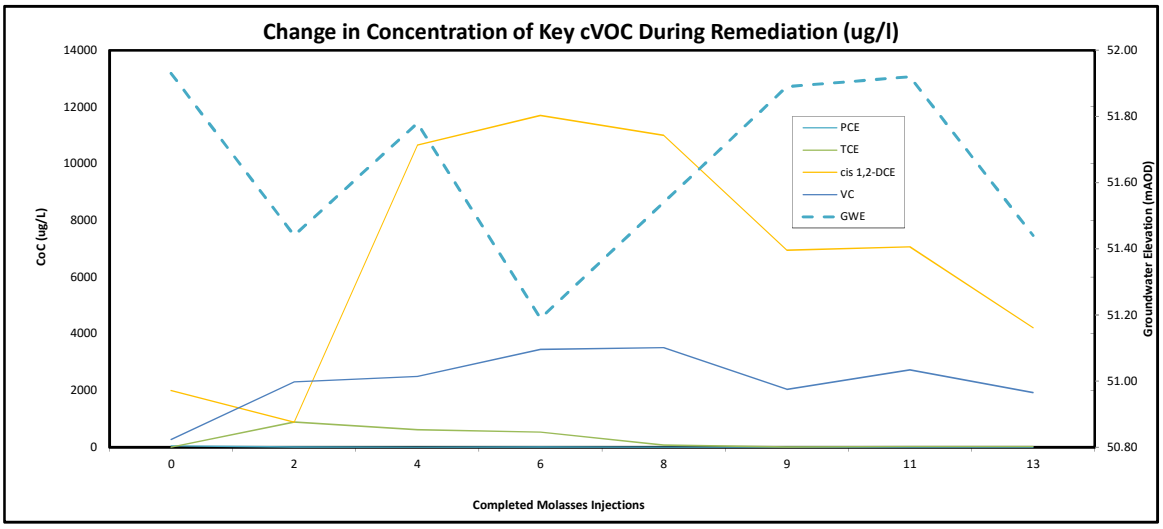


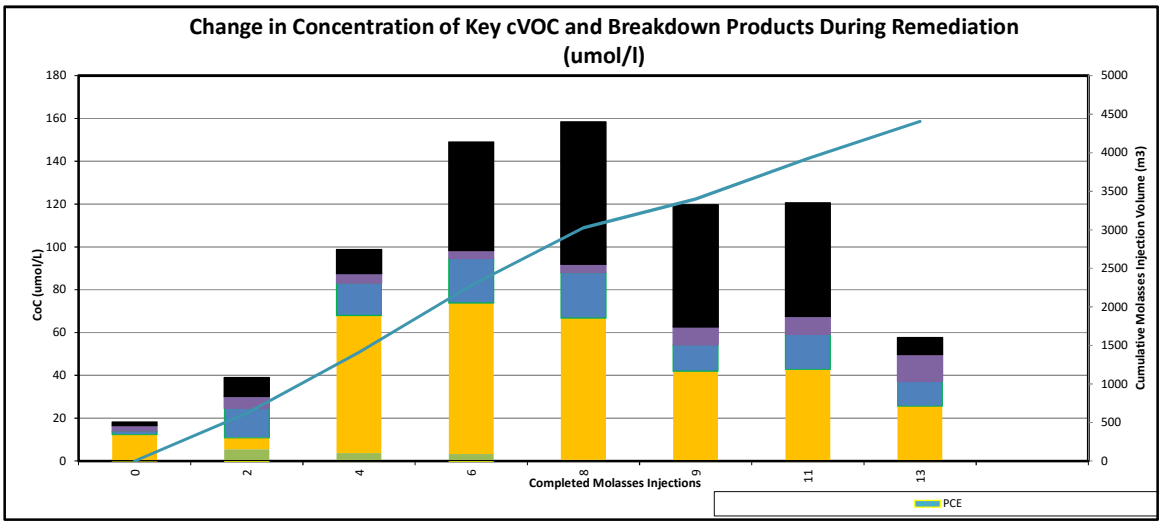


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

RSW7002S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	194%
	Percentage Increase Ethene and Ethane	381%

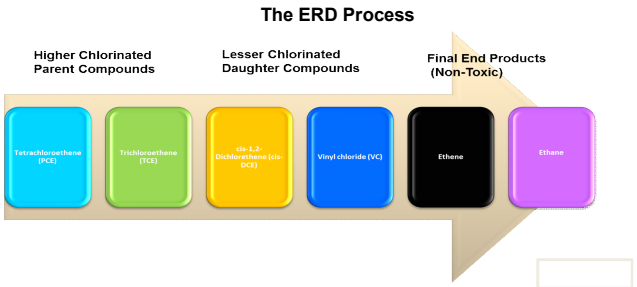


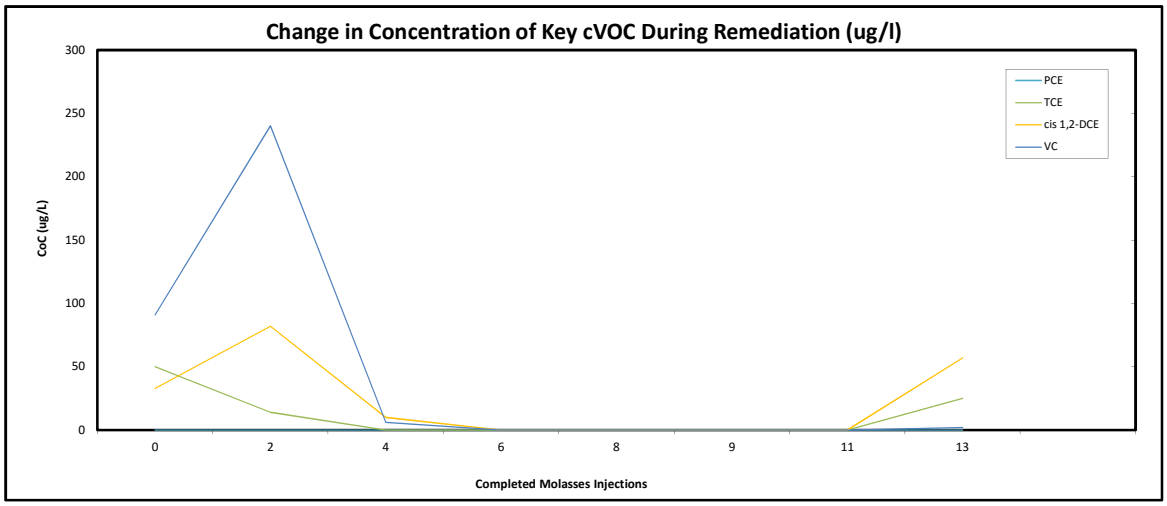


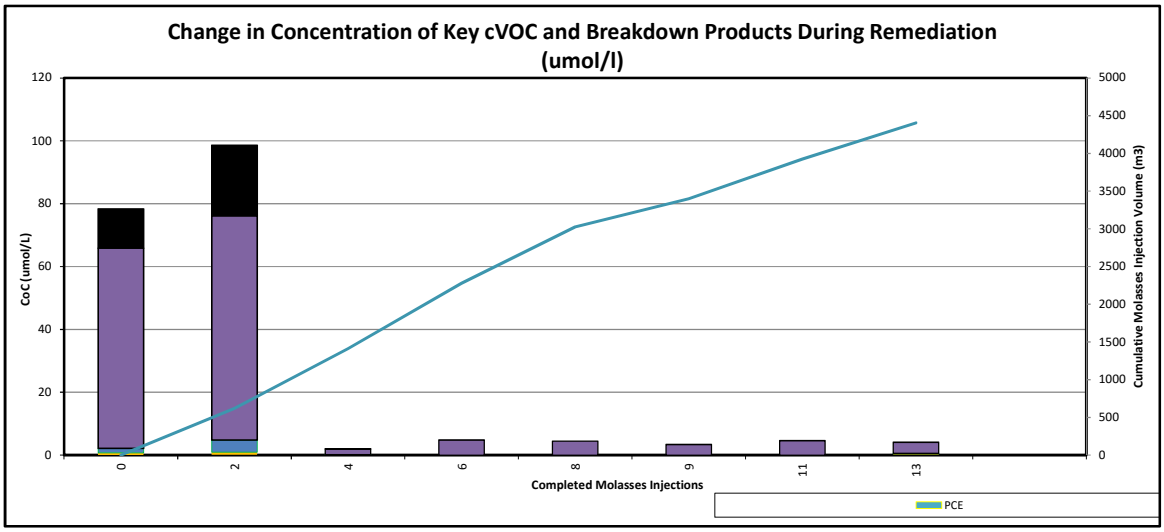


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

RSW7003S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-63%
	Percentage Increase Ethene and Ethane	-74%

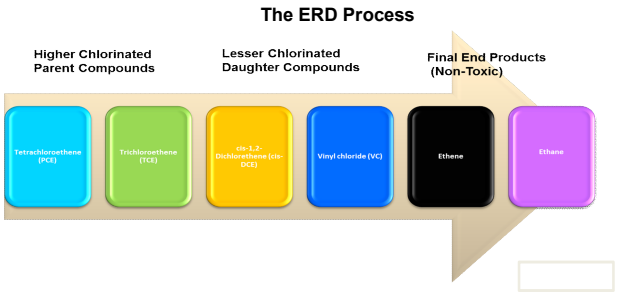


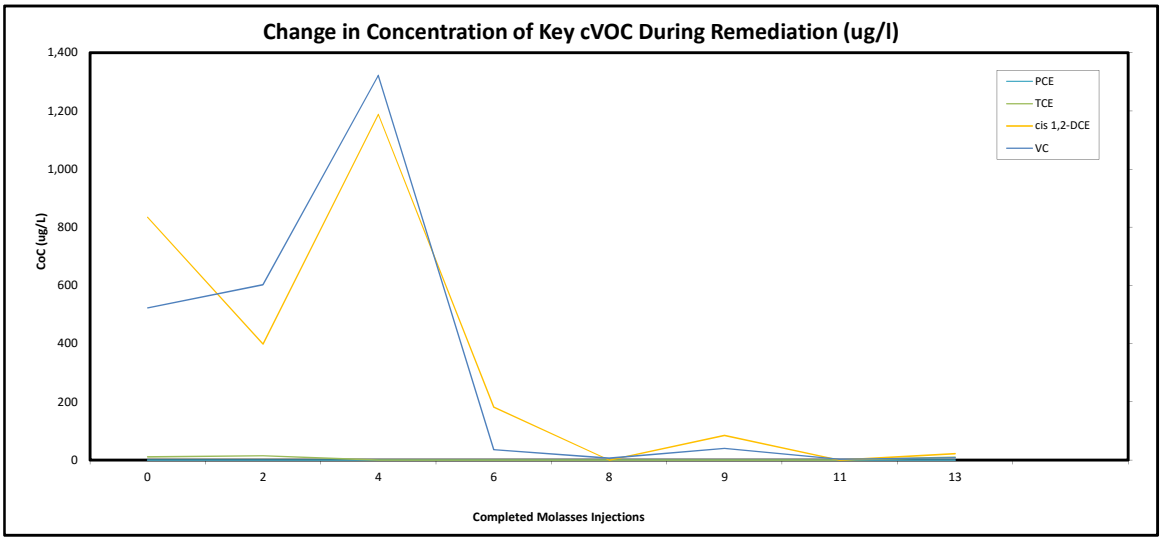


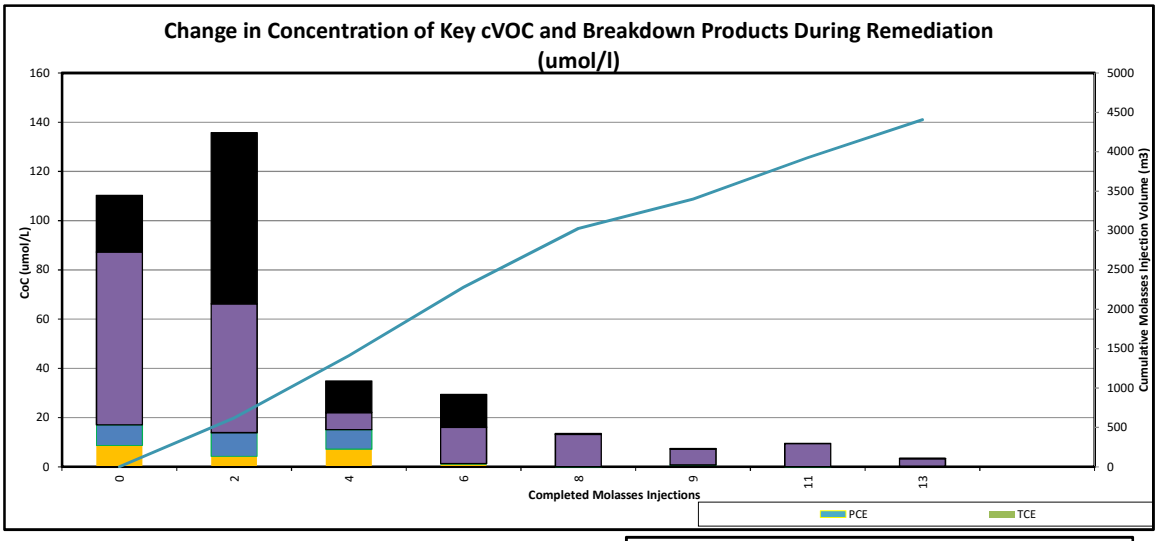


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

RSW7004S Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-97%
	Percentage Increase Ethene and Ethane	-82%

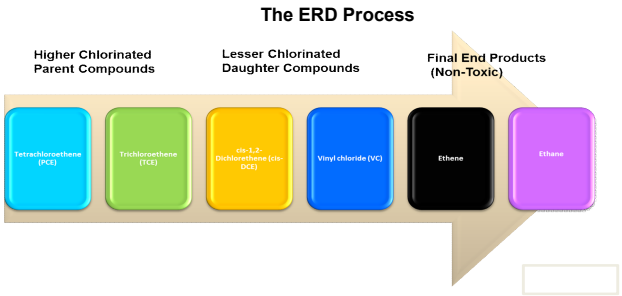


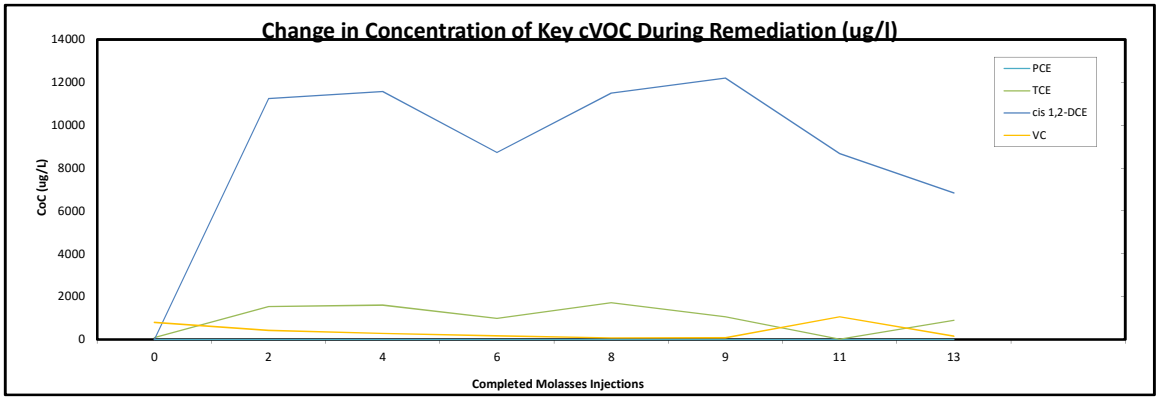


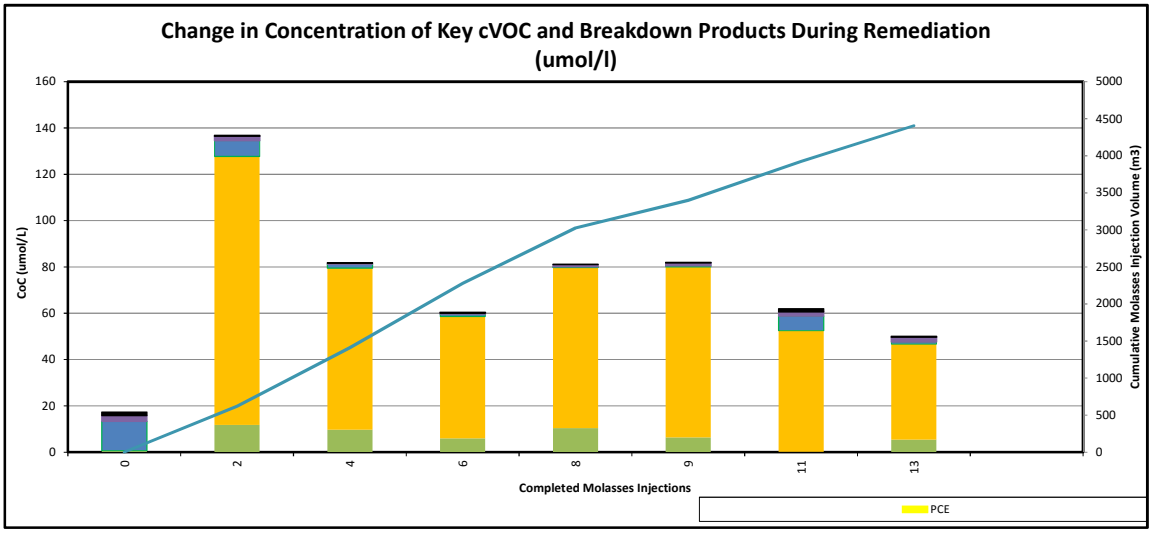


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

RSW7001D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	498%
	Percentage Increase Ethene and Ethane	260%

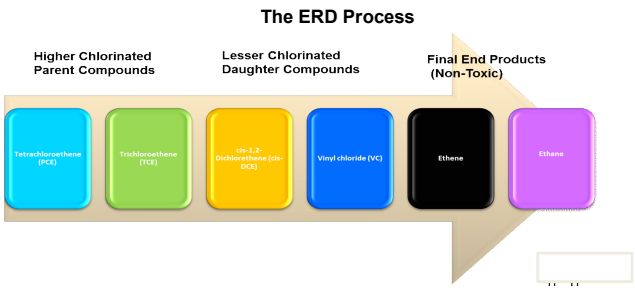


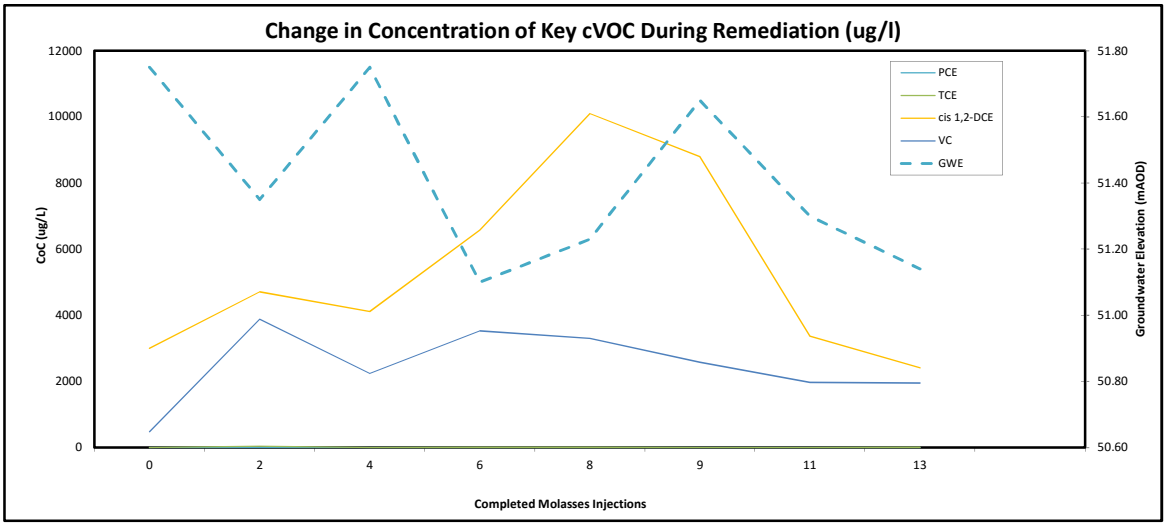


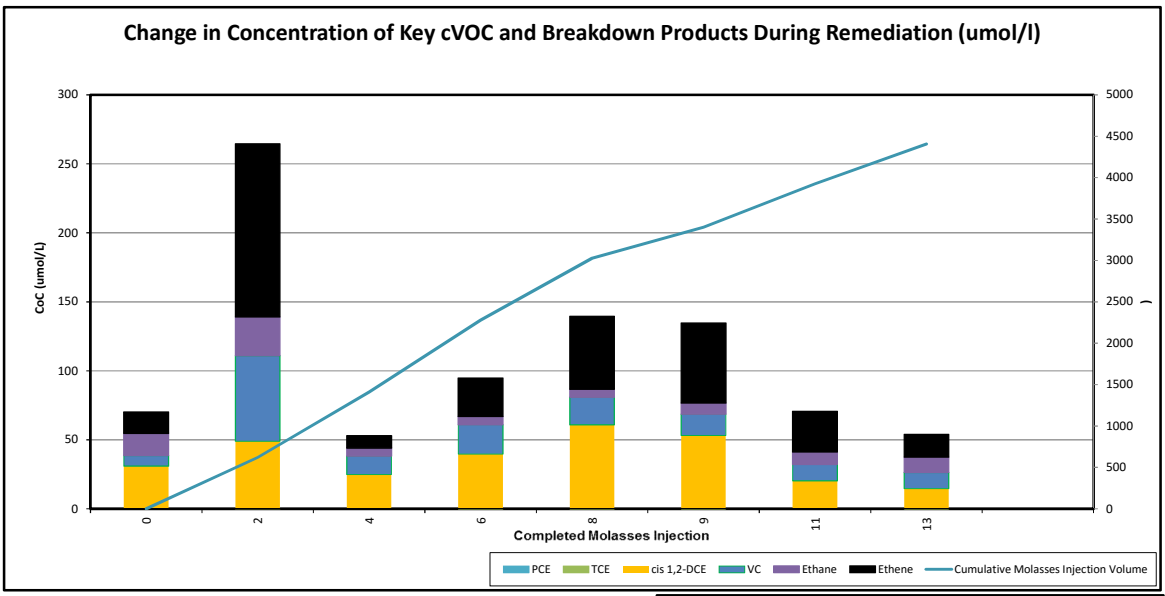


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

RSW7001D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	72%
	Percentage Increase Ethene and Ethane	405%

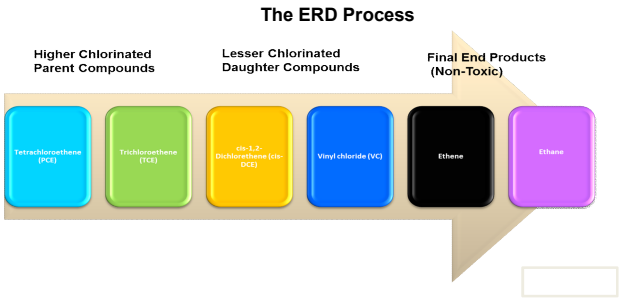


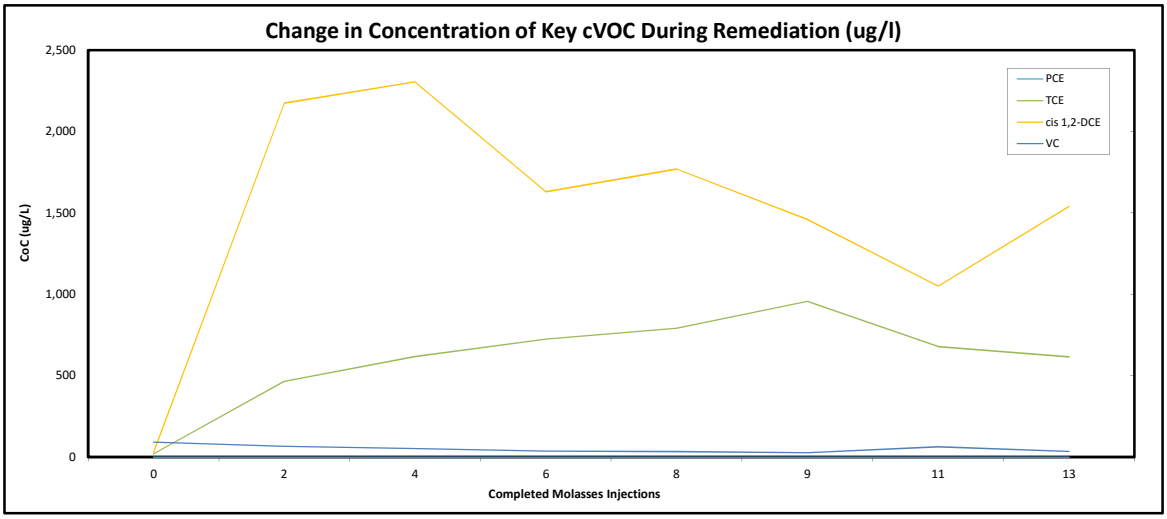


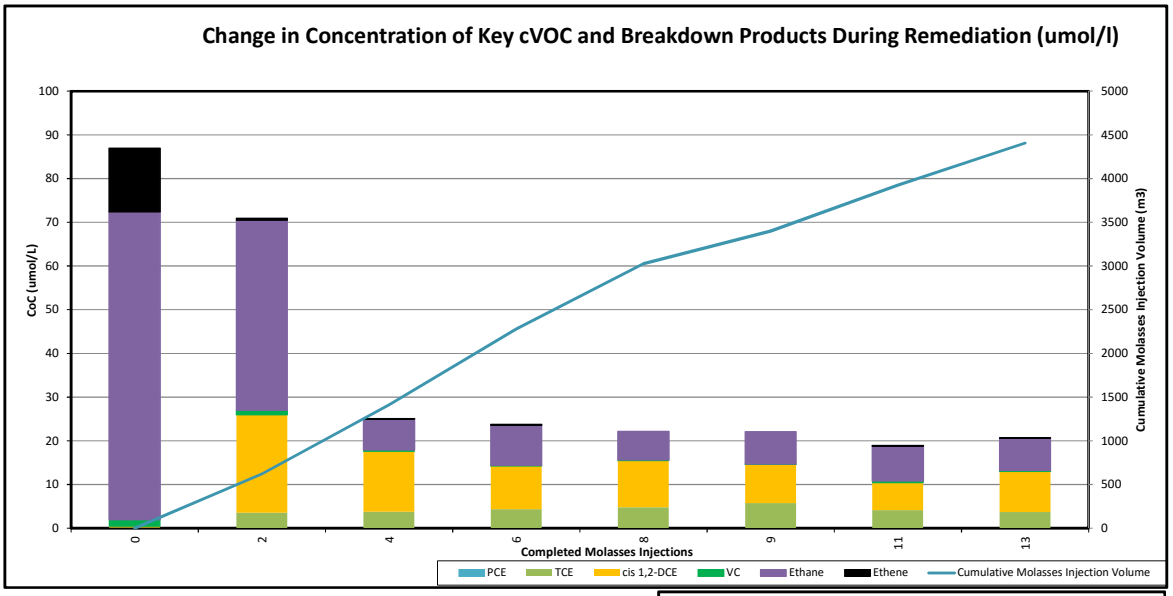


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

RSW7003D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	>500%
	Percentage Increase Ethene and Ethane	-51%

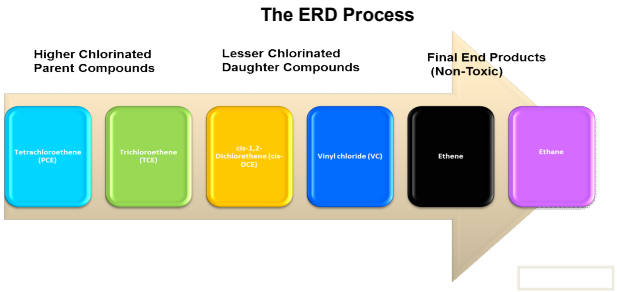


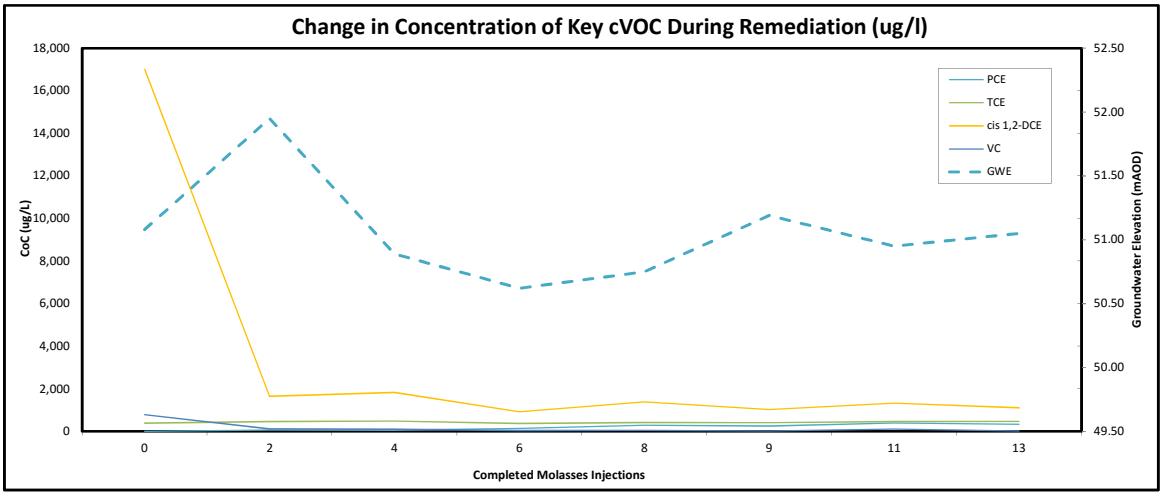


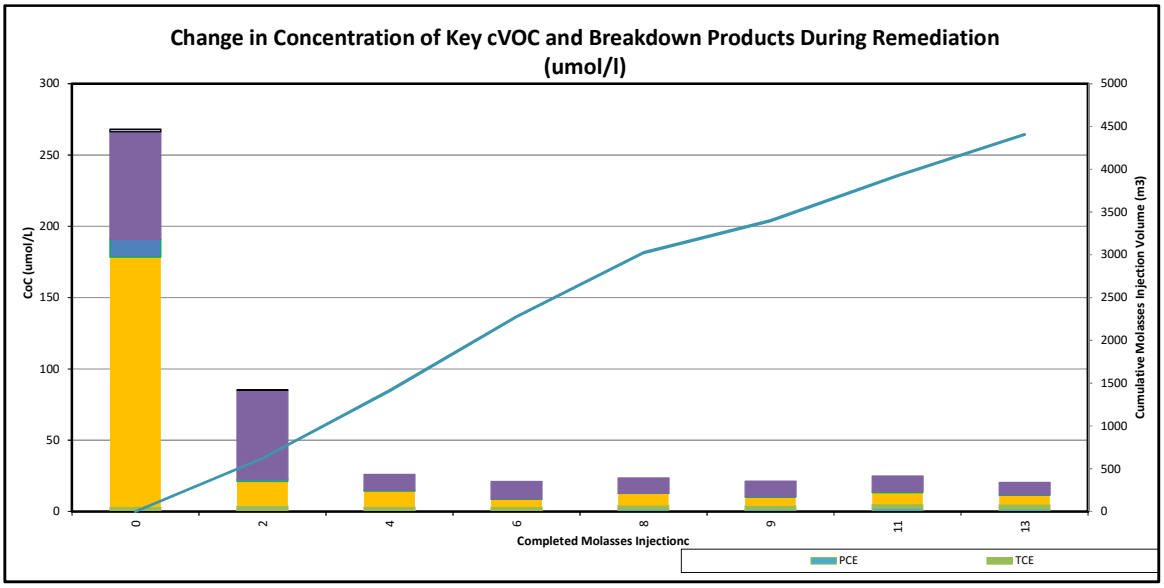


Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

RSW7004D Scorcard		
Contaminant Destruction	Percentage Decrease PCE, TCE, cis-DCE, and VC	-91%
	Percentage Increase Ethene and Ethane	-38%







Notes:
Molasses Injections at approximatly 3 month intervals
Injection at 5% molassses solution except injections 1 and 2 (1% solution) and Injections 3 and 4 (3% solution)

Appendix D.3
Measured Concentrations of Soil Gas (µg/m^3) - Baseline and Remedial Period

Location	Soil Gas SSAC (µg/m^3)		Laboratory Method Detection Limit (ug/m3)	Area A																											
				SG1										SG2									SG3								
Sample Date	Area A On-site Commercial Worker Outdoor Air Only	Area A Off-site Commercial Worker		Apr-10	May-12	Oct-13	Nov-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Feb-17	May-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16	Apr-10	May-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16
Vinyl Choride	3.100E+08	75,900	3.8	14,102	-	20.4	**3,972,356**	196	9,740	-	18,400	**496,000**	33,200	2,765	4,664	33,362	**91,800**	1,620	**110,000**	**252,000**	**97,900**	1,301	-	-	804	-	38.3	-	-	15.8
1,1-Dichloroethene	6.280E+10	1.500E+07	5.9	646	-	-	9,925	-	36.5	-	41.2	3,100	88	-	29.3	859	1,970	16.3	1,120	527	587	83.3	-	-	16.3	-	-	-	-	-
Methylene Chloride	6.740E+09	1.610E+06	35	160	-	-	125	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	-	-	-	-	-	-	-	-	<50
1,1-Dichloroethane	1.620E+11	3.580E+07	6.1	1,660	-	-	984	46.1	49.8	-	-	-	-	-	-	68.8	117	-	129	-	68.4	109	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	1.320E+10	2.890E+06	4	178,763	91.0	28.0	2,783,776	535	3,600	-	2,280	722,000	6,500	6,895	13,357	662,728	1,100,000	345	436,000	2,470	376,000	41,316	155	16.0	11,696	-	135	-	238	182
Chloroform	1.590E+08	36,300	7.3	19.5	-	-	117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	8.810E+11	1.960E+08	8.2	660	-	-	611	-	15.8	-	-	15.8	-	-	-	-	18.6	-	-	-	-	98.2	-	-	-	-	-	-	-	-
Trichloroethene	7.530E+09	1.680E+06	8.1	1,076,693	720	33.3	**8,966,272**	875	505	-	184	5,480	318	8,574	658	35,766	22,400	123	8,170	261	1480	440,155	482	-	2,577	24.2	51.1	-	156	152
1,1,2-Trichloroethane	2.570E+08	57,500	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	1.100E+11	2.390E+07	10.2	475	-	-	9,082	95.6	27.8	-	-	494	33.2	214	-	944	794	24.4	454	26.5	149	414	-	-	53.6	-	-	-	10.9	10.9
Chlorobenzene	1.960E+10	4.330E+06	6.9	-	-	-	78.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Location	Soil Gas SSAC (µg/m^3)		Area B																				
			SG4										SG5			RSG05							
Sample Date	Area B and C On-site Commercial Worker Meritor Reduced Footprint (Building B)	Laboratory Method Detection Limit	Apr-10	Sep-10	May-12	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16	Apr-10	Sep-10	May-12	Oct-13	Mar-14	Oct-14	April-15*	Sep-15	Apr-16	Nov-16	Feb-17
Vinyl Choride	5.580E+05	<3.8	**1,389,808**	**862,320**	3,417	37	-	-	92.8	**2,760,000**	9,100	22,000	**913,520**	95,420	122	1,366	-	Inside a production cage	26,800	**2,020,000**	**4,960,000**	**1,570,000**	8,210
1,1-Dichloroethene	1.080E+08	<5.9	77,954	49,988	-	12.3	-	-	28.5	25,000	218	436	48,905	8,822	-	284	-		3,580	20,700	<29.5	26,300	-
Methylene Chloride	1.160E+07	<35	882	-	-	-	-	-	-	-	<250	-	-	-	-	-	-		63,900	-	<250	<25,000	-
1,1-Dichloroethane	2.440E+08	<6.1	-	2,522	-	-	-	-	-	4,570	35.2	-	-	-	-	19.8	-		-	-	<30.5	9,470	21.5
cis-1,2-Dichloroethene	1.970E+07	<4	8,978,169	3,032,033	103,446	7,640	3,330	1,330	18,000	1,990,000	44,800	479,000	4,813,110	248,958	4,381	41,978	266		1,370,000	4,080,000	5,710,000	3,160,000	53,900
Chloroform	2.550E+05	<7.3	-	3,315	-	19	-	-	-	-	55.2	-	-	-	-	28.8	-		-	-	<36.5	8,300	11.2
1,1,1-Trichloroethane	1.350E+09	<8.2	11,814	5,999	-	-	-	-	-	-	42	64.9	-	-	-	36	-		-	851	2180	<4,100	18.6
Trichloroethene	1.160E+07	<8.1	**32,766,799**	**17,385,538**	613,885	44,314	46,905	5,800	100,000	2,010,000	114,000	548,000	**16,910,799**	1,910,096	22,378	41,719	2,258		1,240,000	3,190,000	5,640,000	2,330,000	56,400
1,1,2-Trichloroethane	3.980E+05	<8.2	-	-	-	-	-	-	-	-	<41.0	-	-	-	-	-	-		-	-	<41.0	<4,100	22.9
Toluene	3.090E+10	<5.7	3,527	1,469	-	54	34.7	-	29.8	1,150	71.6	173	1,632	-	134	72	-		-	283	1,340	554	62.5
Tetrachloroethene	1.620E+08	<10.2	16,123	29,612	-	86	142	-	189	30,700	1,590	7,120	21,075	3,215	24	2,207	-		6,550	5,980	36,600	42,800	800
Chlorobenzene	2.970E+07	<6.9	267	-	-	-	-	-	-	-	<34.5	-	-	-	-	-	-		-	-	<34.5	-	-

Location	Soil Gas SSAC (µg/m^3)		Area B																			
			SG6									SG7										
Sample Date	Area B and C On-site Commercial Worker Meritor Reduced Footprint (Building B)	Laboratory Method Detection Limit	Apr-10	May-12	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16	Apr-10	Sep-10	May-12	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16
Vinyl Choride	558,000	<3.8	376,333	325	475	-	1,500	8,180	-	-	14.8	9,624	566	39.4	-	55	136	8,180	-	-	297
1,1-Dichloroethene	108,000,000	<5.9	1,150	-	-	-	-	52.7	45.6	-		-	-	-	-	-	-	52.7	-	-	-
Methylene Chloride	11,600,000	<35	104	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	244,000,000	<6.1	162	-	7.3	-	-	-	27.9	-		56.7	47.4	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	19,700,000	<4	33,823	5,297	202	-	206	1,490	5,390	559	167	206	448	2,581	59	24	24	1,490	-	238	1,200
Chloroform	255,000	<7.3	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	1,350,000,000	<8.2	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Trichloroethene	1.160E+07	<8.1	1,037	1,351	164	-	129	892	1,670	2,070	364	408	749	626	142	328	173	892	48.9	215	757
1,1,2-Trichloroethane	3.980E+05	<8.2	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
Toluene	3.090E+10	<5.7	75.4	-	14.7	-	-	52.8	290	1050	652	181	105	40.3	39.6	95.7	-	52.8	41.4	1,040	264
Tetrachloroethene	1.620E+08	<10.2	-	17	12.2	-	17	69.9	246	518	40	54.3	109	-	-	68.5	-	69.9	-	44.8	29.8
Chlorobenzene	2.970E+07	<6.9	-	-	-	-	-	-	-	-		18.4	69.1	-	-	-	-	-	-	-	-

Location	Soil Gas SSAC (µg/m^3)		Area C																	
			SG8										SG9							
Sample Date	Area B and C On-site Commercial Worker Meritor Reduced Footprint (Building B)	Laboratory Method Detection Limit	Apr-10	Sep-10	May-12	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16	Apr-10	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16
Vinyl Choride	558,000	<3.8	3,418	-	474	5	-	80	335	-	-	21.5	2,030	22	202	-	84.4	2,630	-	241
1,1-Dichloroethene	108,000,000	<5.9	960	-	-	-	-	-	563	128	-	23.4	829	-	-	-	35.7	476	182	36.5
Methylene Chloride	11,600,000	<35	83	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
1,1-Dichloroethane	244,000,000	<6.1	56.7	-	-	-	-	-	222	28.3	-		101	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	19,700,000	<4	182,189	119,226	10,308	139	2,228	2,240	21,500	4,440	5,870	6,460	612,341	928	6,609	-	9,120	60,300	21,500	16,900
Chloroform	255,000	<7.3	1,865	1,874	-	-	-	52.2	39.1	34.7	25.9	16.6	2,671	-	-	-	16.6	145	71.8	22.9
1,1,1-Trichloroethane	1,350,000,000	<8.2	502	-	-	-	-	25.1	-	-	-		404	-	-	14.7	-	-	-	-
Trichloroethene	1.160E+07	<8.1	4,117,532	3,967,962	735	3,191	91,744	170,000	104,000	87,600	195,000	90,300	7,590,476	2,942	25,209	14	27,100	215,000	61,300	70,400
1,1,2-Trichloroethane	3.980E+05	<8.2	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
Toluene	3.090E+10	<5.7	86.7	-	-	37.3	-	-	18.8	21.1	9	69.7	98	53	-	28.6	27.1	226	-	87
Tetrachloroethene	1.620E+08	<10.2	16,171	11,641	-	-	354	230	370	319	379	121	8,628	-	87.5	-	26.5	480	69.9	40.7
Chlorobenzene	2.970E+07	<6.9	28	-	-	-	-	-	-	-	-		78.3	-	-	-	-	-	-	-

Notes:

Area A	Source area in the south east corner of the South Yard
Area B	Source area in the south of the Production Building
Area C	Source area in the north of the Production Building
	Pre-remediation concentration
SSAC	Site Specific Assessment Criteria
-	Less than laboratory MDL.

Appendix D.4

Natural Attenuation Parameters

Monitoring Well		Alluvium - Production Building													
		BH103	BH107	BH108	BH115	BH122	BH909	BH912	BH919	BH922	BH925	RSW7001S	RSW7002S	RSW7003S	RSW7004S	RSW7004S
Electrical Conductivity	(µS/cm)	LNAPL present - no parameters collected	3.4	LNAPL present - no parameters collected	255.9	LNAPL present - no parameters collected	12.9	LNAPL present - no parameters collected	9.8	LNAPL present - no parameters collected	4.7	LNAPL present - no parameters collected	LNAPL present - no parameters collected	LNAPL present - no parameters collected	LNAPL present - no parameters collected	LNAPL present - no parameters collected
Dissolved Oxygen	(mg/l)		9.03		1.94		5.88		5.62		6.88					
pH	pH units		6.97		7.36		6.35		6.38		6.65					
Oxidation-Reduction Potential	(mV)		31.8		83.1		46.7		84.2		128.9					

Monitoring Well		Alluvium - South Yard											
		BH114A	BH204AS	BH402	BH406	BH923	RSW2006S	RSW2007S	RSW2008S	RSW2009S	RSW2010S	RSW2011S	RSW2012S
Electrical Conductivity	(µS/cm)	2.1	LNAPL present - no parameters collected	LNAPL present - no parameters collected	LNAPL present - no parameters collected	4.8	4.7	LNAPL present - no parameters collected	LNAPL present - no parameters collected	LNAPL present - no parameters collected	4.3	3.4	LNAPL present - no parameters collected
Dissolved Oxygen	(mg/l)	7.80				6.92	6.05				6.27	4.53	
pH	pH units	7.53				7.99	6.61				6.87	7.13	
Oxidation-Reduction Potential	(mV)	127.4				175.0	50.0				-2.1	-57.1	

Monitoring Well		Raglan Mudstone Formation - Production Building							
		BH301S	BH301D	BH303S	BH303D	RSW7001D	RSW7002D	RSW7003D	RSW7004D
Electrical Conductivity	(µS/cm)	5.0	4.2	3.2	2.8	1,001	LNAPL present - no parameters collected	12.6	11.1
Dissolved Oxygen	(mg/l)	6.72	6.08	8.27	7.90	0.63		2.44	7.59
pH	pH units	7.01	6.97	6.93	7.46	7.29		7.33	7.24
Oxidation-Reduction Potential	(mV)	51.7	38.3	68.0	-96.6	-40.1		46.1	63.2

Monitoring Well		Raglan Mudstone Formation - South Yard										
		BH204AD	BH205AD	BH304S	BH304D	RSW2006D	RSW2007D	RSW2008D	RSW2009D	RSW2010D	RSW2011D	RSW2012D
Electrical Conductivity	(µS/cm)	2.6	2.8	6.0	6.1	3.7	4.5	4.5	5.2	4.9	4.8	3.4
Dissolved Oxygen	(mg/l)	6.64	6.43	5.98	4.72	5.46	4.06	5.72	2.52	4.60	4.64	6.60
pH	pH units	7.00	7.35	6.69	6.52	6.64	6.38	6.41	6.04	6.90	6.82	7.12
Oxidation-Reduction Potential	(mV)	-97.7	-1.9	-43.0	-83.4	35.3	-33.3	7.5	-36.0	-63.4	-76.0	-135.6

Monitoring Well		Off site wells					
		Alluvium					RMF
		BHOS409	BHOS410	BHOS411	BHOS412	BHOS414	BHOS307
Electrical Conductivity	(µS/cm)	6.8	5.4	3.6	5.5	3.0	4.6
Dissolved Oxygen	(mg/l)	4.85	8.44	7.18	8.08	7.92	8.35
pH	pH units	6.93	7.25	6.67	7.07	6.87	7.37
Oxidation-Reduction Potential	(mV)	190.0	199.0	173.9	178.2	138.3	-49.9

Notes

µS/cm	microsiemens per centimeter
mg/l	milligram per litre
mV	millivolt
RMF	Raglan Mudstone Formation

Appendix D.4

Natural Attenuation Parameters

Parameter	Unit	Method Detection Limit	Alluvium											
			BH103											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	NAPL	6.92	NAPL	NAPL	NAPL	NAPL	NAPL	6.93	6.89	6.59	6.65	7.05
TOC	mg/l	<2	NAPL	15	NAPL	NAPL	NAPL	NAPL	NAPL	22	32	16	11	20
			BH107											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.44	7.30	7.06	7.25	7.19	7.06	7.04	7.20	7.39	6.83	7.28	7.27
TOC	mg/l	<2	-	4	-	133	2	7	-	5	3	6	-	6
			BH108											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.21	6.93	6.47	6.86	6.80	6.90	6.78	6.92	6.80	7.38	6.83	6.97
TOC	mg/l	<2		12	6	9	9	20	10	20	182	63	31	16
			BH115											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.24	6.91	7.29	7.12	7.35	7.18	7.21	7.22	7.37	7.06	7.31	7.41
TOC	mg/l	<2	<2	5	<2	<2	<2	5	-	2	-	2	-	2
			BH122											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.52	6.56	6.39	6.52	6.54	6.63	6.51	6.53	6.61	6.63	7.12	7.12
TOC	mg/l	<2	<2	41	7	3	24	12	24	18	720	109	1760	247
			BH909											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.54	6.81	6.64	6.89	6.96	6.81	6.64	6.69	6.78	6.75	6.83	6.91
TOC	mg/l	<2	3	5	<2	<2	7	16	7	26	242	33	19	73
			BH912										BH913	BH913
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.47		6.75	6.77	6.49	6.69	6.64	6.51	Lost under new floor, replace with BH913		7.08	7.08
TOC	mg/l	<2	13		6	13	23	24	14	25			1690	17
			BH919											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.45	6.09	5.36	6.23	5.82	5.84	5.9	6.22	6.15	6.08	6.08	6.22
TOC	mg/l	<2	0	10	11	11	21	25	28	15	38	8	42	48
			BH922											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.23	6.37	6.14	6.30	6.31	6.34	6.25	6.37	6.20	6.14	6.61	6.61
TOC	mg/l	<2		57	20	42	126	84	366	360	1220	1160	51	153
			BH925											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.43	6.84	6.34	6.77	6.83	7.30	6.78	6.94	6.85	Sampling not possible	6.73	6.92
TOC	mg/l	<2	<2	2	4	<2	<2	10	-	4	-		21	27
			RSW7001(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.58	6.71	6.56	6.66	6.55	6.53	6.49	4.96	7.06	7.02	6.95	7.27
TOC	mg/l	<2	6	11	26	6	49	51	666	165	221	209	179	201
			RSW7002(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.60	6.65	6.24	6.71	6.61	6.50	6.58	6.65	6.55	6.64	6.7	6.74
TOC	mg/l	<2	<2	8	7	7	6	22	14	16	20	26	28	25
			RSW7003(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.54	6.66	5.26	6.74	6.71	6.80	6.86	6.95	6.85	7.27	6.92	7.21
TOC	mg/l	<2	5	14	11	30	58	77	32	35	45	36	43	52
			RSW7004(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.62	5.73	6.78	6.96	6.81	6.80	6.73	6.89	6.75	7.44	6.87	7.17
TOC	mg/l	<2	<2	12	9	10	6	17	7	13	12	7	10	16

Appendix D.4

Natural Attenuation Parameters

PRODUCTION BUILDING WELLS

Parameter	Unit	Method Detection Limit	Raglan Mudstone Formation											
			BH301(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.36	6.88	6.58	7.08	6.98	6.89	6.95	7.00	7.03	6.95	7.10	7.17
TOC	mg/l	<2	<2	2	8	2	6	23	5	7	5	7	3	3
			BH301(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.36	7.02	6.91	7.07	7.23	6.92	7.22	7.02	6.89	7.01	7.08	7.24
TOC	mg/l	<2	<2	4	6	2	5	19	-	6	-	5	2	8
			BH303(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.58	7.03	7.30	7.13	7.12	7.06	6.83	7.21	7.21	6.83	7.30	7.33
TOC	mg/l	<2	3	9	5	7	3	16	7	9	8	8	4	11
			BH303(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.50	6.90	7.45	7.17	7.10	7.08	7.01	7.13	7.20	6.98	7.46	7.28
TOC	mg/l	<2	2	9	5	7	2	17	8	11	7	5	3	18
			RSW7001(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.01	7.24	6.53	7.31	7.37	7.32	7.25	5.21	7.27	7.24	7.25	7.39
TOC	mg/l	<2	13	5	3	2	2	11	-	7	4	4	-	14
			RSW7002(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.62	6.66	6.45	6.72	6.79	6.79	6.68	6.88	6.64	6.71	6.73	6.83
TOC	mg/l	<2	<2	10	21	11	16	23	13	27	20	21	9	17
			RSW7003(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.55	6.74	7.24	7.56	7.44	7.33	7.46	7.62	7.47	10.60	7.48	7.55
TOC	mg/l	<2	5	5	5	7	3	12	-	4	4	2	-	5
			RSW7004(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.36	7.40	7.05	7.53	7.41	7.53	7.48	7.59	7.45	7.04	7.49	7.57
TOC	mg/l	<2	<2	8	4	7	5	12	3	5	5	4	2	7

Appendix D.4

Natural Attenuation Parameters

SOUTH YARD WELLS

Parameter	Unit	Method Detection Limit	Alluvium											
			RSW2006(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	6.89	6.96	6.89	7.09	7.14	6.93	6.96	7.06	7.04	6.91	6.76	6.88
TOC	mg/l	<2	13	13	6	9	6	14	11	12	12	14	5	15
			RSW2007(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.62	6.88	6.72	6.97	7.09	6,95	6.87	6.80	6.98	6.99	6.61	6.79
TOC	mg/l	<2	5	21	34	13	11	22	11	80	34	26	348	26
			RSW2008(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.25	6.79	6.56	6.50	6.72	6.60	6.75	6.78	6.74	6.57	7.01	6.80
TOC	mg/l	<2	7	20	17	13	15	33	28	30	46	50	19	40
			RSW2009(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.46	6.83	6.57	6.86	5.82	5.90	6.08	6.27	UTA	6.58	6.45	6.83
TOC	mg/l	<2	<2	40	232	38	1,785	2,040	1,920	921	UTA	265	636	103
			RSW2010(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	7.61	7.33	7.44	7.35	7.28	7.16	7.14	7.06	6.79	6.95	6.94	7.05
TOC	mg/l	<2	24	19	5	8	8	32	40	28	53	31	24	26
			RSW2011(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.35	7.14	7.70	7.35	7.38	6.99	7.19	7.27	6.95	6.89	6.77	7.14
TOC	mg/l	<2	6	16	6	4	4	20	23	21	60	15	3	17
			RSW2012(S)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.39	6.92	NAPL	6.71	5.88	6.25	6.63	6.78	6.80	6.74	6.76	7.09
TOC	mg/l	<2	14	38	NAPL	95	1087	556	622	86	163	137	42	56
			BH406											
Date			Jul-13	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16	No baseline data available for BH406. BH406 was added to the selected monitoring well set after BH400, part of the original baseline well set, was lost during the South Yard car park redevelopment works.			
pH	pH units	<0.01	6.83	6.83	6.92	6.96	6.92	7.26	7.15	7.04				
TOC	mg/l	<2	29	29	26	34	27	21	9	27				
			BH114A											
Date			Aug-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16				
pH	pH units	<0.01	8.21	9.50	8.79	7.15	7.28	6.98	8.98	7.68				
TOC	mg/l	<2	-	3	4	3	-	5	-	5				
			BH402											
Date			Aug-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16				
pH	pH units	<0.01	8.38	7.17	6.76	6.79	7.14	7.23	7.30	7.14				
TOC	mg/l	<2	13	14	10	18	8	13	9	12				
			BH923											
Date			Aug-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16				
pH	pH units	<0.01	7.68	7.21	7.34	7.22	7.16	7.16	6.77	7.25				
TOC	mg/l	<2		-	2	3	-	2	-	3				
			BH204AS											
Date			Aug-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16				
pH	pH units	<0.01	8.26	6.43	5.62	6.10	6.36	6.53	6.24	6.58				
TOC	mg/l	<2	4	132	1170	1430	272000	54	479	96				

Appendix D.4

Natural Attenuation Parameters

SOUTH YARD WELLS

Parameter	Unit	Method Detection Limit	Raglan Mudstone Formation											
			RSW2006(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	7.38	7.05	6.96	7.07	7.02	6.90	6.95	7.00	7	6.85	6.78	6.93
TOC	mg/l	<2	13	56	77	15	4	16	11	11	12	15	6	17
			RSW2007(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.28	7.02	7.01	6.68	6.24	6.44	6.54	6.45	6.32	6.28	6.28	6.41
TOC	mg/l	<2	3	128	227	188	566	664	395	485	896	925	245	68
			RSW2008(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.16	6.82	6.99	6.31	6.29	6.34	6.99	6.08	7.07	6.09	6.28	6.96
TOC	mg/l	<2	-	45	86	603	901	666	28	1970	32	970	767	24
			RSW2009(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.17	7.06	6.60	6.55	6.69	6.43	6.43	6	No sample	6.33	6.53	6.77
TOC	mg/l	<2	16	101	218	262	52	111	138	354	No sample	488	92	55
			RSW2010(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	7.87	7.88	7.34	7.29	7.27	7.35	7.31	7.09	7.12	7.09	7.04	6.92
TOC	mg/l	<2	7	13	24	13	4	15	24	99	16	75	11	42
			RSW2011(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.14	7.26	7.26	7.65	7.20	6.97	6.71	6.65	7.07	6.43	6.42	6.68
TOC	mg/l	<2	3	48	5	3	7	38	131	171	25	355	201	107
			RSW2012(D)											
Date			Aug-12	Jul-13	Oct-13	Jan-14	Mar-14	Jun-14	Sep-14	Jan-15	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.21	6.83	7.15	7.01	6.56	6.46	6.81	6.19	6.66	6.77	6.79	6.75
TOC	mg/l	<2	5	53	13	24	202	395	123	1560	112	33	38	99
			BH304S											
Date			Feb-11	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16				
pH	pH units	<0.01	8.03		7.39	7.07	7.02	6.57	6.71	6.71				
TOC	mg/l	<2	**58**		30	26	25	101	7	79				
			BH204AD											
Date			Aug-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16				
pH	pH units	<0.01	8.36	6.97	7.00	7.13	7.25	6.96	6.9	6.94				
TOC	mg/l	<2	-	23	13	33	33	29	31	25				
			BH205AD											
Date			Feb-11	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16				
pH	pH units	<0.01	7.34		7.45	7.34	7.53	6.97	7.44	7.39				
TOC	mg/l	<2	15		2	3	4	3	-	3				
			BH304D											
Date			Aug-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16				
pH	pH units	<0.01	7.88	7.32	7.19	6.96	7.07	6.93	6.66	6.68				
TOC	mg/l	<2	-	59	13	59	19	9	14	75				

Appendix D.4

Natural Attenuation Parameters

OFF SITE WELLS

Parameter	Unit	Method Detection Limit	Alluvium						
			BHOS409						
Date			Aug-12	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.33	6.73	6.64	6	6.28	6.14	6.15
TOC	mg/l	<2	4	3	-	2	-	-	2
			BHOS410						
Date			Aug-12	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	7.24	6.82	6.29	6.34	6.23	6.68	7.16
TOC	mg/l	<2	4	-	-	-	-	-	-
			BHOS412						
Date			Aug-12	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	7.01	5.96		6.19	6.14	6.04	6.36
TOC	mg/l	<2	4	<2		2	-	-	-
			BHOS414						
Date			Aug-12	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.29	7.18	7	7.03	7.11	7.06	7.12
TOC	mg/l	<2	3	2	-	-	-	-	2
Parameter	Unit	Method Detection Limit	Raglan Mudstone Formation						
			BHOS307						
Date			Aug-12	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16
pH	pH units	<0.01	8.36	7.71	6.88	7.79	7.84	6.72	7.04
TOC	mg/l	<2	-	3	-	-	-	-	-

Notes

	No data collected
mg/l	milligram per litre
TOC	Total Organic Carbon
GWM	Groundwater monitoring

Appendix D.4

Natural Attenuation Parameters

Monitoring date	MDL	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Area		**Production Building**							
Sample Identity		**BH103**							
Dissolved Methane	1 µg/l	NAPL	NAPL	NAPL	NAPL	16,700	11,500	11,800	14,000
Dissolved Ethene	1 µg/l					84	131	8	-
Dissolved Ethane	1 µg/l					1,660	1,580	944	897
Dissolved Carbon Dioxide	1 µg/l					190,000	172,000	78,700	120,000
Sulphate	0.05 mg/l					0.39	0.73	3.38	2
Nitrate	0.2 mg/l					0.3	-	0.4	0.3
Sample Identity		**BH107**							
Dissolved Methane	1 µg/l	35	15	15	37	78	1,720	612	87
Dissolved Ethene	1 µg/l	-	-	-	-	-	-	-	8
Dissolved Ethane	1 µg/l	-	2	-	9	8	272	182	21
Dissolved Carbon Dioxide	1 µg/l	53,442	-	42,590	55,000	53,000	45,900	45,200	51,000
Sulphate	0.05 mg/l	38.58	36.91	38.06	47.1	40	12.1	12.3	49.7
Nitrate	0.2 mg/l	0.7	1.5	0.6	-	-	0.8	0.7	1.2
Sample Identity		**BH108**							
Dissolved Methane	1 µg/l	5,430	6,099	10,881	12,200	26,700	24,500	24,500	16,000
Dissolved Ethene	1 µg/l	-	6	-	8	-	-	-	-
Dissolved Ethane	1 µg/l	2,612	1,868	1,319	1,030	573	142	199	369
Dissolved Carbon Dioxide	1 µg/l	62,550	57,842	111,804	196,000	447,000	310,000	252,000	129,000
Sulphate	0.05 mg/l	0.76	2.5	0.26	0.95	-	-	-	-
Nitrate	0.2 mg/l	-	-	-	0.8	-	-	0.6	-
Sample Identity		**BH115**							
Dissolved Methane	1 µg/l	-	-	5	-	8	-	38	6
Dissolved Ethene	1 µg/l	-	-	-	-	-	-	-	-
Dissolved Ethane	1 µg/l	-	-	-	-	-	-	-	-
Dissolved Carbon Dioxide	1 µg/l	21,788	16,896	18,780	23,500	19,600	15,300	14,000	18,100
Sulphate	0.05 mg/l	21.1	22.96	22.74	26.8	28.7	20.8	25.8	22.9
Nitrate	0.2 mg/l	3.3	3	3.1	1.8	3.4	2.4	5.1	2.3
Sample Identity		**BH122**							
Dissolved Methane	1 µg/l	1,096	1,655	7,271	20,900	20,100	22,300	39,500	23,200
Dissolved Ethene	1 µg/l	246	3,555	1,285	1,420	379	-	-	-
Dissolved Ethane	1 µg/l	66	235	114	118	8	269	-	70
Dissolved Carbon Dioxide	1 µg/l	147,007	262,739	221,648	502,000	1,730,000	698,000	1,360,000	611,000
Sulphate	0.05 mg/l	31.58	14.33	15.58	4.17	18	-	-	-
Nitrate	0.2 mg/l	-	-	-	-	0.9	0.8	0.6	-
Sample Identity		**BH909**							
Dissolved Methane	1 µg/l	1,248	259	5,171	5,500	21,200	21,000	18,900	18,000
Dissolved Ethene	1 µg/l	44	7	103	171	-	-	-	-
Dissolved Ethane	1 µg/l	15	-	39	65	28	70	94	33
Dissolved Carbon Dioxide	1 µg/l	102,895	109,459	165,821	245,000	894,000	410,000	338,000	479,000
Sulphate	0.05 mg/l	34.97	60.22	17.94	29.9	-	-	5.76	-
Nitrate	0.2 mg/l	0.4	-	-	-	0.3	0.8	0.7	0.3
Sample Identity		**BH912**						**BH913**	**BH912**
Dissolved Methane	1 µg/l	1,667	1,455	965	2,720	Lost under new floor	Lost under new floor replaced with BH913	78,400	3,230
Dissolved Ethene	1 µg/l	789	699	388	617			-	369
Dissolved Ethane	1 µg/l	288	232	174	229			-	257
Dissolved Carbon Dioxide	1 µg/l	125,632	100,762	192,040	194,000			1,220,000	120,000
Sulphate	0.05 mg/l	9.55	7.85	31.96	7.95			-	17.1
Nitrate	0.2 mg/l	0.5	-	-	-			0.8	0.3

Appendix D.4

Natural Attenuation Parameters

Monitoring date	MDL	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Sample Identity		**BH919**							
Dissolved Methane	1 µg/l	286	190	484	1,520	2,760	5,420	6,320	9,740
Dissolved Ethene	1 µg/l	27	34	72	237	944	7,840	5,640	4,560
Dissolved Ethane	1 µg/l	-	3	-	16	31	68	102	288
Dissolved Carbon Dioxide	1 µg/l	178,667	219,120	254,708	365,000	390,000	373,000	463,000	515,000
Sulphate	0.05 mg/l	34.71	33.94	29.15	21.5	17	11.8	17.3	9.6
Nitrate	0.2 mg/l	-	-	-	-	4.4	0.9	0.4	-
Sample Identity		**BH922**							
Dissolved Methane	1 µg/l	218	530	553	2,460	9,980	11,200	20,000	22,900
Dissolved Ethene	1 µg/l	67	50	61	325	3,060	27,500	15,800	6,080
Dissolved Ethane	1 µg/l	32	35	33	12	11	10	78	1,270
Dissolved Carbon Dioxide	1 µg/l	217,029	154,156	525,108	1,220,000	1,420,000	1,380,000	942,000	732,000
Sulphate	0.05 mg/l	71.54	56.52	67.39	0.24	-	-	1	-
Nitrate	0.2 mg/l	29	0.7	1.2	0.4	2	-	1	-
Sample Identity		**BH925**							
Dissolved Methane	1 µg/l	666	29	29	50	43	Not accessible due to demolition works	37	20
Dissolved Ethene	1 µg/l	-	-	-	-	-		-	-
Dissolved Ethane	1 µg/l	-	-	-	-	-		-	-
Dissolved Carbon Dioxide	1 µg/l	143,964	109,493	72,673	133,000	129,000		231,000	218,000
Sulphate	0.05 mg/l	35.88	50.07	46.27	48.9	49		191	170
Nitrate	0.2 mg/l	2	0.4	0.9	1.3	1.8		1.6	2.6
Sample Identity		**RSW7001S**							
Dissolved Methane	1 µg/l	5,752	3,401	11,270	25,200	27,900	26,000	23,500	26,500
Dissolved Ethene	1 µg/l	2,841	8,439	14,936	987	210	14	-	-
Dissolved Ethane	1 µg/l	756	282	426	806	309	354	569	2,210
Dissolved Carbon Dioxide	1 µg/l	226,472	378,606	572,629	985,000	380,000	369,000	273,000	282,000
Sulphate	0.05 mg/l	7.47	-	-	-	-	-	-	-
Nitrate	0.2 mg/l	-	-	-	-	0.7	-	0.7	-
Sample Identity		**RSW7002S**							
Dissolved Methane	1 µg/l	2,991	7,088	10,314	14,900	15,500	17,300	20,200	21,100
Dissolved Ethene	1 µg/l	278	1,443	1,837	8,390	11,000	9,460	8,790	1,310
Dissolved Ethane	1 µg/l	424	913	753	622	663	1,390	1,380	2,070
Dissolved Carbon Dioxide	1 µg/l	136,204	176,349	325,072	354,000	383,000	399,000	436,000	206,000
Sulphate	0.05 mg/l	27.17	10.55	7.53	4.93	2.73	4.55	1.95	2.3
Nitrate	0.2 mg/l	-	0.4	-	0.8	-	-	0.6	-
Sample Identity		**RSW7003S**							
Dissolved Methane	1 µg/l	17,112	17,777	23,093	21,500	23,700	22,400	28,000	27,600
Dissolved Ethene	1 µg/l	352	628	6	-	-	-	-	-
Dissolved Ethane	1 µg/l	1,914	2,147	303	792	737	559	756	594
Dissolved Carbon Dioxide	1 µg/l	157,840	193,095	597,280	169,000	170,000	116,000	233,000	155,000
Sulphate	0.05 mg/l	2.31	0.5	-	-	0.9	0.44	-	-
Nitrate	0.2 mg/l	-	3.5	-	0.9	0.3	-	-	0.3
Sample Identity		**RSW7004S**							
Dissolved Methane	1 µg/l	9,852	9,414	11,880	19,800	21,400	19,700	28,000	24,300
Dissolved Ethene	1 µg/l	644	1,949	2,125	2,210	50	25	-	6
Dissolved Ethane	1 µg/l	2,112	1,573	1,146	2,450	2,180	1,070	1560	508
Dissolved Carbon Dioxide	1 µg/l	121,188	111,326	248,961	225,000	153,000	98,600	135,000	142,000
Sulphate	0.05 mg/l	0.71	0.6	0.2	0.22	0.86	0.79	0.39	0.8
Nitrate	0.2 mg/l	-	-	-	0.9	4.9	-	0.2	-

Appendix D.4

Natural Attenuation Parameters

Monitoring date	MDL	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
South Yard									
Sample Identity		**BH114A**							
Dissolved Methane	1 µg/l	-	-	5	22	-	12	13	9
Dissolved Ethene	1 µg/l	-	-	-	8	-	-	-	-
Dissolved Ethane	1 µg/l	-	-	-	-	-	-	-	2
Dissolved Carbon Dioxide	1 µg/l	2,154	-	1,584	26,200	-	4,380	1,800	7,870
Sulphate	0.05 mg/l	78.52	39.15	39	46.5	37.8	33.7	25.8	22.7
Nitrate	0.2 mg/l	11.8	6.6	2.9	1.1	4.5	2.1	6.2	2.8
Sample Identity		**BH204AS**							
Dissolved Methane	1 µg/l	16,164	11,307	7,990	NDP	23,500	15,300	24,400	27,300
Dissolved Ethene	1 µg/l	3,983	15,433	5,285	NDP	9,110	9,110	8,100	18,700
Dissolved Ethane	1 µg/l	1,145	1,069	594	NDP	280	263	826	1,730
Dissolved Carbon Dioxide	1 µg/l	166,052	370,779	1,093,692	NDP	689,000	290,000	1,090,000	427,000
Sulphate	0.05 mg/l	6.78	-	36.53	10.6	-	6.14	-	1.5
Nitrate	0.2 mg/l	-	-	-	-	-	-	-	-
Sample Identity		**BH402**							
Dissolved Methane	1 µg/l	1,346	512	728	550	563	1,030	4,740	2,530
Dissolved Ethene	1 µg/l	53	279	1,014	2,780	2,770	1,960	2,680	967
Dissolved Ethane	1 µg/l	-	7	7	-	-	-	156	103
Dissolved Carbon Dioxide	1 µg/l	83,418	85,219	98,145	114,000	84,100	53,000	118,000	76,600
Sulphate	0.05 mg/l	9.57	26.86	7.55	4.88	9.9	2.37	5.03	20
Nitrate	0.2 mg/l	-	-	-	-	-	-	0.4	-
Sample Identity		**BH406**							
Dissolved Methane	1 µg/l	Not Sampled	15,064	17,300	-	22,100	4,550	2,740	14,200
Dissolved Ethene	1 µg/l		14	-	-	-	10	-	9
Dissolved Ethane	1 µg/l		176	70	-	85	25	13	47
Dissolved Carbon Dioxide	1 µg/l		215,310	237,000	21,893	316,000	130,000	73,600	217,000
Sulphate	0.05 mg/l		39.03	27.8	91.21	44.1	171	53.1	27.6
Nitrate	0.2 mg/l		-	-	30.5	0.4	0.8	0.4	-
Sample Identity		**BH923**							
Dissolved Methane	1 µg/l	-	113	8	11	-	-	8	7
Dissolved Ethene	1 µg/l	-	103	6	5	-	-	-	-
Dissolved Ethane	1 µg/l	-	7	-	-	-	-	-	-
Dissolved Carbon Dioxide	1 µg/l	21,893	-	10,174	21,400	22,600	17,300	23,800	23,900
Sulphate	0.05 mg/l	91.21	43.97	40.46	38.4	67.9	77.9	63.8	38.5
Nitrate	0.2 mg/l	30.5	11.9	25	48.7	171	128	82.8	21.3
Sample Identity		**RSW2006S**							
Dissolved Methane	1 µg/l	276	46	369	4,670	4,700	10,100	4,490	5,910
Dissolved Ethene	1 µg/l	13	7	28	43	14	19	16	20
Dissolved Ethane	1 µg/l	21	13	26	51	54	68	75	76
Dissolved Carbon Dioxide	1 µg/l	88,811	-	66,881	83,400	76,900	128,000	143,000	224,000
Sulphate	0.05 mg/l	64.38	48.31	36.89	45.9	43.8	51.3	51.1	55.9
Nitrate	0.2 mg/l	-	0.7	-	-	0.2	-	-	-
Sample Identity		**RSW2007S**							
Dissolved Methane	1 µg/l	21,823	27,687	29,805	26,100	35,400	17,900	25,300	28,700
Dissolved Ethene	1 µg/l	111	79	17	12	7	16	27	336
Dissolved Ethane	1 µg/l	315	198	202	118	62	27	41	580
Dissolved Carbon Dioxide	1 µg/l	69,270	257,893	136,384	152,000	386,000	303,000	150,000	1,010,000
Sulphate	0.05 mg/l	19.27	0.07	0.7	19	-	30.1	-	-
Nitrate	0.2 mg/l	-	-	-	0.7	-	-	0.3	0.3
Sample Identity		**RSW2008S**							
Dissolved Methane	1 µg/l	1,159	2,996	3,795	8,460	19,500	10,900	21,700	29,000
Dissolved Ethene	1 µg/l	-	364	70	194	273	95	136	55
Dissolved Ethane	1 µg/l	32	100	70	172	224	97	182	110
Dissolved Carbon Dioxide	1 µg/l	466,243	-	291,941	346,000	485,000	466,000	487,000	559,000
Sulphate	0.05 mg/l	265.35	176.29	102.8	136	135	167	96.8	51.2
Nitrate	0.2 mg/l	-	0.4	-	0.5	0.4	-	0.3	-

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Natural Attenuation Parameters

Monitoring date	MDL	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Sample Identity		**RSW2009S**							
Dissolved Methane	1 µg/l	13,827	22,079	14,487	NDP	Not accessible due to stockpiled aggregate	24,600	32,500	31,200
Dissolved Ethene	1 µg/l	679	6,329	1,499	NDP		177	169	<1
Dissolved Ethane	1 µg/l	458	1,317	414	NDP		177	98	297
Dissolved Carbon Dioxide	1 µg/l	53,400	442,765	1,586,902	NDP		428,000	1,310,000	414,000
Sulphate	0.05 mg/l	19.96	-	26.88	5.28		-	-	-
Nitrate	0.2 mg/l	-	1.3	-	-		-	-	0.4
Sample Identity		**RSW2010S**							
Dissolved Methane	1 µg/l	2,562	-	5,373	11,000	26,200	23,800	28,400	18,900
Dissolved Ethene	1 µg/l	13	-	60	72	83	16	20	34
Dissolved Ethane	1 µg/l	142	-	52	100	152	99	116	113
Dissolved Carbon Dioxide	1 µg/l	96,661	-	61,936	156,000	515,000	391,000	373,000	478,000
Sulphate	0.05 mg/l	91.62	65.41	32.5	24.3	3.28	22.3	15.6	7.5
Nitrate	0.2 mg/l	-	1.2	0.2	-	0.3	0.7	0.3	-
Sample Identity		**RSW2011S**							
Dissolved Methane	1 µg/l	5	9	21	312	14,900	3,600	5,440	5,220
Dissolved Ethene	1 µg/l	-	3	-	9	982	316	302	667
Dissolved Ethane	1 µg/l	-	2	-	8	98	39	1	109
Dissolved Carbon Dioxide	1 µg/l	48,944	22,515	36,674	83,600	255,000	105,000	100,000	109,000
Sulphate	0.05 mg/l	116.6	94.18	30.62	36	11.5	28.4	22.1	16.6
Nitrate	0.2 mg/l	1.3	1	3.6	0.8	0.6	-	-	0.3
Sample Identity		**RSW2012S**							
Dissolved Methane	1 µg/l	10,851	LNAPL only in well, no groundwater sample collection possible	17,396	23,000	30,600	29,100	2,700	22,900
Dissolved Ethene	1 µg/l	-		666	52	11	13	112	8
Dissolved Ethane	1 µg/l	-		266	41	45	58	120	214
Dissolved Carbon Dioxide	1 µg/l	97,697		1,135,045	1,130,000	938,000	537,000	400,000	351,000
Sulphate	0.05 mg/l	12.34		3.83	-	-	-	2.69	6.1
Nitrate	0.2 mg/l	-		-	0.3	-	-	0.3	-
Off Site									
Sample Identity		**BHOS409**							
Dissolved Methane	1 µg/l	25	Not Sampled	9	19	-	-	-	2
Dissolved Ethene	1 µg/l	-		-	-	-	-	-	-
Dissolved Ethane	1 µg/l	-		-	-	-	-	-	-
Dissolved Carbon Dioxide	1 µg/l	117,011		85,702	122,000	122,000	64,000	125,000	118,000
Sulphate	0.05 mg/l	21.14		24.63	21.2	6.2	22.6	19.5	19.5
Nitrate	0.2 mg/l	10.9		-	0.4	0.5	-	0.3	-
Sample Identity		**BHOS410**							
Dissolved Methane	1 µg/l	-	Not Sampled	6	8	-	-	-	2
Dissolved Ethene	1 µg/l	-		-	-	-	-	-	-
Dissolved Ethane	1 µg/l	-		-	-	-	-	-	-
Dissolved Carbon Dioxide	1 µg/l	126,924		49,784	116,000	100,000	73,500	86,000	57,600
Sulphate	0.05 mg/l	18.01		13.52	16.5	45.2	18.5	13	10
Nitrate	0.2 mg/l	0.8		0.4	0.8	2	1	0.6	-
Sample Identity		**BHOS412**							
Dissolved Methane	1 µg/l	9	Not Sampled	-	Well could not be located	12	8	13	7
Dissolved Ethene	1 µg/l	-		-		-	-	-	-
Dissolved Ethane	1 µg/l	-		-		-	-	-	-
Dissolved Carbon Dioxide	1 µg/l	95,532		62,860		88,900	86,200	78,800	98,000
Sulphate	0.05 mg/l	15.45		14.46		11.1	14	11.2	9.5
Nitrate	0.2 mg/l	-		1.6		0.5	-	-	-
Sample Identity		**BHOS414**							
Dissolved Methane	1 µg/l	5	Not Sampled	-	29	51	40	34	56
Dissolved Ethene	1 µg/l	-		-	-	-	-	-	-
Dissolved Ethane	1 µg/l	-		-	-	-	-	-	-
Dissolved Carbon Dioxide	1 µg/l	77,769		53,188	74,800	69,800	14,500	78,300	108,000
Sulphate	0.05 mg/l	16.49		18.75	17.3	17.4	20.3	15.1	13.9
Nitrate	0.2 mg/l	1.6		1	0.4	0.6	-	0.1	-

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Natural Attenuation Parameters

Monitoring date	MDL	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Area		**Production Building**							
Sample Identity		**BH301S**							
Dissolved Methane	1 µg/l	20,110	10,792	26,589	20,600	14,900	14,800	11,300	11,900
Dissolved Ethene	1 µg/l	698	365	100	80	84	104	138	130
Dissolved Ethane	1 µg/l	27	189	334	198	140	147	137	154
Dissolved Carbon Dioxide	1 µg/l	286,763	128,676	210,052	192,000	156,000	146,000	125,000	127,000
Sulphate	0.05 mg/l	5.14	21	8	8.8	9.85	12.6	13	17
Nitrate	0.2 mg/l	0.4	-	-	-	0.5	1.2	0.7	-
Sample Identity		**BH301D**							
Dissolved Methane	1 µg/l	27,563	11,091	19,537	7,620	7,170	5,980	8,280	8,990
Dissolved Ethene	1 µg/l	511	341	69	48	44	58	107	70
Dissolved Ethane	1 µg/l	43	186	239	86	76	67	104	111
Dissolved Carbon Dioxide	1 µg/l	237,989	125,680	167,310	71,200	73,800	65,500	98,100	115,000
Sulphate	0.05 mg/l	1.9	20.5	9.5	13.5	14.1	15.9	24.8	13.8
Nitrate	0.2 mg/l	0.4	3	-	-	0.4	0.8	0.6	-
Sample Identity		**BH303S**							
Dissolved Methane	1 µg/l	2,719	122	2,156	2,860	3,360	3,460	2,660	3,000
Dissolved Ethene	1 µg/l	22	-	16	23	12	26	17	52
Dissolved Ethane	1 µg/l	1,240	59	910	1,390	1,270	1,150	1,100	842
Dissolved Carbon Dioxide	1 µg/l	71,418	50,006	54,595	86,400	66,400	61,400	59,700	73,000
Sulphate	0.05 mg/l	1.9	7.4	2.1	1.5	4.2	5.6	5.3	4.4
Nitrate	0.2 mg/l	-	-	-	-	-	-	0.5	-
Sample Identity		**BH303D**							
Dissolved Methane	1 µg/l	1,636	157	1,119	3,320	1,210	2,990	2,040	2,000
Dissolved Ethene	1 µg/l	145	17	27	49	64	194	218	201
Dissolved Ethane	1 µg/l	818	125	513	1,120	487	807	576	578
Dissolved Carbon Dioxide	1 µg/l	38,659	47,858	52,711	89,400	56,100	52,100	39,800	48,300
Sulphate	0.05 mg/l	6.9	2.2	7.4	2.1	4.77	5.4	6.8	1.6
Nitrate	0.2 mg/l	-	-	-	-	-	-	0.3	-
Sample Identity		**RSW7001D**							
Dissolved Methane	1 µg/l	366	314	685	2,360	8,440	14,700	20,300	11,700
Dissolved Ethene	1 µg/l	38	12	44	41	15	39	206	74
Dissolved Ethane	1 µg/l	75	55	61	74	148	212	295	337
Dissolved Carbon Dioxide	1 µg/l	11,250	46,572	66,122	75,100	77,100	71,500	71,000	48,900
Sulphate	0.05 mg/l	13.2	16.0	18.7	17.6	19.3	20.7	13.8	14.6
Nitrate	0.2 mg/l	-	-	0.2	-	0.4	-	0.6	-
Sample Identity		**RSW7002D**							
Dissolved Methane	1 µg/l	3,575	8,508	33,934	28,200	18,800	20,700	25,400	29,200
Dissolved Ethene	1 µg/l	432	3,516	1,482	4,600	8,760	9,620	4,890	2,730
Dissolved Ethane	1 µg/l	483	843	951	983	961	1,320	1,490	1,850
Dissolved Carbon Dioxide	1 µg/l	120,264	184,246	359,119	349,000	355,000	355,000	323,000	192,000
Sulphate	0.05 mg/l	24.8	6.0	-	1.2	1.6	4.9	2.3	-
Nitrate	0.2 mg/l	-	-	-	0.7	1	-	0.4	-
Sample Identity		**RSW7003D**							
Dissolved Methane	1 µg/l	17,446	5,078	4,459	4,790	2,550	2,840	5,400	2,830
Dissolved Ethene	1 µg/l	406	11	8	23	-	-	15	11
Dissolved Ethane	1 µg/l	2,120	1,306	1,173	1,520	1,070	1,220	1,330	1,230
Dissolved Carbon Dioxide	1 µg/l	84,774	46,438	51,547	52,800	47,400	52,500	44,300	75,600
Sulphate	0.05 mg/l	4.1	7.6	16.9	9.8	10.6	14.3	9.9	9.6
Nitrate	0.2 mg/l	-	2.7	-	0.9	0.3	-	0.6	0.4
Sample Identity		**RSW7004D**							
Dissolved Methane	1 µg/l	4,952	7,389	5,939	7,460	7,000	6,730	7,470	7,510
Dissolved Ethene	1 µg/l	48	6	17	20	21	9	56	12
Dissolved Ethane	1 µg/l	2,270	1,872	1,834	2,030	1,740	1,790	1,810	1,430
Dissolved Carbon Dioxide	1 µg/l	40,251	45,627	52,884	50,900	54,000	63,200	58,800	75,500
Sulphate	0.05 mg/l	8.0	10.3	14.1	9.1	11.1	11.4	10.2	9.3
Nitrate	0.2 mg/l	-	-	-	1	0	-	0.6	0.4

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Natural Attenuation Parameters

Monitoring date	MDL	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
South Yard									
Sample Identity		BH204AD							
Dissolved Methane	1 µg/l	18,367	14,285	11,709	13,800	31,900	23,400	40,100	44,200
Dissolved Ethene	1 µg/l	2,984	2,740	7,014	12,700	10,800	18,400	15,000	7,880
Dissolved Ethane	1 µg/l	1,298	1,215	974	1,060	1,000	1,160	991	673
Dissolved Carbon Dioxide	1 µg/l	97,106	109,558	147,347	128,000	120,000	106,000	215,000	259,000
Sulphate	0.05 mg/l	11.2	8.3	10.0	9.9	12.9	6.05	0.34	4.7
Nitrate	0.2 mg/l	-	-	-	0.8	0.3	-	0.3	-
Sample Identity		BH205AD							
Dissolved Methane	1 µg/l	267		-	839	1,050	867	462	1,120
Dissolved Ethene	1 µg/l			-	25	-	-	-	-
Dissolved Ethane	1 µg/l			-	164	164	136	99	-
Dissolved Carbon Dioxide	1 µg/l			43,613	53,300	54,600	45,700	43,400	44,000
Sulphate	0.05 mg/l	42.1		34.92	34.9	37.7	39.1	43.4	39.3
Nitrate	0.2 mg/l	10.7		0.8	0.8	0.4	0.9	0.7	0.3
Sample Identity		BH304S							
Dissolved Methane	1 µg/l	1,149		3,547	17,400	40,600	20,600	38,500	30,700
Dissolved Ethene	1 µg/l			332	535	891	251	126	51
Dissolved Ethane	1 µg/l			8	172	262	118	171	89
Dissolved Carbon Dioxide	1 µg/l			23,446	168,000	315,000	760,000	782,000	934,000
Sulphate	0.05 mg/l	19.66		27.47	22.2	7.33	3.54	13.6	10.5
Nitrate	0.2 mg/l	16.5		1.1	0.8	0.4	-	0.3	-
Sample Identity		BH304D							
Dissolved Methane	1 µg/l	979	3,623	8,541	23,200	15,900	30,300	40,700	31,900
Dissolved Ethene	1 µg/l	51	298	388	1,820	11	108	338	569
Dissolved Ethane	1 µg/l	63	57	97	398	121	127	170	164
Dissolved Carbon Dioxide	1 µg/l	83,170	93,800	111,933	238,000	217,000	371,000	719,000	767,000
Sulphate	0.05 mg/l	29.8	14.9	39.9	0.3	39.3	43.6	12	-
Nitrate	0.2 mg/l	4.4	-	-	0.8	0.4	-	-	-
Sample Identity		RSW2006D							
Dissolved Methane	1 µg/l	132	12,728	737	6,470	5810	8,950	5,390	11,400
Dissolved Ethene	1 µg/l	13	4,500	58	40	16	46	40	20
Dissolved Ethane	1 µg/l	23	266	25	70	66	55	76	75
Dissolved Carbon Dioxide	1 µg/l	73,191	-	70,180	96,400	96000	111,000	33,000	215,000
Sulphate	0.05 mg/l	48.7	10.7	35.7	44.9	40.6	52.8	51.8	52.5
Nitrate	0.2 mg/l	3.2	0.7	-	-	0.3	-	-	-
Sample Identity		RSW2007D							
Dissolved Methane	1 µg/l	7,658	12,526	18,777	27,100	23,300	20,900	26,100	27,200
Dissolved Ethene	1 µg/l	204	1,352	9,507	14,200	5,760	3,790	995	1,010
Dissolved Ethane	1 µg/l	1,157	1,122	980	702	169	136	99	118
Dissolved Carbon Dioxide	1 µg/l	46,004	131,024	656,805	491,000	956,000	980,000	1,150,000	132,000
Sulphate	0.05 mg/l	15.2	69.6	-	-	-	-	-	-
Nitrate	0.2 mg/l	0.4	2.5	-	0.6	-	-	-	-
Sample Identity		RSW2008D							
Dissolved Methane	1 µg/l	1,310	3,395	7,325	15,900	16,200	11,900	14,800	24,000
Dissolved Ethene	1 µg/l	26	3,189	21,139	6,130	445	17,600	46,400	8,560
Dissolved Ethane	1 µg/l	358	211	289	216	122	183	383	245
Dissolved Carbon Dioxide	1 µg/l	80,076	-	622,785	362,000	291,000	1,020,000	773,000	425,000
Sulphate	0.05 mg/l	39.0	2.6	-	15.4	42.4	-	-	60.6
Nitrate	0.2 mg/l	12	0.7	-	0.7	1	-	0	0.3
Sample Identity		RSW2009D							
Dissolved Methane	1 µg/l	10,716	4,639	7,328	9,080	Not accessible due to stockpiled aggregate	21,900	27,300	24,600
Dissolved Ethene	1 µg/l	536	1,080	3,813	6,260		11,800	447	145
Dissolved Ethane	1 µg/l	1,241	319	345	305		292	80	185
Dissolved Carbon Dioxide	1 µg/l	47,681	73,927	197,905	347,000		890,000	2,110,000	1,710,000
Sulphate	0.05 mg/l	17.1	-	0.1	4.1		-	-	-
Nitrate	0.2 mg/l	-	-	-	0.7		-	0.4	-

Appendix D.4

Natural Attenuation Parameters

Monitoring date	MDL	Baseline Monitoring August 2012	Performance Monitoring October 2013	Performance Monitoring March 2014	Performance Monitoring September 2014	Performance Monitoring April 2015	Performance Monitoring September 2015	Performance Monitoring April 2016	Performance Monitoring November 2016
Sample Identity		**RSW2010D**							
Dissolved Methane	1 µg/l	1,550	4,097	7,310	6,410	8,100	43,200	45,000	45,800
Dissolved Ethene	1 µg/l	18	911	3,637	4,320	315	4,240	2,210	1,320
Dissolved Ethane	1 µg/l	311	525	421	631	159	967	2,910	2,560
Dissolved Carbon Dioxide	1 µg/l	40,805	-	45,925	53,100	132,000	179,000	171,000	367,000
Sulphate	0.05 mg/l	24.1	0.3	8.3	1.1	17.1	0.1	3.7	-
Nitrate	0.2 mg/l	2.1	0.7	-	-	0.4	0.8	0.3	-
Sample Identity		**RSW2011D**							
Dissolved Methane	1 µg/l	6,586	4	1,781	8,890	5780	13,300	20,800	19,200
Dissolved Ethene	1 µg/l	216	-	857	5,960	1250	23,500	15,200	6,220
Dissolved Ethane	1 µg/l	848	-	187	219	46	354	351	640
Dissolved Carbon Dioxide	1 µg/l	59,447	19,366	71,271	241,000	109000	429,000	744,000	811,000
Sulphate	0.05 mg/l	22.9	91.7	19.4	-	2.2	-	-	-
Nitrate	0.2 mg/l	-	-	-	0.6	0.4	-	-	0.3
Sample Identity		**RSW2012D**							
Dissolved Methane	1 µg/l	4,875	5,717	7,976	14,400	29,300	31,700	35,600	12,900
Dissolved Ethene	1 µg/l	-	1,174	13,210	12,400	3,180	5,690	560	4,130
Dissolved Ethane	1 µg/l	-	430	368	275	40	113	880	361
Dissolved Carbon Dioxide	1 µg/l	46,147	72,141	304,955	233,000	665,000	542,000	107,000	361,000
Sulphate	0.05 mg/l	25.0	12.6	-	0.7	-	-	-	2.7
Nitrate	0.2 mg/l	0.2	-	-	0.7	-	-	0.3	-
Off Site									
Sample Identity		**BHOS307**							
Dissolved Methane	1 µg/l	-	Not sampled	-	15	-	-	-	25
Dissolved Ethene	1 µg/l	-		-	-	-	-	-	-
Dissolved Ethane	1 µg/l	-		-	-	-	-	-	-
Dissolved Carbon Dioxide	1 µg/l	19,995		17,173	78,400	21,600	14,500	111,000	50,700
Sulphate	0.05 mg/l	11.14		8.08	17.6	5.09	6.86	12.8	6.1
Nitrate	0.2 mg/l	-		-	0.5	0.5	-	0.7	-

APPENDIX E

E.1 - Quantitative Risk Assessment Review

E.2 – Selection of Half Lives

E.3 – ConSim Model Calibration

Appendix E.1 - Quantitative Risk Assessment Review

Human Health Risk Assessment Review

Review of the additional data collected following the most recent DQRA undertaken in June 2011 (Arcadis report ref: 909363202) indicates no significant change in the conceptual site model in relation to human health receptors. As such, the soil, groundwater and soil gas human health SSAC previously derived remain appropriate.

However, a sub slab soil gas point (SG10) has since been installed in the vicinity of BH919 to further assess the vapour inhalation pathway in relation to on site commercial worker. No assessment criteria are currently available for comparison with measured concentrations of CVOC in soil gas collected from sub slab point SG10, although at present, soil gas data has not been collected. Sub slab soil gas SSAC have therefore been derived for comparison with future concentrations of CoC in sub slab soil gas point SG10, as detailed in the following sections.

Soil Gas Model Input Parameters

Given that the collection of additional data has not changed the conceptualisation of the subsurface in relation to the human health modelling, the Contaminated Land Exposure Assessment (CLEA) model set up previously (including toxicological, physical and building parameter values) for the derivation of soil gas SSAC for Area B (see Figure 6), Building B, was adopted to enable derivation of soil gas SSAC, with the exception of the depth of source beneath the building. The depth to source was set as 25cm based on the depth of installation of the soil gas point (whilst the indoor air model used a depth of 25cm, 1m depth was used for the outdoor air model to avoid calculation errors via this pathway).

CLEA v1.07 was adopted for the purpose of deriving soil gas SSAC, with the CoC selected based on those modelled previously for soil gas in the vicinity of source area 4R.

Derivation of Sub Slab Soil Gas SSAC

The SSAC are defined using a hazard index of 1.0 at the point of exposure and back-calculating, using fate and transport models where necessary, to determine the contaminant level which is acceptable beneath the Site in the relevant source medium, i.e. soil gas in this case.

The vapour inhalation SSAC were calculated separately for both indoor and outdoor air, assuming a linear relationship between measured concentration of a CoC in soil gas to the predicted concentration in indoor / outdoor air. The SSAC derived for the individual exposure pathways were then combined using the approach outlined in Environment Agency document: *Updated technical background to the CLEA model*. Science Report – SC050021/SR3, with a hazard quotient of 1 across all pathways for each environmental medium modelled.

The soil gas SSAC for on site commercial worker and are presented in Table 1.

Water Resources Risk Assessment Review

The focus of the water resources review is in relation to measured concentrations of CVOC only. Review of the most recent groundwater dataset collected in November 2016 (Section 5.4) indicated that significant source reduction has been achieved on site following the updated DQRA. In addition, multiple rounds of groundwater monitoring have been undertaken following the updated DQRA, both prior to and during remedial activities, with groundwater samples collected from both on and off site wells, which has allowed a better understanding of CVOC fate and transport in relation to water resources.

Review of Updated DQRA Water Resources Model Setup

Model Selected

ConSim was previously adopted as an appropriate tool for assessing the risk to controlled waters. ConSim is a probabilistic model that allows a forward prediction to be undertaken, based on concentrations identified within the source area. Model calibration can then be undertaken if appropriate monitoring wells are identified

on the down gradient plume centre line. ConSim is considered to remain an appropriate modelling tool for the assessment of risk to water resources.

Physical Input Parameters

Further intrusive investigation has been undertaken following the updated DQRA, comprising the installation of remedial infrastructure. The geology encountered was consistent with that identified during the previous phases of investigation, with the source and aquifer conceptualisation previously defined considered to remain appropriate (clayey sand / gravel source zone and sand / gravel aquifer). As such, the physical parameters defined within the updated DQRA remain applicable.

Degradation

Review of the groundwater data from hydraulically down gradient off Site monitoring wells located between the site and the river Afon Lwyd and screening both the Alluvium and Raglan Marl indicates that measured concentrations of CVOC between 2010 and 2016 in these locations has primarily been measured below the laboratory MDL, with the exception of BHOS414. Measured concentrations of CVOC in monitoring well BHOS414 have been noted to be fairly consistent during the monitoring undertaken, ranging from 689µg/L to 1,290µg/L and comprising predominantly TCE and cis-DCE. The absence of concentrations of CVOC in the remaining off site wells indicates that groundwater flow in the southeastern portion of the Site is likely to be in a more south – southeasterly direction than the southeasterly direction previously modelled.

It is noted that several of the off site monitoring wells (BHOS307, BHOS412, BHOS413 and BHOS414) are located approximately 50m to 80m to the south / southeast of source area 7R. Source area 7R is located in the southeastern most portion of the Site, where total CVOC concentrations prior to remedial activities were measured in the order of tens of thousands of µg/l. It is noted that CVOC breakthrough travel times to the Afon Lwyd calculated as part of the updated DQRA for the more mobile CoC, for example VC, for source area 7R was approximately 2 to 4 years and at a predicted concentration of approximately 4,700µg/l. Further, that predicted concentrations of CVOC in the down gradient wells BHOS407, BHOS410, BHOS412 and BHOS413 were in the order of tens of thousands µg/l for TCE, cis-DCE and VC. The time elapsed following the updated DQRA (approximately 6 years) and the absence of concentrations in the hydraulically down gradient wells within the range predicted in the updated DQRA, indicates that attenuation of CVOC is occurring at a much more rapid rate than suggested by the modelling.

Where available, conservative low end degradation rates were previously adopted for CVOC within the updated DQRA, as presented in Appendix E.2. Given that the model overpredicts the concentration of CVOC in hydraulically down gradient wells by several orders of magnitude, and that the hydrogeological conceptualisation of the Site is considered appropriate, this suggests that the degradation rates adopted in the model were overly conservative. As such, it was considered appropriate to review the degradation parameters, through model calibration.

Model Calibration

Model calibration was undertaken to aid selection of degradation rates which best represent the attenuation observed on Site.

The ConSim model set up defined as part of the updated DQRA was adopted, with the source concentrations from 2011 retained to reflect pre-remediation conditions which can be considered as best for assessing steady state conditions relating to down gradient concentrations. Model calibration was undertaken for source area 7R, given that it is located on the south-eastern Site boundary, that prior to remediation some of the highest concentrations of CVOC were measured in source 7R and that a hydraulically down gradient monitoring well (BHOS414) is located approximately 60m down gradient. The timeframe was set to 5 years (to reflect the time elapsed since the updated DQRA and the most recent monitoring), with degradation in the dissolved phase only. The longitudinal dispersion was set to 6m (in line with EA guidance that recommends 10% of the compliance point distance), while the lateral dispersion was set to 0.01 to reflect that measured concentrations in off site monitoring wells BHOS307 and BHOS413 was generally below the laboratory MDL, indicating limited lateral dispersion. For the purpose of calibration, maximum measured concentrations of CVOC collected in groundwater from monitoring well BHOS414 between 2010 and 2016, located to the south, were adopted for comparison with model predicted concentrations.

The degradation rates were amended for each CVOC, until the predicted concentration reasonably matched the maximum measured concentration from BHOS414. The degradation rates were limited to the range presented within literature.

The model calibration output is presented in Appendix E.3, while the selected half life following calibration is presented in Appendix E.2. As can be seen, for the most prevalent CVOC (TCE, cis-1,2-DCE and VC), generally the most rapid degradation rates produced the best match with down-gradient concentrations, although it was noted that even using the highest degradation rates presented in literature for TCE and VC resulted in an over prediction (two orders of magnitude in the case of VC). This indicates that it is likely that some sorbed mass was present. As such, model calibration was again undertaken with a revised source term to account for sorbed mass. The selected half lives for degradation is presented in Appendix E.2, while the model output is presented in Appendix E.3. It can be seen that a closer correlation between predicted and measured concentrations of TCE and VC is observed, although VC was still noted to overpredict by an order of magnitude.

Revised Model Inputs

Following model calibration, the source areas defined in the updated DQRA from zone 3 (source 3R, 4R, 5, 6 and 7R) were refined to reflect the distribution of CVOC observed during the most recent groundwater monitoring event in November 2016 and to recognise that significant source reduction has been achieved through remedial activities. The distribution of CVOC during the most recent monitoring event is presented on Figure E.1, along with the revised modelled source areas. It is noted however, that in some instances, no reduction or only limited reduction of the modelled source areas could be achieved (source 6R and 3R – no reduction, and only limited reduction of source 4R), given the limited distribution of wells monitored during recent groundwater monitoring. As such, the source area dimensions are likely to be overestimated, and therefore the predicted down gradient concentrations associated with these source areas will be overestimated.

The model was set up to incorporate the maximum concentrations of CVOC measured during the most recent monitoring event in each source area, with a source term based on the dissolved and sorbed phase. The groundwater flow direction was adjusted such that BHOS414 was within the source 7R plume centreline, in line with the model calibration set-up.

Consideration of Compliance Point

It is noted that guidance has been issued by the EA following the updated DQRA, regarding the selection of compliance points (Environment Agency, Groundwater Protection: Policy and Practice, GP3, 2013). The EA recommends a distance of 50m for hazardous substances, although notes that this distance should be considered in the context of likely cost and benefit in relation to remedial actions in addition to the environmental site setting. Groundwater underlying the Site is associated with a Secondary A Aquifer, while no groundwater abstractions or Source Protection Zones are located within 1km of the Site. The river Afon Lwyd is located approximately 150m from the Site at its closest point.

Given the findings of the model calibration (set at a distance of 60m), it is clear that setting a compliance point at a distance of 50m will result in SSAC exceedances that in the context of remediation, may prove challenging to meet and incur significant costs (particularly in the case of VC). Given the significant reduction in concentrations already achieved on Site, it was therefore considered appropriate to retain the compliance point of 150m from the updated DQRA for each source area. This was considered sufficient to provide protection to both the aquifer and the river Afon Lwyd.

Model Output

The results of the forward prediction are presented in Table 2, which additionally includes Water Quality Standards (WQS) for comparison with predicted concentrations.

None of the predicted concentrations of CVOC associated with source areas 3R, 5 or 6R were in excess of the applicable WQS. However, predicted concentrations of TCE and cis-DCE associated with source area 4R and cis-DCE in relation to source area 7R were in excess of the WQS, as summarised in the table below:

Source Area	Compound	Iniitial Concentration (mg/l)	Point of Compliance Predicted Concentration(mg/l)	Water Quality Standard (mg/l)
4R	TCE	8.57	0.0068	0.005
	Cis-DCE	73.1	0.155	0.025
7R	Cis-DCE	17.7	0.056	0.025

The cumulative plume output from ConSim for TCE and cis-DCE have been overlaid over the Site layout plan to provide a visual representation of the combined effect of the source areas, as presented on Figures 8 (TCE) and 9 (cis-DCE). It can be seen from these that predicted concentrations of TCE and cis-DCE at the Afon Lwyd are below the laboratory MDL for these compounds.

Water Resource Risk Evaluation

It is noted that several conservatisms are built into the modelling, as follows:

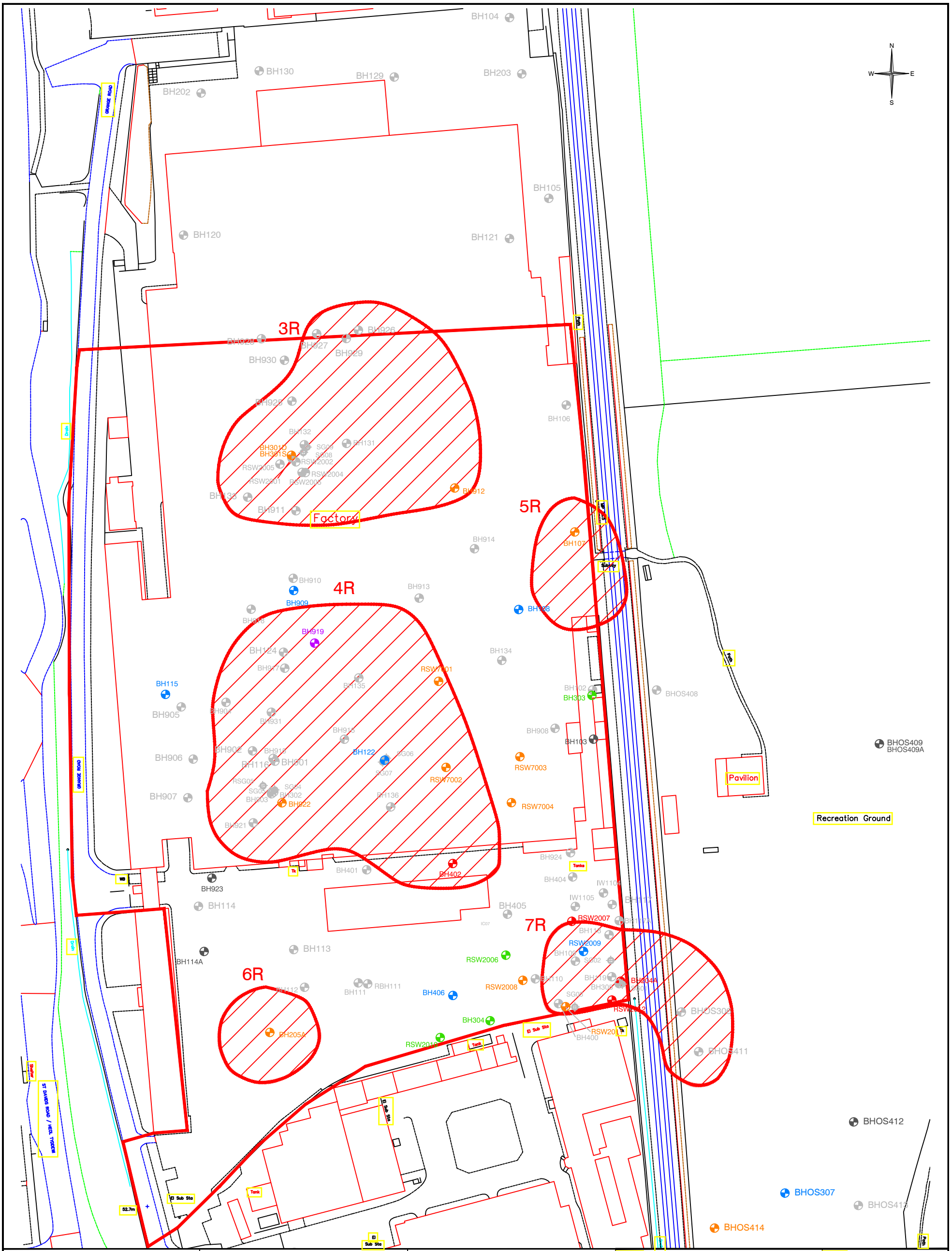
- Calibration was undertaken assuming the maximum measured concentrations in monitoring well BHOS414 between 2010 and 2016, with average concentrations within the source area assumed as the start concentration. As such, it is possible that the extent of attenuation modelled is lower than what is actually occurring;
- The maximum measured concentration for each source from November 2016 was used for the purpose of forward prediction, which assumes that these concentrations are present throughout the entirety of the source area;
- The source dimensions for 4R in particular are likely to be much smaller than that modelled based on the decrease in dissolved phase CVOC generally observed across the Site as a result of remediation, but has been made conservatively large in the absence of lateral data to prove this; and,
- Predicted concentrations have been assessed based on the 95th percentile.

Given the above, it was considered prudent to further evaluate the risk to water resources. The model set up from the section above was adopted, with the exception of the source concentrations. The source concentrations of TCE and cis-DCE in relation to source area 4R, and cis-DCE in relation to source area 7R were amended to reflect the average concentrations identified in the respective source areas. The findings are summarised in the table below:

Source Area	Compound	IniitialConcentration (mg/L)*	Point of Compliance Predicted Concentration(mg/L)	Water Quality Standard (mg/L)
4R	TCE	0.943	0.0008	0.005
	Cis-DCE	10.725	0.024	0.025
7R	Cis-DCE	4.278	0.014	0.025

* Average concentrations adopted from groundwater samples collected from monitoring wells located within the revised source area, from groundwater monitoring undertaken in November 2016. Where measured concentrations of TCE and cis-DCE were below the laboratory MDL, half the value of the MDL was adopted as a concentration for the purpose of deriving an average.

Given that the predicted concentrations were below the WQS at a distance of 150m, the risk presented to both the aquifer and river Afon Lwyd is not considered to be significant.



DISCLAIMER	NOTES	KEY
NOTE: ALL ENTITIES SHOWN ON THIS DRAWING ARE TO BE REGARDED AS APPROXIMATE AND ARE INDICATIVE ONLY. NO MEASUREMENTS TAKEN FROM THIS DRAWING SHOULD BE USED FOR THE LOCATION OF INTRUSIVE INVESTIGATION WORKS ON SITE. SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE. - CONTACT ARCADIS UK IN CASE OF ANY QUERY	Reproduced from the OS MasterMap by permission of Ordnance Survey® on behalf of The Controller of Her Majesty's Stationery Office. © Crown Copyright. All rights reserved. Licence Number 100021489.	SUM CHLORINATED VOLATILE ORGANIC COMPOUND CONCENTRATION (NOVEMBER 2016) NOT SAMPLED <MDL MDL - 100µg/l 100µg/l - 1,000µg/l 1,000µg/l - 10,000µg/l 10,000µg/l - 50,000µg/l >50,000µg/l MODELLED SOURCE AREA MERITOR SITE BOUNDARY

TITLE:	DISTRIBUTION OF CVOC AND REVISED MODELLED SOURCE AREA	SITE:	CWMBRAN
PROJECT:	27662105	CLIENT:	MERITOR
DATE:	25/04/17	PRINT:	A3
DRAWN BY:	JC	REV:	-
DRG.No.:	2766210516-CAD		FIGURE E.1

ARCADIS Design & Consultancy for natural and built assets

Appendix E.2
Selection of Half Lives

Contaminant	Half Life (days)				
Chlorinated Volatile Organic Compounds	Aerobic Conditions	Anaerobic Conditions	Half Life Selected in Updated DQRA [3]	Half Life Selected Following Model Calibration (degradation in the dissolved phase only)	Half Life Selected Following Model Calibration (degradation in the dissolved and sorbed phase)
Tetrachloroethene	No degradation [1] 360 - 720 [2]	100 - 1000 [1] NA	720	100	165
Trichloroethene	No degradation [1] 321 - 1,653 [2]	100 - 1000 [1]	1653	100	200
cis-1,2-dichloroethene	50 - 350 [1] 56 - 2875 [2]	200 - 3,000 [1]	2875	110	150
trans-1,2-dichloroethene	50 - 350 [1] 56 - 2875 [2]	200 - 3,000 [1]	2875	110	150
Vinyl Chloride	50 - 200 [1] 56 - 2,875 [2]	100 - 500 [1]	3000	50	50
1,1,1-trichloroethane	NA 140 - 546 [2]		546	185	400
1,1,2-trichloroethane	NA 136 - 730 [2]		730	200	365
1,1-dichloroethene	50 - 350 [1] 56 - 132 [2]	NA	132	100	100
1,1-dichloroethane	100 - 500 [1] 56 - 360 [2]	200 - 3,000 [1]	360	110	220

Notes

NA Not applicable

References

[1] Noble and Morgan, 2002. The Effects of Contaminant Concentration on the Potential for Natural Attenuation.

[2] Howard et al. Handbook of Environmental Degradation Rates, Lewis Publishers Inc. Chelsea. MI (1991).

[3] Updated Detailed Quantitative Risk Assessment (Arcadis report ref: 909363202)

Appendix E.3
ConSim Model Calibration

Compound	Start Concentration - Source 7R (mg/l)[#]	Degradation in the dissolved phase only			Degradation in the dissolved and sorbed phase		
		Predicted time required to reach BHOS414*	Predicted Concentration - BHOS414**	Maximum Measured Concentration - BHOS414***	Predicted time required to reach BHOS414*	Predicted Concentration - BHOS414**	Maximum Measured Concentration - BHOS414***
Vinyl Chloride	11.02	1.3	0.128	0.0011	1.3	0.078	0.0011
1,1-dichloroethene	0.061	1.8	0.005	<0.003	1.8	0.003	<0.003
Trans-1,2-dichloroethene	0.093	1.7	0.009	0.004	1.7	0.007	0.004
Cis-1,2-dichloroethene	29.0	1.5	2.69	1.160	1.6	2.55	1.160
Trichloroethene	12.3	2.5	0.916	0.390	2.5	0.73	0.390
1,1,2-trichloroethane[##]	0.006	1.8	0.001	<0.002	1.9	0.002	<0.002
Tetrachloroethene	0.217	3.7	0.016	<0.003	3.8	0.002	<0.003
1,1-Dichloroethane[##]	0.014	1.5	0.001	<0.003	1.5	0.003	<0.003
1,1,1-Trichloroethane[##]	0.005	2.4	0.001	<0.003	2.5	0.001	<0.003

Notes

<	Concentration below the laboratory method detection limit
#	Start concentrations adopted from updated DQRA (Arcadis report ref: 909363202)
##	Start concentration around the laboratory method detection limit, with measured concentrations below the laboratory method detection limit downgradient. As such, half life selected such that predicted concentration marginally below the laboratory method detection limit, although this could be considered conservative.
*	Presented travel times are the 5th percentile of predicted travel times as calculated by the model.
**	Maximum predicted concentrations have been derived assuming maximum measured concentrations on site are present throughout the theoretical source zone and are presented as 95th percentile.
***	From data collected between April 2010 and November 2016

APPENDIX F

F.1 – Measured Concentrations of BTEX in Soil Gas (ug/m^3) – Baseline and Remedial Period

F.2 – Percentage Reduction in LNAPL Levels - TFP Network

F.3 – Extraction Well Trend Data

F.4 – Monitoring Well Trend Data

F.5 –Cumulative LNAPL Recovery April 2013 to March 2017

F.6 - Duty of Care Documentation LNAPL Recovery

F.7 – NAPL Recovery Rates

F.8 - Total Petroleum Hydrocarbons in Groundwater During Biannual Monitoring (µg/l)

F.9 - Total Petroleum Hydrocarbons in Groundwater Dissolved Phase Assessment (µg/l)

F.10 - Petroleum Hydrocarbons Detected in LNAPL Leaching Tests

Appendix F.1

Measured Concentrations of BTEX in Soil Gas (ug/m3) – Baseline and Remedial Period

Location	Soil Gas SSAC (µg/m³)		Laboratory Method Detection Limit (ug/m3)	Area A																										
				SG1										SG2									SG3								
Sample Date	Area A On-site Commercial Worker Outdoor Air Only	Area A Off-site Commercial Worker		Apr-10	May-12	Oct-13	Nov-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Feb-17	May-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16	Apr-10	May-12	Oct-13	Mar-14	Sep-14	Apr-15	Sep-15	Apr-16	Nov-16
Benzene	1.830E+09	4.180E+06	<4.8	-	30.0	-	99.0	9.3	-	-	-	49.5	9.6	-	-	30	31.9	11.8	39.9	-	28.8	38.3	-	-	-	-	24.6	-	-	-
Toluene	2.050E+12	4.540E+09	<5.7	52.8	113	44.1	648	15.1	-	-	19.2	101	15.4	-	38.8	111	59.9	13.2	134	-	183	60.3	38.8	42.6	16.6	6	30.5	13.2	-	8.3
Ethylbenzene	3.550E+11	7.690E+08	<6.5	34.7	38.2	7.4	109	-	-	-	7.8	19.1	9.1	-	-	22.6	-	17.4	20	-	-	21.7	-	-	-	-	33	6.5	-	-
m&p - Xylenes	9.430E+10	2.050E+08	<6.5	26.1	187	24.3	126	-	-	-	30.4	22.1	16.5	-	12.6	29.1	-	101	36.5	-	-	30.4	-	16.5	11.3	15.6	112	23	-	-
o-Xylene			<6.5	8.7	44.3	-	39.1	-	-	-	-	-	-	-	-	20.0	-	-	-	-	-	13.0	-	-	-	-	-	-	-	-

Location			Area B																				
			SG4										SG5			RSG05							
Sample Date	Area B and C On-site Commercial Worker Meritor Reduced Footprint (Building B)	Laboratory Method Detection Limit	Apr-10	Sep-10	May-12	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16	Apr-10	Sep-10	May-12	Oct-13	Mar-14	Oct-14	April-15*	Sep-15	Apr-16	Nov-16	Feb-17
Benzene	2.900E+07	<4.8	419	-	-	-	-	-	55.6	537	<24.0	39	-	-	8.6	10.9	-	Inside a production cage	-	87.2	473	<2,400	6.7
Toluene	3.090E+10	<5.7	3,527	1,469	-	54	34.7	-	29.8	1,150	71.6	173	1,632	-	134	72	-		-	283	1,340	554	62.5
Ethylbenzene	5.150E+09	<6.5	130	-	-	6.9	7.4	-	16.1	66.9	<32.5	29.1	82.5	-	17.8	-	-		3,310	26.1	162	50.4	14.3
m&p - Xylenes	1.370E+09	<6.5	248	-	-	19.5	30.4	-	40.4	53.4	36	26.9	78.2	-	64.3	15.2	-		6,990	45.6	114	29.5	31.3
o-Xylene		<6.5	122	-	-	-	11.7	-	-	-	<77.5	13.5	39.1	-	35.2	-	-		-	-	<77.5	-	-

Location			Area B																			
			SG6										SG7									
Sample Date	Area B and C On-site Commercial Worker Meritor Reduced Footprint (Building B)	Laboratory Method Detection Limit	Apr-10	May-12	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16	Apr-10	Sep-10	May-12	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16
Benzene	2.900E+07	<4.8	73.5	-	-	-	-	10.5	16.9	6.7	6.1	35.1	-	15.3	-	-	-	10.5	-	13.7	-	
Toluene	3.090E+10	<5.7	75.4	-	14.7	-	-	52.8	290	1050	652	181	105	40.3	39.6	95.7	-	52.8	41.4	1,040	264	
Ethylbenzene	5.150E+09	<6.5	-	9.6	-	-	-	12.6	27.8	14.3	-	17.4	13.9	23.9	6.9	24.7	-	12.6	12.2	7.8	-	
m&p - Xylenes	1.370E+09	<6.5	-	33.9	10.9	-	-	43.9	58.2	46.5	-	56.4	59.1	123	21.7	133	-	43.9	45.6	25.6	-	
o-Xylene		<6.5	-	16.9	-	-	-	-	-	-	-	21.7	25.2	25.2	-	67.3	-	-	-	-	-	

Location			Area C																	
			SG8										SG9							
Sample Date	Area B and C On-site Commercial Worker Meritor Reduced Footprint (Building B)	Laboratory Method Detection Limit	Apr-10	Sep-10	May-12	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16	Apr-10	Oct-13	Mar-14	Oct-14	Apr-15	Sep-15	Apr-16	Nov-16
Benzene	2.900E+07	<4.8	70.3	-	-	-	-	-	13.7	-	16	5.8	95.8	-	-	-	12.8	13.4	7.4	6.1
Toluene	3.090E+10	<5.7	86.7	-	-	37.3	-	-	18.8	21.1	9	69.7	98	53	-	28.6	27.1	226	-	87
Ethylbenzene	5.150E+09	<6.5	30	-	-	-	-	-	8.7	22.6	6.5	-	26.1	8	-	-	10	10.9	-	-
m&p - Xylenes	1.370E+09	<6.5	26	-	-	17.4	-	-	21.3	68.2	-	-	26.1	25	-	-	32.6	30	-	-
o-Xylene		<6.5	-	-	-	-	-	-	-	-	-	-	21.7	-	-	-	-	-	-	-

Notes:

Area A	Source area in the south east corner of the South Yard
Area B	Source area in the south of the Production Building
Area C	Source area in the north of the Production Building
	Pre-remediation concentration
SSAC	Site Specific Assessment Criteria
-	Less than laboratory MDL.
*	Not tested

Appendix F.2

Percentage Reduction in LNAPL Levels - TFP Network

Date	Baseline August 2012	Shutdown August 2016
Extraction well	LNAPL Thickness (m)	LNAPL Thickness (m)
EX01		0.05
EX02		0.23
EX03		<0.005
EX04		0.28
EX05		0.21
EX06	0.16	0.08
EX07	1.38	0.005
EX08	0.85	0.37
EX09	0.48	0.08
EX10	-	0.12
EX11	-	-
EX12	-	-
EX13	0.02	0.56
EX14	0.07	0.005
EX15	2.07	0.50
EX16	1.00	0.33
EX17	0.67	0.03
EX18	0.60	0.08
EX19	0.97	0.40
EX20	1.07	0.35
EX21	0.58	0.86
EX22	-	0.02
EX23	1.16	1.41
EX6001	0.39	0.07
EX6002	0.62	0.88
EX6003	0.26	UTA
EX6004	1.90	0.10
EX6005	2.03	1.69
EX6006	1.65	0.09
EX6007	1.40	0.05
EX6008	0.91	0.02
EX6009	0.42	0.14
EX6010	0.42	0.17
EX6011	0.62	0.72

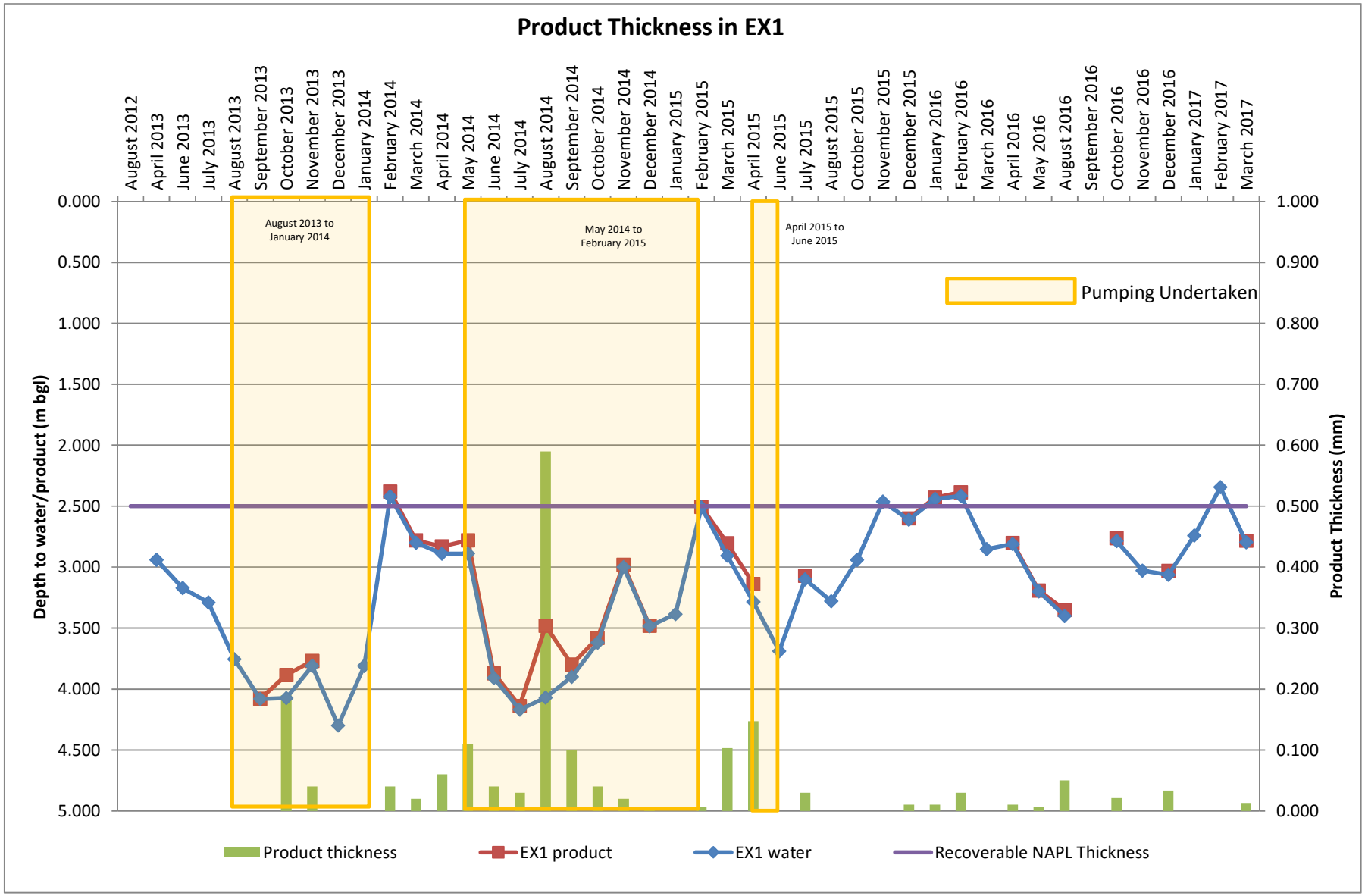
Notes

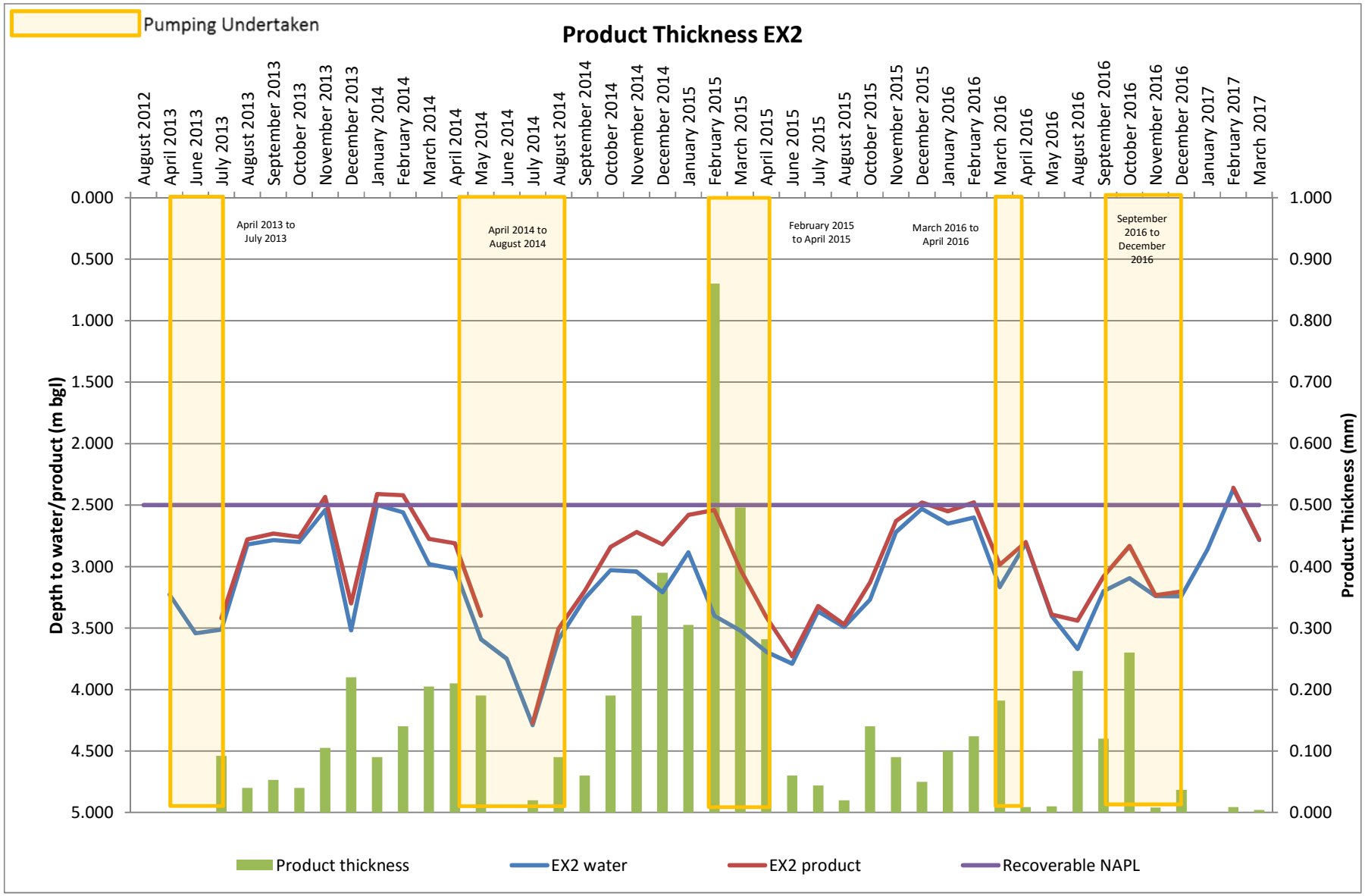
	Baseline data not recorded no comparis
n/a	not applicable no NAPL present during n

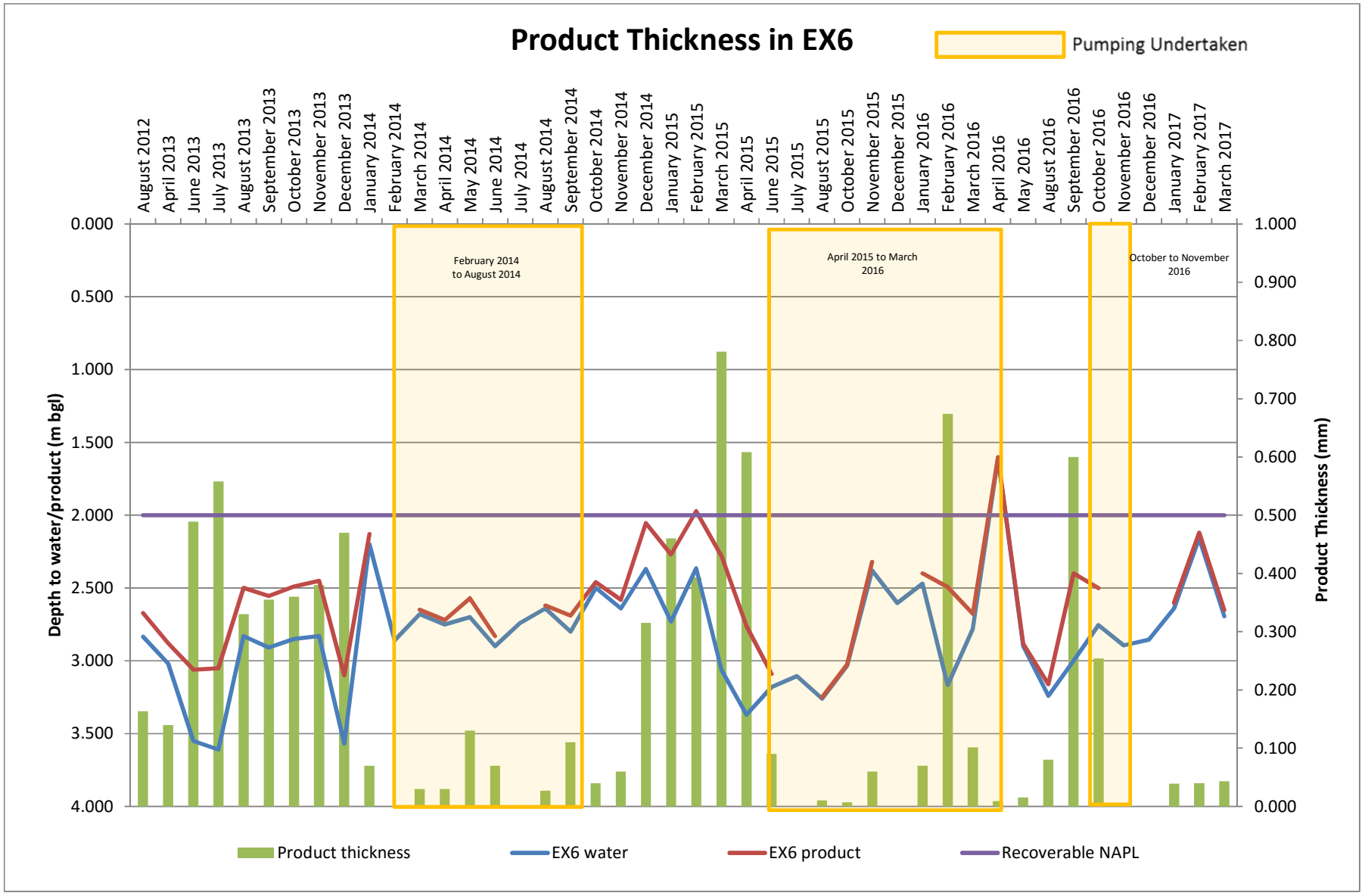
Appendix F.3
Extraction Well Trend Data

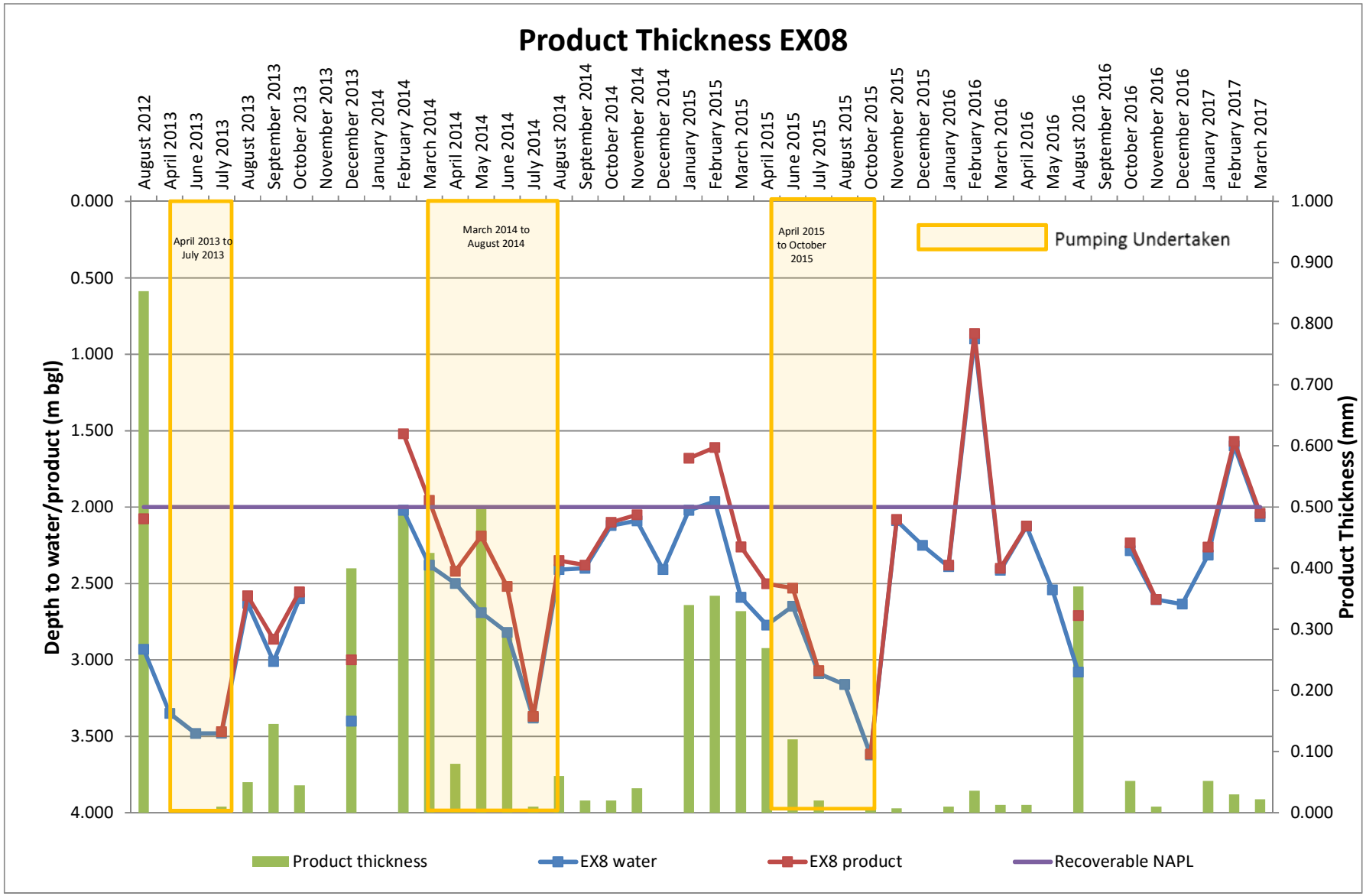
Extraction well	Graph Presented? And Comment Comment
EX01	Graph Presented - Example of very low yeild well
EX02	Graph Presented - Example of low yeild well
EX03	No Graph Presented - Infrequent / no LNAPL Identified
EX04	No Graph Presented - Very low yeild well
EX05	No Graph Presented - Medium yeild well
EX06	Graph Presented - Example of medium yeild well
EX07	No Graph Presented - Infrequent / no LNAPL Identified
EX08	Graph Presented - Example of a medium yeild well becoming a low yeild well
EX09	No Graph Presented - Very low yeild well
EX10	No Graph Presented - Very low yeild well
EX11	No Graph Presented - Infrequent / no LNAPL Identified
EX12	No Graph Presented - Infrequent / no LNAPL Identified
EX13	No Graph Presented - Very low yeild well
EX14	No Graph Presented - Infrequent / no LNAPL Identified
EX15	No Graph Presented - Low yeild well
EX16	No Graph Presented - Low yeild well
EX17	Graph Presented - Example of a medium yeild well becoming a low yeild well
EX18	No Graph Presented - Medium yeild well becoming a very low yeild well
EX19	Graph Presented - Medium Yield Well
EX20	No Graph Presented - Low yeild well
EX21	Graph Presented - High yeild well becoming a very low yeild well
EX22	No Graph Presented - Infrequent / no LNAPL Identified
EX23	No Graph Presented - High Yield Well
EX6001	No Graph Presented - High Yield Well
EX6002	No Graph Presented - Medium yeild well
EX6003	No Graph Presented - Unable to access for pumping
EX6004	No Graph Presented - Low yeild well
EX6005	Graph Presented - High yield well
EX6006	No Graph Presented - High yield becoming a low yield well
EX6007	No Graph Presented - High Yield Well
EX6008	Graph Presented - High yield well
EX6009	No Graph Presented - High becoming medium yeild well
EX6010	Graph Presented - Example of low yeild well
EX6011	No Graph Presented - Medium yeild well

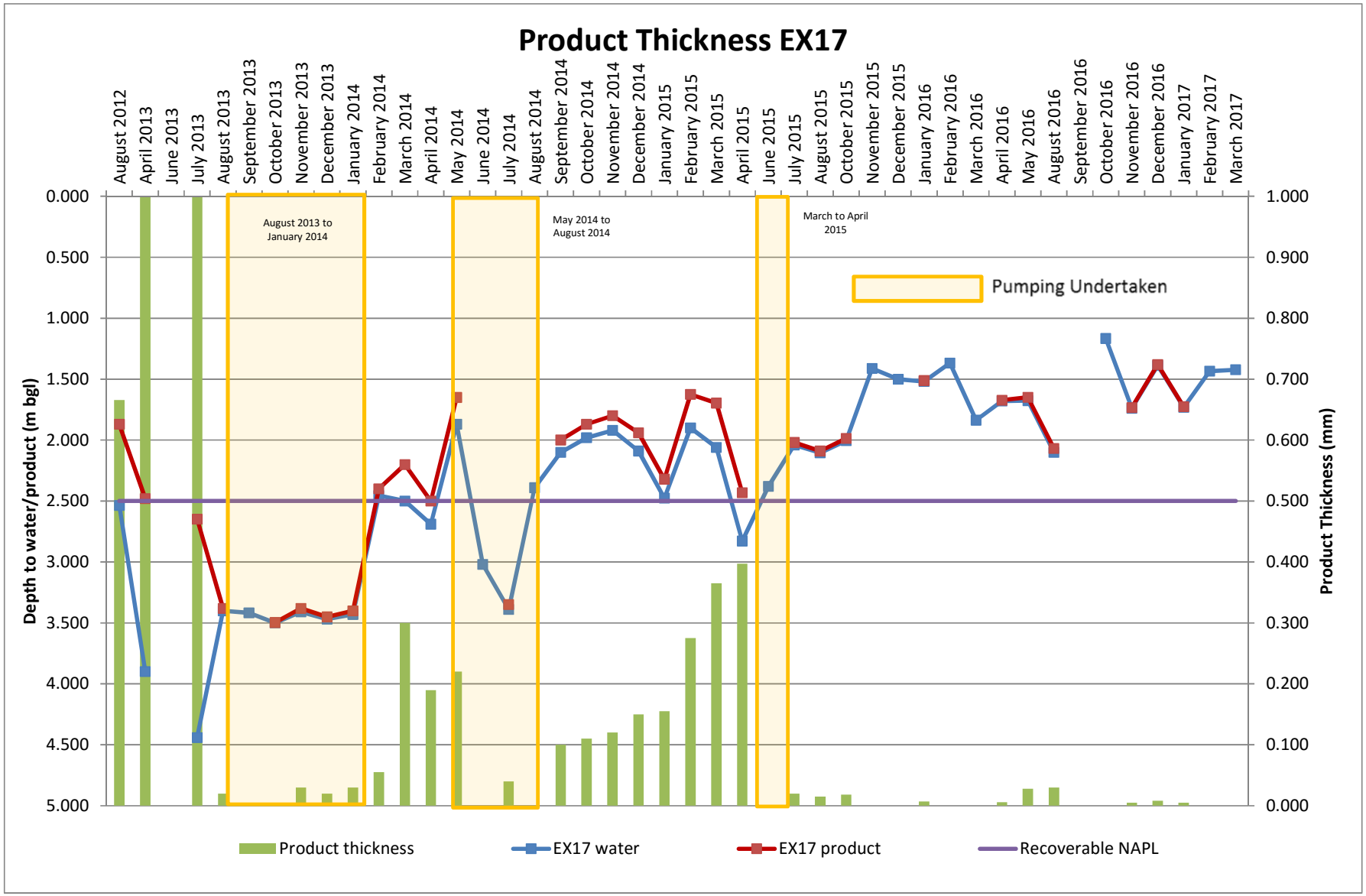
Key	
Infrequent/no napl	
Very Low Yeild	LNAPL thicknesses generally below 100mm
Low Yeild	LNAPL thicknesses generally below 300mm
Med Yield	LNAPL thicknesses generally frequently above 500mm
High Yield	LNAPL thicknesses generally infrequently above 500mm

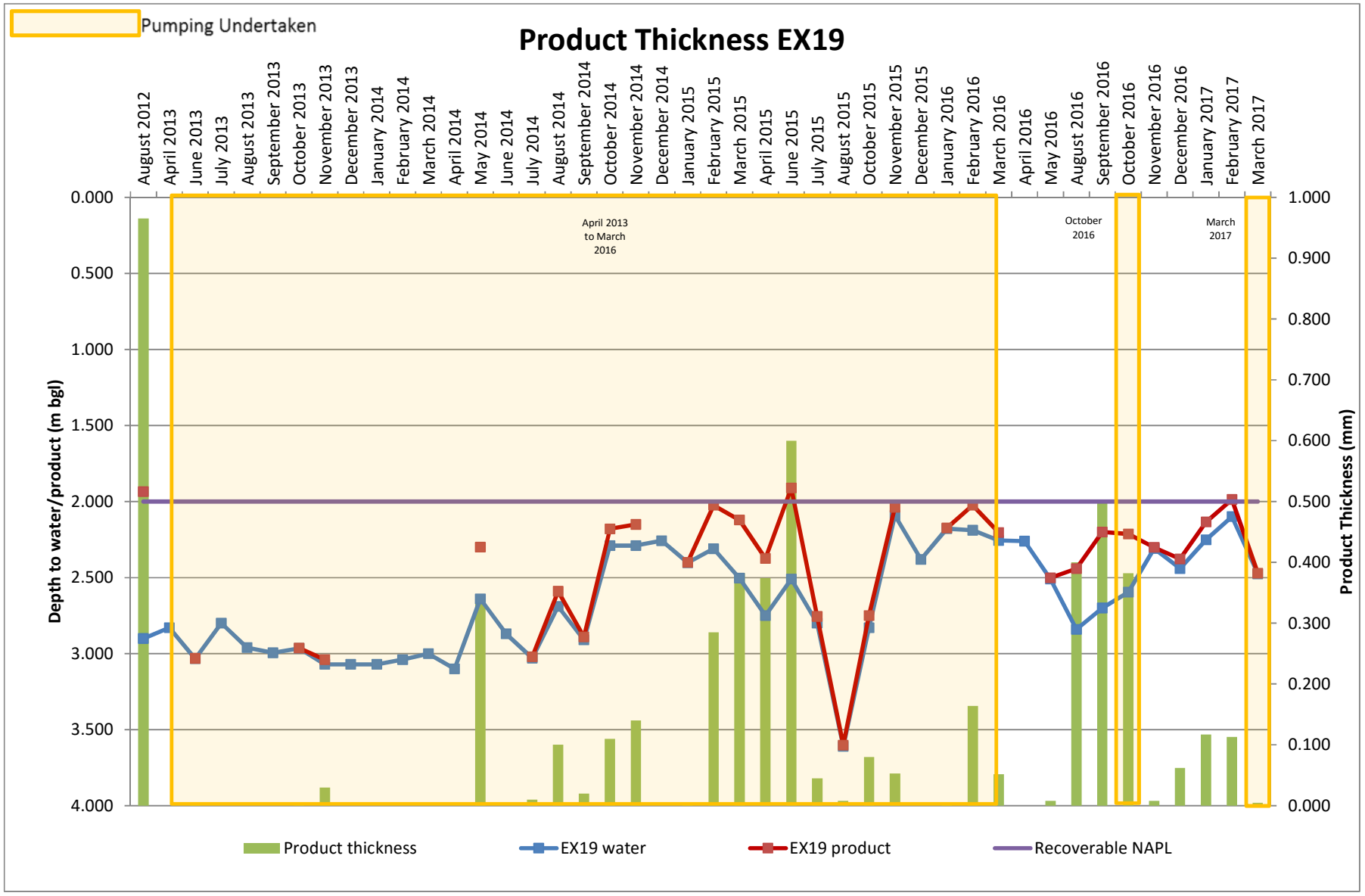

Product Thickness in EX1
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
August 2013 to January 2014
May 2014 to February 2015
April 2015 to June 2015
Pumping Undertaken
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX1 product
EX1 water
Recoverable NAPL Thickness

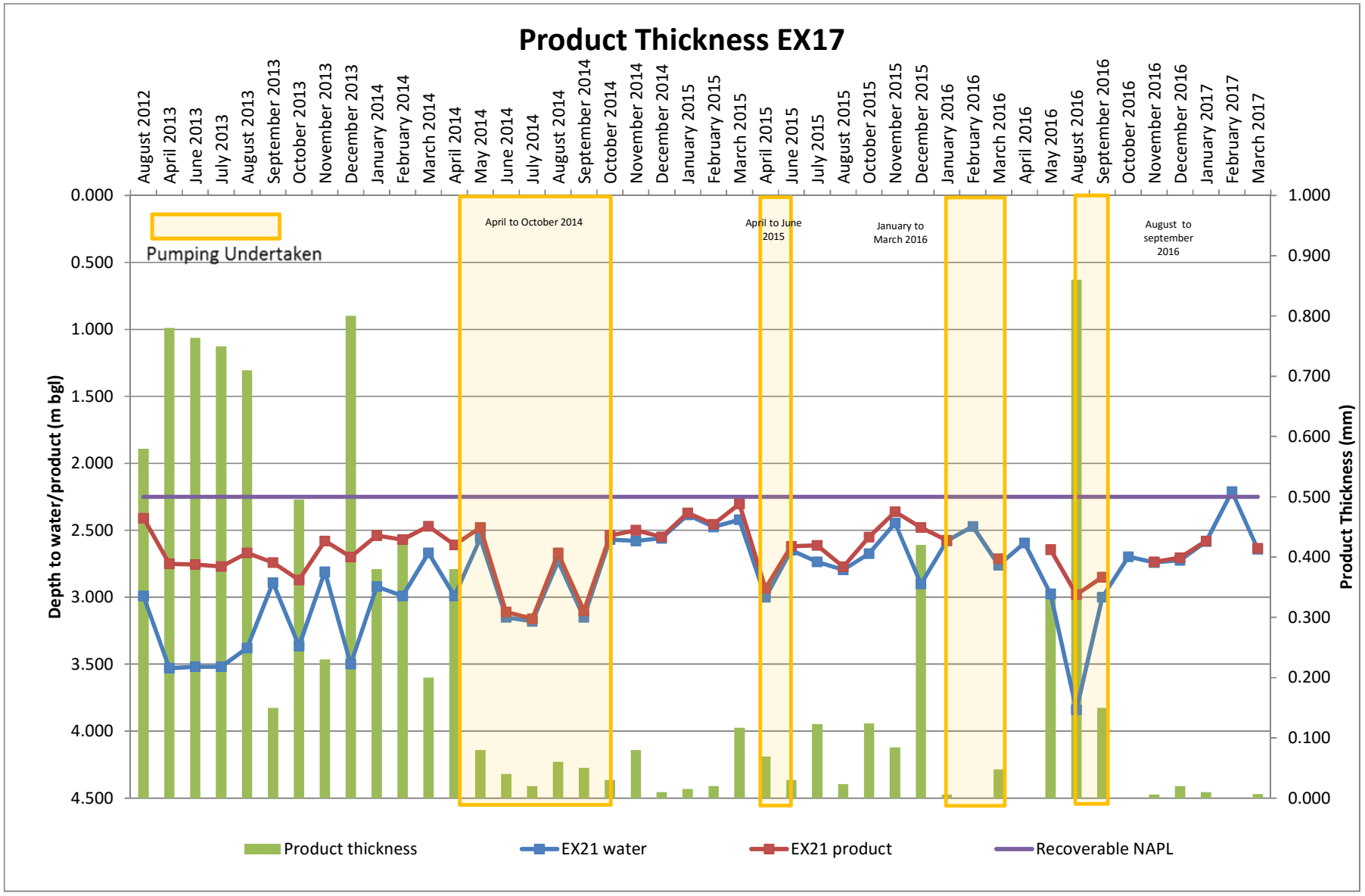

Pumping Undertaken
Product Thickness EX2
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
April 2013 to July 2013
April 2014 to August 2014
February 2015 to April 2015
March 2016 to April 2016
September 2016 to December 2016
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX2 water
EX2 product
Recoverable NAPL

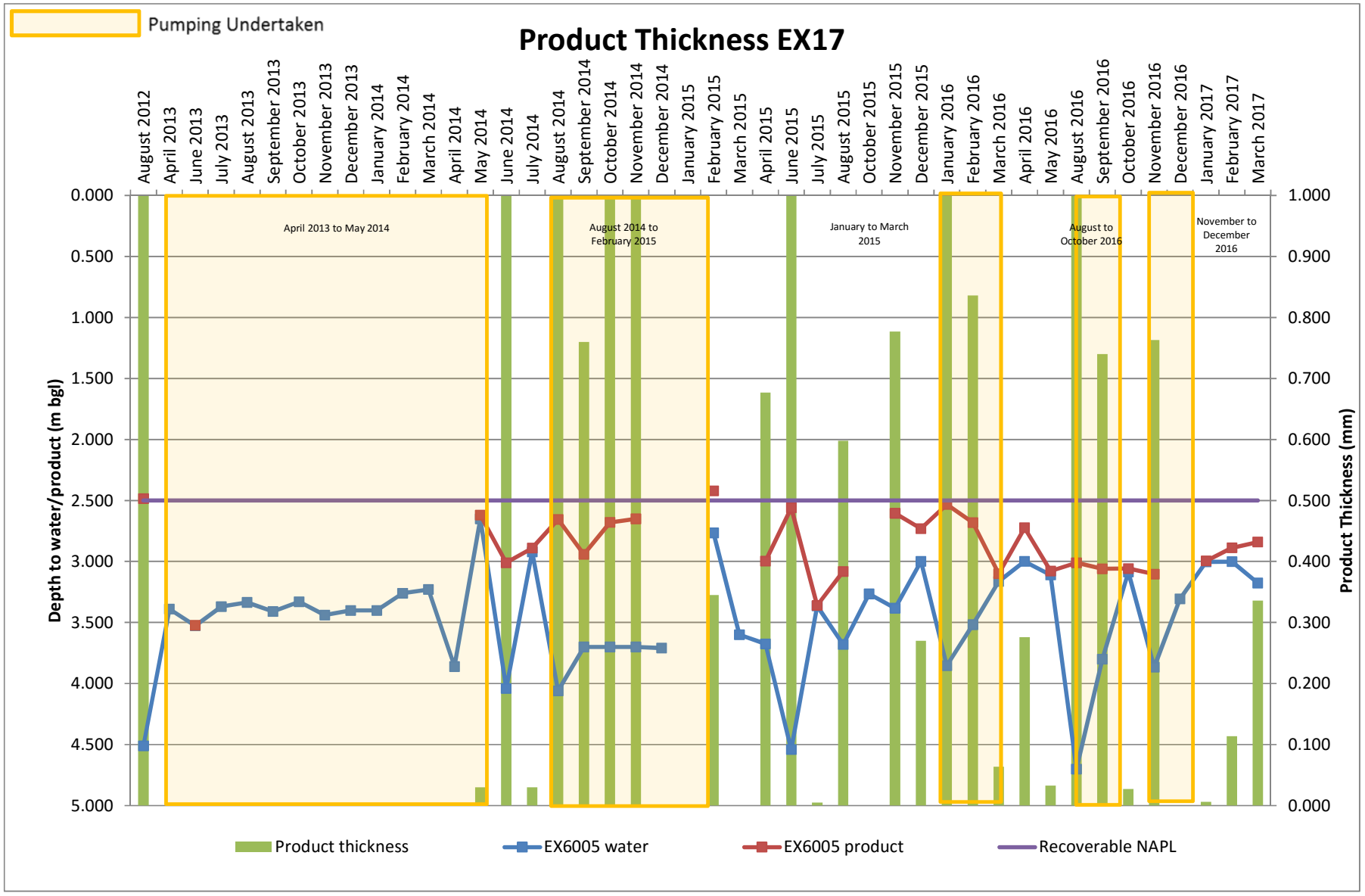

Product Thickness in EX6
Pumping Undertaken
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
February 2014 to August 2014
April 2015 to March 2016
October to November 2016
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX6 water
EX6 product
Recoverable NAPL

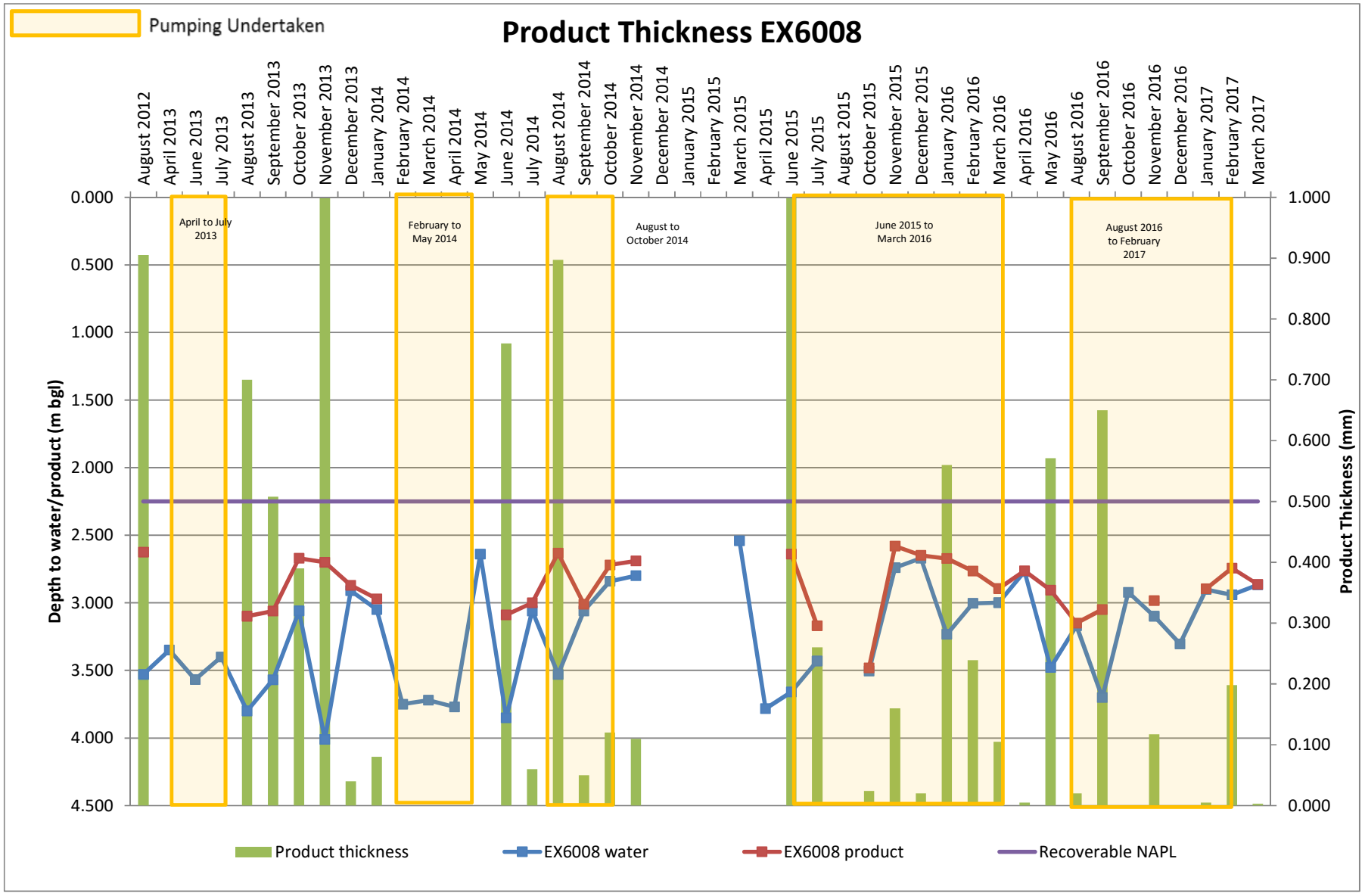

Product Thickness EX08
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
April 2013 to July 2013
March 2014 to August 2014
April 2015 to October 2015
Pumping Undertaken
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX8 water
EX8 product
Recoverable NAPL

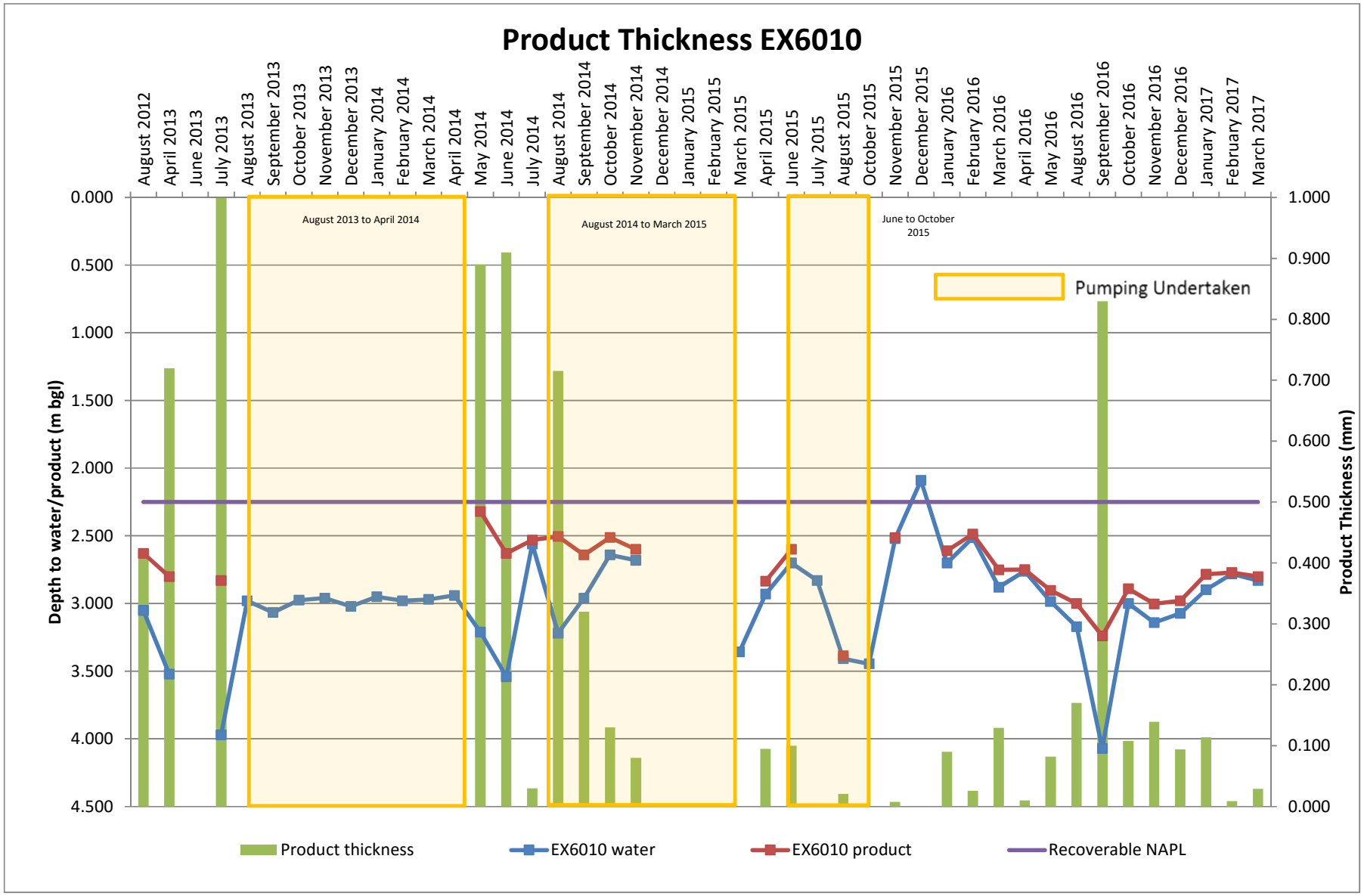

Product Thickness EX17
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
August 2013 to January 2014
May 2014 to August 2014
March to April 2015
Pumping Undertaken
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX17 water
EX17 product
Recoverable NAPL


Pumping Undertaken
Product Thickness EX19
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
April 2013 to March 2016
October 2016
March 2017
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX19 water
EX19 product
Recoverable NAPL

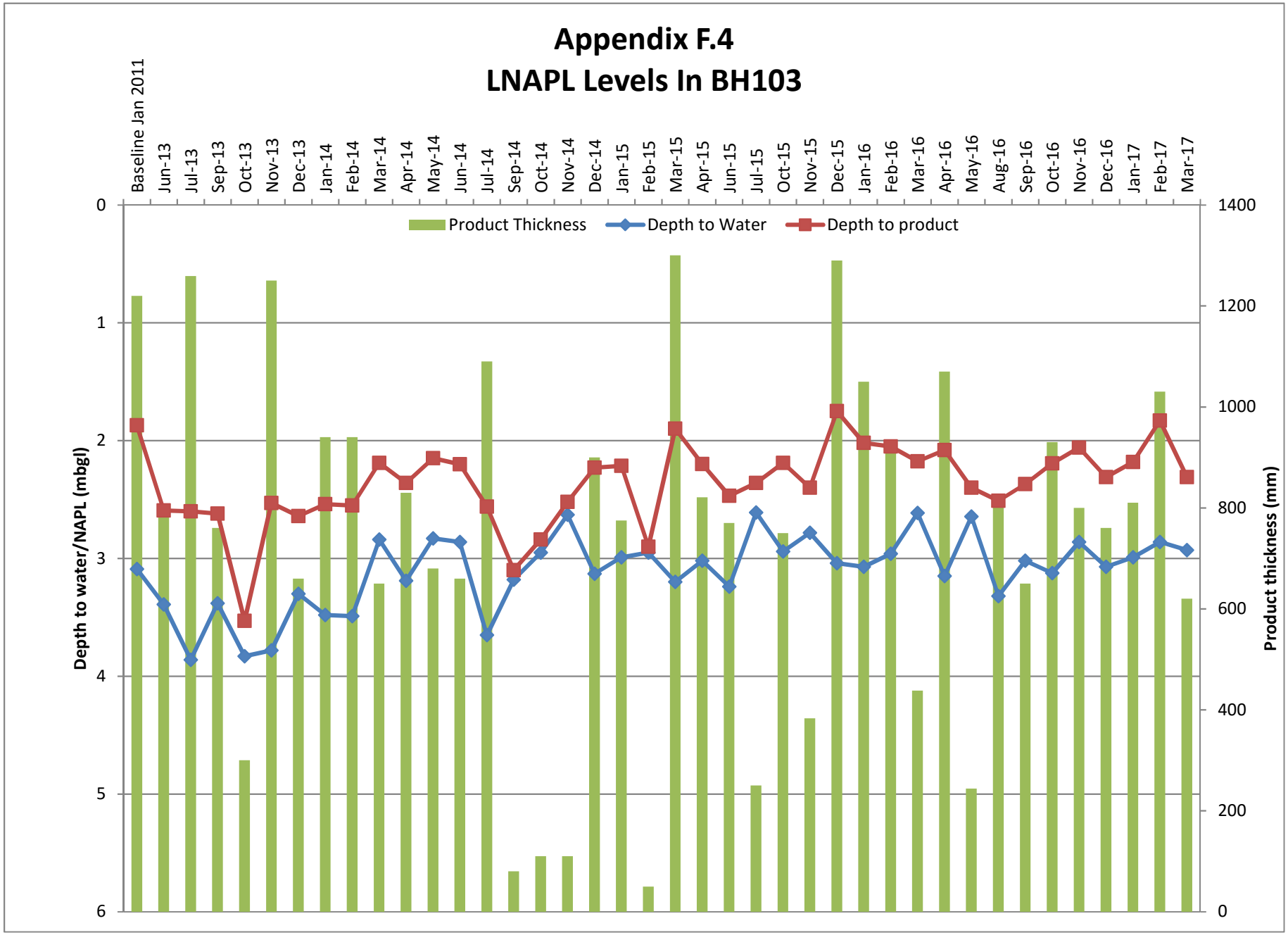

Product Thickness EX17
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
Pumping Undertaken
April to October 2014
April to June 2015
January to March 2016
August to september 2016
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX21 water
EX21 product
Recoverable NAPL


Pumping Undertaken
Product Thickness EX17
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
April 2013 to May 2014
August 2014 to February 2015
January to March 2015
August to October 2016
November to December 2016
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX6005 water
EX6005 product
Recoverable NAPL

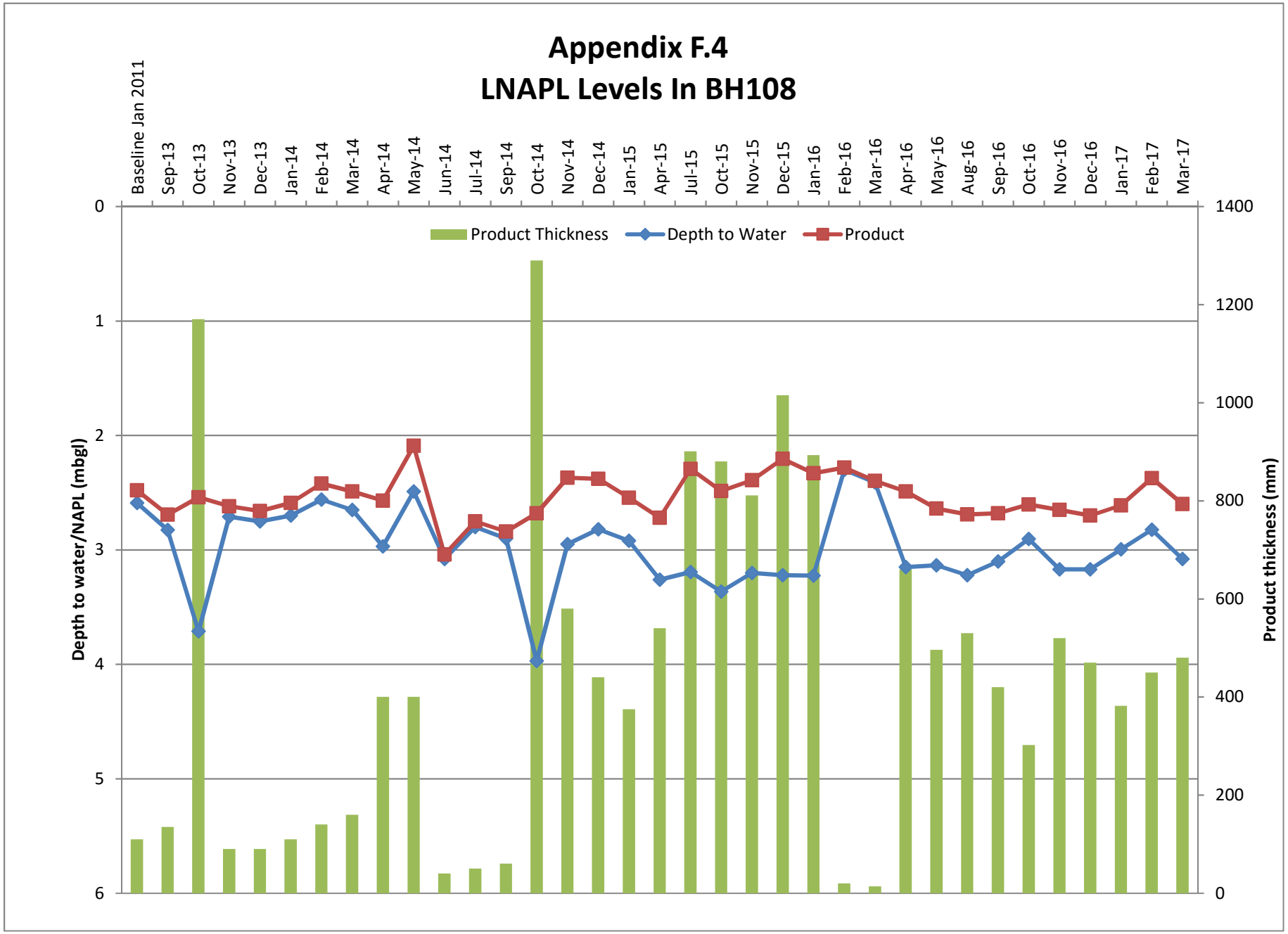

Pumping Undertaken
Product Thickness EX6008
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
April to July 2013
February to May 2014
August to October 2014
June 2015 to March 2016
August 2016 to February 2017
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX6008 water
EX6008 product
Recoverable NAPL


Product Thickness EX6010
August 2012
April 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013
January 2014
February 2014
March 2014
April 2014
May 2014
June 2014
July 2014
August 2014
September 2014
October 2014
November 2014
December 2014
January 2015
February 2015
March 2015
April 2015
June 2015
July 2015
August 2015
October 2015
November 2015
December 2015
January 2016
February 2016
March 2016
April 2016
May 2016
August 2016
September 2016
October 2016
November 2016
December 2016
January 2017
February 2017
March 2017
August 2013 to April 2014
August 2014 to March 2015
June to October 2015
Pumping Undertaken
Depth to water/product (m bgl)
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
Product Thickness (mm)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Product thickness
EX6010 water
EX6010 product
Recoverable NAPL

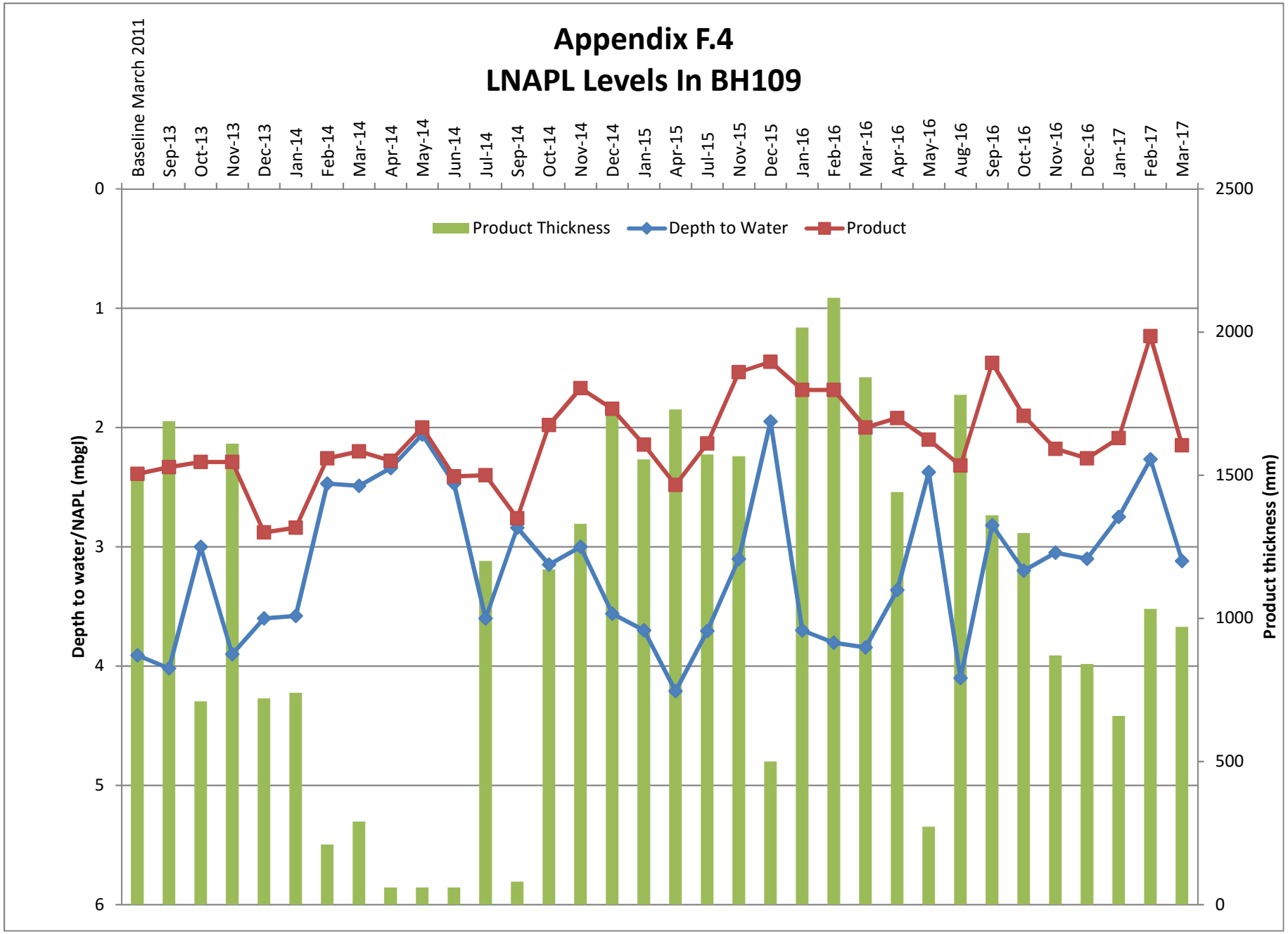
Appendix F.4
LNAPL Levels In BH103



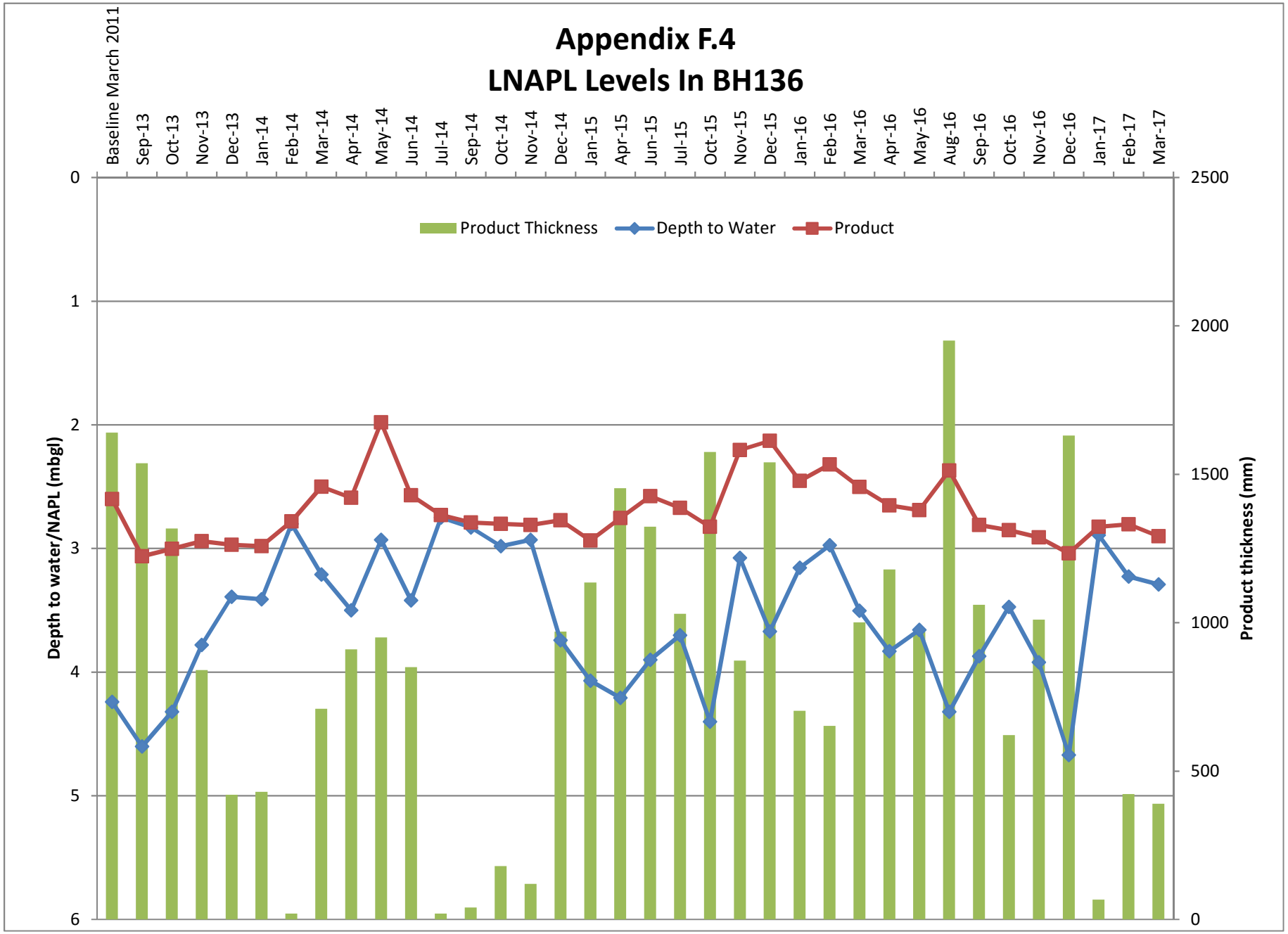
Appendix F.4
LNAPL Levels In BH108



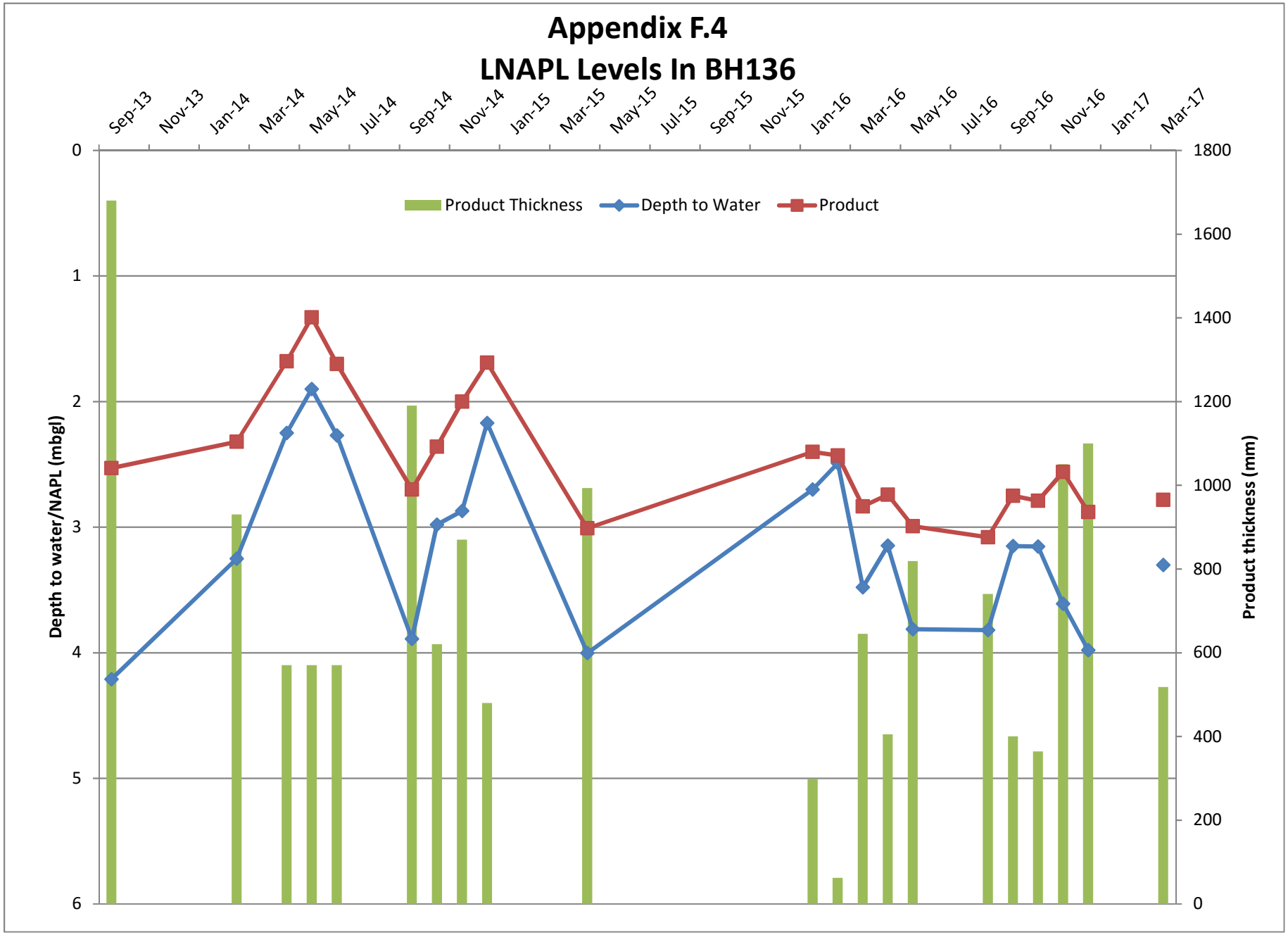
Appendix F.4
LNAPL Levels In BH109



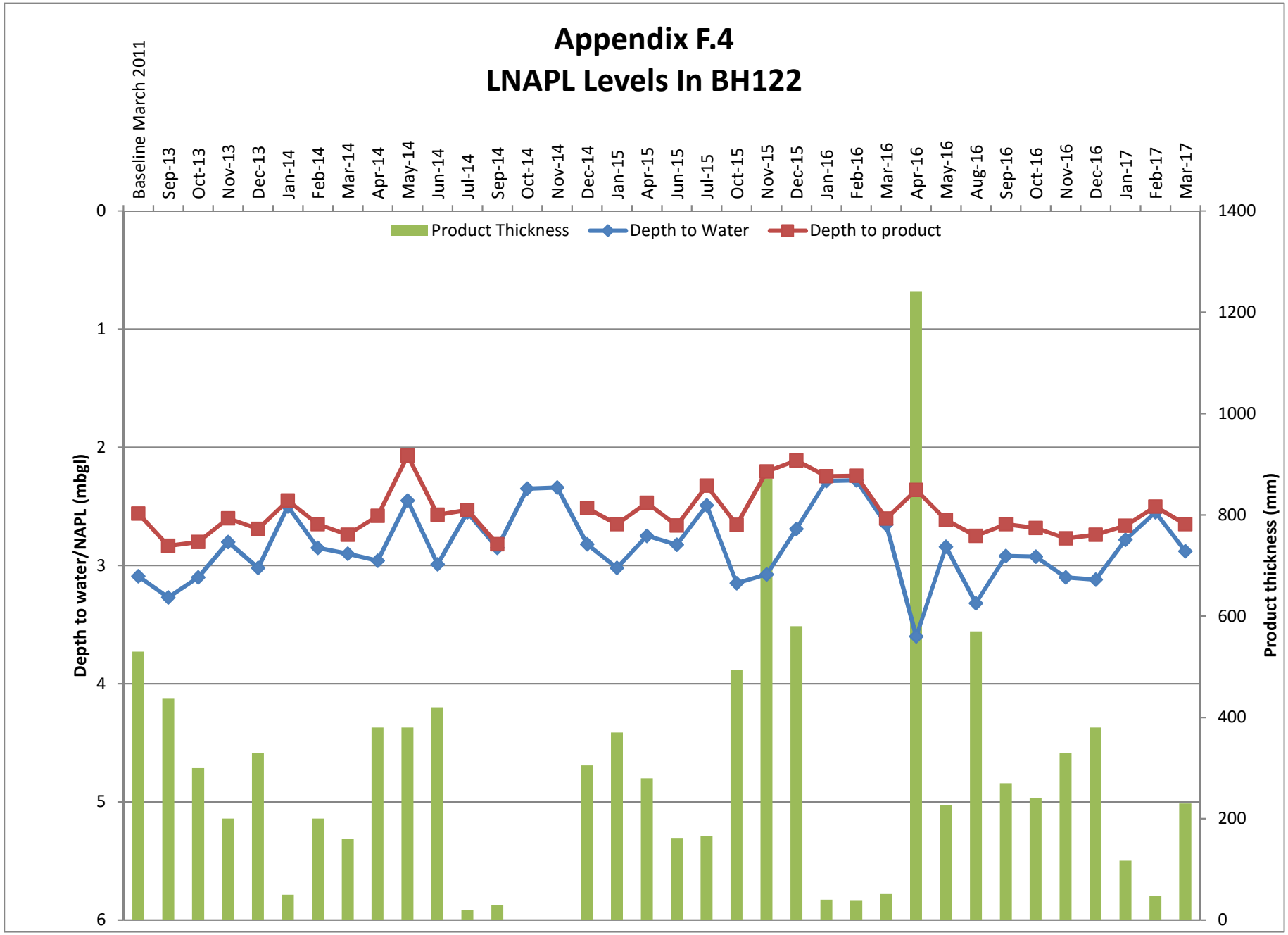
Appendix F.4
LNAPL Levels In BH136



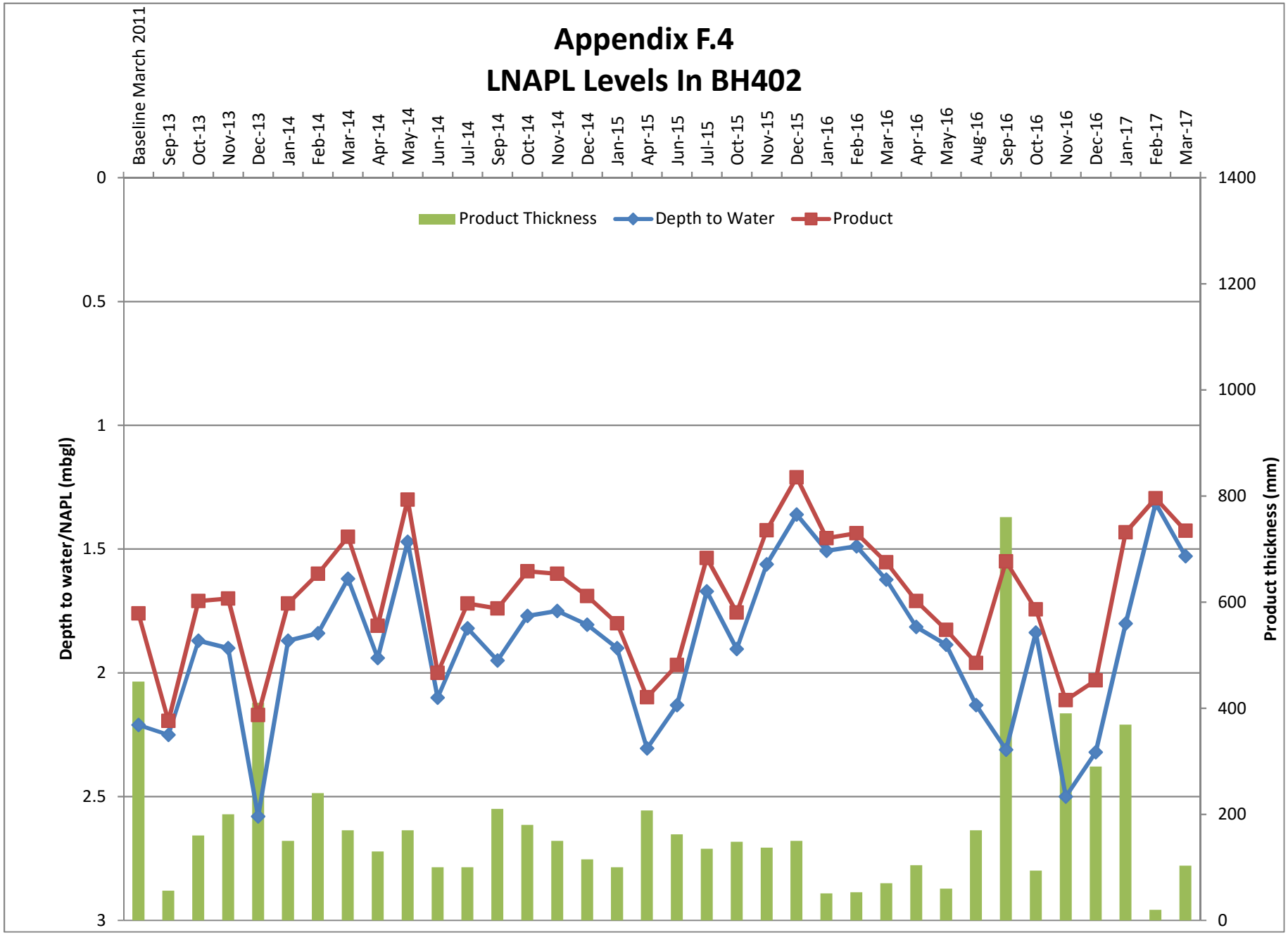
Appendix F.4
LNAPL Levels In BH136



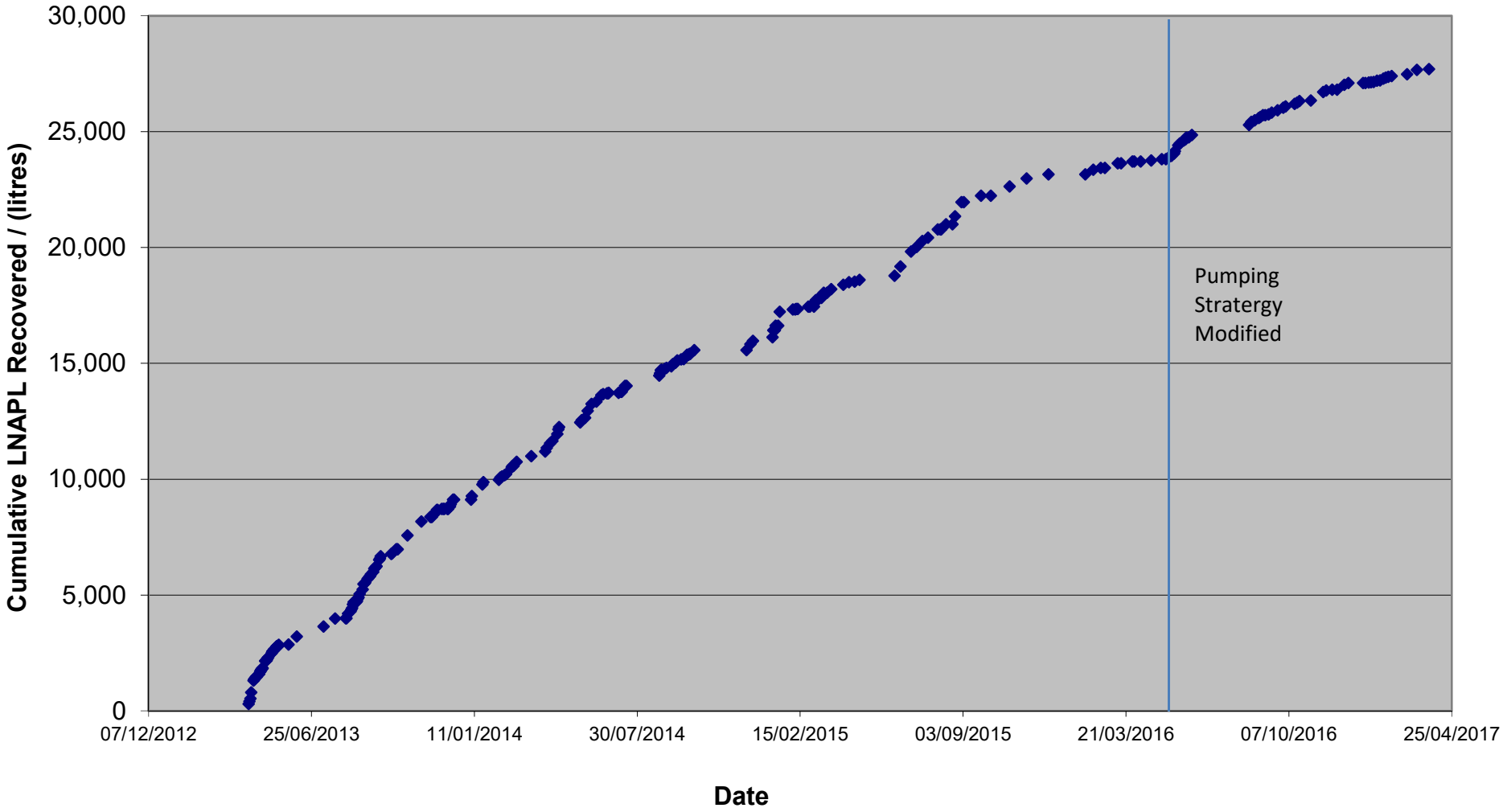
Appendix F.4
LNAPL Levels In BH122

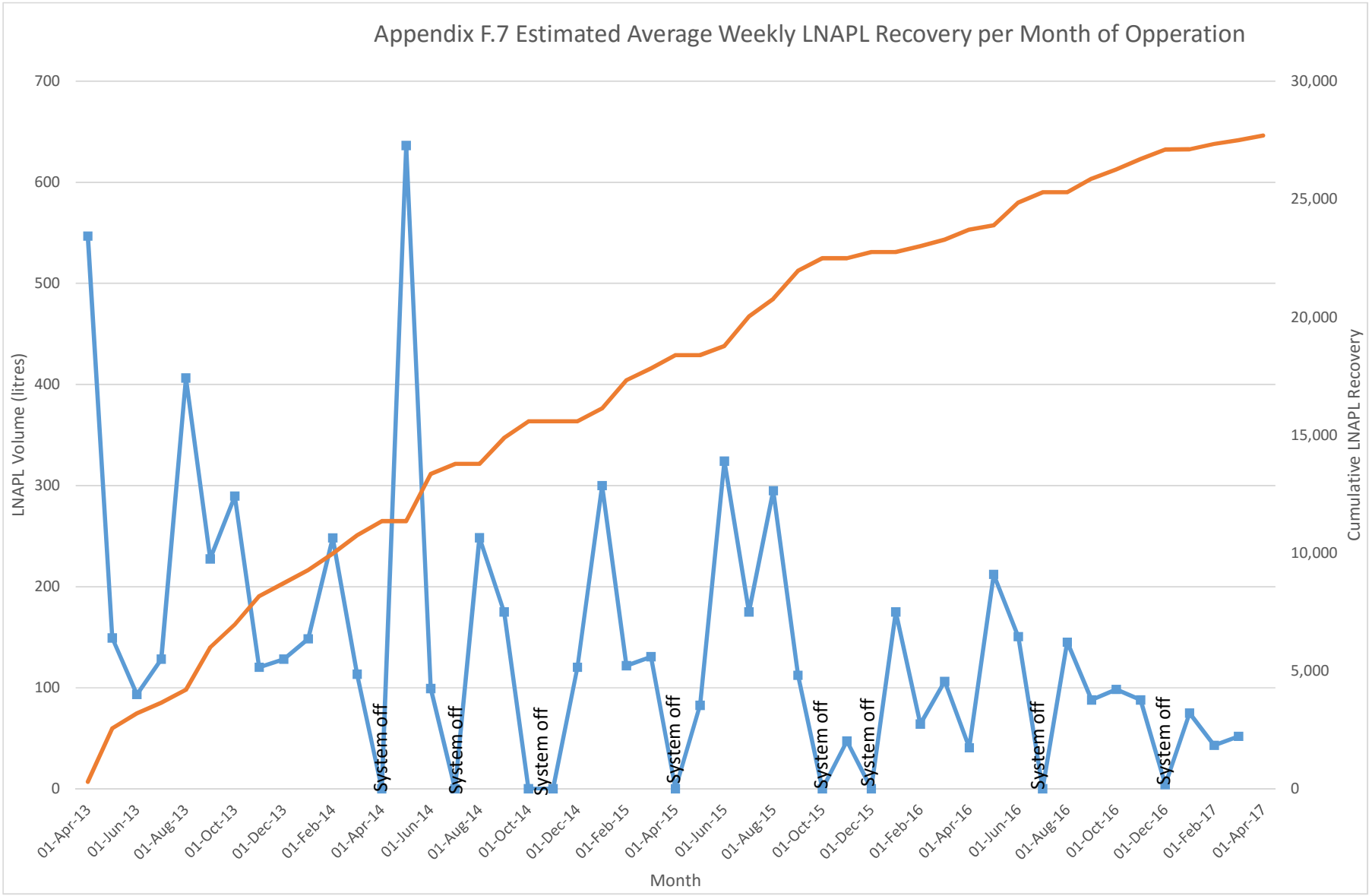


Appendix F.4
LNAPL Levels In BH402



Appendix F.5: Cumulative LNAPL Recovery April 2013 to March 2017




Appendix F.7 Estimated Average Weekly LNAPL Recovery per Month of Opperation
LNAPL Volume (litres)
Cumulative LNAPL Recovery
Month
700
600
500
400
300
200
100
0
30,000
25,000
20,000
15,000
10,000
5,000
0
System off
01-Apr-13
01-Jun-13
01-Aug-13
01-Oct-13
01-Dec-13
01-Feb-14
01-Apr-14
01-Jun-14
01-Aug-14
01-Oct-14
01-Dec-14
01-Feb-15
01-Apr-15
01-Jun-15
01-Aug-15
01-Oct-15
01-Dec-15
01-Feb-16
01-Apr-16
01-Jun-16
01-Aug-16
01-Oct-16
01-Dec-16
01-Feb-17
01-Apr-17

Appendix F.8

Total Petroleum Hydrocarbons in Groundwater During Biannual Monitoring (µg/l)

Formation	Laboratory Method Detection Limit	SSAC		Biannual Monitoring Rresults				
Monitoring Well				BH109	BH108	BH103	EX10	
Aliphatics		Human Health	Water Resources	Apr-14	Sep-15	Sep-15	Oct-13	Mar-15
$>C_5$-C_6	<5	*	42,000	-	5	-	-	-
$>C_6$-C_8	<5	*	4,120	-	20	11	13	-
$>C_8$-C_{10}	<5	ND	*	-	6	7	-	-
$>C_{10}$-C_{12}	<5	ND	*	-	-	-	-	-
$>C_{12}$-C_{16}	< 10	ND	*	-	640	800	40	10
$>C_{16}$-C_{21}	< 10	*	*	-	5,800	18,300	1,220	400
$>C_{21}$-C_{35}	< 10	*	*	-	5,070	20,800	1,210	350
Aromatics								
$>C_6$-C_7	<5	*	*	-	-	-	-	-
$>C_7$-C_8	<5	*	*	-	-	-	-	-
$>C_8$-C_{10}	<5	*	*	-	-	-	-	-
$>C_{10}$-C_{12}	<5	ND	7,170	-	-	-	-	-
$>C_{12}$-C_{16}	< 10	ND	25,100	-	530	610	10	-
$>C_{16}$-C_{21}	< 10	*	*	90	3,380	14,400	830	280
$>C_{21}$-C_{35}	< 10	*	*	120	2,750	14,300	440	110
PRO	Sum C_4-C_{12}	**	**	-	31	18	-	-
TPH	Sum C_4-C_{35}	**	**	210	18,201	69,236	3,763	1,150
MTBE	<0.1	*	*	-	-	-	-	-
Benzene	<0.5	190,000	909	-	-	-	-	0.9
Toluene	<0.5	ND	*	-	-	-	-	-
Ethylbenzene	<0.5	ND	*	-	-	-	-	1.1
p/m-Xylene	<1	ND	2,430	-	-	-	-	-
o-Xylene	<0.5			-	-	-	-	-

Notes

PRO	Petrol Range Organics
TPH	Total Petroleum Hydrocarbons
MTBE	Methyl *tertiary*-butyl ether
NA	Not anlaysed due to the presence of LNAPL in the well
*	No SSAC derived
**	No SSAC derived due to multiple components
ND	Results of risk assessment demonstrate
-	Less than laboratory MDL.

Appendix F.9

Total Petroleum Hydrocarbons in Groundwater Dissolved Phase Assessment(µg/l)

Monitoring Well	Laboratory Method Detection Limit	SSAC		Down Gradient Dissolved Phase													
				BH923			BH924		EX14		BHOS411			BHOS412			
Aliphatics		Human Health	Water Resources	Mar-11	Aug-12	Nov-16	Mar-11	Nov-16	Mar-11	Nov-16	Apr-10	Feb-11	Nov-16	Apr-10	Feb-11	Aug-12	Nov-16
>C_5-C_6	<5	*	42,000	-	-	-	-	-	-	-	-	71	8	-	-	-	-
>C_6-C_8	<5	*	4,120	-	-	-	-	-	-	-	-	-	2,030	-	-	-	-
>C_8-C_{10}	<5	ND	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>C_{10}-C_{12}	<5	ND	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>C_{12}-C_{16}	< 10	ND	*	-	-	-	-	10	-	-	-	-	-	-	-	-	-
>C_{16}-C_{21}	< 10	*	*	-	-	-	-	560	-	-	-	-	-	-	-	-	-
>C_{21}-C_{35}	< 10	*	*	-	-	-	-	500	-	-	-	-	-	-	-	-	-
Aromatics																	
>C_6-C_7	<5	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>C_7-C_8	<5	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>C_8-C_{10}	<5	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>C_{10}-C_{12}	<5	ND	7,170	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>C_{12}-C_{16}	< 10	ND	25,100	-	-	-	-	30	-	-	-	-	-	-	-	-	-
>C_{16}-C_{21}	< 10	*	*	-	-	-	-	520	-	-	-	-	-	-	-	-	-
>C_{21}-C_{35}	< 10	*	*	-	-	-	-	250	-	-	-	-	-	-	-	-	-
PRO	Sum C_4-C_{12}	**	**	-	-	-	-	0	-	-	-	-	2,038	-	-	-	-
TPH	Sum C_4-C_{35}	**	**	-	-	-	-	1,870	-	-	-	-	2,038	-	-	-	-
MTBE	<0.1	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	<0.5	190,000	909	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	<0.5	ND	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<0.5	ND	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<1	ND	2,430	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	<0.5			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes

PRO	Petrol Range Organics
TPH	Total Petroleum Hydrocarbons
MTBE	Methyl *tertiary*-butyl ether
*	No SSAC derived
**	No SSAC derived due to multiple components
ND	Results of risk assessment demonstrate contaminant does not present significant level of risk via this pathway.
-	Less than laboratory MDL.

Appendix F.9

Total Petroleum Hydrocarbons in Groundwater Dissolved Phase Assessment(µg/l)

Monitoring Well	Laboratory Method Detection Limit	SSAC		Dissolved Phase Below NAPL												
				BH122				BH402		BH406		EX23		EX6008		
Aliphatics		Human Health	Water Resources	Mar-10	Apr-10	Mar-11	Nov-16	Apr-11	Nov-16	Feb-11	Sep-15	Mar-11	Nov-16	Mar-11	Sep-15	Nov-16
$>C_5$-C_6	<5	*	42,000	36	40	NAPL No Sample	-	-	-	-	-	-	-	NAPL No Sample	-	-
$>C_6$-C_8	<5	*	4,120	4,870	2,439		116	553	1,010	-	-	-	-		15	31
$>C_8$-C_{10}	<5	ND	*	99	46		-	-	8	-	-	-	-		-	-
$>C_{10}$-C_{12}	<5	ND	*	-	-		-	-	-	-	17	-	7		-	-
$>C_{12}$-C_{16}	< 10	ND	*	2,009	-		240	140	590	10	330	170	690		20	120
$>C_{16}$-C_{21}	< 10	*	*	32,372	-		2,840	2,830	14,700	800	2,830	3,990	14,400		520	1,480
$>C_{21}$-C_{35}	< 10	*	*		-		2,430	2,720	12,300	910	3,140	3,700	12,600		420	1,400
Aromatics																
$>C_6$-C_7	<5	*	*	-	-	NAPL No Sample	-	-	-	-	-	-	-	NAPL No Sample	-	-
$>C_7$-C_8	<5	*	*	-	-		64	-	-	-	-	-	-		-	-
$>C_8$-C_{10}	<5	*	*	-	-		-	-	-	-	-	-	-		-	-
$>C_{10}$-C_{12}	<5	ND	7,170	-	-		-	-	-	30	-	110	-		-	-
$>C_{12}$-C_{16}	< 10	ND	25,100	580	-		110	20	240	370	110	2,520	340		-	20
$>C_{16}$-C_{21}	< 10	*	*	10,068	-		1,790	1,840	9,500	650	1,560	2,470	10,400		250	640
$>C_{21}$-C_{35}	< 10	*	*	8,454	-		1,500	1,400	7,480	1,050	2,110	5,100	8,630		100	490
PRO	Sum C_4-C_{12}	**	**	5,005	2,525	NAPL no Sample	180	553	1,018	-	-	-	-	NAPL no Sample	15	31
TPH	Sum C_4-C_{35}	**	**	58,488	2,525		9,503	9,503	45,828	3,820	10,097	18,060	47,067		1,325	4,181
MTBE	<0.1	*	*	-	-	NAPL No Sample	-	-	-	-	-	-	-	NAPL No Sample	-	-
Benzene	<0.5	190,000	909	-	-		86	-	-	-	-	-	-		-	-
Toluene	<0.5	ND	*	-	-		0.6	-	-	-	-	-	-		-	-
Ethylbenzene	<0.5	ND	*	-	-		-	-	-	-	-	-	-		-	-
p/m -Xylene	<1	ND	2,430	-	-		-	-	-	-	-	-	-		-	-
o -Xylene	<0.5			-	-		-	-	-	-	-	-	-		-	-

Notes

PRO	Petrol Range Organics
TPH	Total Petroleum Hydrocarbons
MTBE	Methyl *tertiary* -butyl ether
*	No SSAC derived
**	No SSAC derived due to multiple compone
ND	Results of risk assessment demonstrate c
-	Less than laboratory MDL.

Appendix F.9

Total Petroleum Hydrocarbons in Groundwater Dissolved Phase Assessment(µg/l)

Monitoring Well	Laboratory Method Detection Limit	SSAC	
Aliphatics		**Human Health**	**Water Resources**
>C_5-C_6	<5	*	42,000
>C_6-C_8	<5	*	4,120
>C_8-C_{10}	<5	ND	*
>C_{10}-C_{12}	<5	ND	*
>C_{12}-C_{16}	< 10	ND	*
>C_{16}-C_{21}	< 10	*	*
>C_{21}-C_{35}	< 10	*	*
Aromatics			
>C_6-C_7	<5	*	*
>C_7-C_8	<5	*	*
>C_8-C_{10}	<5	*	*
>C_{10}-C_{12}	<5	ND	7,170
>C_{12}-C_{16}	< 10	ND	25,100
>C_{16}-C_{21}	< 10	*	*
>C_{21}-C_{35}	< 10	*	*
PRO	Sum C_4-C_{12}	**	**
TPH	Sum C_4-C_{35}	**	**
MTBE	<0.1	*	*
Benzene	<0.5	190,000	909
Toluene	<0.5	ND	*
Ethylbenzene	<0.5	ND	*
p/m-Xylene	<1	ND	2,430
o-Xylene	<0.5		

Notes

PRO	Petrol Range Organics
TPH	Total Petroleum Hydrocarbons
MTBE	Methyl *tertiary*-butyl ether
*	No SSAC derived
**	No SSAC derived due to multiple compone
ND	Results of risk assessment demonstrate c
-	Less than laboratory MDL.

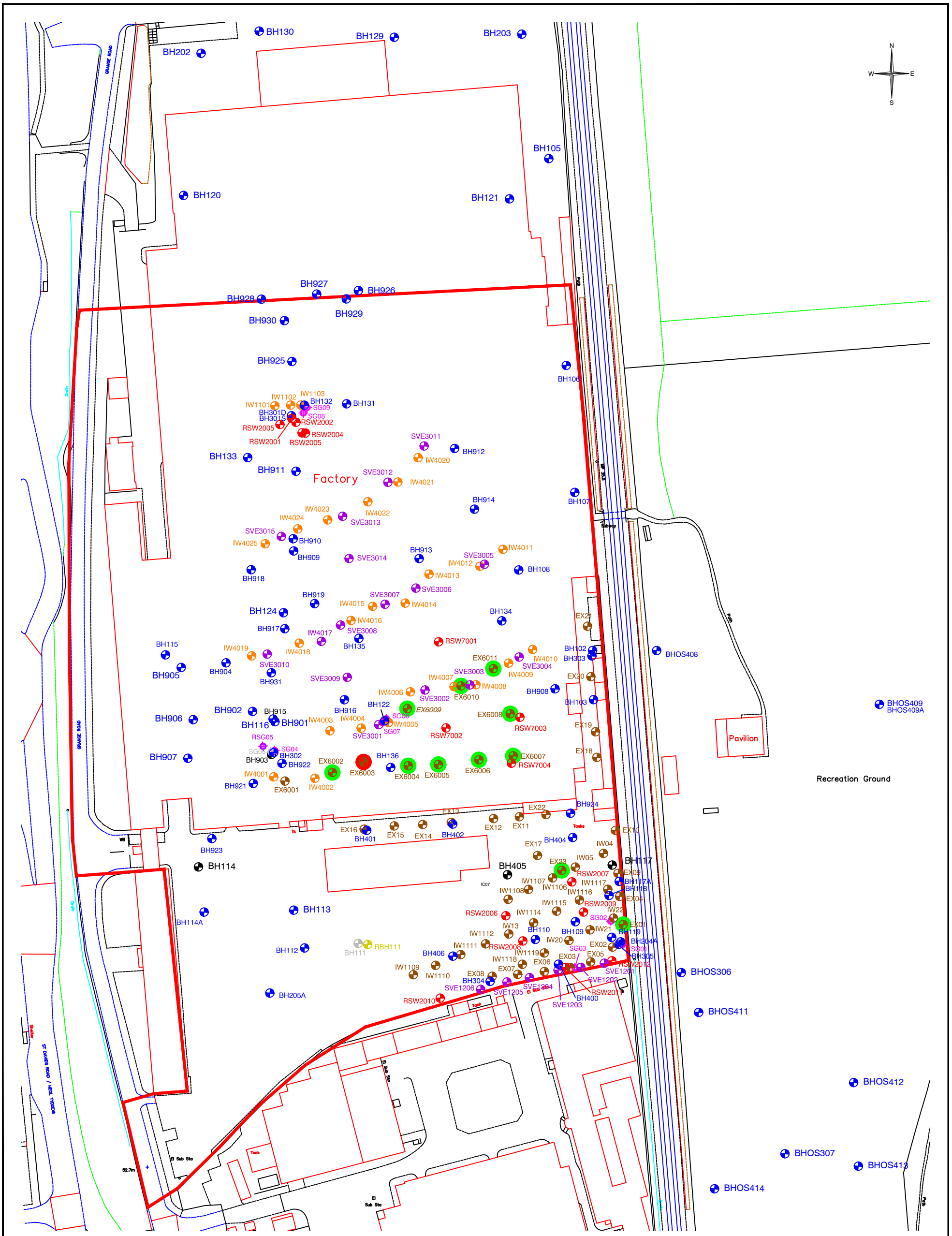
Appendix F.10

Petroleum Hydrocarbons Detected in LNAPL Leaching Tests

Sample ID	Laboratory Method Detection Limit (ug/l)	Petroleum Hydrocarbon SSAC		BH109	BH136	BH103	RSW2009(S)
Sampled Date		Human Health	Water Resources	10/10/2016	10/10/2016	10/10/2016	10/10/2016
Methyl Tertiary Butyl Ether	<0.1	*	*	-	-	0.6	-
Benzene	<0.5	190,000	909	-	-	1.5	-
Toluene	<5	ND	*	-	-	-	92
Ethylbenzene	<0.5	ND	*	-	-	1.3	0.8
p/m-Xylene	<1	ND	2,430	-	-	4	2
o-Xylene	<0.5			-	-	2.6	1.9

Notes

MTBE	Methyl *tertiary*-butyl ether
*	No SSAC derived
**	No SSAC derived due to multiple components
ND	Results of risk assessment demonstrate contaminant does not present significant level of risk via this pathway.



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