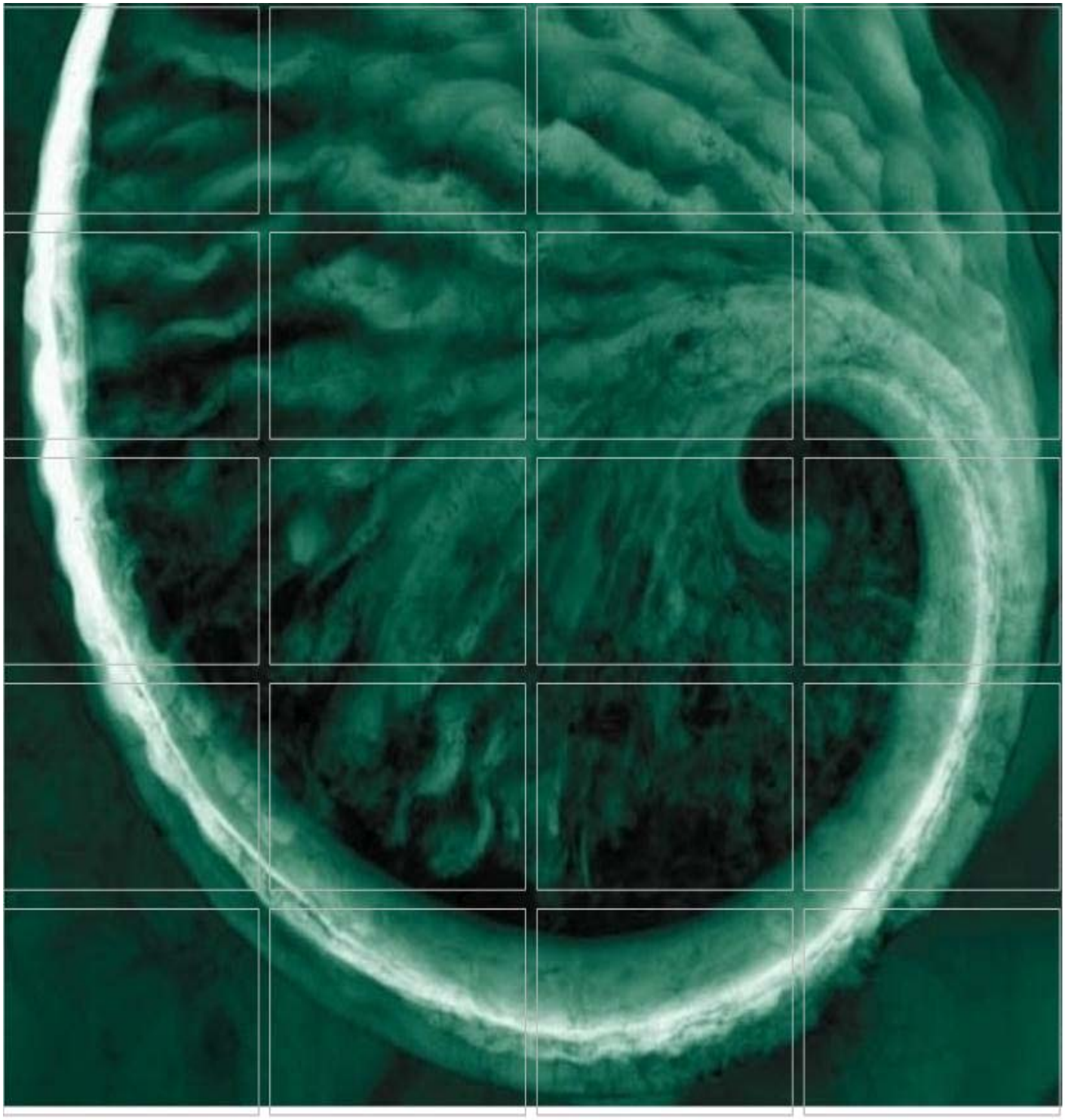

Supplement to Site Investigation Report and RECAP Evaluation

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana
AI# 91357

February 15, 2016

www.erm.com

ERM's New Orleans Office

3838 North Causeway Boulevard, Suite 3000
Metairie, Louisiana 70002
T: 504-831-6700
F: 504-407-2098
www.erm.com

Union Oil Company of California

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Project No. 0116008

Angela M. Levert
Partner-In-Charge

Alyson Hubbs
Project Manager

Environmental Resources Management Southwest, Inc.
3838 North Causeway Boulevard, Suite 3000
Metairie, Louisiana 70002
504-831-6700

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1.0 INTRODUCTION

On behalf of Union Oil Company of California (UNOCAL), this report provides supplemental site characterization and risk evaluation completed for the East White Lake study area on Vermilion Parish School Board Property. A *Site Investigation Report and RECAP Evaluation* was provided to the LDNR previously on October 1, 2015 as an appendix to the Most Feasible Plan for Evaluation/Remediation (MP&A, 2015). The plan was developed pursuant to LSA-R.S. 30:29 to evaluate and/or remediate "environmental damage" related to oilfield operations on the site. The risk evaluation, including this supplement, was performed in accordance with Louisiana's Risk Evaluation/Corrective Action Program (RECAP) under Management Option 3 (MO-3).

The supplemental data collected following submittal of the October 2015 RECAP report include sediment and ground water samples collected by ICON Environmental Services Inc. (ICON) and split by Michael Pisani and Associates, Inc. (MP&A). The data collected by both investigators were reviewed for this RECAP supplement, and usability of the data for quantitative risk assessment was determined. Following the data quality review, data identified as representative of site conditions from both investigators were used in the quantitative RECAP assessment, as applicable. The reported concentrations were evaluated using the RECAP MO-3 methods presented in detail previously, with no change to the risk assessment methods. This report therefore provides a summary of the additional data collected, data quality and usability review, updates to critical tables and figures from the prior RECAP report, and a summary of the conclusions based upon incorporation of the additional data.

Attachments to this report include data summary tables, the RECAP data quality evaluation form, and updated risk evaluation tables and figures. The table and figure numbers of the prior RECAP report have been amended to include *Suppl*, indicating they have been updated to include the supplemental data/evaluation (e.g., Table 5-1 Suppl, Figure 3-1 Suppl). Tables and figures that did not require modification are not included except where warranted for completeness as noted in the text of this report.

1.1 SCOPE OF SUPPLEMENTAL DATA COLLECTION

1.1.1 Sediment

ICON collected sediment samples from 10 boring locations (SS-16 through SS-26) using a Russian Peat borer or hand auger. Sediment samples were also collected from three monitor well locations during installation of the wells (TBB-1D, TBB-2D, TBB-2M) by pushing a split-spoon core barrel ahead of a mud-rotary wash boring. The sediment samples were collected at the base of canals below the water column and from canal banks. Many of the supplemental samples were collected from the active E&P operations area, in the central facility and associated tank battery area. Samples were collected for analysis of metals and hydrocarbon constituents from multiple depths at each location, to a maximum depth of 19 feet bgs, for a total of 34 sediment samples with data useful for quantitative RECAP assessment. Samples were analyzed for metals, hydrocarbon mixtures (by ICON) and hydrocarbon fractions (by MP&A).

The sediment sample locations were added to Figures 3-1 through 3-5 of the RECAP evaluation, with the new locations distinguished for easy reference (no new locations were completed in the quadrants shown in Figures 3-3 and Figure 3-5, but the figures are included for completeness).

1.1.2 Ground Water

ICON installed and sampled 14 wells ranging in total depth from 24 feet below ground surface (bgs) to 489 feet bgs. The screened intervals for each well are included in the data summary tables in Appendix A. The wells were installed using mud-rotary wash method. Observations regarding the installation methods and field procedures are separately provided by MP&A (MP&A, 2016), who was present during well installation, development, and sampling. The observations provided by MP&A were incorporated into the data quality and data usability evaluation provided in Section 2.

The ground water sample locations were added to Figure 3-6 of the RECAP evaluation, with the new locations distinguished for easy reference. Ground water samples were analyzed for metals, chlorides and salt indicator parameters, hydrocarbon mixtures, hydrocarbon fractions (by MP&A), semivolatile organic constituents, and BTEX[1]. Samples from one location were analyzed for semivolatile organic constituents by MP&A specifically to examine suspected cross contamination observed during the drilling process as further discussed in the data quality review, Section 2.

[1] Benzene, ethylbenzene, toluene, and xylenes

2.0 SUMMARY OF LABORATORY RESULTS AND DATA QUALITY REVIEW

Samples were submitted by ICON to Element Materials Technology Lafayette Laboratory for analysis. Split samples were submitted by MP&A to Gulf Coast Analytical Laboratory (GCAL) and Element Laboratory (for some samples with a focus on salt and 29-B parameters). The laboratories are LELAP certified in accordance with LDEQ guidance. The samples were analyzed by one or more of the following methods, depending upon location:

- Metals [SW-846 6010B, 6020A, and 7470/7471 (Hg)],
- Benzene, toluene, ethylbenzene, xylenes (BTEX, SW-846 8260 and 8021B),
- Semivolatile organic constituents (SVOCs, SW-846 8270),
- Total petroleum hydrocarbons (TPH, SW-846 8015), and
- Petroleum hydrocarbon fractions (MADEP VPH/EPH for RECAP carbon ranges).

Some samples were also analyzed by both investigators for salt indicators using methods relevant to Statewide Order 29B for sediment and EPA methods for ground water. The laboratories provided a standard Quality Assurance/Quality Control (QA/QC) package to support data quality review in accordance with RECAP Section 2.5.

2.1 CHEMICAL ANALYTICAL RESULTS

Chemical analytical results are summarized in tables in Appendix A. Results for split samples are provided side-by side, where available. Split results from ICON were unavailable for five sample locations because ICON has not provided laboratory reports as of the time of this submittal. Tabulated analytical data include the following:

- Sediment (Table A-1)
- Ground Water (Table A-2, Table A-3)

To reduce duplication in submittals, the laboratory reports for ICON and MP&A data are not appended to this report but are incorporated by reference (ICON, 2016; MP&A, 2016).

2.2 DATA QUALITY EVALUATION/ DATA USABILITY REVIEW

A data quality evaluation and data usability review were performed for the supplemental data. The evaluation included review of features such as analytical and field methods, laboratory performance (e.g., QA/QC samples and indicators), sample quantitation limits, and split sample results. In accordance with RECAP Section 2.5, the review was focused on the identification of representative (definitive) data appropriate for use in quantitative risk assessment.

RECAP Form 3 (Analytical Data Evaluation) documenting the data quality review is provided in Appendix B, and results of the review are summarized below. For the majority of analytical results, no major deficiencies were noted

that warranted rejection of the data from the RECAP evaluation. Ground water samples from one location were rejected as not representative, and the results for ground water samples collected in the former Tank Battery B area and at location BC-2 were identified as warranting confirmation as discussed below. Based on the data quality review, the remaining chemical analytical results are considered appropriately representative and useable for site characterization and quantitative risk evaluation. Additional details are provided below.

Analytical Methods. The analyses of site samples were generally performed using RECAP-recommended analytical methods at LELAP-certified labs, and available laboratory reports indicated laboratory QA/QC was performed in accordance with SW-846 method requirements with exceptions noted in the discussion below. The following discussion also identifies limitations (e.g., artifacts of the sampling method) affecting the analytical results and observations regarding use of split sample results from two separate laboratories.

- The use of the 29-B sample preparation method for metals analysis of sediment samples differs from the routine SW-846 preparation method by the addition of a pulverizing step before extraction and subsequent analysis of the extract for metals. This pulverizing step is not representative of exposure conditions in the natural environment. The 29-B preparation method was used by Element Laboratory for the ICON sediment samples, while the MP&A sediment samples included the routine SW-846 preparation method. While this difference in sample preparation is recognized and may contribute to differences in split metals results, the subsequent analysis of extract is comparable, and data from both investigators were considered usable for the risk assessment to make best use of the data available.

- ICON investigation results provided Total Petroleum Hydrocarbon (TPH) mixture analyses expressed as TPH-GRO, TPH-DRO, and TPH-ORO. MP&A analysis results provided further hydrocarbon fractionation data for the split samples of all sediment and ground water samples that were analyzed by ICON for TPH mixtures. Conclusions presented in this report for risk associated with hydrocarbons in the East White Lake study area are based upon the risk assessment completed using the fraction data, consistent with RECAP Appendix D and supporting guidance.

Sampling Methods/Representative Samples. A requirement of the data usability review is to identify results that are representative of field conditions and true concentrations. The following observations were identified and informed the selection of data for use in the quantitative risk evaluation:

- Based on the high turbidity of the ground water sample from location TBB-1D (result not recorded by the sampler, ICON), both investigators performed analysis for dissolved metals to provide results representative of ground water constituent levels (and not suspended solids). The analysis of filtered metals for the turbid sample is consistent with guidance of RECAP Appendix B Section B2.5.4, and dissolved metals results are used in the quantitative analysis for this sample. For all

remaining samples, both the total and dissolved metals results were evaluated in the risk assessment.

- MP&A observed the drilling and installation of monitor well TBB-3D (66-76') by ICON and its drilling contractor, and identified through visual and olfactory observation that the well was drilled through a creosote-treated wooden piling. Because MP&A suspected creosote contamination of the drilling fluids and potential cross contamination of the deeper sediment and ground water in this well, samples of the drilling mud and ground water during purging were collected and analyzed for SVOCs. The analyses confirmed the presence of TPH-DRO-range organics, hydrocarbon fractions, and PAHs in the drilling mud (see Table A-4) and ground water (see Table A-2), indicative of creosote contamination. PAHs were absent from the shallower well (TBB-3S at 14-24') completed adjacent to TBB-3D through a separate well installation; fractions were not detected, and TPH-DRO was reported at a concentration ten times lower in the shallow ground water sample. The shallow well installation did not encounter creosote-treated pilings. The final ground water sample collected by ICON from TBB-3D following well development was split by MP&A and analyzed for SVOCs as well. The results indicate the following PAHs were detected above the screening standard as a result of creosote contamination to the 66-76' interval (suspected to have been introduced by ICON"s drilling methods): 2-methylnaphthalene, acenaphthene, fluorene, naphthalene, and phenanthrene. In addition, 2-methylnpahthalene and naphthalene were above default GW 2 RECAP standards (i.e., beyond screening). The results for well TBB-3D, therefore, are not reliable as representative of field conditions, and instead reflect artifacts of the drilling process. The data are not used to assess potential risk associated with historical E&P operations at the site.

- MP&A observed the drilling and installation of monitor wells completed by ICON in the former Tank Battery B area (wells named with the TBB prefix) in locations that ICON has identified as former pit areas, specifically TBB-1S and 1D, TBB-2M and 2D (see ICON Figure 1-10 of Plaintiff's Feasible Plan, 2016). Shallow sediment samples collected in these locations contained detectable hydrocarbons. MP&A identified that the shallow soils were not properly cased off during mud-rotary drilling (MP&A, 2016). As a result, constituents in shallow soil could be transported vertically using the mud-rotary drilling method, and introduced to the ground water sampling intervals. For this reason, the data collected in these monitor wells are identified as requiring confirmation. In particular, the benzene detection in well TBB-1S (33-43') at a level (0.007 mg/L) very near the detection limit and above the RECAP screening standard warrants confirmation. The data from these wells are used in the RECAP assessment provided herein for completeness, and the resulting conclusions are noted as preliminary and requiring confirmation.

- MP&A observed the drilling and installation of monitor well BC-2 completed by ICON at a depth of 279-299 feet bgs, and identified well construction, development, and sampling issues that may result in data

that is not representative of the sampled interval (see MP&A for details). The data collected in BC-2 and the vicinity (BC-3, BC-4) require confirmation. The data are used in the RECAP assessment provided herein for completeness, and the resulting conclusions are noted as requiring confirmation.

Laboratory Performance Indicators: QA/QC samples included laboratory-prepared method blanks, matrix spikes, and laboratory control samples. Results of QA/QC samples were reviewed and the following observations are noted for the ICON-reported and MP&A-reported analytical results.

- The review concluded that there were no significant QC deficiencies in the laboratory performance, and the data were therefore considered technically valid and acceptable for risk assessment purposes. Minor QC deviations documented in the lab reports did not warrant rejection of results due to laboratory performance.

Sample Quantitation Limits. Sample quantitation limits were evaluated relative to RECAP screening and final MO-3 standards, in accordance with RECAP Section 2.5. Quantitation limits for the supplemental data were below RECAP Screening Standards with few exceptions. Observations regarding quantitation or reporting limits are identified below.

- For sediment, the reporting limits (wet weight) for non-detect results were less than RECAP Screening Standards with the exception of two fractions (aliphatics and aromatics in the >C10-C12 range) for a single sample (SS-26 0-2'). Dilution of the sample was performed due to hydrocarbon concentrations present in the longer chain ranges, and the detection limits were below final MO-3 RECAP standards.

- For ground water, reporting limits for metals and hydrocarbons were below Screening Standards with the exception of TBB-1S and TBB-2M, TBA-2, BC-2, and BC-4, for which the reporting limits provided by MP&A (GCAL laboratory) exceeded the Screening Standards for arsenic, cadmium, and lead. The reporting limits in splits of TBB-1S and TBB-2M, collected and reported by ICON, were below Screening Standards for each of these constituents. Splits of the remaining samples have not yet been provided by ICON.

- For ground water, a full list of semivolatile organic constituents (SVOCs) was analyzed with routine SW-846 method detection limits for samples TBB-3S, TBB-3D, and BC-1. Reporting limits for some SVOCs were above screening standards (see Table A-2). No J-qualified detections were reported (above method detection limit and below the reporting limit), and the SVOCs are not reasonably expected to be COCs in ground water for E&P sites.

No significant deficiencies in site characterization or risk characterization were identified based upon sample quantitation limits.

Use of Representative Split Sample Results: Consistent with the prior RECAP report, where valid split results were available based on results of this QA/QC review, the average of detected concentrations in the split results for sediment and ground water are identified in the data summary tables and used in the risk evaluation as most representative of the concentration at a location. Where a single valid result (with no split) is available, the result is used in the risk evaluation. For the few instances of one detection and one non-detect in splits for ground water, detections were averaged with the full detection limit of the non-detect result, which conservatively assumes the constituent is present at a value equal to the reporting limit.

3.0 RECAP EVALUATION METHODS AND RESULTS

The conceptual site model (CSM) was presented previously and no changes have been identified through the additional sampling and analysis of sediment and ground water. No changes have been made to the exposure scenarios used in the MO-3 evaluation developed in accordance with RECAP requirements.

Consistent with the prior evaluation, the supplemental data were incorporated into the screening evaluation to confirm constituents of concern (COCs) warranting further evaluation under MO-3. The supplemental data were then incorporated into the site-specific MO-3 evaluation.

Consistent with the prior evaluation, screening standards (SS) were used as a preliminary screen to identify the distribution of COCs in sediment and ground water, and MO-3 standards were used to identify the final AOIs.

3.1 SEDIMENT

3.1.1 Sediment Screening Evaluation

Tables 5-1 and 5-2 of the RECAP evaluation were updated to include the supplemental data, and the modifications are highlighted for ease of review. Table 5-1 provides a comparison of the maximum constituent concentrations reported in surface samples to the industrial ($Soil_{SSi}$) and non-industrial ($Soil_{SSni}$) soil direct contact SS. As presented previously, the surface interval was identified as the upper three feet, consistent with the RECAP provisions for surface soil to address site-specific conditions. Table 5-2 provides a comparison of the maximum constituent concentrations reported in samples collected from all depths to ground water protection SS ($Soil_{SSGW}$). The sediment data included in the direct contact evaluation are identified in the updated Table 5-3. The sediment data included in the evaluation for ground water protection are identified in the updated Table 5-4.

Based upon the screening evaluation using maximum concentrations, no additional COCs were identified in sediment for further evaluation under MO-3 of RECAP.

The maximum reported constituent concentrations in site sediment remain less than screening levels for industrial direct contact. The hydrocarbon fractions and three metals (barium, lead, mercury) reported above non-industrial (residential) direct contact SS or ground water protection SS remain the same. The results of the screening evaluation are illustrated in tables and figures as follows:

- Figure 5-1 was updated to include one supplemental sample location with concentrations detected above the non-industrial (residential) direct contact SS.
- Figure 5-2 was updated to include two supplemental sample locations with concentrations detected above ground water protection SS. For the locations with no concentrations posted in Figures 5-1 and 5-2, constituent concentrations were below SS.

- Table 5-5 was updated to provide a comprehensive summary of the constituents, concentrations, and sample locations identified in the figures, i.e., the RECAP SS exceedances. The updates are highlighted.

The COCs and concentrations exceeding the SS are further evaluated under MO-3 using more applicable exposure assumptions. In addition, salt (chlorides measured in sediment) is a non-traditional parameter per RECAP (with no screening value) that is addressed under MO-3.

3.1.2 Sediment MO-3 Evaluation

Direct Contact: No additional COCs were identified for sediment contact, and the supplemental data do not identify any new maximum concentrations for the COCs in surface soil. Therefore, the only update (highlighted) to the MO-3 evaluation in Table 6-3 is an update to concentrations that will remain at the site following the corrective action at locations WL-3 and WL-4 (locations WL-3 and WL-4 were previously identified as exceeding aesthetic limits and warranting action). The supplemental data provide no change to the conclusion of the prior evaluation: the maximum constituent concentrations in the supplemental data are demonstrated to comply with the limiting risk-based RECAP Standards and the aesthetic standard for total hydrocarbon fractions. The reported concentrations in the supplemental sediment samples are protective of site workers and recreational receptors. The locations identified as exceeding final RECAP Standards are WL-3 and WL-4.

Ground Water Protection: No additional COCs were identified for sediment to ground water protection, and the supplemental data identify a single update to a maximum concentration (for one fraction). The MO-3 evaluation in Table 6-4 was updated to include the supplemental data, and no change to the conclusion of the prior evaluation is identified: the residual COC concentrations in sediment samples collected within the Peat Zone interval are estimated to be protective of the uppermost water-bearing zone. These results are consistent with the conclusions of the direct evaluation of the uppermost water bearing unit, the Peat Zone, and the direct evaluation of surface water data for the water bodies assumed to receive ground water discharge. In addition, no exceedances of ground water protection SS for metals and organics were identified in sediment samples collected beneath the Peat Zone.

Chlorides in Sediment: For chlorides in soil (and similarly sediment), the protection of aesthetics (i.e., support of the growth of wild vegetation) and ground water protection are the focus of evaluation. The health of vegetation is addressed in the ecological risk assessment, provided separately from this report. In accordance with RECAP, a quantitative standard for protection of the Class 3 ground water (Peat Zone) is not appropriate given the naturally salty designation of the potential receiving surface water and lack of an appropriate promulgated water quality standard for chlorides (e.g., for estuarine water bodies).

Leachate data were collected by ICON using the 29B Leachate Chlorides test, with most samples collected within the saturated sediment of the Peat Zone. These leachate data are not valid representations of the leaching potential of

sediment, but are reflective of the combined salt levels in Peat Zone ground water and sediment. Prior to the supplemental data collection, a single Leachate Chlorides sample had been collected beneath the Peat Zone [SB-1 (46.5'-47.5')] to support sediment-to-ground water evaluation for deeper ground water. The supplemental data provide additional samples in the 20 to 42 feet bgs interval beneath the Peat Zone at only one boring location, TBB-1S. The maximum resulting leachate concentration for all of the samples collected beneath the Peat Zone was 1560 mg/L, slightly above the estimated background threshold range identified for chlorides in Chicot Confining Unit ground water (see Table 6-7). The remaining results for samples collected beneath the Peat Zone were less than the estimated threshold range of 1100 to 1200 mg/L chlorides.

3.2 GROUND WATER

3.2.1 Ground Water Screening Evaluation

Table 5-7 of the RECAP evaluation was updated to include the supplemental data. Table 5-7 provides a comparison of the maximum constituent concentrations reported in each ground water interval to the ground water SS (GW_{SS}). The ground water data included in the evaluation are identified in the updated Table 5-6. The intervals of evaluation were modified as noted below, with supplemental monitor well data added to each interval as follows:

Prior Terminology	*Current Term*	*Wells/Data Added*
Peat Zone	No change: Peat Zone	TBB-3S (14-24')
40-Foot Zone	40 to 60 Foot Zone	TBB-1S (33-43'), TBB-2M (49-59')
70-Foot Zone	70 to 90 Foot Zone	TBA-1D (75-85'), TBA-2 (69-79'), TBB-1D (65-75'), TBB-2D (81-91')
90-Foot Zone	90 to 250 Foot Zone	MC-1 (161-181'), MC-2 (139-159')
-	>250 Foot Zone	BC-2 (279-299'), BC-3 (279-299'), BC-4 (269.5-289.5')
Upper Sand of Chicot Aquifer	No change: Upper Sand of Chicot Aquifer	BC-1 (469-489')

As described in the prior RECAP evaluation, the Peat Zone is identified as a clay/peat horizon distinct from the underlying sand layers within the Chicot Confining Unit (called Confining Unit hereafter). The sands within the confining unit are considered to have some hydraulic communication, with intervening clay layers providing attenuation of the vertical movement of water and constituents. The sand layers are not identified as separate ground water zones, but for ease of discussion in this report, the sample intervals in the confining unit are referred to as the 40 to 60 Foot Zone , 70 to 90 Foot Zone, 90 to 250 Foot Zone, and >250 Foot Zone. Viewing (mapping) and evaluating the data in these intervals is helpful for understanding the vertical concentration profile and where delineation is achieved vertically. These intervals are separated from the underlying Chicot Aquifer system (including Upper Sand of Chicot Aquifer) by a greater than 100-foot thick clay aquitard, and this separation is demonstrated through the difference in natural salinity identified by the USGS studies and publications for the region. Sand layers in the Confining Unit are naturally salty, and the Chicot Aquifer system contains fresh water (i.e., below 250 mg/L chlorides).

Based upon the screening evaluation provided in Table 5-7 using maximum concentrations, one additional site-related COC was identified in ground water for further evaluation under MO-3 of RECAP (i.e., one hydrocarbon fraction). The supplemental data confirm the prior selection of site-related COCs for MO-3 evaluation.

Peat Zone. Constituents that exceeded SS and are identified as site-related COCs for further GW3NDW evaluation include barium, strontium, TPH-DRO and TPH-ORO (TPH included due to absence of fraction data for most samples). Chlorides are carried forward and addressed as a non-traditional parameter under MO-3.

40 to 60 Foot Zone. Constituents that exceeded SS and are identified as site-related COCs for further evaluation include barium, strontium, and benzene. Chlorides are carried forward and addressed as a non-traditional parameter under MO-3.

70 to 90 Foot Zone. Barium and strontium exceeded the SS in a single location and are identified as site-related COCs for further evaluation. Chlorides are carried forward and addressed as a non-traditional parameter under MO-3.

90 to 250 Foot Zone. No site-related COCs are identified above SS in the 90 to 250 Foot Zone. Chlorides are carried forward and addressed as a non-traditional parameter under MO-3.

>250 Foot Zone. Constituents that exceeded SS and are identified as site-related COCs for further evaluation include barium, strontium, benzene, and Aromatics >C8-C10. Chlorides are carried forward and addressed as a non-traditional parameter under MO-3.

Upper Sand of Chicot Aquifer. The ground water quality in the Upper Sand of the Chicot Aquifer does not exhibit impacts as a result of vertical migration of COCs, and does not exhibit any RECAP SS exceedances with the exception of naturally elevated iron and manganese. Chlorides in this zone are less than the SMCL of 250 mg/L, which provides an appropriate screening value for the fresh water Class 1 Zone. No further assessment of this zone beyond screening is warranted.

Table 5-8 of the RECAP evaluation provided a summary of the constituents that exceeded RECAP SS in one or more samples and were not identified as COCs warranting further evaluation because they are naturally occurring and available data do not indicate they are present as a result of site operations. The supplemental data are consistent with the prior observations and further support the conclusions presented previously for arsenic, iron, manganese, and selenium. One additional constituent, lead, was reported above the SS of 0.015 mg/L in a single supplemental sample in the 70 to 90 Foot Zone (in TBB-1D 65-75'). Lead is not identified above SS in shallower ground water at this location (TBB-1S 33-43') or any other representative ground water samples in the original or supplemental data, including those most affected with E&P-related COCs. Lead is not identified as a site-related COC for further risk evaluation.

The figures illustrating the distribution of site-related COCs by sampling interval have been updated as noted below. Figure 5-11a and Figures 5-16 through 5-19 have been added. Exceedances of SS are identified in the figures, where applicable. In addition, the distribution of chlorides is identified for each ground water interval.

Figure 5-3 Peat Zone – Barium Concentrations

Figure 5-4 Peat Zone – Strontium Concentrations

Figure 5-5 Peat Zone – Petroleum Hydrocarbon Concentrations

Figure 5-6 Peat Zone – Chlorides Concentrations

Figure 5-7 40-60 Foot Zone – Barium Concentrations

Figure 5-8 40-60 Foot Zone – Strontium Concentrations

Figure 5-9 40-60 Foot Zone – Benzene Concentrations

Figure 5-10 40-60 Foot Zone – Chlorides Concentrations

Figure 5-11a 70-90 Foot Zone – Barium Concentrations

Figure 5-11b 70-90 Foot Zone – Chlorides Concentrations

Figure 5-12 90-250 Foot Zone – Chlorides Concentrations

Figure 5-13 Upper Sand of Chicot Aquifer – Chlorides Concentrations

Figure 5-16 >250 Foot Zone – Barium Concentrations

Figure 5-17 >250 Foot Zone – Benzene Concentrations

Figure 5-18 >250 Foot Zone – Aromatics >C8-C10 Concentrations

Figure 5-19 >250 Foot Zone – Chlorides Concentrations

Preliminary AOIs defined relative to the risk-based RECAP SS for the site-related COCs, and warranting further evaluation, are shown for the Peat Zone and 40 to 60 Foot Zone in the updated Figures 5-14 and 5-15. The final AOIs for these zones are identified relative to the final MO-3 ground water standards. There is no change to the preliminary AOIs warranting further evaluation for the Peat Zone (i.e., no change to the AOIs shown in Figure 5-14). Based on the concerns regarding reliability of the supplemental ground water data collected in the 40 to 60 Foot Zone in the former Tank Battery B area (TBB-1S and TBB-2M), a potential AOI in this area is subject to confirmation and potentially delineation. The reported concentrations of COCs in these locations are identified on the figures herein (Figures 5-7 through 5-10; Figure 5-15), however, the area is not designated/drawn as an AOI, pending confirmation.

Similarly, pending confirmation sampling and delineation in the >250 Foot Zone of the Confining Unit, the reported concentrations of COCs in the BC-2 through BC-4 locations are identified on the figures herein (Figures 5-16 through 5-19),

however, the area is not designated/drawn as an AOI. The data are carried forward and fully evaluated under MO-3.

Based on all available data, metals and hydrocarbon COCs are delineated to below screening standards vertically at the 70 to 90 Foot Zone, except in a single location (TBA-2) where barium and strontium were detected slightly above screening levels. In this location, barium and strontium are delineated to below the screening standard at 139-159 feet (sample location MC-2). All COCs are below screening standards for samples collected within the 90 to 250 Foot Zone, and reported chlorides concentrations are consistent with expected natural (background) range in samples from this interval with the possible exception of location MC-2 (139-159').

A separate occurrence of elevated COC concentrations is identified at a depth of 279-299 feet in the vicinity of sample location BC-2. The vertical profile for the Confining Unit sands in this location includes samples HP-MPA-09-T (42-45'), TBA-2 (69-79'), MC-2 (139-159'), and BC-2 (279-299'). The reported concentrations of COCs are higher in BC-2 than in shallower intervals, pending confirmation.

3.2.2 Ground Water MO-3 Evaluation

The MO-3 evaluation for ground water addresses the site-related COCs identified through screening evaluation. As identified in the RECAP evaluation, ground water was evaluated under MO-3 based upon the following classifications:

Peat Zone: Class 3
Confining Unit (40 to >250 Foot intervals): Class 2

Peat Zone. The development of RECAP standards (RS) for the Peat Zone and comparison to maximum reported concentrations were presented in Table 6-6 of the RECAP evaluation, and no revisions to the MO-3 assessment in Table 6-6 were required for the supplemental data. The conclusion of the MO-3 assessment for the Peat Zone is unchanged. The reported concentrations in the Peat Zone ground water comply with GW3NDW RECAP Standards and are protective of surface water and its users, assuming no attenuation or dilution occurs during migration or discharge to the surface water (which is not a realistic assumption). For chlorides, a surface water quality standard and a GW3NDW standard cannot be identified. Alternatively, surface water samples were collected throughout the East White Lake study area during site investigations, and a direct evaluation of the surface water data was previously provided as part of the MO-3 risk assessment.

40 to 60 Foot Zone. Evaluation of the 40 to 60 Foot Zone (and other sand layers of the Confining Unit) included two components. A default domestic supply scenario that includes daily ingestion was evaluated in accordance with RECAP requirements for ground water meeting the definition of GW2. Based upon the documented use of this ground water zone and water quality that is not suitable for domestic use without treatment, the ongoing and more likely future use as a non-potable camp well (recreational) source was quantitatively evaluated using a

RME scenario defined based upon available information about actual, current use in accordance with RECAP MO-3 requirements.

Table 6-7a has been updated to incorporate the supplemental data. No changes to the default GW2 or the site-specific MO-3 standards were required. Concentrations for the 70 to 90 Foot Zone were added to Table 6-7a for the SB-1-MW AOI, the one AOI where concentrations exceed SS in that interval. The potential AOI in the former Tank Battery B area has been added to the table for complete information. Additions to the table are highlighted for easy reference.

The conclusions of the assessment for the 40 to 60 Foot sampling interval remain unchanged. The maximum reported concentrations of the COCs in each preliminary AOI are below the site-specific RECAP standards, indicating concentrations are protective of recreational ground water users assuming hypothetical placement of a camp supply well directly within the AOIs. There is currently no exposure to the ground water within the AOIs, and there is no human health risk associated with any concentrations reported in the ground water samples. Exceedances of default GW2 health-based standards are identified for benzene and barium (see updated Figure 6-3). These exceedances are reasonably delineated with the possible exception of HP-08 and the former Tank Battery B area (pending confirmation), and there is no threat to the non-potable supply wells that are completed in this zone (i.e., the Hebert well and abandoned Crouch well north of the AOIs and Schooner Bayou). Chlorides are elevated above potential background range within those same AOIs and at HP-MPA-02-T.

A potential background threshold range for chlorides has been added to Table 6-7a and was calculated using the ProUCL software tool recommended by LDEQ for statistical analysis under RECAP. The ProUCL tool provides for more rigorous evaluation than the simplified methods identified in RECAP Section 2.13. A range of Background Threshold Values (BTVs) of 1100 to 1200 mg/L chlorides was calculated using wells on the East White Lake site identified as most likely representative of the natural salt levels in this site setting. BTVs are the statistical metric that should be used when comparing individual data points (point-by-point) to background to determine if conditions are consistent with background and to provide delineation at a known, defensible confidence level. The wells included in the potential site-specific background calculation were identified by MP&A based upon examination of the water chemistry (e.g., cation and anion distribution, sulfate concentrations) and absence of indicators of oil and gas impact (e.g., no confirmed detectable hydrocarbon, low barium and strontium levels). Details of the calculations are provided in Appendix C.

It is noted that the chlorides result of 1600 mg/L for the abandoned Crouch well (TD 34') located north of Schooner Bayou is likely influenced by infiltration of surface water, based on examination of the water chemistry (MP&A, 2016). This well was therefore excluded from the background threshold calculation. It contains no indicators of E&P impact (e.g., elevated barium, hydrocarbons) and is not an AOI related to E&P activities.

70 to 90 Foot Zone. Maximum reported constituent concentrations in the 70 to 90 Foot Zone were less than RECAP SS with the exception of a single location (TBA-2) for barium and strontium, within the SB-1-MW AOI (as noted above). This location was evaluated as part of the SB-1-MW AOI in Table 6-7a, and concentrations are below the site-specific RECAP standards protective for recreational ground water users. Barium exceeds the default GW2 health-based standard. The exceedance is delineated laterally in this interval (see Figure 5-11a). In the absence of a screening level, chlorides were retained for further evaluation. The chlorides distribution for this zone is shown in Figure 5-11b. Concentrations are below or within the estimated background threshold range except within the SB-1-MW AOI (see locations SB-1D and HP-MPA-09-I). Concentrations in the Tank Battery B area warrant confirmation. The concentrations beneath AOIs demonstrate attenuation relative to the 40 to 60 Foot Zone.

90 to 250 Foot Zone. No site-related metals or hydrocarbon COCs are identified above SS in the 90 to 250 Foot Zone and no further evaluation was required. The chlorides concentration at MC-2 in this zone was 1220 mg/L, and other reported concentrations within this interval were below the estimated background threshold range.

>250 Foot Zone. Maximum concentrations were reported in the sampling interval >250 feet at location BC-2, and were evaluated as described for the 40 to 60 Foot Zone: considering a non-potable camp well (recreational) scenario and a hypothetical default GW2 domestic supply scenario. The evaluation is provided in Table 6-7b. A single constituent, benzene, exceeds the recreational standard developed for a $1x10^{-6}$ target risk, and therefore calculation of the risk associated with the reported benzene concentration is warranted to identify whether the estimated risk falls within target risk range of MO-3. The estimated risk for benzene assuming recreational use of the ground water is $5x10^{-6}$. Additionally, the cumulative risk for multimedia exposure, including all site-related COCs, was updated (as discussed in the following section). The cumulative carcinogenic risk estimates for recreational and industrial exposures are within the MO-3 target risk range of 10^{-6} to 10^{-4}. Quantitative evaluation of this exposure scenario is provided for complete information and to demonstrate risk estimates relative to target risk range. As a practical matter, it is recognized that non-potable camp site use of ground water is more likely to occur from the shallow confining unit sand layers due to feasibility, consistent with current use.

Exceedances of default GW2 standards are identified for benzene, barium, strontium, and Aromatics >C8-C10, pending confirmation and delineation. Chlorides are elevated in the BC-2 location. Because increased chlorides concentrations in the deeper sand layers of the Confining Unit (relative to the shallower sands) has been documented in the literature (i.e., TDS ≥ 2300 ppm; Barrett, 2010) and site-specific data are not available, a background threshold for chlorides is not identified in Table 6-7b.

3.3 CUMULATIVE RISK

Cumulative exposures were addressed in addition to comparison of the individual constituent levels to RECAP Standards, in accordance with RECAP requirements for MO-3 evaluations. Exposure to multiple constituents and media has been addressed in two ways:

- Summation of the carcinogenic risks and noncarcinogenic hazards estimated as the ratio of site concentrations to final MO-3 RECAP Standards, and
- Through comprehensive baseline risk evaluation prepared by Dr. Barbara Beck of Gradient in accordance with EPA guidance (the "forward" calculation of risk completed in the baseline assessment readily supports a cumulative risk calculation).

Table 6-16 provides the summation of RECAP MO-3 Hazard Index (HI) estimates and was updated to include the supplemental data, including the maximum reported concentrations of COCs within the sand layers of the Confining Unit. The updates in the cumulative organ-specific (HI) estimates are highlighted at the bottom of Table 6-16. No change to the conclusions regarding cumulative hazard is identified: the cumulative, multi-media HIs are less than the target value of 1 for both industrial and recreational exposures with non-potable use of ground water. Table 6-17 provides the summation of carcinogenic risk estimates, updated to include the supplemental data (with updated values highlighted). Again, no change to the conclusions regarding cumulative risk is identified: the cumulative risk of $9x10^{-6}$ is within the target range identified in RECAP, and less than 10^{-5}.

The conclusions regarding cumulative hazard and risk are consistent with the conclusions of the baseline risk assessment conducted by Gradient.

3.4 UNCERTAINTY ANALYSIS

A detailed discussion of the areas of uncertainty that affect the site-specific RECAP assessment was presented with the prior RECAP evaluation. The following discussion is specific to the supplemental data collection. Note that uncertainty in the reliability of certain supplemental data was identified previously in Section 2.

Hydrocarbon Mixture Risk Evaluation: As in prior phases of site investigation, both hydrocarbon mixture (SW-846 Method 8015) and hydrocarbon fraction data have been collected. The RECAP evaluation was conducted in accordance with Appendix D of RECAP, which identifies "*If TPH fractionation data and TPH mixture data have both been collected at an AOI and the two data sets yield different conclusions concerning management of the AOI, then management decisions shall be based on the fractionation data since the fractionation method yields more specific information regarding the TPH constituents present and thus more accurately characterizes site conditions.*" To the extent that this represents an uncertainty in

the risk estimates, the risk assessment provided by Gradient addressed the uncertainty through evaluation of both kinds of data. The conclusions were consistent using both data sets, and consistent with the conclusions of this RECAP assessment.

Polycyclic Aromatic Hydrocarbons (PAHs): PAHs were not analyzed in supplemental sediment samples by either investigator. Based upon detected concentrations of hydrocarbon fractions above RECAP SS at one boring location, SS-26, collection and analysis of a sediment sample for analysis of PAHs at this location is recommended to confirm compliance with RECAP standards.

4.0 RECAP EVALUATION RESULTS AND RECOMMENDATIONS

Incorporation of the supplemental investigation data for sediment and ground water into the RECAP assessment provided confirmation of the site COCs. Maximum reported concentrations in supplemental sediment samples are less than RECAP standards for industrial and recreational land use, and less than standards developed for protection of ground water. Further confirmation sampling, and potentially delineation, is appropriate at boring location SS-26. This sediment sample location contained hydrocarbon fraction concentrations above SS and was located in a former pit feature.

The supplemental ground water data support the conclusions of the prior RECAP assessment. Compliance Concentrations of all AOIs/COCs were below Class 3 ground water standards (GW3NDW) for the Peat Zone. For the 40 to 60 Foot Zone, Compliance Concentrations of site COCs were below site-specific recreational use standards, considering the current and potential future use of ground water for non-potable purposes in a camp water supply well. No site-related COCs are identified above SS in the 90 to 250 Foot Zone, and chlorides detected in this zone are within or very near expected natural range. For the >250 Foot Zone, Compliance Concentrations of site COCs result in risk estimates for recreational exposure within RECAP target risk range.

Using default Class 2 (GW2) health-based standards that are based on assumed use of ground water as a primary drinking water supply (with no dilution assumed), AOIs were identified for the COCs benzene and barium in the 40 to 60 Foot Zone (see updated Figure 6-3). Additionally, chlorides exceeded the natural (background) levels in the same AOIs. The concentrations reported in the supplemental data for the Tank Battery B area are a potential AOI in this interval, pending confirmation and potentially delineation. A potential AOI is identified in the >250 Foot interval in the vicinity of BC-2, including COCs benzene, barium, strontium, chlorides, and Aromatics >C8-C10, pending confirmation and delineation.

The Upper Sand of the Chicot Aquifer is the first naturally fresh zone of ground water beneath the site, generally expected to meet the SMCL for chlorides. Chlorides were confirmed to be below the SMCL in supplemental samples collected from this zone at the site.

Confirmation sampling (and possibly delineation, pending results) for PAHs is recommended at sediment sample location SS-26 and for site-related COCs in the 40 to 60 Foot Zone ground water in the former Tank Battery B area and the >250 Foot Zone in the BC-2 area.

As identified in the prior RECAP evaluation, for the sand layers of the Confining Unit, it is recommended that the reviewing agencies consider the risk level associated with actual and hypothetical ground water use as one of multiple factors in identifying the most appropriate response plan for the site, in accordance with the RECAP regulation. Additional factors in determining the need for and scope of corrective action include site-specific characteristics, a balance of actual and potential risk, confidence in site characterization and exposure scenarios, weight of scientific evidence for exposure and toxicity,

background constituent levels, and the technical and economic feasibility of remediation. This supplemental RECAP evaluation report provides the risk estimates required for agency review as well as information regarding evidence related to exposure scenarios and toxicity. The corrective action plan provided separately by MP&A addresses the factors related to technical and economic feasibility for agency consideration in adoption of an appropriate corrective action plan.

5.0 REFERENCES

ICON Environmental Services Inc., ICON (2016). Plaintiff's Feasible Plan, State of Louisiana and Vermilion Parish School Board vs. Louisiana Land and Exploration, et al, Docket No. 82162, Div "D"; 15th JDC, East White Lake Field, Vermilion Parish, LA. January 2016.

Mary L. Barrett, Ph.D. (2010). Barrett Supplemental Report, VPSB v. LL&E et al., East White Lake Field, Vermilion Parish, LA; Electric Log Interpretation of the Chico Aquifer, T15S-R1E. July 18, 2010.

Michael Pisani and Associates, MP&A (2015). Feasible Plan for Evaluation/Remediation, Vermilion Parish School Board (VPSB) Property, Section 16 T15S, R01E, East White Lake Oilfield Vermilion Parish, Louisiana, State of Louisiana and the Vermilion Parish School Board v. Louisiana Land and Exploration, et al., Docket No. 82,162, Division "D" 15th Judicial District Court, Parish of Vermilion. October 1, 2015.

Michael Pisani and Associates, MP&A (2016). Supplement to the Most Feasible Plan for Evaluation/Remediation, Vermilion Parish School Board (VPSB) Property, Section 16 T15S, R01E, East White Lake Oilfield Vermilion Parish, Louisiana, State of Louisiana and the Vermilion Parish School Board v. Louisiana Land and Exploration, et al., Docket No. 82,162, Division "D" 15th Judicial District Court, Parish of Vermilion. February 15, 2016.

Tables

Project No. 0116008
UNOCAL
Vermilion Parish, Louisiana

Environmental Resources Management Southwest, Inc.
3838 North Causeway Boulevard, Suite 3000
Metairie, Louisiana 70002
(504) 831-6700

TABLE 5-1 SUPPL

SEDIMENT (0-3 FT)
COMPARISON TO RECAP DIRECT CONTACT SCREENING STANDARDS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Constituents (a)	$Soil_{SSni}$ (b) (mg/kg)	$Soil_{SSi}$ (c) (mg/kg)	Maximum (0-3') (d) (mg/kg-wet)	Location of Maximum Concentration
Metals				
Arsenic	12	12	8.23	SS7 (1.4-2.5')
Barium	550	14,000	**5170**	SS7 (1.4-2.5')
Cadmium	3.9	100	2.2	WL-3 (0-2')
Chromium	12000	310,000	17.8	SS11 (0-2.5')
Lead	400	1,400	88.3	WL-3 (0-2')
Mercury	2.3	61	**4.47**	Hg-MPA-07 (0.5-2')
Selenium	39	1,000	0.60	SED24 (0-2')
Strontium (e)	4700	120,000	129	SS7 (1.4-2.5')
Zinc	2300	61,000	1260	WL-3 (0-2')
Volatile Organic Compounds (VOCs)				
Benzene	1.5	3.1	ND (0.04)	-
Ethylbenzene	160	230	ND (0.25)	-
Toluene	68	470	ND (0.25)	-
Xylenes	18	120	ND (0.75)	-
Semi-Volatile Organic Compounds (SVOCs)				
Benzo(b)fluoranthene	0.62	2.9	0.019	SED-9 (0-0.5')
Chrysene	62	290	0.021	SED-9 (0-0.5')
Fluoranthene	220	2900	0.5	SS7 (1.4-2.5')
Fluorene	280	5400	0.65	SS7 (1.4-2.5')
Indeno(1,2,3-cd)pyrene	0.62	2.9	0.095	SED-9 (0-0.5')
2-Methylnaphthalene	22	170	2.03	SS7 (1.4-2.5')
Phenanthrene	2100	43000	1.87	SS7 (1.4-2.5')
TPH - Fractions (f)				
Aliphatics >C06-C8	1200	8000	ND (15-29.7) (g)	-
Aliphatics >C08-C10	120	880	ND (15-29.7) (g)	-
Aliphatics >C10-C12	230	2000	**353**	WL-3 (0-2')
Aliphatics >C12-C16	370	3800	**2500**	WL-3 (0-2')
Aliphatics >C16-C35	7100	10000	**7110**	WL-3 (0-2')
Aromatics >C08-C10	65	510	ND (10-29.7)	-
Aromatics >C10-C12	120	1100	74.4	WL-3 (0-2')
Aromatics >C12-C16	180	2100	**403**	WL-3 (0-2')
Aromatics >C16-C21	150	1700	**1070**	WL-3 (0-2')
Aromatics >C21-C35	180	2500	**1370**	WL-3 (0-2')
Polychlorinated Biphenyls (PCBs)				
Total PCBs	0.11	0.90	ND (0.033-0.42)	-

Notes:
Per RECAP 2003, concentrations are expressed in mg/kg wet weight for this exposure pathway.
ND - Nondetect at the detection limit, or range of detection limits, shown in parentheses.
TPH - Total Petroleum Hydrocarbons.
A **bold and boxed** value indicates that the maximum reported concentration exceeds a screening standard for the respective constituent and is identified as a site-related COC subject to further evaluation under a higher Management Option.

(a) Constituents in this table include constituents detected in sediment and indicator constituents for petroleum hydrocarbons (e.g., BTEX, PAHs).
(b) $Soil_{SSni}$ = RECAP Screening Option Standard from Table 1 of RECAP 2003 for soil protective of nonindustrial land use.
(c) $Soil_{SSi}$ = RECAP Screening Option Standard from Table 1 of RECAP 2003 for soil protective of industrial land use.
(d) The maximum reported concentration in sediment samples most representative of surface sediment in the 0 to 3 foot interval (remediated areas excluded). The samples included in the direct contact evaluation are summarized in Table 5-3. Detections in split sample results from two separate laboratories (as submitted by ICON and MP&A) were averaged when valid data were available from both laboratories, and the detected value was used when one detection was reported.
(e) Value not provided in RECAP; the risk-based values were calculated in accordance with Appendix H of RECAP 2003 (see Appendix G).
(f) RECAP identifies 10,000 mg/kg as an aesthetic limit for TPH in soil (wet weight); this is not specifically addressed for sediment. The aesthetic guideline is not a health based limit.
(g) A single sample, WL-3 (0-2') was reported as ND (150) for this fraction due to high concentrations of other fractions.

TABLE 5-2 SUPPL

SEDIMENT (ALL DEPTHS)
COMPARISON TO RECAP GROUND WATER PROTECTION SCREENING STANDARDS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Constituents (a)	$Soil_{SSGW}$ (b) (mg/kg)	Maximum (c) (mg/kg-dry)	Location of Maximum Concentration
Metals (Total)			
Arsenic	100	39	B2 (10-10.5')
Barium	2000	**15700**	SS7 (0-1.4')
Cadmium	20	3.45	B12 (6.5-7.5')
Chromium	100	25.1	SS11 (0-2.5')
Lead	100	**125**	WL-3 (0-2')
Mercury	4	**14**	SS8 (2-4')
Selenium	20	2.2	SED32 (4-6')
Strontium (d)	44000	459	AB13 (0-3')
Zinc	2800	1780	WL-3 (0-2')
Volatile Organic Compounds (VOCs)			
Benzene	0.051	ND (0.0565-0.141)	-
Ethylbenzene	19	ND (0.353-0.883)	-
Toluene	20	ND (0.353-0.883)	-
Xylenes	150	ND (1.06-2.65)	-
Semi-Volatile Organic Compounds			
Benzo(b)fluoranthene	220	0.0625	SED-9 (0-0.5')
Chrysene	76	0.069	SED-9 (0-0.5')
Fluoranthene	1200	1.3	SS7 (1.4-2.5')
Fluorene	230	1.69	SS7 (1.4-2.5')
Indeno(1,2,3-cd)pyrene	9.2	0.313	SED-9 (0-0.5')
2-Methylnaphthalene	1.7	**5.29**	SS7 (1.4-2.5')
Phenanthrene	660	4.87	SS7 (1.4-2.5')
TPH - Fractions (e)			
Aliphatics C6-C8	10000	626	WL-4 (11-12.5')
Aliphatics >C8-C10	5300	632	WL-4 (11-12.5')
Aliphatics >C10-C12	10000	699	WL-4 (11-12.5')
Aliphatics >C12-C16	10000	3950	WL-4 (11-12.5')
Aliphatics >C16-C35	10000	**13800**	SS-26 (0-2')
Aromatics >C8-C10	65	**281**	WL-4 (11-12.5')
Aromatics >C10-C12	100	**480**	WL-4 (4-11')
Aromatics >C12-C16	200	**2660**	WL-4 (11-12.5')
Aromatics >C16-C21	2100	**3230**	WL-4 (4-11')
Aromatics >C21-C35	10000	3090	WL-4 (4-11')
PCBs			
Total PCBs	19	0.248	SED7 (4-6')

Notes:
Per RECAP 2003 and related FAQ guidance, concentrations are expressed in mg/kg dry weight for sediment for this transport pathway.
A **bold and boxed** value indicates that the maximum reported concentration exceeds a screening standard for the respective constituent and is identified as a site-related COC subject to further evaluation under a higher Management Option.

(a) Constituents in this table include constituents detected in sediment and indicator constituents for petroleum hydrocarbons BTEX, PAHs).
(b) $Soil_{SSGW}$ = RECAP Screening Option Standard for soil protective of ground water, from Table 1 of RECAP 2003.
(c) The maximum reported concentration in representative sediment samples collected from any depth throughout the study area (remediated areas excluded). Samples were collected to a maximum depth of 20 feet bgs, and were more soil-like at the deepest depths. The samples included in the evaluation of migration from sediment to ground water are summarized in Table 5-4. Detections in split sample results from two separate laboratories (as submitted by ICON and MP&A) were averaged when valid data were available from both laboratories, and the detected value was used when one detection was reported.
(d) Value not provided in RECAP; the risk-based values were calculated in accordance with Appendix H of RECAP 2003 (see Appendix G).
(e) RECAP identifies 10,000 mg/kg (wet weight) as an aesthetic limit for TPH in soil; this is not specifically addressed for sediment. The aesthetic guideline is not a health based limit.

TABLE 5-3 SUPPL

SEDIMENT DATA INCLUDED IN DIRECT CONTACT QUANTITATIVE EVALUATION

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

ICON 2006		
Sample	Depth Interval	Sample Date
SS1	0-2.1'	25-Apr-06
SS1	2.1-2.5'	25-Apr-06
SS2	0-1'	25-Apr-06
SS2	1-1.5'	25-Apr-06
SS3	0-0.6'	25-Apr-06
SS3	0.6-2.2'	25-Apr-06
SS3	2.2-2.6'	25-Apr-06
SS4	0-0.6'	26-Apr-06
SS4	0.6-2.7'	26-Apr-06
SS5	0-2.15'	26-Apr-06
SS6	0-1.65'	26-Apr-06
SS6	1.65-2.5'	26-Apr-06
SS7	0-1.4'	26-Apr-06
SS7	1.4-2.5'	26-Apr-06
SS8	0-1.9'	27-Apr-06
SS8	1.9-2.3'	27-Apr-06
SS9	0-1.7'	27-Apr-06
SS9	1.7-3.2'	27-Apr-06
SS10	0-1.5'	27-Apr-06
SS10	1.5-2.5'	27-Apr-06
SS11	0-2.5'	27-Apr-06
SS12	0-3.7'	27-Apr-06
SS13	0-1'	28-Apr-06
SS13	1-2.75'	28-Apr-06
SS14	0-0.8'	28-Apr-06
SS14	0.8-1.7'	28-Apr-06
SS15	0-3'	28-Apr-06
AB1	0-3'	13-Nov-06
AB2	0-3'	13-Nov-06
AB3	0-3'	13-Nov-06
AB4	0-3'	13-Nov-06
AB5	0-6'	13-Nov-06
AB13	0-3'	13-Nov-06
AB14	0-3'	13-Nov-06
AB15	0-6'	13-Nov-06
B2	2-4'	8-Aug-06
B4	0-1'	9-Aug-06
B5	0-1.5'	9-Aug-06
B6	1.5-3'	9-Aug-06
B9	0-0.5'	9-Aug-06
B9	0.5-3.5'	9-Aug-06
B10	1.5-4'	9-Aug-06
B12	0-1.5'	10-Aug-06
B14	0-1'	10-Aug-06
B17	0-3'	10-Aug-06
B18	2-4'	10-Aug-06
B19	1-2.5'	10-Aug-06
B21	0-2'	10-Aug-06

MPA August 2010		
Sample	Depth Interval	Sample Date
AB-13	0-3'	Aug-10
AB-14	0-3'	Aug-10
AB-13-SO-E	0-3'	Aug-10

ICON/MPA 1Q 2010 Splits[1]		
Sample	Depth Interval	Sample Date
SS-08	0-2'	26-Feb-10
SS-10	0-2'	26-Feb-10
SED-4	0-2'	25-Feb-10
SED-5	0-2'	25-Feb-10
SED-6	0-2'	25-Feb-10
SED-7	0-2'	25-Feb-10
SED-8	0-2'	25-Feb-10
SED-9	0-2'	25-Feb-10
SED-10	0-2'	25-Feb-10
SED-11	0-2'	25-Feb-10
SED-12	0-2'	25-Feb-10
SED-13	0-2'	26-Feb-10
SED-14	0-2'	26-Feb-10
SED-16	0-2'	26-Feb-10
SED-17	0-2'	26-Feb-10
SED-18	0-2'	26-Feb-10
SED-19	0-2'	26-Feb-10
SED-20	0-2'	26-Feb-10
SED-21	0-2'	26-Feb-10
SED-22	0-2'	26-Feb-10
SED-23	0-2'	2-Mar-10
SED-24	0-2'	2-Mar-10
SED-25	0-2'	2-Mar-10
SED-26	0-2'	2-Mar-10
SED-27	0-2'	2-Mar-10
SED-28	0-2'	2-Mar-10
SED-29	0-2'	2-Mar-10
SED-30	0-2'	2-Mar-10
SED-31	0-2'	1-Mar-10
SED-32	0-2'	1-Mar-10
SED-33	0-2'	1-Mar-10

MPA/ICON Former Pit Delineation Samples[1]		
Sample	Depth Interval	Sample Date
SP-MPA-01[2]	0-0.5'; 0.5-2'	5 and 6-Oct-10
SP-MPA-02[2]	0-0.5'; 0.5-2'	5-Oct-10
SP-MPA-03[2]	0-0.5'; 0.5-2'	5-Oct-10
SP-MPA-04[2]	0-0.5'; 0.5-2'	6-Oct-10

ICON/MPA Nov/Dec 2015 Splits[1]		
Sample	Depth Interval	Sample Date
SS-16	0-2'	13-Nov-15
SS-17	0-2'	12-Nov-15
SS-19	0-2'	12-Nov-15
SS-20	0-2'	12-Nov-15
SS-21	0-2'	16-Nov-15
SS-22	0-2'	12-Nov-15
SS-23	0-2'	16-Nov-15
SS-24	0-2'	16-Nov-15
SS-25	0-2'	16-Nov-15
SS-26	0-2'	12-Nov-15
TBB-1D	0-5'	25-Nov-15
TBB-2D	Grab	1-Dec-15
TBB-2M	0-7'	2-Dec-15

MPA/ICON May 2010 Splits[1]		
Sample	Depth Interval	Sample Date
SED-8	0-0.5'	6-May-10
SED-9	0-0.5'	5-May-10
SED-11	0-0.5'	6-May-10
SED-13	0-0.5'	6-May-10
SED-19	0-0.5'	6-May-10
SED-24	0-0.5'	5-May-10
SED-26	0-0.5'	5-May-10
SED-120**	0-0.5'	7-May-10
SED-31	0-0.5'	5-May-10
MPA-AB-13	0-3'	19-May-10
SED-BK-01	0-0.5'	10-May-10
SED-BK-02	0-0.5'	10-May-10
SED-BK-03	0-0.5'	10-May-10
SED-BK-04	0-0.5'	10-May-10
SED-BK-05	0-0.5'	11-May-10
SED-BK-06	0-0.5'	10-May-10
SED-BK-07	0-0.5'	11-May-10
SED-BK-08	0-0.5'	11-May-10
SED-BK-09	0-0.5'	11-May-10
SED-BK-10	0-0.5'	19-May-10
SED-BK-11	0-0.5'	19-May-10

MPA/ICON Mercury Assessment Samples[1]		
Sample	Depth Interval	Sample Date
Hg-MPA-01	0-0.5'; 0.5-2'	6-Oct-10
Hg-MPA-02	0-0.5'; 0.5-2'	6-Oct-10
Hg-MPA-03	0-0.5'; 0.5-2'	6-Oct-10
Hg-MPA-04	0-0.5'; 0.5-2'	6-Oct-10
Hg-MPA-05[2]	0-0.5'; 0.5-2'	6-Oct-10
Hg-MPA-06	0-0.5'; 0.5-2'	7-Oct-10
Hg-MPA-07	0-0.5'; 0.5-2'	7-Oct-10
Hg-MPA-08	0-0.5'; 0.5-2'	7-Oct-10
Hg-MPA-09	0-0.5'; 0.5-2'	7-Oct-10
Hg-MPA-09dup	0.5-2'	7-Oct-10

MPA Delineation Samples		
Sample	Depth Interval	Sample Date
MPA-Sed 15-N	0-2'	8-Jun-10
MPA-Sed-15-W	0-2'	8-Jun-10
MPA-Sed-15-W-2	0-2'	8-Jun-10
MPA-Sed-15-E	0-2'	8-Jun-10
MPA-Sed-15-E-2	0-2'	8-Jun-10

ICON/MPA January 2015 Splits[1]		
Sample	Depth Interval	Sample Date
WL-1	0-2'	5-Jan-15
WL-2	0-2'	5-Jan-15
WL-3	0-2'	6-Jan-15
WL-4	0-2'	6-Jan-15
WL-5	0-2'	6-Jan-15
WL-6	0-2'	6-Jan-15
WL-7	0-2'	6-Jan-15
WL-8	0-2'	6-Jan-15

Notes:
** SED-120 is the same location as SED-30
For purposes of evaluating direct contact with sediment, the samples most representative of surface sediment in the 0 to 3 foot interval were identified.
The samples and intervals listed are those for which chemical analytical data useful for human health risk evaluation are available and were used in the risk evaluation.
Locations AB-1 through AB-4 and locations Sed-BK-1 through Sed-BK-11 likely represent conditions unimpacted by site E&P activities. However, for completeness, the reported constituent levels in these locations were not used to exclude any site locations or concentrations from the quantitative risk evaluation, and therefore they are included in the data set for risk evaluation.
[1] Detections in split sample results from two separate laboratories (as submitted by ICON and MP&A) were averaged when valid data were available from both
[2] No ICON Split Collected

The following samples were located in the area that has been remediated as part of the SED-15 Pit Closure, and have been excluded from the quantitative risk evaluation:

Sample	Depth Interval	Sample Date
SED-15	0-2'	26-Feb-10
SED-15	0-0.5'	6-May-10
SED-115* [2]	0-0.5'	6-May-10
MPA-Sed 15	0-2'	8-Jun-10
SP-MPA-05	0-5'	5-Oct-10

* SED-115 is a duplicate of SED-15

TABLE 5-4 SUPPL

SEDIMENT DATA INCLUDED IN GROUND WATER PROTECTION QUANTITATIVE EVALUATION

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

ICON 2006		
Sample	Depth Interval	Sample Date
SS1	0-2.1'; 2.1-2.5'	25-Apr-06
SS2	0-1'; 1-1.5'	25-Apr-06
SS3	0-0.6'; 0.6-2.2'; 2.2-2.6'	25-Apr-06
SS4	0-0.6'; 0.6-2.7'; 2.7-3.8'	26-Apr-06
SS5	0-2.15'	26-Apr-06
SS6	0-1.65'; 1.65-2.5'	26-Apr-06
SS7	0-1.4'; 1.4-2.5'; 2.5-3.5'	26-Apr-06
SS8	0-1.9'; 1.9-2.3'	27-Apr-06
SS9	0-1.7'; 1.7-3.2'; 3.2-3.7'	27-Apr-06
SS10	0-1.5'; 1.5-2.5'	27-Apr-06
SS11	0-2.5'; 2.5-3.4'; 3.4-3.7'	27-Apr-06
SS12	0-3.7'	27-Apr-06
SS13	0-1'; 1-2.75'; 2.75-3.2'	28-Apr-06
SS14	0-0.8'; 0.8-1.7'	28-Apr-06
SS15	0-3'; 3-3.25'	28-Apr-06
B2	2-4'; 4-6'; 6-8'; 10-10.5'	8-Aug-06
B3	4-7'; 9-12'	9-Aug-06
B4	0-1'; 3-5'; 5-8'	9-Aug-06
B5	0-1.5'; 4-5.5'; 8-10'	9-Aug-06
B6	1.5-3'; 3-10.5'	9-Aug-06
B7	4-5'; 8-11'	9-Aug-06
B8	5.5-7'; 9.5-11.5'	9-Aug-06
B9	0-0.5'; 0.5-3.5'; 8-9'	9-Aug-06
B10	1.5-4, 4-7.5'	9-Aug-06
B12	0-1.5'; 3.5-5'; 6.5-7.5'	10-Aug-06
B13	3-5'; 7.5-9.5'	10-Aug-06
B14	0-1'; 4-8'	10-Aug-06
B15	4-6'; 8-11.5'	10-Aug-06
B17	0-3'; 3-6'; 8.5-10.5'; 10.5-12'	10-Aug-06
B18	2-4'; 4-5'; 7.5-10'; 10-11.5'	10-Aug-06
B19	1-2.5'; 2.5-4'; 4-6.5'; 6.5-9.5'	10-Aug-06
B20	3-4.5'; 7.5-10'	10-Aug-06
B21	0-2'; 2-4'	10-Aug-06
AB1	0-3'; 3-6'; 6-8'; 12-14'	13-Nov-06
AB2	0-3'; 3-6'; 4-6'; 10-12'	13-Nov-06
AB3	0-3'; 3-6'; 4-6'; 8-10'	13-Nov-06
AB4	0-3'; 3-6'; 4-6'; 10-12'	13-Nov-06
AB5	0-6'; 4-6'; 10-12';14-16';18-20'	13-Nov-06
AB6	8-10'; 12-14'	3-Nov-06
AB7	6-8'; 10-12'	3-Nov-06
AB8	6-8'; 10-12'; 14-16'	6-Nov-06
AB9	6-8'; 12-14'; 18-20'	6-Nov-06
AB10	4-6'; 12-14'; 14-16'	6-Nov-06
AB11	4-6'; 6-8';16-18'	6-Nov-06
AB12	6-8'; 12-14'	7-Nov-06
AB13	0-3'; 3-6'; 4-6'; 8-10'; 10-12'	13-Nov-06
AB14	0-3'; 3-6'; 4-6'; 8-10'	13-Nov-06
AB15	0-6'; 4-6'; 12-14'	13-Nov-06
AB16	4-6'; 8-10'; 10-12'; 12-14'	7-Nov-06
AB18	4-6'; 10-12'; 12-14'	8-Nov-06
AB19	4-6'; 8-10'; 12-14'	8-Nov-06
AB20	6-8'; 10-12'; 14-16'; 16-18'	8-Nov-06
AB21	4-6'; 6-8'; 8-10'; 12-14'	8-Nov-06
AB22	4-6'; 6-8'; 12-14'; 16-18'	8-Nov-06

MPA Delineation Samples		
Sample	Depth Interval	Sample Date
MPA-Sed 15-N	0-2'	8-Jun-10
MPA-Sed-15-W	0-2'	8-Jun-10
MPA-Sed-15-W-2	0-2'	8-Jun-10
MPA-Sed-15-E	0-2'	8-Jun-10
MPA-Sed-15-E-2	0-2'	8-Jun-10

MPA/ICON May 2010 Splits[1]		
Sample	Depth Interval	Sample Date
SED-8	0-0.5'	6-May-10
SED-9	0-0.5'	5-May-10
SED-11	0-0.5'	6-May-10
SED-13	0-0.5'	6-May-10
SED-19	0-0.5'	6-May-10
SED-24	0-0.5'	5-May-10
SED-26	0-0.5'	5-May-10
SED-120**	0-0.5'	7-May-10
SED-31	0-0.5'	5-May-10
MPA-AB5 (A)	4-6'	19-May-10
MPA-AB5 (B)	4-6'	19-May-10
MPA-AB5 (C)	4-6'	19-May-10
MPA-AB-6	8-10'	19-May-10
MPA-AB-8	6-8'	19-May-10
MPA-AB-13	0-3'	19-May-10
SED-BK-01	0-0.5'	10-May-10
SED-BK-02	0-0.5'	10-May-10
SED-BK-03	0-0.5'	10-May-10
SED-BK-04	0-0.5'	10-May-10
SED-BK-05	0-0.5'	11-May-10
SED-BK-06	0-0.5'	10-May-10
SED-BK-07	0-0.5'	11-May-10
SED-BK-08	0-0.5'	11-May-10
SED-BK-09	0-0.5'	11-May-10
SED-BK-10	0-0.5'	19-May-10
SED-BK-11	0-0.5'	19-May-10

MPA August 2010		
Sample	Depth Interval	Sample Date
AB-5a	4-5.5'	Aug-10
AB-5 SO-NE	4-6'	Aug-10
AB-5 SO-NW	4-6'	Aug-10
AB-6	8-10'	Aug-10
AB-8	6-8'	Aug-10
AB-8 SO-S	6-8'	Aug-10
AB-13	0-3'	Aug-10
AB-13-SO-E	0-3'	Aug-10
AB-14	0-3'	Aug-10
AB-15	4-5.5'	Aug-10

MPA/ICON Former Pit Delineation Samples[1]		
Sample	Depth Interval	Sample Date
SP-MPA-01[2]	0-0.5'; 0.5-2'; 2-4.3'; 4.3-4.7'; 8-9'	5 and 6-Oct-10
SP-MPA-02[2]	0-0.5'; 0.5-2'; 3-4'; 4-5'	5-Oct-10
SP-MPA-02a[2]	3-5, 7-8'	6-Oct-10
SP-MPA-03[2]	0-0.5'; 0.5-2'; 4-6'; 9-10'	5-Oct-10
SP-MPA-04[2]	0-0.5'; 0.5-2'; 5-7'; 9-10'	6-Oct-10

MPA/ICON Mercury Assessment Samples[1]		
Sample	Depth Interval	Sample Date
Hg-MPA-01	0-0.5'; 0.5-2'; 5-7'	6-Oct-10
Hg-MPA-02	0-0.5'; 0.5-2'; 5-7'	6-Oct-10
Hg-MPA-03	0-0.5'; 0.5-2'; 4-6'	6-Oct-10
Hg-MPA-04	0-0.5'; 0.5-2'; 3-5'	6-Oct-10
Hg-MPA-05[2]	0-0.5'; 0.5-2'; 6-8'	6-Oct-10
Hg-MPA-06	0-0.5'; 0.5-2'; 5-6'	7-Oct-10
Hg-MPA-07	0-0.5'; 0.5-2'; 6.5-7'	7-Oct-10
Hg-MPA-08	0-0.5'; 0.5-2'; 7.5-8'	7-Oct-10
Hg-MPA-09	0-0.5'; 0.5-2'; 6-7'	7-Oct-10
Hg-MPA-09dup	0.5-2'	7-Oct-10

ICON/MPA 1Q 2010 Splits[1]		
Sample	Depth Interval	Sample Date
SS-08	0-2, 2-4'	26-Feb-10
SS-10	0-2, 2-4'	26-Feb-10
SED4	0-2'	25-Feb-10
SED5	0-2'	25-Feb-10
SED6	0-2'	25-Feb-10
SED7	0-2, 2-4, 4-6'	25-Feb-10
SED8	0-2'; 2-4'	25-Feb-10
SED9	0-2'; 2-4'	25-Feb-10
SED10	0-2'; 2-4'	25-Feb-10
SED11	0-2'; 2-4'	25-Feb-10
SED12	0-2'; 2-4'; 4-6'	25-Feb-10
SED13	0-2'; 2-4'	26-Feb-10
SED14	0-2'; 2-4'	26-Feb-10
SED16	0-2'	26-Feb-10
SED17	0-2'; 2-4'	26-Feb-10
SED18	0-2'; 2-4'	26-Feb-10
SED19	0-2'; 2-4'	26-Feb-10
SED20	0-2'; 2-4'	26-Feb-10
SED21	0-2'; 2-4'; 4-6'; 6-8'	26-Feb-10
SED22	0-2'; 2-4'	26-Feb-10
SED23	0-2'; 2-4'	2-Mar-10
SED24	0-2'; 2-4'	2-Mar-10
SED25	0-2'; 2-4'	2-Mar-10
SED26	0-2'; 2-4'	2-Mar-10
SED27	0-2'; 2-4'	2-Mar-10
SED28	0-2'; 2-4'	2-Mar-10
SED29	0-2'; 2-4'	2-Mar-10
SED30	0-2'; 2-4'	2-Mar-10
SED31	0-2'; 2-4'; 4-6'	1-Mar-10
SED32	0-2'; 2-4'; 4-6'	1-Mar-10
SED33	0-2'; 2-4'; 4-6'	1-Mar-10

ICON/MPA January 2015 Splits[1]		
Sample	Depth Interval	Sample Date
WL-1	0-2'; 2-4'; 6-8'; 9-13'	5-Jan-15
WL-2	0-2'; 2-4'; 8-10'; 14-16'	5-Jan-15
WL-3	0-2'; 4-6/4-8'; 10-13'	6-Jan-15
WL-4	0-2'; 2-4'; 4-11'; 11-12.5'	6-Jan-15
WL-5	0-2, 2-13'	6-Jan-15
WL-6	0-2'; 4-6'; 8-10'; 10-13'	6-Jan-15
WL-7	0-2'; 2-4'; 4-6'; 6-8'	6-Jan-15
WL-8	0-2'; 2-4'; 4-6'; 6-9'	6-Jan-15

ICON/MPA Nov/Dec 2015 Splits[1]		
Sample	Depth Interval	Sample Date
SS-16	0-2'; 2-4'; 4-6'	13-Nov-15
SS-17	0-2'; 2-4'; 4-6'; 6-8'	12-Nov-15
SS-19	0-2'; 2-4'	12-Nov-15
SS-20	0-2'; 2-4'; 4-6'	12-Nov-15
SS-21	0-2'; 2-4'	16-Nov-15
SS-22	0-2'; 2-4'; 4-6'; 6-8'	12-Nov-15
SS-23	0-2'; 2-4'	16-Nov-15
SS-24	0-2'; 2-4'	16-Nov-15
SS-25	0-2'; 2-4'; 4-6'	16-Nov-15
SS-26	0-2'; 2-4'	12-Nov-15
TBB-1D	0-5'; 5-10'	25-Nov-15
TBB-2D	Grab	1-Dec-15
TBB-2M	0-7'; 7-15'; 15-17'; 17-19'	2-Dec-15

Notes:
** SED-120 is the same location as SED-30
The samples and intervals listed are those for which chemical analytical data useful for human health risk evaluation are available and were used in the risk evaluation.
Locations AB-1 through AB-4 and locations Sed-BK-1 through Sed-BK-11 likely represent conditions unimpacted by site E&P activities. However, for completeness, the reported constituent levels in these locations were not used to exclude any site locations or concentrations from the quantitative risk evaluation, and therefore they are included in the data set for risk evaluation.
[1] Detections in split sample results from two separate laboratories (as submitted by ICON and MP&A) were averaged when valid data were available from both laboratories.
[2] No ICON Split Collected
The following samples were located in the area that has been remediated as part of the SED-15 Pit Closure, and have been excluded from the quantitative risk evaluation:

Sample	Depth Interval	Sample Date
SED15	0-2; 2-4	26-Feb-10
MPA-Sed 15	6.5-8.5	8-Jun-10
SED-15	0-0.5	6-May-10
SED-115* [2]	0-0.5	6-May-10
SP-MPA-05	0-5; 7-9	5-Oct-10

* SED-115 is a duplicate of SED-15

TABLE 5-5 SUPPL

SUMMARY OF CONSTITUENT CONCENTRATIONS AND LOCATIONS
THAT EXCEED RECAP SCREENING STANDARDS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Residential Direct Contact Screening
Sediment (0-3') COCs > Soilssni (wet weight)

Sample	Depth	Date	mg/kg-wet
Barium		***Soilssni =***	***550***
B2	2-4'	8-Aug-06	815
SS3	0-0.6'	25-Apr-06	597
	0.6-2.2'	25-Apr-06	948
	2.2-2.6'	25-Apr-06	555
SS5	0-2.15'	26-Apr-06	3170
SS7	0-1.4'	26-Apr-06	4440
	1.4-2.5'	26-Apr-06	5170
SS11	0-2.5'	27-Apr-06	1950
SS12	0-3.7'	27-Apr-06	1100
SED11	0-2'	25-Feb-10	566
SED19	0-2'	26-Feb-10	1270
Mercury		***Soilssni =***	***2.3***
SED6	0-2'	25-Feb-10	2.73
Hg-MPA-07 (0.5-2)	0.5-2'	7-Oct-10	4.47
WL-3	0-2'	6-Jan-15	4.23
Aliphatic >C10-C12		***Soilssni =***	***230***
WL-3	0-2'	6-Jan-15	353
Aliphatic >C12-C16		***Soilssni =***	***370***
WL-3	0-2'	6-Jan-15	2500
SS-26	0-2'	12-Nov-15	1400
Aliphatic >C16-C35		***Soilssni =***	***7100***
WL-3	0-2'	6-Jan-15	7110
Aromatic >C12-C16		***Soilssni =***	***180***
WL-3	0-2'	6-Jan-15	403
Aromatic >C16-C21		***Soilssni =***	***150***
SED26	0-2'	2-Mar-10	161
SED28	0-2'	2-Mar-10	290
WL-3	0-2'	6-Jan-15	1070
SS-26	0-2'	12-Nov-15	496
Aromatic >C21-C35		***Soilssni =***	***180***
SED28	0-2'	2-Mar-10	433
SED29	0-2'	2-Mar-10	183
SED30	0-2'	2-Mar-10	215
WL-3	0-2'	6-Jan-15	1370
SS-26	0-2'	12-Nov-15	958

Ground Water Protection Screening
Sediment (all depths) COCs > Soilssgw (dry weight)

Sample	Depth	Date	mg/kg-dry	
Barium		***Soilssgw =***	***2000***	
B2	2-4'	8-Aug-06	3590	
SS3	0.6-2.2'	25-Apr-06	2330	
SS5	0-2.15'	26-Apr-06	7450	- SPLP
SS7	0-1.4'	26-Apr-06	15700	- SPLP
	1.4-2.5'	26-Apr-06	13500	
	2.5-3.5'	26-Apr-06	3780	
SS11	0-2.5'	27-Apr-06	2750	- SPLP
	2.5-3.4'	27-Apr-06	2170	
SS12	0-3.7'	27-Apr-06	2030	
SED17	2-4'	26-Feb-10	2160	
SED19	0-2'	26-Feb-10	3750	
SS-17	4-6'	12-Nov-15	2680	
Lead		***Soilssgw =***	***100***	
SS5	0-2.15'	26-Apr-06	117	- SPLP
SS7	1.4-2.5'	26-Apr-06	117	
WL-3	0-2'	6-Jan-15	125	
Mercury		***Soilssgw =***	***4***	
SS8	2-4'	26-Feb-10	14	- SPLP
SED6	0-2'	25-Feb-10	7.59	
Hg-MPA-07	0.5-2'	7-Oct-10	8.52	
Hg-MPA-09	0-0.5'	7-Oct-10	5.57	
WL-3	0-2'	6-Jan-15	5.94	
WL-3	4-6/'4-8'	6-Jan-15	5.99	
2-Methylnaphthalene		***Soilssgw =***	***1.7***	
SS7	1.4-2.5'	6-Apr-26	5.29	
Aliphatics >C16-C35		***Soilssgw =***	***10,000***	
SED28	0-2'	2-Mar-10	12600	
SS-26	0-2'	12-Nov-15	13800	
Aliphatic >C8-C10		***Soilssgw =***	***65***	
WL-4	4-11'	1/6/2015	176	
	11-12.5'	1/6/2015	281	
WL-5	2-13'	1/6/2015	83.4	
Aromatic >C10-C12		***Soilssgw =***	***100***	
WL-4	4-11'	1/6/2015	480	
	11-12.5'	1/6/2015	407	
WL-5	2-13'	1/6/2015	169	
Aromatic >C12-C16		***Soilssgw =***	***200***	
SED26	0-2'	2-Mar-10	273	
SED28	0-2'	2-Mar-10	790	
WL-3	0-2'	1/6/2015	534	
	4-6/'4-8'	1/6/2015	870	
WL-4	2-4'	1/6/2015	410	
	4-11'	1/6/2015	2360	
	11-12.5'	1/6/2015	2660	
WL-5	2-13'	1/6/2015	938	
Aromatic >C16-C21		***Soilssgw =***	***2100***	
WL-4	4-11'	1/6/2015	3230	
	11-12.5'	1/6/2015	2700	

Notes:
Detections in split sample results from two separate laboratories (as submitted by ICON and MP&A) were averaged when valid data were available from both laboratories.
SPLP - Sample location selected for SPLP analysis of exceeding metal.

TABLE 5-6 SUPPL
GROUND WATER DATA INCLUDED IN QUANTITATIVE EVALUATION

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Boring ID	Screened Interval (ft. bgs)	Date
ICON 2006		
Peat Zone		
AB2	11-21	10-Nov-06
AB3	10-20	10-Nov-06
AB5	12-22	13-Nov-06
AB6	8-18	10-Nov-06
AB6DUP	8-18	10-Nov-06
AB7	10-20	13-Nov-06
AB15	8-18	13-Nov-06
AB19	8-18	10-Nov-06
40 to 60 Ft Zone		
AB1	40-50	10-Nov-06
Upper Sand of Chicot Aquifer		
AWW1	400	10-Nov-06
ICON/MPA Dec. 2015 - Feb. 2016 Splits[2]		
Peat Zone		
TBB-3S	14-24'	18-Dec-15
40 to 60 Ft Zone		
TBB-2M	49-59'	14-Dec-15
TBB-1S	33-43'	17-Dec-15
70 to 90 Ft Zone		
TBA-1D	75-85'	22-Dec-15
TBA-2	69-79'	02-Feb-16
TBB-1D	65-75'	17-Dec-15
TBB-2D	81-91'	15-Dec-15
90 to 250 Ft Zone		
MC-1	161-181'	16-Dec-15
MC-2	139-159'	01-Feb-16
90 to 250 Ft Zone		
BC-2	279-299'	03-Feb-16
BC-3	279-299'	09-Feb-16
BC-4	269.5-289.5'	04-Feb-16
Upper Sand of Chicot Aquifer		
BC-1	469-489'	28-Dec-15

Boring ID	Screened Interval (ft. bgs)	Date
MPA/ICON May 2010 Splits[2]		
Upper Sand of Chicot Aquifer		
WW-1	400	25-May-10
40 to 60 Ft Zone		
MW-6S	47-50	12-May-10
SB-1-MW-S	44-54	7-May-10
SB-1-MW-S	44-54	8-Jun-10
SB-2-MW-S	42-52	11-May-10
SB-3-MW-S	37-47	12-May-10
SB-3-MW-SD *	37-47	12-May-10
70 to 90 Ft Zone		
MW-4D	75-77	12-May-10
MW-5D	75-77	12-May-10
MW-6D	75-77	12-May-10
SB-1-MW-D	72-74	6-May-10
90 to 250 Ft Zone		
MW-1C	97-100	13-May-10
MPA 2014		
40 to 60 Ft Zone		
Hebert	TD 41	21-Apr-14
SB-1 MPA (same as SB-1-MW-S)	44-54	21-Apr-14
EWL dup***	44-54	21-Apr-14
ICON/MPA 1Q 2010 Splits[2]		
40 to 60 Ft Zone		
MW1	44-54	5-Mar-10
MW50 **	44-54	5-Mar-10
MW-2/MW-2R	42-52	5-Mar-10
MW-3/MW-3R	37.5-47.5	5-Mar-10

Sample ID	Screened Interval (ft. bgs)	Date
ICON/MPA Sept/Oct 2010 Splits[2]		
Upper Sand of Chicot Aquifer		
J. Guidry Well	TD 519	1-Sep-10
40 to 60 Ft Zone		
Purvis Hebert Well	TD 41	1-Sep-10
Purvis Hebert (dup)	TD 41	1-Sep-10
A. Crouch Well	TD 34	1-Sep-10
HP-MPA-01-T	42-45	29-Sep-10
HP-MPA-02-T	42-45	29-Sep-10
HP-MPA-03-T	42-45	30-Sep-10
HP-MPA-04-T	42-45	30-Sep-10
HP-MPA-05-T	42-45	30-Sep-10
HP-MPA-06-T	42-45	30-Sep-10
HP-MPA-07-T	42-45	01-Oct-10
HP-MPA-08-T	42-45	01-Oct-10
HP-MPA-09-T	42-45	01-Oct-10
HP-MPA-10-T	42-45	01-Oct-10
70 to 90 Ft Zone		
HP-MPA-02-I	72-75	29-Sep-10
HP-MPA-03-I	72-75	04-Oct-10
HP-MPA-04-I	80-83	04-Oct-10
HP-MPA-05-I	72-75	06-Oct-10
HP-MPA-06-I	72-75	06-Oct-10
HP-MPA-07-I	72-75	05-Oct-10
HP-MPA-08-I	72-75	05-Oct-10
HP-MPA-09-I	72-75	06-Oct-10
HP-MPA-10-I	72-75	06-Oct-10
MPA/ICON January 2015 Splits		
Peat Zone		
WL-6	8.5-13	7-Jan-15

Notes:
* Duplicate of SB-3-MW-S
** Duplicate of MW1
*** Duplicate of SB-1 MPA
TD is an estimated total depth; screened interval not available.
In accordance with RECAP, the most recent sampling results were used in the RECAP assesment for wells that were sampled more than once over time: WW1 (also called facility well and AWW1), Hebert well, and SB-1-MW-S. The older sampling dates, not used in the current assessment, are identified in this table with gray
[2] Split sample results from two separate laboratories (as submitted by ICON and MP&A) were averaged when valid data were available from both laboratories.
Note: Locations identified as likely representing conditions unimpacted by site E&P activities were not used to exclude any site locations or concentrations from the quantitative risk evaluation, but the results are used as a reference for interpreting results for naturally occurring constituents.

TABLE 5-7 SUPPL

GROUND WATER
COMPARISON TO RECAP SCREENING STANDARDS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

		Maximum Reported Concentrations in Ground Water (mg/L) (c)					
Constituents (a)	GWss (b)	Peat Zone	40 to 60 Ft Zone	70 to 90 Ft Zone	90-250 Ft Zone	>250 Ft Zone	Upper Sand of Chicot Aquifer
Metals (dissolved) (g)							
Arsenic	0.01	0.0074	**0.0145**	**0.0215**	<0.01	<0.05	<0.005
Barium	2	**10.8**	**15.7**	**2.56**	1.74	**21**	0.8
Cadmium	0.005	<0.1	<0.05	<0.02	<0.01	<0.05	<0.005
Chromium	0.1	<0.1	<0.05	0.0258	<0.01	<0.05	<0.005
Iron	0.3 (e)	**16.7**	**52.2**	**13.6**	**4.51**	**13.5**	**0.89**
Lead	0.015	<0.1	<0.05	**0.0163**	<0.01	<0.05	<0.005
Manganese	0.05 (e)	**5.12**	**11.4**	**0.72**	**0.65**	**1.5**	**0.11**
Mercury	0.002	<0.0002	<0.002	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	0.05	-	**0.072**	**0.0688**	0.0355	-	-
Strontium (d)	2.2	**18.4**	**23.7**	**3.67**	1.42	**31.3**	0.79
Zinc	1.1	<2	0.09	0.188	<0.2	<1	<0.1
Metals (total)							
Arsenic	0.01	**0.025**	**0.021**	0.014	0.01	<0.05	<0.01
Barium	2	**12.0**	**15.5**	**2.66**	1.7	**22.5**	0.87
Cadmium	0.005	0.002	0.001	<0.02	<0.01	<0.05	<0.005
Chromium	0.1	<0.055	<0.03	0.015	0.021	<0.05	<0.01
Iron	0.3 (e)	**18.1**	**68.9**	**17.8**	**16.6**	**17.3**	**1.08**
Lead	0.015	0.011	0.0125	0.011	0.013	<0.05	<0.015
Manganese	0.05 (e)	**5.37**	**11.5**	**0.941**	**0.569**	**1.62**	**0.14**
Mercury	0.002	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	<0.0002
Selenium	0.05	**0.058**	**0.077**	<0.02	-	-	<0.04
Strontium (d)	2.2	**17.9**	**25.2**	**3.45**	1.41	**29.6**	0.84
Zinc	1.1	1.01	0.511	0.0805	0.056	<1	0.31
TPH Fractions							
Aliphatic >C10-C12	0.15	<0.15	<0.15	<0.15	<0.15	-	<0.15
Aliphatic >C12-C16	0.15	<0.15	<0.15	<0.15	<0.15	-	<0.15
Aliphatic >C16-C35	7.3	<0.15	<0.15	<0.15	<0.15	-	<0.15
Aliphatic >C8-C10	0.15	<0.15	<0.15	<0.15	<0.15	0.141	<0.15
Aliphatic C6-C8	3.2	<0.15	0.044	<0.15	<0.15	0.636	<0.15
Aromatic >C10-C12	0.15	<0.15	<0.15	<0.15	<0.15	**0.405**	<0.15
Aromatic >C12-C16	0.15	<0.15	<0.15	<0.15	<0.15	-	<0.15
Aromatic >C16-C21	0.15	<0.15	<0.15	<0.15	<0.15	-	<0.15
Aromatic >C21-C35	0.15	<0.15	<0.15	<0.15	<0.15	-	<0.15
Aromatic >C8-C10	0.15	<0.15	<0.15	<0.15	<0.15	-	<0.15
TPH - Mixtures (f)							
TPH-GRO	0.15	<0.15	See Fractions	See Fractions	See Fractions	See Fractions	See Fractions
TPH-DRO	0.15	**0.477**	See Fractions	See Fractions	See Fractions	See Fractions	See Fractions
TPH-ORO	0.15	**0.405**	See Fractions	See Fractions	See Fractions	See Fractions	See Fractions
Volatile Organic Compounds							
Benzene	0.005	0.005	**0.029**	0.00343	<0.005	**0.2**	<0.005
Ethylbenzene	0.7	<0.005	<0.005	<0.005	<0.005	0.00932	<0.005
Toluene	1	<0.0075	0.00882	0.0105	<0.0075	<0.005	<0.0075
Xylenes	10	<0.0325	<0.05	<0.03	<0.0325	<0.015	<0.03
Chloride	NA (h)	17350	15200	3060	1220	16600	194

TABLE 5-7 SUPPL

GROUND WATER
COMPARISON TO RECAP SCREENING STANDARDS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Notes:

Concentrations expressed in mg/L.

TPH - Total Petroleum Hydrocarbons.

- Not analyzed

Essential elements that are generally not considered toxic to humans (i.e. calcium, magnesium, potassium, sodium) are not included in the risk evaluation for ground water.

A **bold** value indicates that the maximum reported concentration exceeds a screening standard for the respective constituent. See Table 5-8 for additional discussion on these constituents and selection of site-related COCs.

A **bold and boxed** value indicates that the maximum reported concentration exceeds a screening standard for the respective constituent and is identified as a site-related COC subject to further evaluation under a higher Management Option.

(a) Constituents shown in this table include detected constituents and indicator constituents for petroleum hydrocarbons (e.g., BTEX).

(b) GW_{SS} = RECAP Screening Standard from Table 1 of RECAP 2003.

(c) Maximum reported concentrations in ground water samples collected in each respective interval. The samples included in the risk evaluation are summarized in Table 5-6. Split sample results from two separate laboratories (as submitted by ICON and MP&A) were averaged when valid data were available from both laboratories. A proxy value equal to the sample quantitation limit was used for non-detect results in the average of split samples. For locations where samples were collected in multiple events over time, the most recent sample data were used to represent current conditions at that location.

(d) Value not provided in RECAP; the risk-based values were calculated in accordance with Appendix H of RECAP 2003 (see Appendix G).

(e) EPA Secondary Maximum Contaminant Level (SMCL), a non-enforceable guideline for public water systems addressing undesirable aesthetic effects such as taste, color, and odor.

(f) RECAP Appendix D states that "If TPH fractionation data and TPH mixture data have both been collected at an AOI and the two data sets yield different conclusions about management of the AOI, then management decisions shall be based on the fractionation data since the fractionation method yields more specific information regarding the TPH constituents present and thus more accurately characterizes site conditions." Adequate TPH-Fraction data were available and used for the assessment of all zones in accordance with this guidance except for the Peat Zone, where fraction data were available for only 2 of 9 sample locations. Therefore, TPH mixtures were assessed in addition to fractions in the Peat Zone.

(g) For the samples collected with hydropunch methodology, filtered samples (i.e., dissolved results) were collected and are used in the risk evaluation. In addition, monitor wells that could not achieve suitably low turbidity during sampling were also filtered and dissolved results for these wells are used in the risk evaluation. For the remaining monitor well sample locations, both total metals and dissovled metals results are included if available.

(h) Because chlorides naturally exceed 250 mg/L in the sands of the Chicot Aquifer Confining Unit, a screening standard is not identified for the Peat Zone, the 40 to 60 Ft Zone, 70 to 90 Ft Zone, 90 to 250 Ft Zone, or >250 Ft Zone. The EPA Secondary Maximum Contaminant Level (SMCL) for chlorides of 250 mg/L is applicable to the Upper Sand of the Chicot Aquifer.

TABLE 6-3 SUPPL

SEDIMENT
COMPARISON TO MO-3 DIRECT CONTACT STANDARDS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Nonindustrial Direct Contact COCs (a)	Sed_r Adult (b)	Sed_r Child (b)	Industrial $Soil_i$ (c)	Additivity Divisor (d)	Final Sed_r Adult (e)	Final Sed_r Child (e)	Final Industrial $Soil_i$ (e)	$Soil_{sat}$ (f)	Limiting RS (g)	AOIC (mg/kg-wet) (h) Maximum Sediment Concentration	AOIC (mg/kg-wet) (h) Maximum excluding WL-3 & WL-4
Metals											
Barium	980,000	280,000	409,000	2	490,000	140,000	204,500	NA	140,000	5,170	5,170
Mercury	1,500	420	610	1	1,500	420	610	NA	420	4.47	4.47
TPH - Fractions (i)											
Aliphatics >C10-C12	51,000	17,000	20,000	2	25,500	8,500	10,000	NA	8,500	353	110
Aliphatics >C12-C16	98,000	32,000	38,000	2	49,000	16,000	19,000	NA	16,000	2,500	1,400
Aliphatics >C16-C35	1,400,000	130,000	690,000	2	700,000	65,000	345,000	NA	65,000	7,110	6,640
Aromatics >C12-C16	55,000	18,000	21,000	1	55,000	18,000	21,000	NA	18,000	403	169
Aromatics >C16-C21	30,000	2,200	17,000	2	15,000	1,100	8,500	NA	1,100	1,070	496
Aromatics >C21-C35	38,000	2,300	25,000	2	19,000	1,150	12,500	NA	1,150	**1,370**	958

Notes:
Concentrations in milligrams per kilogram (mg/kg) wet weight
MO-3 - Management Option 3 under RECAP
RS - RECAP Standard
COC - Constituent of Concern
AOIC - Area of Investigation Concentration
TPH - Total Petroleum Hydrocarbons
NA - Not Applicable
Sedr - site-specific RECAP Standard for sediment protective of human health for recreational land use.
A **bold** value indicates that the reported concentration exceeds the Limiting RS for the respective constituent.

(a) Constituents with concentrations above the RECAP $Soil_{SSni}$ in sediment samples representative of the 0 to 3 foot interval were included for further evaluation under MO-3 (screening evaluation provided in Table 5-1). See Table 5-3 for a list of sediment samples collected by ICON and MP&A used in the quantitative evaluation.

(b) Sediment RS were developed using the algorithms provided in Appendix H of RECAP for direct contact (per RECAP FAQ guidance), with updated toxicity factors, and modifying exposure assumptions as appropriate for sediment exposure. Exposure assumptions are identified for an adult and child recreational scenario in Table 6-2, with references/rationale for the selected exposure assumptions. Exposure pathways include ingestion, dermal contact, and inhalation of volatiles released to the breathing zone.

(c) RECAP standard protective of industrial land use, calculated in accordance with Appendix H of RECAP (2003), using default industrial exposure parameters provided in RECAP with current toxicity factors (as identified in Table 6-1).

(d) Additivity divisor for non-carcinogenic effects on the same target organ/ system applied in accordance with Appendices D and G of RECAP (2003). Target organs are identified as follows:
Barium - Kidney Effects
Mercury - Immune system
Aliphatics >C8-C16 - Liver, Hematological Effects
Aliphatics >C16-C35 - Liver
Aromatics >C8-C16 - Decreased Body Weight
Aromatics >C16-C35 - Kidney

(e) Final RS - Initial RS divided by additivity divisor.

(f) Soilsat - Soil saturation concentration (RECAP Table 2)

(g) The limiting RS is the minimum of the Final Sedr adult, Sedr child, and Industrial Soili.

(h) The AOIC is the maximum reported concentration (after split results were averaged) in samples most representative of surface sediment in the 0 to 3 foot interval. Sediment samples included in the direct contact evaluation are summarized in Table 5-3. Maximum concentrations excluding WL-3 and WL-4 are also provided.

(i) RECAP identifies 10,000 mg/kg (wet weight) as an aesthetic limit for TPH in soil (this is not specifically addressed for sediment). This value is not a health based limit (health based limits are shown in this table), but indicates potential for colored or oily and odorous soil. WL-3 and WL-4 are the only locations with total TPH fraction results greater than 10,000 mg/kg.

TABLE 6-4 SUPPL

SEDIMENT
COMPARISON TO MO-3 GROUND WATER PROTECTION STANDARDS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Ground Water Protection Sediment COCs (a)	$Soil_{GW3NDW}$ (b) (mg/kg)	**AOIC (Maximum Concentration) (c) (mg/kg-dry)**
Semi-Volatile Organic Compounds		
2-Methylnaphthalene	48	5.29
TPH - Fractions		
Aliphatics >C16-C35	1.2E+11 (d,e)	13800
Aromatics >C8-C10	6100	281
Aromatics >C10-C12	9600	480
Aromatics >C12-C16	19,000 (d)	2660
Aromatics >C16-C21	45,000 (d)	3230

Notes:

Per RECAP 2003 and related FAQ guidance, concentrations are expressed in mg/kg dry weight for sediment for this transport pathway.

MO-3 - Management Option 3 under RECAP
COC - Constituent of Concern
AOIC - Area of Investigation Concentration
TPH - Total Petroleum Hydrocarbons

(a) Constituents with concentrations above the RECAP SoilSSGW in sediment samples collected from all depths were included for further evaluation under MO-3 (screening evaluation provided in Table 5-2). See Table 5-4 for a list of sediment samples collected by ICON and MP&A used in the quantitative evaluation.

(b) SoilGW3NDW = RECAP Standard for soil protective of ground water, calculated in accordance with Appendix H of RECAP (2003) using current toxicity factors and bioconcentration factors. The NDW designation is based on the uses designated in the Surface Water Quality regulations (LAC Title 33, Part IX, Subpart I, Chapter 11) for Segment 050703 (White Lake).

(c) The AOIC is the maximum concentration (after split results were averaged). See Table 5-4 for the list of samples included in the evaluation.

(d) RECAP identifies 10,000 mg/kg (wet weight) as an aesthetic limit for TPH in soil (this is not specifically addressed for sediment). This value is not a health based limit (health based limits are shown in this table), but indicates potential for colored or oily and odorous soil. WL-3 and WL-4 are the only locations with total TPH greater than 10,000 mg/kg.

(e) A value of 1,000,000 mg/kg (one million parts per million) is a physical upper limit of soil constituent content, and indicates that the constituent is not a human health concern by this pathway at any concentration in soil.

TABLE 6-7a SUPPL

40 TO 60 FT ZONE GROUND WATER
COMPARISON TO DEFAULT AND SITE-SPECIFIC MO-3 STANDARDS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Constituents (a)	**Default RECAP Standard GW2 (b)**	Child Recreational GW RS (c)	Adult Recreational GW RS (c)	Shower Inhalation Scenario GW RS (d)	**Limiting Recreational GW RS (e)**	**Compliance Concentration in the 40 to 60 Ft Zone (f)**		**Compliance Concentration in the 70 to 90 Ft Zone**
SB-1-MW AOI (g)						MW-1	SB-1-MW	TBA-2
Benzene	0.005	0.347	0.0404	0.0442	0.0404	0.029	0.015	<0.005
Barium (dissolved)	2	357	249	-	249	-	3.52	2.56
Barium (total)	2	357	249	-	249	14.8	3.32	2.66
Strontium (dissolved)	22	15,300	10,700	-	10700	-	-	3.67
Strontium (total)	22	15,300	10,700	-	10700	13.9	5.42	3.45
Chloride	1100-1200 (i)	NS (j)	NS (j)	NS (j)	NS (j)	9370	3120	3060
SB-3-MW AOI						SB-3-MW		No COCs identified (see data for MW-5D)
Barium (dissolved)	2	357	249	-	249	6.06		
Barium (total)	2	357	249	-	249	7.96 (h)		
Strontium (dissolved)	22	15,300	10,700	-	10700	6.84		
Strontium (total)	22	15,300	10,700	-	10700	8.42 (h)		
Chloride	1100-1200 (i)	NS (j)	NS (j)	NS (j)	NS (j)	7160		
HP MPA-8 AOI						HP MPA-8		No COCs identified (see data for HP-MPA-08-I)
Barium (dissolved)	2	357	249	-	249	2.17		
Chloride	1100-1200 (i)	NS (j)	NS (j)	NS (j)	NS (j)	1510		
Tank Battery B Potential AOI (k)						TBB-1S		No COCs identified (see data for TBB-1D & TBB-2D)
Benzene	0.005	0.347	0.0404	0.0442	0.0404	0.00689		
Barium (dissolved)	2	357	249	-	249	15.7		
Barium (total)	2	357	249	-	249	15.5		
Strontium (dissolved)	22	15,300	10,700	-	10700	23.7		
Strontium (total)	22	15,300	10,700	-	10700	25.2		
Chloride	1100-1200 (i)	NS (j)	NS (j)	NS (j)	NS (j)	15200		

Notes:
Concentrations expressed in mg/L
- Not applicable
RS - RECAP Standard
See Table 5-6 for a list of ground water samples collected by ICON and MP&A used in the quantitative evaluation.

(a) Constituents determined to be site-related with concentrations above the RECAP GW_{SS} were included for further evaluation under MO-3.

(b) GW2 = RECAP Standard for Class 2 Ground Water, from Table 3 of RECAP 2003, prior to application of a dilution attenuation factor (DAF).

(c) Management Option 3 RECAP Standard developed to express Reasonable Maximum Exposure, assuming dermal contact with ground water used as wash water (recreational scenario). Exposure parameters with references are tabulated separately (Table 6-8).

(d) Management Option 3 RECAP Standard developed to express Reasonable Maximum Exposure, assuming inhalation of volatile COCs from ground water used for showering. Exposure parameters with references are tabulated separately (Table 6-8).

(e) Limiting RECAP Standard is the minimum of the site-specific MO-3 RS for ground water (recreational adult, recreational child, and shower scenario).

(f) Compliance Concentration is the maximum reported concentration in the AOI (after split results were averaged). For location SB-1-MW, where samples were collected in multiple events over time, the most recent sample data were used to represent current conditions.

(g) Two POC values are shown for the SB-1-MW AOI because the sampling locations are immediately adjacent, with MW-1 last sampled in 2010 and SB-1-MW sampled more recently in 2014.

(h) Value shown is from the adjacent sample location, MW-3, because the unfiltered (total) results for SB-3-MW were not considered representative (due to turbid samples).

(i) Because the natural levels of chlorides are elevated above the SMCL, an alternative GW2 RECAP standard is appropriate for chlorides. Chlorides concentrations in wells considered representative of natural levels at the site were used to develop a range of Background Threshold Values.

(j) No standard applicable (NS): constituent is not toxic via the relevant exposure route.

(k) Tank Battery B is identified as a potential AOI, requiring confirmation, as reported concentrations may be affected (biased high) by artifacts of the drilling method.

TABLE 6-7 b SUPPL

>250 FT ZONE GROUND WATER
COMPARISON TO DEFAULT AND SITE-SPECIFIC MO-3 STANDARDS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Constituents (a)	**Default RECAP Standard GW2 (b)**	Child Recreational GW RS (c)	Adult Recreational GW RS (c)	Shower Inhalation Scenario GW RS (d)	**Limiting Recreational GW RS (e)**	**Compliance Concentration in the>250 Ft Zone (f)**
SB-1-MW AOI (g)						BC-2
Benzene	0.005	0.347	0.0404	0.0442	0.0404	0.2 (Risk = $5x10^{-6}$) (i)
Barium (dissolved)	2	357	249	-	249	21
Barium (total)	2	357	249	-	249	22.5
Strontium (dissolved)	22	15,300	10,700	-	10700	31.3
Strontium (total)	22	15,300	10,700	-	10700	29.6
Aromatics >C8-C10	0.34	55	38	34	34	0.405
Chloride	NA (g)	NS (h)	NS (h)	NS (h)	NS (h)	16600

Notes:
Concentrations expressed in mg/L
- Not applicable
RS - RECAP Standard
See Table 5-6 for a list of ground water samples collected by ICON and MP&A used in the quantitative evaluation.

(a) Constituents determined to be site-related with concentrations above the RECAP GW_{SS} were included for further evaluation under MO-3.

(b) GW2 = RECAP Standard for Class 2 Ground Water, from Table 3 of RECAP 2003, prior to application of a dilution attenuation factor (DAF).

(c) Management Option 3 RECAP Standard developed to express Reasonable Maximum Exposure, assuming dermal contact with ground water used as wash water (recreational scenario). Exposure parameters with references are tabulated separately (Table 6-8).

(d) Management Option 3 RECAP Standard developed to express Reasonable Maximum Exposure, assuming inhalation of volatile COCs from ground water used for showering. Exposure parameters with references are tabulated separately (Table 6-8).

(e) Limiting RECAP Standard is the minimum of the site-specific MO-3 RS for ground water (recreational adult, recreational child, and shower scenario).

(f) Compliance Concentration is the maximum reported concentration in the potential AOI. Concentrations reported at BC-2 require confirmation due to well construction, development, and sampling deficiencies.

(g) Because the natural levels of chlorides are elevated above the SMCL, an alternative GW2 RECAP standard is appropriate for chlorides. A site-specific value has not been identified for this ground water interval.

(h) No standard applicable (NS): constituent is not toxic via the relevant exposure route.

(i) For the single constituent with maximum concentration (CC) above the RS calculated for $1x10^{-6}$, the risk was estimated as follows: (CC/Limiting RS) x 10^{-6}

TABLE 6-16 SUPPL

CUMULATIVE HAZARD INDEX CALCULATIONS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

COCs (a)	Multiple Media HI (b) RME Scenario	Target Organs (c)	SEDIMENT DIRECT CONTACT Sediment DC LRS (d)	AOIC Maximum Conc. (e)	Sediment (Max) HQ	>250 FT ZONE GROUND WATER >250-FT GW LRS (f)	CC Maximum Conc. (g)	GW HQ	SURFACE WATER SW LRS (h)	Maximum Conc. (i)	SW HQ	CRAB EDIBLE TISSUE Default TSLs (j)	Site ETC (k)	Crab ETC HQ
Metals														
Arsenic	0.021	Skin, Vascular	--	--	--	--	--	--	2.67	0.014	0.0052	0.7	0.011	0.016
Barium	0.14	Kidney	280,000	5,170	0.018	249	22.5	0.09	124	1.1	0.0089	470	9.2	0.02
Cadmium	0.0039	Urinary	--	--	--	--	--	--	0.22	0.00086	0.0039	--	--	--
Chromium	0.000029	NA	--	--	--	--	--	--	173	0.0051	0.000029	--	--	--
Lead (l)	NA	NA	--	--	--	--	--	--	-	0.0088	NA	--	--	--
Mercury	0.11	Immune System	420	4.47	0.011	--	--	--	0.19	0.00012	0.00063	0.7	0.069	0.099
Methyl Mercury	0.17	Neurological	--	--	--	--	--	--	--	--	--	0.23	0.039	0.17
Selenium	0.00073	Integument (hair, skin, nails), Dental, Hematological, CNS	--	--	--	--	--	--	44	0.032	0.00073	--	--	--
Strontium	0.0032	Bone	--	--	--	10700	31.3	0.0029	5330	1.66	0.00031	--	--	--
Zinc	0.0000052	Blood	--	--	--	--	--	--	4440	0.023	0.0000052	--	--	--
BTEX														
Benzene	0.053	Blood	--	--	--	3.8	0.2	0.053	--	--	--	--	--	--
PAH														
Acenaphthene	0.000026	Liver	--	--	--	--	--	--	5.01	0.000131	0.000026	--	--	--
TPH - Fractions (m)														
Aliphatics >C10-C12	0.021	Liver, Hematological	17,000	353	0.021	--	--	--	--	--	--	--	--	--
Aliphatics >C12-C16	0.078		32,000	2,500	0.078	--	--	--	--	--	--	--	--	--
Aliphatics >C16-C35	0.055	Liver	130,000	7,110	0.055	--	--	--	--	--	--	--	--	--
Aromatics >C08-C10	0.011	Decreased BW	--	--	--	38	0.405	0.011	--	--	--	--	--	--
Aromatics >C12-C16	0.022	Decreased BW	18,000	403	0.022	--	--	--	--	--	--	--	--	--
Aromatics >C16-C21	0.49	Kidney	2,200	1,070	0.49	--	--	--	--	--	--	--	--	--
Aromatics >C21-C35	0.6		2,300	1,370	0.6	--	--	--	--	--	--	--	--	--
TPH														
TPH > C8-16	0.1	Liver, Hematological, Decreased BW	--	--	--	--	--	--	--	--	--	160	16	0.1
TPH >C16-28	0.02	Lliver, Kidney	--	--	--	--	--	--	--	--	--	2400	49	0.02

Target Organ-Specific HIs (n)		
Target Organ	**HI**	**COCs**
Skin	0.02	arsenic, selenium
Kidney	0.8	barium, aromatics >C16-35, TPH>C16-28
Immune System	0.1	mercury
Liver	0.3	acenaphthene, aliphatics >C10-16, aliphatics >C16-35, TPH>C8-16, TPH>C16-28
Blood/Hematologic.	0.2	selenium, zinc, benzene, aliphatics >C10-16, TPH>C8-16
Bone	0.003	strontium
Body Weight	0.1	aromatics >C08-10, aromatics >C12-16, TPH>C8-16
Neurological/CNS	0.2	methyl mercury, selenium

TABLE 6-16 SUPPL

CUMULATIVE HAZARD INDEX CALCULATIONS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Notes:

HQ - Hazard Quotient, equal to the Area of Investigation Concentration (AOIC) or Compliance Concentration (CC) for each Constituent of Concern (COC) divided by the applicable risk based standard.

RME - Reasonable Maximum Exposure

LRS - Limiting RECAP Standard

DC - Direct Contact

(a) COCs - Constituents of Concern include those constituents evaluated under Management Option 3 (MO-3) in sediment, ground water, surface water, and crab.

(b) Multiple Media Hazard Index (HI) is the sum of the HQs for each COC in each medium where it warranted evaluation under MO-3.

(c) Target organs associated with each detected constituent that elicits noncarcinogenic effects. Target organs are associated with the reference doses used in this evaluation and were obtained from RAIS, with the exception of selenium and TPH, which were provided by RECAP.

(d) Limiting recreational RECAP Standard for direct contact with sediment, prior to adjusting for additive effects (from Table 6-3).

(e) Maximum reported concentrations in sediment across the site in the 0-3 foot interval, including WL-3 and WL-4 (from Table 6-3).

(f) Limiting recreational RECAP Standard for the >250 Ft Zone ground water (from Table 6-7b).

(g) Maximum concentration in the Chicot Confining Unit ground water (which occurred in the >250 Ft Zone), considering all AOIs and both dissolved and total metals (from Table 6-7b).

(h) Limiting recreational RECAP Standard for surface water (from Table 6-9).

(i) Maximum reported concentrations in surface water, using dissolved metals concentrations (from Table 6-9).

(j) Default Tissue Screening Levels (TSLs) calculated using the default LDHH crab consumption scenario (30 g/day) for edible tissues (from Table 6-12).

(k) Average Edible Tissue Concentration (ETC) considering crabs collected on site (from Table 6-12).

(l) Based on lead's mechanism of toxicity, EPA considers it inappropriate to develop a RfD for lead. Risk-based standards for lead are developed using toxicokinetic models based on acceptable blood lead levels in sensitive receptor populations. Therefore, lead is not included in the assessment for additive health effects.

(m) Per RECAP (2003), when accounting for additivity for the TPH fractions, the following fractions should be treated as individual COCs: aliphatics C>6-C8, aliphatics C>8-C16, aliphatics C>16-C35, aromatics C>8-C16, and aromatics C>16-C35.

(n) Target organ specific HIs were calculated by summing the multiple-media HIs from COCs affecting each respecitve target organ. Target organs affected by more than one COC or more than one medium were included. For TPH fractions that are considered a single COC for the pupose of addressing additive effects, the larger HI was used to represent that range in calculating the target organ specific HI.

TABLE 6-17 SUPPL

CUMULATIVE RISK CALCULATIONS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

		>250 FT ZONE GROUND WATER			SURFACE WATER			CRAB EDIBLE TISSUE		
COCs (a)	**Multiple Media Risk (b)**	**GW LRS (c)**	**CC Maximum Conc. (d)**	**GW Risk**	**SW LRS (e)**	**Maximum Conc. (f)**	**SW Risk**	**Default TSLs (g)**	**Site ETC (h)**	**Crab ETC Risk**
Metals										
Arsenic	4.1E-06	--	--	--	1.4E-02	1.4E-02	1.0E-06	3.6E-01	1.1E-02	3.1E-06
BTEX										
Benzene	5.0E-06	4.0E-02	2.0E-01	5.0E-06	--	--	--	--	--	--

Total Risk	9E-06

Notes:

Risk - equal to the Area of Investigation Concentration (AOIC) or Compliance Concentration (CC) for each Constituent of Concern (COC) divided by the applicable risk based standard, and multiplied by the target risk used in developing the standard: 10^{-6} for all media except crab, and 10^{-4} for crab per LDHH guidance.

LRS - Limiting RECAP Standard

(a) COCs - Constituents of Concern include those carcinogenc constituents that warranted evaluation under Management Option 3 (MO-3) in sediment (none) , ground water, surface water, and crab.

(b) Multiple Media Risk is the sum of risk for each COC in each medium where it warranted evaluation under MO-3.

(c) Limiting recreational RECAP Standard for the >250 Ft Zone ground water (from Table 6-7b).

(d) Maximum concentration in the Chicot Confining Unit ground water (which occurred in the >250 Ft Zone), considering all AOIs and both dissolved and total metals (from Table 6-7b).

(e) Limiting recreational RECAP Standard for surface water (from Table 6-9).

(f) Maximum reported concentrations in surface water, using dissolved metals concentrations (from Table 6-9).

(g) Default Tissue Screening Levels (TSLs) calculated using the default LDHH crab consumption scenario (30 g/day) for edible tissues (from Table 6-12).

(h) Average Edible Tissue Concentration (ETC) considering crabs collected on site (from Table 6-12).

Figures

Project No. 0116008
UNOCAL
Vermilion Parish, Louisiana

Environmental Resources Management Southwest, Inc.
3838 North Causeway Boulevard, Suite 3000
Metairie, Louisiana 70002
(504) 831-6700

Data Summary Tables

Appendix A

Project No. 0116008
UNOCAL
Vermilion Parish, Louisiana

Environmental Resources Management Southwest, Inc.
3838 North Causeway Boulevard, Suite 3000
Metairie, Louisiana 70002
(504) 831-6700

TABLE A-1

SEDIMENT ANALYTICAL RESULTS - NOVEMBER/DECEMBER 2015

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Boring ID	Core Interval (ft bls)	Date	Moisture Content		Arsenic				As Average		Barium				Ba Average	
					ICON		Pisani				ICON		Pisani			
			ICON	MPA	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.
SS-16	0-2	13-Nov-15	0.659	0.687	6.95	2.37	7.28	2.28	7.12	2.33	722	246	466	146	594	196
SS-16	2-4	13-Nov-15	0.843	0.836	9.59	1.51	8.6	1.41	9.1	1.46	578	90.7	665	109	622	99.9
SS-16	4-6	13-Nov-15	0.723	0.744	6.34	1.76	6.05	1.55	6.2	1.66	333	92.2	414	106	374	99.1
SS-17	0-2	12-Nov-15	0.571	0.566	6.52	2.8	6.06	2.63	6.29	2.72	690	296	588	255	639	276
SS-17	2-4	12-Nov-15	0.568	0.567	5.07	2.19	6.86	2.97	5.97	2.58	1260	544	1950	846	1610	695
SS-17	4-6	12-Nov-15	0.589	0.58	9.37	3.85	9.05	3.8	9.21	3.83	2250	925	3100	1300	2680	1110
SS-17	6-8	12-Nov-15	0.51	0.524	8.56	4.19	7.79	3.71	8.18	3.95	356	174	632	301	494	238
SS-19	0-2	12-Nov-15	0.627	0.614	8.87	3.31	3.52	1.36	6.2	2.34	514	192	492	190	503	191
SS-19	2-4	12-Nov-15	0.632	0.559	8.65	3.18	7.73	3.41	8.19	3.3	419	154	624	275	522	215
SS-20	0-2	12-Nov-15	0.675	0.671	9.02	2.93	9.39	3.09	9.21	3.01	774	252	1130	371	952	312
SS-20	2-4	12-Nov-15	0.683	0.67	7.26	2.3	7.18	2.37	7.22	2.34	421	133	482	159	452	146
SS-20	4-6	12-Nov-15	0.662	0.65	8.73	2.95	11.3	3.96	10	3.46	596	201	949	332	773	267
SS-21	0-2	16-Nov-15	0.646	0.592	6.71	2.38	7.01	2.86	6.86	2.62	460	163	449	183	455	173
SS-21	2-4	16-Nov-15	0.856	0.823	11.8	1.7	12	2.12	11.9	1.91	420	60.5	489	86.5	455	73.5
SS-22	0-2	12-Nov-15	0.745	0.756	8.87	2.26	12.2	2.97	10.5	2.62	581	148	664	162	623	155
SS-22	2-4	12-Nov-15	0.62	0.619	7.23	2.75	6.9	2.63	7.07	2.69	949	361	1230	469	1090	415
SS-22	4-6	12-Nov-15	0.629	0.631	6.76	2.51	6.07	2.24	6.42	2.38	719	267	816	301	768	284
SS-22	6-8	12-Nov-15	0.576	0.56	7.98	3.38	5.41	2.38	6.7	2.88	344	146	245	108	295	127
SS-23	0-2	16-Nov-15	0.545	0.527	4.67	2.12	8.96	4.24	6.82	3.18	255	116	216	102	236	109
SS-23	2-4	16-Nov-15	0.807	0.817	10	1.93	15	2.75	12.5	2.34	262	50.6	233	42.6	248	46.6
SS-24	0-2	16-Nov-15	0.637	0.635	7.29	2.65	9.26	3.38	8.28	3.02	151	54.8	142	51.9	147	53.4
SS-24	2-4	16-Nov-15	0.843	0.843	11.6	1.82	13.4	2.1	12.5	1.96	252	39.6	264	41.5	258	40.6
SS-25	0-2	16-Nov-15	0.673	0.693	7.38	2.41	7.3	2.24	7.34	2.33	425	139	528	162	477	151
SS-25	2-4	16-Nov-15	0.633	0.632	6.42	2.36	9.35	3.44	7.89	2.9	692	254	1160	426	926	340
SS-25	4-6	16-Nov-15	0.615	0.605	8	3.08	9.65	3.81	8.83	3.45	460	177	552	218	506	198
SS-26	0-2	12-Nov-15	0.522	0.519	4.46	2.13	8.25	3.97	6.36	3.05	806	385	609	293	708	339
SS-26	2-4	12-Nov-15	0.802	0.794	9.59	1.9	9.32	1.92	9.46	1.91	603	119	519	107	561	113
TBB-1D	0-5	25-Nov-15	0.782	0.756	6.07	1.32	7.25	1.77	6.66	1.55	1010	220	943	230	977	225
TBB-1D	5-10	25-Nov-15	0.47	0.538	5.74	3.04	5.78	2.67	5.76	2.86	198	105	173	80	186	92.5
TBB-2D	Grab	1-Dec-15	0.651	0.657	8.4	2.93	9.18	3.15	8.79	3.04	654	228	857	294	756	261
TBB-2M	0-7	2-Dec-15	0.458	0.524	6.62	3.59	7.23	3.44	6.93	3.52	180	97.6	237	113	209	105
TBB-2M	7-15	2-Dec-15	0.724	0.682	6.77	1.87	7.64	2.43	7.21	2.15	154	42.5	122	38.8	138	40.7
TBB-2M	15-17	2-Dec-15	0.276	-	5.11	3.7	-	-	5.11	3.7	218	158	-	-	218	158
TBB-2M	17-19	2-Dec-15	0.239	-	5.27	4.01	-	-	5.27	4.01	219	167	-	-	219	167

Notes:
All chemical analytical results are in units of mg/kg, shown as both wet weight and dry weight.

TABLE A-1

SEDIMENT ANALYTICAL RESULTS - NOVEMBER/DECEMBER 2015

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Boring ID	Core Interval (ft bls)	Cadmium				Cd Average		Chromium				Cr Average		Lead				Pb Average	
		ICON		Pisani				ICON		Pisani				ICON		Pisani			
		Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.
SS-16	0-2	*<0.499*	*<0.17*	*<0.824*	*<0.258*	-	-	14	4.77	11.3	3.55	**12.7**	**4.16**	19.9	6.79	14.1	4.4	**17**	**5.6**
SS-16	2-4	*<0.498*	*<0.0782*	*<1.6*	*<0.262*	-	-	6.97	1.09	9.02	1.48	**8**	**1.29**	8.15	1.28	9.57	1.57	**8.86**	**1.43**
SS-16	4-6	*<0.5*	*<0.139*	*<0.984*	*<0.252*	-	-	10.4	2.88	10.6	2.72	**10.5**	**2.8**	17.1	4.74	11.3	2.9	**14.2**	**3.82**
SS-17	0-2	*<0.5*	*<0.215*	*<0.599*	*<0.26*	-	-	14.6	6.26	13.6	5.92	**14.1**	**6.09**	23.3	10	19.6	8.51	**21.5**	**9.26**
SS-17	2-4	*<0.5*	*<0.216*	*<0.6*	*<0.26*	-	-	16.3	7.04	15.5	6.71	**15.9**	**6.88**	21.4	9.24	24.9	10.8	**23.2**	**10**
SS-17	4-6	*<0.499*	*<0.205*	*<0.598*	*<0.251*	-	-	19	7.81	20.1	8.43	**19.6**	**8.12**	34.9	14.3	50.7	21.3	**42.8**	**17.8**
SS-17	6-8	*<0.497*	*<0.244*	*<0.55*	*<0.262*	-	-	15.1	7.4	15.5	7.4	**15.3**	**7.4**	16.5	8.09	19	9.03	**17.8**	**8.56**
SS-19	0-2	0.839	0.313	*<0.694*	*<0.268*	**0.839**	**0.313**	18.3	6.83	10.6	4.08	**14.5**	**5.46**	19.2	7.16	13	5.02	**16.1**	**6.09**
SS-19	2-4	0.607	0.223	*<0.603*	*<0.266*	**0.607**	**0.223**	15.6	5.74	11.2	4.93	**13.4**	**5.34**	30.7	11.3	17.5	7.71	**24.1**	**9.51**
SS-20	0-2	*<0.5*	*<0.163*	*<0.781*	*<0.257*	-	-	12.8	4.16	14.1	4.65	**13.5**	**4.41**	24.3	7.9	23.9	7.86	**24.1**	**7.88**
SS-20	2-4	*<0.495*	*<0.157*	*<0.809*	*<0.267*	-	-	11.4	3.61	12.5	4.11	**12**	**3.86**	16.8	5.33	16.8	5.55	**16.8**	**5.44**
SS-20	4-6	*<0.495*	*<0.167*	*<0.749*	*<0.262*	-	-	12	4.06	15.4	5.39	**13.7**	**4.73**	19.9	6.73	24.8	8.67	**22.4**	**7.7**
SS-21	0-2	*<0.498*	*<0.176*	*<0.62*	*<0.253*	-	-	14.1	4.99	13.7	5.57	**13.9**	**5.28**	21.7	7.68	22.4	9.14	**22.1**	**8.41**
SS-21	2-4	*<0.498*	*<0.0717*	*<1.44*	*<0.255*	-	-	6.74	0.971	7.68	1.36	**7.21**	**1.17**	6.75	0.972	8.98	1.59	**7.87**	**1.28**
SS-22	0-2	0.789	0.201	*<1.07*	*<0.261*	**0.789**	**0.201**	22.4	5.71	22.5	5.48	**22.5**	**5.6**	27.2	6.94	32.4	7.91	**29.8**	**7.43**
SS-22	2-4	0.529	0.201	*<0.706*	*<0.269*	**0.529**	**0.201**	18.1	6.88	18.1	6.91	**18.1**	**6.9**	26.3	9.99	25.5	9.71	**25.9**	**9.85**
SS-22	4-6	*<0.498*	*<0.185*	*<0.694*	*<0.256*	-	-	18.1	6.72	19.8	7.32	**19**	**7.02**	20.5	7.61	24.2	8.94	**22.4**	**8.28**
SS-22	6-8	*<0.497*	*<0.211*	*<0.58*	*<0.255*	-	-	14.3	6.06	10.6	4.65	**12.5**	**5.36**	15.3	6.49	11.4	5.01	**13.4**	**5.75**
SS-23	0-2	*<0.499*	*<0.227*	*<0.562*	*<0.266*	-	-	14	6.37	14.8	6.99	**14.4**	**6.68**	17.2	7.83	16.2	7.65	**16.7**	**7.74**
SS-23	2-4	*<0.499*	*<0.0963*	*<1.49*	*<0.273*	-	-	10.1	1.95	9.13	1.67	**9.62**	**1.81**	10.1	1.95	7.87	1.44	**8.99**	**1.7**
SS-24	0-2	*<0.499*	*<0.181*	*<0.726*	*<0.265*	-	-	14.7	5.34	15.1	5.52	**14.9**	**5.43**	16.1	5.84	15.8	5.78	**16**	**5.81**
SS-24	2-4	*<0.498*	*<0.0782*	*<1.77*	*<0.278*	-	-	9.1	1.43	8.34	1.31	**8.72**	**1.37**	8.73	1.37	6.94	1.09	**7.84**	**1.23**
SS-25	0-2	*<0.498*	*<0.163*	*<0.919*	*<0.282*	-	-	15.5	5.07	17.8	5.46	**16.7**	**5.27**	19.3	6.31	22.1	6.8	**20.7**	**6.56**
SS-25	2-4	*<0.5*	*<0.184*	*<0.736*	*<0.271*	-	-	14	5.14	17.2	6.33	**15.6**	**5.74**	20.5	7.52	23	8.47	**21.8**	**8**
SS-25	4-6	*<0.5*	*<0.193*	*<0.777*	*<0.307*	-	-	15.1	5.81	16.5	6.5	**15.8**	**6.16**	19	7.32	19.6	7.73	**19.3**	**7.53**
SS-26	0-2	*<0.498*	*<0.238*	*<0.534*	*<0.257*	-	-	11.1	5.31	9.9	4.76	**10.5**	**5.04**	17.2	8.22	19.2	9.23	**18.2**	**8.73**
SS-26	2-4	*<0.499*	*<0.0988*	*<1.3*	*<0.268*	-	-	9.06	1.79	8.35	1.72	**8.71**	**1.76**	10.7	2.12	9.9	2.04	**10.3**	**2.08**
TBB-1D	0-5	*<0.498*	*<0.109*	*<1.07*	*<0.262*	-	-	10.5	2.29	14	3.42	**12.3**	**2.86**	13.2	2.88	17.5	4.26	**15.4**	**3.57**
TBB-1D	5-10	*<0.499*	*<0.264*	*<0.569*	*<0.263*	-	-	13.2	7	11.8	5.45	**12.5**	**6.23**	17.2	9.12	11.7	5.42	**14.5**	**7.27**
TBB-2D	Grab	*<0.496*	*<0.173*	*<0.743*	*<0.255*	-	-	12.9	4.5	14.7	5.05	**13.8**	**4.78**	19.6	6.84	21.2	7.26	**20.4**	**7.05**
TBB-2M	0-7	*<0.498*	*<0.27*	*<0.571*	*<0.272*	-	-	12.8	6.94	15.3	7.27	**14.1**	**7.11**	15	8.13	15.9	7.56	**15.5**	**7.85**
TBB-2M	7-15	*<0.495*	*<0.137*	*<0.789*	*<0.251*	-	-	10.4	2.87	15.9	5.06	**13.2**	**3.97**	10.9	3.01	16.9	5.36	**13.9**	**4.19**
TBB-2M	15-17	*<0.496*	*<0.359*	-	-	-	-	12.3	8.91	-	-	**12.3**	**8.91**	11.1	8.04	-	-	**11.1**	**8.04**
TBB-2M	17-19	*<0.498*	*<0.379*	-	-	-	-	10.6	8.07	-	-	**10.6**	**8.07**	13.4	10.2	-	-	**13.4**	**10.2**

Notes:
All chemical analytical results are in units of mg/kg, shown as both wet weight and dry weight.

TABLE A-1

SEDIMENT ANALYTICAL RESULTS - NOVEMBER/DECEMBER 2015

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

		Mercury				Hg Average		Selenium				Se Average		Silver				Ag Average	
		ICON		Pisani				ICON		Pisani				ICON		Pisani			
Boring ID	Core Interval (ft bls)	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	mg/kg-dry	mg/kg-wet	mg/kg-dry	mg/kg-wet	Dry Wt.	Wet Wt.
SS-16	0-2	0.24	0.0818	*<0.319*	*<0.1*	**0.24**	**0.0818**	*<1.99*	*<0.679*	*<3.29*	*<1.03*	-	-	-	-	*<0.824*	*<0.258*	-	-
SS-16	2-4	*<0.1*	*<0.0157*	*<0.61*	*<0.1*	-	-	*<1.99*	*<0.312*	*<6.4*	*<1.05*	-	-	-	-	*<1.6*	*<0.262*	-	-
SS-16	4-6	*<0.09*	*<0.0249*	*<0.391*	*<0.1*	-	-	*<2*	*<0.554*	*<3.95*	*<1.01*	-	-	-	-	*<0.984*	*<0.252*	-	-
SS-17	0-2	0.2	0.0858	*<0.23*	*<0.1*	**0.2**	**0.0858**	*<2*	*<0.858*	*<2.4*	*<1.04*	-	-	-	-	*<0.599*	*<0.26*	-	-
SS-17	2-4	*<0.1*	*<0.0432*	*<0.231*	*<0.1*	-	-	*<2*	*<0.864*	*<2.4*	*<1.04*	-	-	-	-	*<0.6*	*<0.26*	-	-
SS-17	4-6	*<0.11*	*<0.0452*	*<0.238*	*<0.1*	-	-	*<2*	*<0.822*	*<2.4*	*<1.01*	-	-	-	-	*<0.598*	*<0.251*	-	-
SS-17	6-8	*<0.11*	*<0.0539*	*<0.21*	*<0.1*	-	-	*<1.99*	*<0.975*	*<2.21*	*<1.05*	-	-	-	-	*<0.55*	*<0.262*	-	-
SS-19	0-2	0.74	0.276	0.57	0.22	**0.655**	**0.248**	*<2*	*<0.746*	*<2.77*	*<1.07*	-	-	-	-	*<0.694*	*<0.268*	-	-
SS-19	2-4	0.84	0.309	0.34	0.15	**0.59**	**0.23**	*<1.99*	*<0.732*	*<2.4*	*<1.06*	-	-	-	-	*<0.603*	*<0.266*	-	-
SS-20	0-2	0.14	0.0455	*<0.304*	*<0.1*	**0.14**	**0.0455**	*<2*	*<0.65*	*<3.13*	*<1.03*	-	-	-	-	*<0.781*	*<0.257*	-	-
SS-20	2-4	*<0.11*	*<0.0349*	*<0.303*	*<0.1*	-	-	*<1.98*	*<0.628*	*<3.24*	*<1.07*	-	-	-	-	*<0.809*	*<0.267*	-	-
SS-20	4-6	0.13	0.0439	*<0.286*	*<0.1*	**0.13**	**0.0439**	*<1.98*	*<0.669*	*<3*	*<1.05*	-	-	-	-	*<0.749*	*<0.262*	-	-
SS-21	0-2	0.29	0.103	*<0.27*	*<0.11*	**0.29**	**0.103**	*<1.99*	*<0.704*	*<2.48*	*<1.01*	-	-	*<0.498*	*<0.176*	*<0.62*	*<0.253*	-	-
SS-21	2-4	*<0.11*	*<0.0158*	*<0.565*	*<0.1*	-	-	*<1.99*	*<0.287*	*<5.76*	*<1.02*	-	-	*<0.498*	*<0.0717*	*<1.44*	*<0.255*	-	-
SS-22	0-2	0.36	0.0918	*<0.41*	*<0.1*	**0.36**	**0.0918**	*<2*	*<0.51*	*<4.3*	*<1.05*	-	-	-	-	*<1.07*	*<0.261*	-	-
SS-22	2-4	0.19	0.0722	*<0.262*	*<0.1*	**0.19**	**0.0722**	*<2*	*<0.76*	*<2.83*	*<1.08*	-	-	-	-	*<0.706*	*<0.269*	-	-
SS-22	4-6	0.2	0.0742	0.379	0.14	**0.29**	**0.107**	*<1.99*	*<0.738*	*<2.76*	*<1.02*	-	-	-	-	*<0.694*	*<0.256*	-	-
SS-22	6-8	*<0.1*	*<0.0424*	*<0.227*	*<0.1*	-	-	*<1.99*	*<0.844*	*<2.32*	*<1.02*	-	-	-	-	*<0.58*	*<0.255*	-	-
SS-23	0-2	*<0.1*	*<0.0455*	*<0.233*	*<0.11*	-	-	*<1.99*	*<0.905*	*<2.24*	*<1.06*	-	-	*<0.499*	*<0.227*	*<0.562*	*<0.266*	-	-
SS-23	2-4	0.11	0.0212	*<0.546*	*<0.1*	**0.11**	**0.0212**	*<2*	*<0.386*	*<5.96*	*<1.09*	-	-	*<0.499*	*<0.0963*	*<1.49*	*<0.273*	-	-
SS-24	0-2	0.1	0.0363	*<0.247*	*<0.09*	**0.1**	**0.0363**	*<2*	*<0.726*	*<2.9*	*<1.06*	-	-	*<0.499*	*<0.181*	*<0.726*	*<0.265*	-	-
SS-24	2-4	*<0.09*	*<0.0141*	*<0.637*	*<0.1*	-	-	*<1.99*	*<0.312*	*<7.07*	*<1.11*	-	-	*<0.498*	*<0.0782*	*<1.77*	*<0.278*	-	-
SS-25	0-2	*<0.1*	*<0.0327*	*<0.326*	*<0.1*	-	-	*<1.99*	*<0.651*	*<3.68*	*<1.13*	-	-	*<0.498*	*<0.163*	*<0.919*	*<0.282*	-	-
SS-25	2-4	0.27	0.0991	*<0.272*	*<0.1*	**0.27**	**0.0991**	*<2*	*<0.734*	*<2.93*	*<1.08*	-	-	*<0.5*	*<0.184*	*<0.736*	*<0.271*	-	-
SS-25	4-6	0.19	0.0732	*<0.253*	*<0.1*	**0.19**	**0.0732**	*<2*	*<0.77*	*<3.11*	*<1.23*	-	-	*<0.5*	*<0.193*	*<0.777*	*<0.307*	-	-
SS-26	0-2	0.12	0.0574	*<0.229*	*<0.11*	**0.12**	**0.0574**	*<1.99*	*<0.951*	*<2.14*	*<1.03*	-	-	-	-	*<0.534*	*<0.257*	-	-
SS-26	2-4	*<0.1*	*<0.0198*	*<0.534*	*<0.11*	-	-	*<1.99*	*<0.394*	*<5.19*	*<1.07*	-	-	-	-	*<1.3*	*<0.268*	-	-
TBB-1D	0-5	*<0.1*	*<0.0218*	*<0.41*	*<0.1*	-	-	*<1.99*	*<0.434*	*<4.3*	*<1.05*	-	-	-	-	*<1.07*	*<0.262*	-	-
TBB-1D	5-10	*<0.1*	*<0.053*	*<0.216*	*<0.1*	-	-	*<2*	*<1.06*	*<2.27*	*<1.05*	-	-	-	-	*<0.569*	*<0.263*	-	-
TBB-2D	Grab	*<0.09*	*<0.0314*	*<0.292*	*<0.1*	-	-	*<1.98*	*<0.691*	*<2.97*	*<1.02*	-	-	-	-	*<0.743*	*<0.255*	-	-
TBB-2M	0-7	*<0.09*	*<0.0488*	*<0.21*	*<0.1*	-	-	*<1.99*	*<1.08*	*<2.29*	*<1.09*	-	-	-	-	*<0.571*	*<0.272*	-	-
TBB-2M	7-15	*<0.09*	*<0.0248*	*<0.314*	*<0.1*	-	-	*<1.98*	*<0.546*	*<3.14*	*<1*	-	-	-	-	*<0.789*	*<0.251*	-	-
TBB-2M	15-17	*<0.1*	*<0.0724*	-	-	-	-	*<1.98*	*<1.43*	-	-	-	-	-	-	-	-	-	-
TBB-2M	17-19	*<0.1*	*<0.0761*	-	-	-	-	*<1.99*	*<1.51*	-	-	-	-	-	-	-	-	-	-

Notes:
All chemical analytical results are in units of mg/kg, shown as both wet weight and dry weight.

TABLE A-1

SEDIMENT ANALYTICAL RESULTS - NOVEMBER/DECEMBER 2015

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

		Strontium				St Average		Zinc				Zn Average		TPH-DRO		TPH-ORO		Aliphatic C6-C8	
		ICON		Pisani				ICON		Pisani				ICON		ICON		Pisani	
Boring ID	Core Interval (ft bls)	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.
SS-16	0-2	111	37.9	-	-	**111**	**37.9**	72.2	24.6	40.9	12.8	**56.6**	**18.7**	-	-	-	-	*<94.9*	*<29.7*
SS-16	2-4	413	64.8	-	-	**413**	**64.8**	31.8	4.99	30.4	4.99	**31.1**	**4.99**	-	-	-	-	*<182*	*<29.9*
SS-16	4-6	217	60.1	-	-	**217**	**60.1**	45.2	12.5	31.9	8.16	**38.6**	**10.3**	-	-	-	-	*<114*	*<29.3*
SS-17	0-2	42.3	18.1	-	-	**42.3**	**18.1**	47.7	20.5	45.4	19.7	**46.6**	**20.1**	65	27.9	113	48.4	*<66.8*	*<29.0*
SS-17	2-4	85.1	36.8	-	-	**85.1**	**36.8**	50.7	21.9	53.3	23.1	**52**	**22.5**	345	149	262	113	*<66.7*	*<28.9*
SS-17	4-6	105	43.2	-	-	**105**	**43.2**	66.5	27.3	63.6	26.7	**65.1**	**27**	345	142	205	84.2	*<68.8*	*<28.9*
SS-17	6-8	47.6	23.3	-	-	**47.6**	**23.3**	68.1	33.4	64.9	30.9	**66.5**	**32.2**	40.2	19.7	33.3	16.3	*<62.2*	*<29.6*
SS-19	0-2	189	70.5	-	-	**189**	**70.5**	164	61.2	85	32.8	**125**	**47**	134	49.9	121	45.1	*<75.9*	*<29.3*
SS-19	2-4	87.1	32.1	-	-	**87.1**	**32.1**	78.7	29	68.9	30.4	**73.8**	**29.7**	323	119	227	83.5	*<67.6*	*<29.8*
SS-20	0-2	53.9	17.5	-	-	**53.9**	**17.5**	58.2	18.9	65.7	21.6	**62**	**20.3**	412	134	326	106	*<90*	*<29.6*
SS-20	2-4	67.5	21.4	-	-	**67.5**	**21.4**	52.6	16.7	68.2	22.5	**60.4**	**19.6**	341	108	382	121	*<87.9*	*<29.0*
SS-20	4-6	62.2	21	-	-	**62.2**	**21**	52.9	17.9	65.1	22.8	**59**	**20.4**	533	180	426	144	*<83.4*	*<29.2*
SS-21	0-2	-	-	-	-	**-**	**-**	62.5	22.1	61	24.9	**61.8**	**23.5**	3190	1130	1340	473	*<72.5*	*<29.6*
SS-21	2-4	-	-	-	-	**-**	**-**	23	3.31	24.9	4.41	**24**	**3.86**	924	133	551	79.3	*<168*	*<29.8*
SS-22	0-2	53.1	13.5	-	-	**53.1**	**13.5**	182	46.4	223	54.5	**203**	**50.5**	2010	513	4860	1240	*<121*	*<29.5*
SS-22	2-4	72.4	27.5	-	-	**72.4**	**27.5**	113	42.9	103	39.3	**108**	**41.1**	3260	1240	5000	1900	*<77.2*	*<29.4*
SS-22	4-6	99.1	36.8	-	-	**99.1**	**36.8**	76.4	28.3	72.6	26.8	**74.5**	**27.6**	3020	1120	2620	973	*<78.9*	*<29.1*
SS-22	6-8	57.3	24.3	-	-	**57.3**	**24.3**	61.2	25.9	36.6	16.1	**48.9**	**21**	587	249	672	285	*<66.1*	*<29.1*
SS-23	0-2	-	-	-	-	**-**	**-**	86.9	39.5	73.4	34.7	**80.2**	**37.1**	140	63.7	174	79.1	*<58.8*	*<27.8*
SS-23	2-4	-	-	-	-	**-**	**-**	36.1	6.97	27.3	5	**31.7**	**5.99**	-	-	-	-	-	-
SS-24	0-2	-	-	-	-	**-**	**-**	62.4	22.7	60.8	22.2	**61.6**	**22.5**	994	361	355	129	*<74*	*<27.0*
SS-24	2-4	-	-	-	-	**-**	**-**	23.8	3.74	21.9	3.44	**22.9**	**3.59**	177	27.8	206	32.4	*<183*	*<28.7*
SS-25	0-2	-	-	-	-	**-**	**-**	57.4	18.8	67.1	20.6	**62.3**	**19.7**	225	73.7	162	52.9	*<95.8*	*<29.4*
SS-25	2-4	-	-	-	-	**-**	**-**	57.7	21.2	71.7	26.4	**64.7**	**23.8**	853	313	343	126	*<76.4*	*<28.1*
SS-25	4-6	-	-	-	-	**-**	**-**	57.8	22.3	61	24.1	**59.4**	**23.2**	1140	437	465	179	*<75.9*	*<30.0*
SS-26	0-2	134	64.1	-	-	**134**	**64.1**	41.4	19.8	42.4	20.4	**41.9**	**20.1**	9230	4410	6210	2970	*<60.7*	*<29.2*
SS-26	2-4	272	53.9	-	-	**272**	**53.9**	29.5	5.84	26.3	5.42	**27.9**	**5.63**	2790	553	2300	455	*<141*	*<29.1*
TBB-1D	0-5	229	49.9	-	-	**229**	**49.9**	97.6	21.3	145	35.4	**121**	**28.4**	7290	1590	3780	824	*<117*	*<28.5*
TBB-1D	5-10	111	58.8	-	-	**111**	**58.8**	41.9	22.2	45.2	20.9	**43.6**	**21.6**	29.2	15.5	68.9	36.5	*<63.2*	*<29.2*
TBB-2D	Grab	84.4	29.5	-	-	**84.4**	**29.5**	67.6	23.6	74.3	25.5	**71**	**24.6**	699	244	708	247	*<81.9*	*<28.1*
TBB-2M	0-7	80.7	43.7	-	-	**80.7**	**43.7**	42.6	23.1	44.5	21.2	**43.6**	**22.2**	469	254	218	118	*<61.6*	*<29.3*
TBB-2M	7-15	82.2	22.7	-	-	**82.2**	**22.7**	34.6	9.55	51.9	16.5	**43.3**	**13**	67.8	18.7	155	42.7	*<91.2*	*<29.0*
TBB-2M	15-17	38	27.5	-	-	**38**	**27.5**	22.7	16.4	-	-	**22.7**	**16.4**	-	-	-	-	-	-
TBB-2M	17-19	28.1	21.4	-	-	**28.1**	**21.4**	31.2	23.7	-	-	**31.2**	**23.7**	-	-	-	-	-	-

Notes:
All chemical analytical results are in units of mg/kg, shown as both wet weight and dry weight.

TABLE A-1

SEDIMENT ANALYTICAL RESULTS - NOVEMBER/DECEMBER 2015

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Boring ID	Core Interval (ft bls)	Aliphatic >C8-C10		Aliphatic >C10-C12		Aliphatic >C12-C16		Aliphatic >C16-C35		Aromatic >C8-C10		Aromatic >C10-C12		Aromatic >C12-C16		Aromatic >C16-C21		Aromatic >C21-C35	
		Pisani		Pisani		Pisani		Pisani		Pisani		Pisani		Pisani		Pisani		Pisani	
		Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.	Dry Wt.	Wet Wt.
SS-16	0-2	*<94.9*	*<29.7*	*<19.2*	*<6.00*	58.5	18.3	345	108	*<94.9*	*<29.7*	*<19.2*	*<6.00*	*<19.2*	*<6.00*	50.5	15.8	106	33.2
SS-16	2-4	*<182*	*<29.9*	*<36.6*	*<6.00*	*<36.6*	*<6.00*	*<36.6*	*<6.00*	*<182*	*<29.9*	*<36.6*	*<6.00*	*<36.6*	*<6.00*	*<36.6*	*<6.00*	*<36.6*	*<6.00*
SS-16	4-6	*<114*	*<29.3*	*<23.4*	*<6.00*	*<23.4*	*<6.00*	*<23.4*	*<6.00*	*<114*	*<29.3*	*<23.4*	*<6.00*	*<23.4*	*<6.00*	*<23.4*	*<6.00*	*<23.4*	*<6.00*
SS-17	0-2	*<66.8*	*<29.0*	*<13.5*	*<5.88*	13.7	5.96	143	62.2	*<66.8*	*<29.0*	*<13.5*	*<5.88*	*<13.5*	*<5.88*	*<13.5*	*<5.88*	37.3	16.2
SS-17	2-4	*<66.7*	*<28.9*	*<13.9*	*<6.00*	32.1	13.9	147	63.7	*<66.7*	*<28.9*	*<13.9*	*<6.00*	*<13.9*	*<6.00*	*<13.9*	*<6.00*	*<13.9*	*<6.00*
SS-17	4-6	*<68.8*	*<28.9*	16	6.73	185	77.5	607	255	*<68.8*	*<28.9*	*<14.3*	*<6.00*	20.1	8.46	73.1	30.7	93.8	39.4
SS-17	6-8	*<62.2*	*<29.6*	*<12.6*	*<6.00*	49.8	23.7	186	88.4	*<62.2*	*<29.6*	*<12.6*	*<6.00*	*<12.6*	*<6.00*	31.3	14.9	40.8	19.4
SS-19	0-2	*<75.9*	*<29.3*	*<15.5*	*<6.00*	57.3	22.1	332	128	*<75.9*	*<29.3*	*<15.5*	*<6.00*	*<15.5*	*<6.00*	38.6	14.9	70.7	27.3
SS-19	2-4	*<67.6*	*<29.8*	*<13.6*	*<6.00*	*<13.6*	*<6.00*	88.4	39	*<67.6*	*<29.8*	*<13.6*	*<6.00*	*<13.6*	*<6.00*	*<13.6*	*<6.00*	*<13.6*	*<6.00*
SS-20	0-2	*<90*	*<29.6*	*<18.2*	*<6.00*	*<18.2*	*<6.00*	31.6	10.4	*<90*	*<29.6*	*<18.2*	*<6.00*	*<18.2*	*<6.00*	*<18.2*	*<6.00*	*<18.2*	*<6.00*
SS-20	2-4	*<87.9*	*<29.0*	*<18.2*	*<6.00*	*<18.2*	*<6.00*	77.9	25.7	*<87.9*	*<29.0*	*<18.2*	*<6.00*	*<18.2*	*<6.00*	*<18.2*	*<6.00*	*<18.2*	*<6.00*
SS-20	4-6	*<83.4*	*<29.2*	*<17.1*	*<6.00*	39.7	13.9	204	71.4	*<83.4*	*<29.2*	*<17.1*	*<6.00*	*<17.1*	*<6.00*	27.9	9.75	46.9	16.4
SS-21	0-2	*<72.5*	*<29.6*	*<14.7*	*<6.00*	16.8	6.86	858	350	*<72.5*	*<29.6*	*<14.7*	*<6.00*	29.9	12.2	103	41.9	101	41.2
SS-21	2-4	*<168*	*<29.8*	*<33.9*	*<6.00*	*<33.9*	*<6.00*	346	61.2	*<168*	*<29.8*	*<33.9*	*<6.00*	*<33.9*	*<6.00*	*<33.9*	*<6.00*	*<33.9*	*<6.00*
SS-22	0-2	*<121*	*<29.5*	*<24.6*	*<6.00*	93	22.7	1040	254	*<121*	*<29.5*	*<24.6*	*<6.00*	*<24.6*	*<6.00*	68.4	16.7	255	62.2
SS-22	2-4	*<77.2*	*<29.4*	*<15.7*	*<6.00*	91.3	34.8	811	309	*<77.2*	*<29.4*	*<15.7*	*<6.00*	21	8.02	64	24.4	133	50.7
SS-22	4-6	*<78.9*	*<29.1*	*<81.3*	*<30.0*	229	84.6	1060	391	*<78.9*	*<29.1*	*<32.5*	*<12.0*	*<32.5*	*<12.0*	99.7	36.8	199	73.5
SS-22	6-8	*<66.1*	*<29.1*	*<13.6*	*<6.00*	50.5	22.2	327	144	*<66.1*	*<29.1*	*<13.6*	*<6.00*	*<13.6*	*<6.00*	29.8	13.1	53.9	23.7
SS-23	0-2	*<58.8*	*<27.8*	*<12.7*	*<6.00*	*<12.7*	*<6.00*	*<12.7*	*<6.00*	*<58.8*	*<27.8*	*<12.7*	*<6.00*	*<12.7*	*<6.00*	*<12.7*	*<6.00*	*<12.7*	*<6.00*
SS-23	2-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SS-24	0-2	*<74*	*<27.0*	*<16.1*	*<5.88*	*<16.1*	*<5.88*	40.8	14.9	*<74*	*<27.0*	*<16.1*	*<5.88*	*<16.1*	*<5.88*	*<16.1*	*<5.88*	*<16.1*	*<5.88*
SS-24	2-4	*<183*	*<28.7*	*<38.2*	*<6.00*	*<38.2*	*<6.00*	61.7	9.68	*<183*	*<28.7*	*<38.2*	*<6.00*	*<38.2*	*<6.00*	*<38.2*	*<6.00*	*<38.2*	*<6.00*
SS-25	0-2	*<95.8*	*<29.4*	*<18.8*	*<5.77*	*<18.8*	*<5.77*	55.7	17.1	*<95.8*	*<29.4*	*<18.8*	*<5.77*	*<18.8*	*<5.77*	*<18.8*	*<5.77*	*<18.8*	*<5.77*
SS-25	2-4	*<76.4*	*<28.1*	*<16.3*	*<6.00*	170	62.6	924	340	*<76.4*	*<28.1*	*<16.3*	*<6.00*	19.4	7.15	94.8	34.9	119	43.8
SS-25	4-6	*<75.9*	*<30.0*	*<15*	*<5.94*	38	15	316	125	*<75.9*	*<30.0*	*<15*	*<5.94*	*<15*	*<5.94*	30.4	12	39.7	15.7
SS-26	0-2	*<60.7*	*<29.2*	*<595*	*<286*	2910	1400	13800	6640	*<60.7*	*<29.2*	*<237*	*<114*	*<237*	*<114*	1030	496	1990	958
SS-26	2-4	*<141*	*<29.1*	*<140*	*<28.8*	942	194	5150	1060	*<141*	*<29.1*	*<140*	*<28.8*	*<140*	*<28.8*	480	98.9	1070	220
TBB-1D	0-5	*<117*	*<28.5*	68.4	16.7	249	60.7	627	153	*<117*	*<28.5*	*<24.6*	*<6.00*	30.6	7.46	38.6	9.42	34.9	8.51
TBB-1D	5-10	*<63.2*	*<29.2*	*<13*	*<6.00*	*<13*	*<6.00*	40.3	18.6	*<63.2*	*<29.2*	*<13*	*<6.00*	*<13*	*<6.00*	*<13*	*<6.00*	*<13*	*<6.00*
TBB-2D	Grab	*<81.9*	*<28.1*	*<17.5*	*<6.00*	66.5	22.8	269	92.4	*<81.9*	*<28.1*	*<17.5*	*<6.00*	*<17.5*	*<6.00*	*<17.5*	*<6.00*	62.7	21.5
TBB-2M	0-7	*<61.6*	*<29.3*	*<12.6*	*<6.00*	*<12.6*	*<6.00*	*<12.6*	*<6.00*	*<61.6*	*<29.3*	*<12.6*	*<6.00*	*<12.6*	*<6.00*	*<12.6*	*<6.00*	*<12.6*	*<6.00*
TBB-2M	7-15	*<91.2*	*<29.0*	*<18.9*	*<6.00*	*<18.9*	*<6.00*	*<18.9*	*<6.00*	*<91.2*	*<29.0*	*<18.9*	*<6.00*	*<18.9*	*<6.00*	*<18.9*	*<6.00*	*<18.9*	*<6.00*
TBB-2M	15-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TBB-2M	17-19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
All chemical analytical results are in units of mg/kg, shown as both wet weight and dry weight.

Table A-2
Groundwater Analytical Results
December 2015 Split Samples

East White Lake Field
Vermilion Parish, Louisiana

Zone		Peat Zone										40 to 60 Ft Zone																			
Sample ID		TBB-3S						TBB-3S				TBB-1S						TBB-1S				TBB-2M						TBB-2M			
Sample Interval (ft)		14-24'						14-24'				33-43'						33-43'				49-59'						49-59'			
Sample Date		12/18/2015						12/18/2015				12/17/2015						12/17/2015				12/14/2015						12/14/2015			
Sampled By		MPA			ICON			AVG				MPA			ICON			AVG				MPA			ICON			AVG			
Parameter	GWss							REPRESENT										REPRESENT										REPRESENT			
Dissolved Metals (mg/L)																															
Arsenic	0.01	0.0074			-			0.0074				0.05	U		-			0.05	U	0.05	U	0.02	U		-			0.02	U	0.02	U
Barium	2	0.62			-			0.62				15.7			-			15.7		15.7		5.81			-			5.81		5.81	
Cadmium	0.005	0.005	U		-			0.005	U	0.005	U	0.05	U		-			0.05	U	0.05	U	0.02	U		-			0.02	U	0.02	U
Chromium	0.10	0.005	U		-			0.005	U	0.005	U	0.05	U		-			0.05	U	0.05	U	0.02	U		-			0.02	U	0.02	U
Iron	0.3	3.22			-			3.22		3.22		52.2			-			52.2		52.2		13.2			-			13.2		13.2	
Lead	0.015	0.005	U		-			0.005	U	0.005	U	0.05	U		-			0.05	U	0.05	U	0.02	U		-			0.02	U	0.02	U
Manganese	0.05	0.32			-			0.32		0.32		11.4			-			11.4		11.4		3.6			-			3.6		3.6	
Mercury	0.002	0.0002	U		-			0.0002	U	0.0002	U	0.0002	U		-			0.0002	U	0.0002	U	0.0002	U		-			0.0002	U	0.0002	U
Selenium	0.05	-			-			-		-		-			-			-				-			-			-			
Strontium	2.2	0.94			-			0.94		0.94		23.7			-			23.7		23.7		5.47			-			5.47		5.47	
Zinc	1.1	0.1	U		-			0.1	U	0.1	U	1	U		-			1	U	1	U	0.4	U		-			0.4	U	0.4	U
Total Metals (mg/L)																															
Arsenic	0.01	0.0087			0.017			0.0129		0.0129		0.05	U		0.01	U		0.03	U	0.03	U	0.02	U		0.01	U		0.015	U	0.015	U
Barium	2	0.67			0.542			0.606		0.606		17.5			13.5			15.5		15.5		6.1			5.12			5.61		5.61	
Cadmium	0.005	0.005	U		0.005	U		0.005	U	0.005	U	0.05	U		0.005	U		0.0275	U	0.0275	U	0.02	U		0.005	U		0.0125	U	0.0125	U
Calcium	-	137			109			123		123		1780			1260			1520		1520		574			463			519		519	
Chromium	0.10	0.005	U		0.01	U		0.0075	U	0.0075	U	0.05	U		0.01	U		0.03	U	0.03	U	0.02	U		0.01	U		0.015	U	0.015	U
Iron	0.3	5.61			6.13			5.87		5.87		57.9			44.2			51.1		51.1		15.8			13.4			14.6		14.6	
Lead	0.015	0.005	U		0.01	U		0.0075	U	0.0075	U	0.05	U		0.01	U		0.03	U	0.03	U	0.02	U		0.01	U		0.015	U	0.015	U
Magnesium	-	45.3			37.9			41.6		41.6		1050			816			933		933		316			248			282		282	
Manganese	0.05	0.37			0.311			0.341		0.341		13.1			9.91			11.5		11.5		4.1			3.08			3.59		3.59	
Mercury	0.002	0.0002	U		0.0002	U		0.0002	U	0.0002	U	0.0002	U		0.0002	U		0.0002	U	0.0002	U	0.0002	U		0.0002	U		0.0002	U	0.0002	U
Potassium	-	3.74			5	U		4.37		4.37		15.8			19.6			17.7		17.7		8.71			11.2			9.96		9.96	
Selenium	0.05	-			0.02	U		0.02	U	0.02	U	-			0.052			0.052		0.052		-			0.03			0.03		0.03	
Sodium	-	648			503			576		576		5680			4420			5050		5050		2190			1780			1990		1990	
Strontium	2.2	1.03			0.77			0.9		0.9		25.8			24.6			25.2		25.2		5.82			4.77			5.3		5.3	
Zinc	1.1	0.1	U		0.014			0.057		0.057		1	U		0.021			0.511		0.511		0.4	U		0.346			0.373		0.373	
TPH Fractions (mg/L)																															
Aliphatic >C10-C12	0.15	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U
Aliphatic >C12-C16	0.15	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U
Aliphatic >C16-C35	7.3	0.15	U		-			0.15	U	0.15	U	0.15	U		-			0.15	U	0.15	U	0.15	U		-			0.15	U	0.15	U
Aliphatic >C8-C10	0.15	0.02	U		-			0.02	U	0.02	U	0.02	U		-			0.02	U	0.02	U	0.02	U		-			0.02	U	0.02	U
Aliphatic C6-C8	3.2	0.03	U		-			0.03	U	0.03	U	0.044			-			0.044		0.044		0.03	U		-			0.03	U	0.03	U
Aromatic >C10-C12	0.15	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U
Aromatic >C12-C16	0.15	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U
Aromatic >C16-C21	0.15	0.15	U		-			0.15	U	0.15	U	0.15	U		-			0.15	U	0.15	U	0.15	U		-			0.15	U	0.15	U
Aromatic >C21-C35	0.15	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U	0.1	U		-			0.1	U	0.1	U
Aromatic >C8-C10	0.15	0.03	U		-			0.03	U	0.03	U	0.03	U		-			0.03	U	0.03	U	0.03	U		-			0.03	U	0.03	U
TPH Mixtures (mg/L)																															
TPH-GRO	0.15	0.1	U		0.15	U		0.125	U	FRACT		0.1	U		0.15	U		0.125	U	FRAC		0.1	U		0.15	U		0.125	U	FRAC	
TPH-DRO	0.15	0.157			0.131	U		0.144		FRACT		0.157			0.133	U		0.145		FRAC		0.236			0.131	U		0.184		FRAC	
TPH-ORO	0.15	0.125	U		0.121	U		0.123	U	FRACT		0.214			0.122	U		0.168		FRAC		0.125	U		0.121			0.123		FRAC	
BTEX (mg/L)																															
Benzene	0.005	0.005	U		0.005	U		0.005	U	0.005	U	0.00707			0.0067			0.00689		0.00689		0.005	U		0.005	U		0.005	U	0.005	U
Ethylbenzene	0.7	0.005	U		0.005	U		0.005	U	0.005	U	0.005	U		0.005	U		0.005	U	0.005	U	0.005	U		0.005	U		0.005	U	0.005	U
Toluene	1	0.005	U		0.01	U		0.0075	U	0.0075	U	0.005	U		0.01	U		0.0075	U	0.0075	U	0.005	U		0.01	U		0.0075	U	0.0075	U
Xylene	10	0.015	U		0.05	U		0.0325	U	0.0325	U	0.015	U		0.05	U		0.0325	U	0.0325	U	0.015	U		0.05	U		0.0325	U	0.0325	U
Other																															
Chloride	-	1120			969			1040		1040		16900			13400			15200		15200		4820			4520			4670		4670	
Bromide	-	3.77			2.92			3.35		3.35		23.9			17.2			20.6		20.6		10	U		4.04			7.02		7.02	
Sulfate	250	1.63			2.66			2.15		2.15		10	U		12.5	U		11.3	U	11.3	U	10	U		5	U		7.5	U	7.5	U
Bicarbonate Alkalinity	-	393			388			391		391		316			298			307		307		416			410			413		413	
Carbonate Alkalinity	-	1	U		10	U		5.5	U	5.5	U	1	U		10	U		5.5	U	5.5	U	1	U		10	U		5.5	U	5.5	U
Turbidity (NTU)	-	-			14			14		14		-			22.2			22.2		22.2		-			12.7			12.7		12.7	
TDS	500	2010			2080			2050		2050		33100			24700			28900		28900		7160			9350			8260		8260	
Field EC	-	-			3173			3173		3173		-			32150			32150		32150		-			12960			12960		12960	
Field pH	-	-			7.45			7.45		7.45		-			7.18			7.18		7.18		-			7.34			7.34		7.34	
SVOCs																															
1,2,4-Trichlorobenzene	0.07	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
1,2-Dichlorobenzene	0.6	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
1,2Diphenylhydrazine/Azobenzene	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
1,3-Dichlorobenzene	0.01	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
1,4-Dichlorobenzene	0.075	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2,4,6-Trichlorophenol	0.01	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2,4-Dichlorophenol	0.011	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2,4-Dimethylphenol	0.073	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2,4-Dinitrophenol	0.05	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2,4-Dinitrotoluene	0.01	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2,6-Dinitrotoluene	0.01	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2-Chloronaphthalene	0.049	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2-Chlorophenol	0.01	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2-Methylnaphthalene	0.00062	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
2-Nitrophenol	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
3,3-Dichlorobenzidine	0.02	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
4,6-Dinitro-2-methylphenol	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
4-Bromophenyl phenyl ether	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
4-Chloro-3-methylphenol	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
4-Chlorophenyl phenyl ether	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
4-Nitrophenol	0.05	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Acenaphthene	0.037	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Acenaphthylene	0.1	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Anthracene	0.043	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Benzidine	-	0.05	U		-			0.05	U	0.05	U	-			-			-		-		-			-			-		-	
Benzo(a)anthracene	0.0078	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Benzo(a)pyrene	0.0002	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Benzo(b)fluoranthene	0.0048	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Benzo(g,h,i)perylene	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Benzo(k)fluoranthene	0.0025	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Bis(2-Chloroethoxy)methane	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Bis(2-Chloroethyl)ether	0.0057	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Bis(2-Chloroisopropyl)ether	0.0057	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Bis(2-Ethylhexyl)phthalate	0.006	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Butyl benzyl phthalate	0.73	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Chrysene	0.0016	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Di-n-butyl phthalate	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Di-n-octyl phthalate	0.02	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Dibenz(a,h)anthracene	0.0025	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Diethyl phthalate	2.9	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Dimethyl phthalate	37	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Fluoranthene	0.15	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Fluorene	0.024	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Hexachlorobenzene	0.001	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Hexachlorobutadiene	0.00073	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Hexachlorocyclo-pentadiene	0.05	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Hexachloroethane	0.01	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Indeno(1,2,3-cd)pyrene	0.0037	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Isophorone	0.07	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Naphthalene	0.01	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Nitrobenzene	0.0019	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Pentachlorophenol	0.001	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Phenanthrene	0.18	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Phenol	0.18	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
Pyrene	0.018	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
n-Nitrosodi-n-propylamine	0.01	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
n-Nitrosodimethylamine	-	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	
n-Nitrosodiphenylamine	0.013	0.01	U		-			0.01	U	0.01	U	-			-			-		-		-			-			-		-	

Table A-2
Groundwater Analytical Results
December 2015 Split Samples

East White Lake Field
Vermilion Parish, Louisiana

Zone		70 to 90 Ft Zone																			
Sample ID		TBA-1D			TBA-1D	TBB-1D			TBB-1D	TBB-2D			TBB-2D	TBB-3D			TBB-3D	TBB-3D Purge Water @ 5 Gal			TBB-3D Purge
Sample Interval (ft)		75-85'			75-85'	65-75'			65-75'	81-91'			81-91'	66-76'			66-76'	66-76'			66-76'
Sample Date		12/22/2015			12/22/2015	12/17/2015			12/17/2015	12/15/2015			12/15/2015	12/15/2015			12/15/2015	12/15/2015			12/15/2015
Sampled By		MPA	ICON	AVG	AVG	MPA	ICON	AVG	AVG	MPA	ICON	AVG	AVG	MPA	ICON	AVG	AVG	MPA	ICON	AVG	AVG
Parameter	**GWss**				**REPRESENT**				**REPRESENT**				**REPRESENT**				**REPRESENT**				**REPRESENT**
Dissolved Metals (mg/L)																					
Arsenic	0.01	0.005 U	-	0.005 U	0.005 U	0.005 U	0.012	0.0085	0.0085	0.005 U	-	0.005 U	0.005 U	0.005 U	-	0.005 U	0.005 U	-	-	-	-
Barium	2	1.12	-	1.12	1.12	0.89	0.908	0.899	0.899	1.06	-	1.06	1.06	1.01	-	1.01	1.01	-	-	-	-
Cadmium	0.005	0.005 U	-	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	-	0.005 U	0.005 U	0.005 U	-	0.005 U	0.005 U	-	-	-	-
Chromium	0.10	0.005 U	-	0.005 U	0.005 U	0.005 U	0.028	0.0165	0.0165	0.005 U	-	0.005 U	0.005 U	0.005 U	-	0.005 U	0.005 U	-	-	-	-
Iron	0.3	1.67	-	1.67	1.67	3.05	24.2	13.6	13.6	4.37	-	4.37	4.37	0.5 U	-	0.5 U	0.5 U	-	-	-	-
Lead	0.015	-	-	-	-	0.0095	0.023	0.0163	0.0163	0.005 U	-	0.005 U	0.005 U	0.005 U	-	0.005 U	0.005 U	-	-	-	-
Manganese	0.05	0.25	-	0.25	0.25	0.55	0.717	0.634	0.634	0.72	-	0.72	0.72	0.16	-	0.16	0.16	-	-	-	-
Mercury	0.002	0.0002 U	-	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	-	0.0002 U	0.0002 U	0.0002 U	-	0.0002 U	0.0002 U	-	-	-	-
Selenium	0.05	-	-	-	-	-	0.02 U	0.02 U	0.02 U	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	2.2	1.19	-	1.19	1.19	1.16	1.07	1.12	1.12	1.35	-	1.35	1.35	1.07	-	1.07	1.07	-	-	-	-
Zinc	1.1	0.1 U	-	0.1 U	0.1 U	0.1 U	0.078	0.089	0.089	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	-	-	-	-
Total Metals (mg/L)																					
Arsenic	0.01	0.005 U	0.014	0.0095	0.0095	0.02	0.013	0.0165	DISS	0.0062	0.01 U	0.0081	0.0081	0.005 U	0.01 U	0.0075 U	0.0075 U	-	-	-	-
Barium	2	1.19	0.996	1.09	1.09	1.66	1.26	1.46	DISS	1.33	1.12	1.23	1.23	1.07	0.886	0.978	0.978	-	-	-	-
Cadmium	0.005	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	DISS	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-
Calcium	-	144	115	130	130	136	95	116	DISS	162	121	142	142	164	122	143	143	-	-	-	-
Chromium	0.10	0.005 U	0.01 U	0.0075 U	0.0075 U	0.051	0.052	0.0515	DISS	0.012	0.018	0.015	0.015	0.0053	0.01 U	0.00765	0.00765	-	-	-	-
Iron	0.3	1.76	1.53	1.65	1.65	60.5	50.5	55.5	DISS	19.9	15.7	17.8	17.8	1.86	1.92	1.89	1.89	-	-	-	-
Lead	0.015	-	0.01 U	0.01 U	0.01 U	0.082	0.047	0.0645	DISS	0.012	0.01 U	0.011	0.011	0.005 U	0.01 U	0.0075 U	0.0075 U	-	-	-	-
Magnesium	-	48.6	40.1	44.4	44.4	74.1	52.8	63.5	DISS	67.1	50.9	59	59	48	37.3	42.7	42.7	-	-	-	-
Manganese	0.05	0.26	0.217	0.239	0.239	1.65	1.23	1.44	DISS	1.13	0.751	0.941	0.941	0.19	0.16	0.175	0.175	-	-	-	-
Mercury	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	DISS	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	-	-	-	-
Potassium	-	4.26	5 U	4.63	4.63	11.9	11.9	11.9	DISS	7	7.77	7.39	7.39	5.17	5.23	5.2	5.2	-	-	-	-
Selenium	0.05	-	0.02 U	0.02 U	0.02 U	-	0.02 U	0.02 U	DISS	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	505	369	437	437	765	572	669	DISS	661	509	585	585	404	318	361	361	-	-	-	-
Strontium	2.2	1.23	0.936	1.08	1.08	1.66	1.2	1.43	DISS	1.51	1.26	1.39	1.39	1.08	0.877	0.979	0.979	-	-	-	-
Zinc	1.1	0.1 U	0.01 U	0.055 U	0.055 U	0.19	0.186	0.188	DISS	0.1 U	0.061	0.0805	0.0805	0.1 U	0.014	0.057	0.057	-	-	-	-
TPH Fractions (mg/L)																					
Aliphatic >C10-C12	0.15	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	-	-	-	-
Aliphatic >C12-C16	0.15	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	-	-	-	-
Aliphatic >C16-C35	7.3	0.15 U	-	0.15 U	0.15 U	0.15 U	-	0.15 U	0.15 U	0.15 U	-	0.15 U	0.15 U	0.15 U	-	0.15 U	0.15 U	-	-	-	-
Aliphatic >C8-C10	0.15	0.02 U	-	0.02 U	0.02 U	0.02 U	-	0.02 U	0.02 U	0.02 U	-	0.02 U	0.02 U	0.2 U	-	0.2 U	0.2 U	-	-	-	-
Aliphatic C6-C8	3.2	0.03 U	-	0.03 U	0.03 U	0.03 U	-	0.03 U	0.03 U	0.03 U	-	0.03 U	0.03 U	0.3 U	-	0.3 U	0.3 U	-	-	-	-
Aromatic >C10-C12	0.15	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	-	-	-	-
Aromatic >C12-C16	0.15	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	-	-	-	-
Aromatic >C16-C21	0.15	0.15 U	-	0.15 U	0.15 U	0.15 U	-	0.15 U	0.15 U	0.15 U	-	0.15 U	0.15 U	0.15 U	-	0.15 U	0.15 U	-	-	-	-
Aromatic >C21-C35	0.15	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	0.1 U	-	0.1 U	0.1 U	-	-	-	-
Aromatic >C8-C10	0.15	0.03 U	-	0.03 U	0.03 U	0.03 U	-	0.03 U	0.03 U	0.03 U	-	0.03 U	0.03 U	2.05	-	2.05	2.05	-	-	-	-
TPH Mixtures (mg/L)																					
TPH-GRO	0.15	0.1 U	0.15 U	0.125 U	FRAC	0.1 U	0.15 U	0.125 U	FRAC	0.1 U	0.15 U	0.125 U	FRAC	0.1 U	0.15 U	0.125 U	FRAC	-	-	-	-
TPH-DRO	0.15	0.125 U	0.245	0.185	FRAC	0.125 U	0.137 U	0.131 U	FRAC	0.13	0.218	0.174	FRAC	2.13	2.28	2.21	FRAC	-	-	-	-
TPH-ORO	0.15	0.125 U	0.579	0.352	FRAC	0.186	0.126 U	0.156	FRAC	0.125 U	0.12 U	0.123 U	FRAC	0.25 U	0.12 U	0.185 U	FRAC	-	-	-	-
BTEX (mg/L)																					
Benzene	0.005	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-
Ethylbenzene	0.7	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	-	-	-	-
Toluene	1	0.005 U	0.01 U	0.0075 U	0.0075 U	0.005 U	0.01 U	0.0075 U	0.0075 U	0.005 U	0.01 U	0.0075 U	0.0075 U	0.005 U	0.01 U	0.0075 U	0.0075 U	-	-	-	-
Xylene	10	0.015 U	0.05 U	0.0325 U	0.0325 U	0.015 U	0.05 U	0.0325 U	0.0325 U	0.015 U	0.05 U	0.0325 U	0.0325 U	0.015 U	0.05 U	0.0325 U	0.0325 U	-	-	-	-
Other																					
Chloride	-	876	806	841	841	1220	1050	1140	1140	1020	942	981	981	721	666	694	694	-	-	-	-
Bromide	-	1 U	0.835	0.918	0.918	1.65	0.93	1.29	1.29	1.54	0.893	1.22	1.22	1.18	0.663	0.922	0.922	-	-	-	-
Sulfate	250	1 U	1.18	1.09	1.09	102	68	85	85	45.2	44	44.6	44.6	7.06	6.83	6.95	6.95	-	-	-	-
Bicarbonate Alkalinity	-	363	355	359	359	330	308	319	319	345	338	342	342	320	315	318	318	-	-	-	-
Carboante Alkalinity	-	1 U	10 U	5.5 U	5.5 U	1 U	10 U	5.5 U	5.5 U	1 U	10 U	5.5 U	5.5 U	1 U	10 U	5.5 U	5.5 U	-	-	-	-
Turbidity (NTU)	-	-	2.27	2.27	2.27	-	-	-	-	-	21	21	21	-	16	16	16	-	-	-	-
TDS	500	1600	1560	1580	1580	2030	2040	2040	2040	1910	2030	1970	1970	1220	1470	1350	1350	-	-	-	-
Field EC	-	-	3075	3075	3075	-	4062	4062	4062	-	3587	3587	3587	-	2700	2700	2700	-	-	-	-
Field pH	-	-	7.27	7.27	7.27	-	7.81	7.81	7.81	-	7.42	7.42	7.42	-	7.88	7.88	7.88	-	-	-	-
SVOCs																					
1,2,4-Trichlorobenzene	0.07	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
1,2-Dichlorobenzene	0.6	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
1,2DiphenylhydrazineAzobenzer	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
1,3-Dichlorobenzene	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
1,4-Dichlorobenzene	0.075	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
2,4,6-Trichlorophenol	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
2,4-Dichlorophenol	0.011	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
2,4-Dimethylphenol	0.073	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
2,4-Dinitrophenol	0.05	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
2,4-Dinitrotoluene	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
2,6-Dinitrotoluene	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
2-Chloronaphthalene	0.049	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
2-Chlorophenol	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
2-Methylnaphthalene	0.00062	-	-	-	-	-	-	-	-	-	-	-	-	0.111	-	0.111	**0.111**	0.029	-	0.029	**0.029**
2-Nitrophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
3,3-Dichlorobenzidine	0.02	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
4,6-Dinitro-2-methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
4-Bromophenyl phenyl ether	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
4-Chloro-3-methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
4-Chlorophenyl phenyl ether	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
4-Nitrophenol	0.05	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Acenaphthene	0.037	-	-	-	-	-	-	-	-	-	-	-	-	0.122	-	0.122	**0.122**	0.042	-	0.042	**0.042**
Acenaphthylene	0.1	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Anthracene	0.043	-	-	-	-	-	-	-	-	-	-	-	-	0.018	-	0.018	0.018	0.03	-	0.03	0.03
Benzidine	-	-	-	-	-	-	-	-	-	-	-	-	-	0.051 U	-	0.051 U	0.051 U	0.1 U	-	0.1 U	0.1 U
Benzo(a)anthracene	0.0078	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Benzo(a)pyrene	0.0002	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Benzo(b)fluoranthene	0.0048	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Benzo(k)fluoranthene	0.0025	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Bis(2-Chloroethoxy)methane	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Bis(2-Chloroethyl)ether	0.0057	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Bis(2-Chloroisopropyl)ether	0.0057	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Bis(2-Ethylhexyl)phthalate	0.006	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Butyl benzyl phthalate	0.73	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Chrysene	0.0016	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Di-n-butyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Di-n-octyl phthalate	0.02	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Dibenz(a,h)anthracene	0.0025	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Diethyl phthalate	2.9	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Dimethyl phthalate	37	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Fluoranthene	0.15	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	0.02	0.02	0.077	-	0.077	0.077
Fluorene	0.024	-	-	-	-	-	-	-	-	-	-	-	-	0.096	-	0.096	**0.096**	0.044	-	0.044	**0.044**
Hexachlorobenzene	0.001	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Hexachlorobutadiene	0.00073	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Hexachlorocyclo-pentadiene	0.05	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Hexachloroethane	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Indeno(1,2,3-cd)pyrene	0.0037	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Isophorone	0.07	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Naphthalene	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.548	-	0.548	**0.548**	0.063	-	0.063	**0.063**
Nitrobenzene	0.0019	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Pentachlorophenol	0.001	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Phenanthrene	0.18	-	-	-	-	-	-	-	-	-	-	-	-	0.14	-	0.14	0.14	0.147	-	0.147	0.147
Phenol	0.18	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
Pyrene	0.018	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	0.01	0.01	0.05	-	0.05	**0.05**
n-Nitrosodi-n-propylamine	0.01	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
n-Nitrosodimethylamine	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U
n-Nitrosodiphenylamine	0.013	-	-	-	-	-	-	-	-	-	-	-	-	0.01 U	-	0.01 U	0.01 U	0.02 U	-	0.02 U	0.02 U

Table A-2
Groundwater Analytical Results
December 2015 Split Samples

East White Lake Field
Vermilion Parish, Louisiana

	Zone	>90-250 Ft Zone										Chicot									
	Sample ID	MC-1						MC-1				BC-1						BC-1			
	Sample Interval (ft)	161-181'						161-181'				469-489'						469-489'			
	Sample Date	12/16/2015						12/16/2015				12/28/2015						12/28/2015			
	Sampled By	MPA		ICON		AVG		AVG				MPA		ICON		AVG		AVG			
Parameter	GWss							REPRESENT										REPRESENT			
Dissolved Metals (mg/L)																					
Arsenic	0.01	0.005	U	-		0.005	U	0.005	U			0.005	U	-		0.005	U	0.005	U		
Barium	2	1.74		-		1.74		1.74				0.8		-		0.8		0.8			
Cadmium	0.005	0.005	U	-		0.005	U	0.005	U			0.005	U	-		0.005	U	0.005	U		
Chromium	0.10	0.005	U	-		0.005	U	0.005	U			0.005	U	-		0.005	U	0.005	U		
Iron	0.3	1.08		-		1.08		1.08				0.89		-		0.89		0.89			
Lead	0.015	0.005	U	-		0.005	U	0.005	U			0.005	U	-		0.005	U	0.005	U		
Manganese	0.05	0.65		-		0.65		0.65				0.11		-		0.11		0.11			
Mercury	0.002	0.0002	U	-		0.0002	U	0.0002	U			0.0002	U	-		0.0002	U	0.0002	U		
Selenium	0.05	-		-		-		-				-		-		-		-			
Strontium	2.2	1.42		-		1.42		1.42				0.79		-		0.79		0.79			
Zinc	1.1	0.1	U	-		0.1	U	0.1	U			0.1	U	-		0.1	U	0.1	U		
Total Metals (mg/L)																					
Arsenic	0.01	0.005	U	0.01	U	0.0075	U	0.0075	U			0.005	U	-		0.005	U	0.005	U		
Barium	2	1.85		1.55		1.7		1.7				0.87		-		0.87		0.87			
Cadmium	0.005	0.005	U	0.005	U	0.005	U	0.005	U			0.005	U	-		0.005	U	0.005	U		
Calcium	-	151		118		135		135				88.9		-		88.9		88.9			
Chromium	0.10	0.005	U	0.01	U	0.0075	U	0.0075	U			0.005	U	-		0.005	U	0.005	U		
Iron	0.3	1.48		1.48		1.48		1.48				0.99		-		0.99		0.99			
Lead	0.015	0.005	U	0.01	U	0.0075	U	0.0075	U			0.005	U	-		0.005	U	0.005	U		
Magnesium	-	57.9		43.9		50.9		50.9				31.4		-		31.4		31.4			
Manganese	0.05	0.67		0.468		0.569		0.569				0.14		-		0.14		0.14			
Mercury	0.002	0.001		0.0002	U	0.0006		0.0006				0.0002	U	0.0002	U	0.0002	U	0.0002	U		
Potassium	-	6.11		6.02		6.07		6.07				3.84		-		3.84		3.84			
Selenium	0.05	-		-		-		-				-		-		-		-			
Sodium	-	514		409		462		462				160		-		160		160			
Strontium	2.2	1.54		1.27		1.41		1.41				0.84		-		0.84		0.84			
Zinc	1.1	0.1	U	0.012		0.056		0.056				0.1	U	-		0.1	U	0.1	U		
TPH Fractions (mg/L)																					
Aliphatic >C10-C12	0.15	0.1	U	-		0.1	U	0.1	U			0.1	U	-		0.1	U	0.1	U		
Aliphatic >C12-C16	0.15	0.1	U	-		0.1	U	0.1	U			0.1	U	-		0.1	U	0.1	U		
Aliphatic >C16-C35	7.3	0.15	U	-		0.15	U	0.15	U			0.15	U	-		0.15	U	0.15	U		
Aliphatic >C8-C10	0.15	0.02	U	-		0.02	U	0.02	U			0.02	U	-		0.02	U	0.02	U		
Aliphatic C6-C8	3.2	0.03	U	-		0.03	U	0.03	U			0.03	U	-		0.03	U	0.03	U		
Aromatic >C10-C12	0.15	0.1	U	-		0.1	U	0.1	U			0.1	U	-		0.1	U	0.1	U		
Aromatic >C12-C16	0.15	0.1	U	-		0.1	U	0.1	U			0.1	U	-		0.1	U	0.1	U		
Aromatic >C16-C21	0.15	0.15	U	-		0.15	U	0.15	U			0.15	U	-		0.15	U	0.15	U		
Aromatic >C21-C35	0.15	0.1	U	-		0.1	U	0.1	U			0.1	U	-		0.1	U	0.1	U		
Aromatic >C8-C10	0.15	0.03	U	-		0.03	U	0.03	U			0.03	U	-		0.03	U	0.03	U		
TPH Mixtures (mg/L)																					
TPH-GRO	0.15	0.1	U	0.15	U	0.125	U	FRAC				0.1	U	0.15	U	0.125	U	FRAC			
TPH-DRO	0.15	0.125	U	0.13	U	0.128	U	FRAC				0.125	U	-		0.125	U	FRAC			
TPH-ORO	0.15	0.125	U	0.12	U	0.123	U	FRAC				0.125	U	-		0.125	U	FRAC			
BTEX (mg/L)																					
Benzene	0.005	0.005	U	0.005	U	0.005	U	0.005	U			0.005	U	0.005	U	0.005	U	0.005	U		
Ethylbenzene	0.7	0.005	U	0.005	U	0.005	U	0.005	U			0.005	U	0.005	U	0.005	U	0.005	U		
Toluene	1	0.005	U	0.01	U	0.0075	U	0.0075	U			0.005	U	0.005	U	0.005	U	0.005	U		
Xylene	10	0.015	U	0.05	U	0.0325	U	0.0325	U			0.015	U	0.015	U	0.015	U	0.015	U		
Other																					
Chloride	-	837		769		803		803				165		184		175		175			
Bromide	-	2.18		1.48		1.83		1.83				0.406		0.23		0.318		0.318			
Sulfate	250	106		61.4		83.7		83.7				1.84		2.45		2.15		2.15			
Bicarbonate Alkalinity	-	349		332		341		341				343		350		347		347			
Carbonate Alkalinity	-	1	U	10	U	5.5	U	5.5	U			1	U	10	U	5.5	U	5.5	U		
Turbidity (NTU)	-	-		2.66		2.66		2.66				-		1.59		1.59		1.59			
TDS	500	1750		1640		1700		1700				643		-		643		643			
Field EC	-	-		3130		3130		3130				-		1241		1241		1241			
Field pH	-	-		7.61		7.61		7.61				-		8.06		8.06		8.06			
SVOCs																					
1,2,4-Trichlorobenzene	0.07	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
1,2-Dichlorobenzene	0.6	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
1,2Diphenylhydrazine\Azobenze	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
1,3-Dichlorobenzene	0.01	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
1,4-Dichlorobenzene	0.075	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2,4,6-Trichlorophenol	0.01	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2,4-Dichlorophenol	0.011	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2,4-Dimethylphenol	0.073	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2,4-Dinitrophenol	0.05	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2,4-Dinitrotoluene	0.01	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2,6-Dinitrotoluene	0.01	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2-Chloronaphthalene	0.049	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2-Chlorophenol	0.01	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2-Methylnaphthalene	0.00062	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
2-Nitrophenol	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
3,3-Dichlorobenzidine	0.02	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
4,6-Dinitro-2-methylphenol	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
4-Bromophenyl phenyl ether	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
4-Chloro-3-methylphenol	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
4-Chlorophenyl phenyl ether	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
4-Nitrophenol	0.05	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Acenaphthene	0.037	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Acenaphthylene	0.1	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Anthracene	0.043	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Benzidine	-	-		-		-		-				0.05	U	-		0.05	U	0.05	U		
Benzo(a)anthracene	0.0078	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Benzo(a)pyrene	0.0002	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Benzo(b)fluoranthene	0.0048	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Benzo(g,h,i)perylene	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Benzo(k)fluoranthene	0.0025	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Bis(2-Chloroethoxy)methane	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Bis(2-Chloroethyl)ether	0.0057	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Bis(2-Chloroisopropyl)ether	0.0057	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Bis(2-Ethylhexyl)phthalate	0.006	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Butyl benzyl phthalate	0.73	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Chrysene	0.0016	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Di-n-butyl phthalate	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Di-n-octyl phthalate	0.02	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Dibenz(a,h)anthracene	0.0025	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Diethyl phthalate	2.9	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Dimethyl phthalate	37	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Fluoranthene	0.15	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Fluorene	0.024	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Hexachlorobenzene	0.001	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Hexachlorobutadiene	0.00073	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Hexachlorocyclo-pentadiene	0.05	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Hexachloroethane	0.01	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Indeno(1,2,3-cd)pyrene	0.0037	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Isophorone	0.07	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Naphthalene	0.01	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Nitrobenzene	0.0019	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Pentachlorophenol	0.001	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Phenanthrene	0.18	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Phenol	0.18	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
Pyrene	0.018	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
n-Nitrosodi-n-propylamine	0.01	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
n-Nitrosodimethylamine	-	-		-		-		-				0.01	U	-		0.01	U	0.01	U		
n-Nitrosodiphenylamine	0.013	-		-		-		-				0.01	U	-		0.01	U	0.01	U		

Table A-2
Groundwater Analytical Results
December 2015 Split Samples

East White Lake Field
Vermilion Parish, Louisiana

Notes:

- Indicates no standard in the RECAP standard column, or parameter not analyzed in the data section

U Not detected, value is the detection limit

Yellow highlighting indicates a detected concentration exceeds the screening level.

Grey shading indicates the total metals results are not included in the quantitative risk evaluation because they were affected by high turbidity in the sample (see DISS definition).

The results for well TBB-3D are shaded to indicate the results are not considered representative of environmental contamination from E&P activities. The results reflect contamination introduced by the drilling process, specifically creosote constituents introduced by drilling through a creosote-treated piling.

FRACT - TPH fraction data are available for this location and are utilized in lieu of TPH mixtures.

DISS - Dissolved metals, when available, were used in lieu of total metals.

GWSS = RECAP Screening Standard from Table 1 of RECAP 2003.

AVG - represents the average of split sample results, calculated as outlined below.

REPRESENT - This column presents the constituent concentrations considered representative for each sample. Concentrations were identified as the following:

- Single sample results provided by one lab, where no split sample was collected.
- If split samples were collected, the average concentration for each parameter was determined as follows:
  - Parameters with detected concentrations in both splits: the detected concentrations were averaged.
  - Parameters reported as nondetect in both splits: the detection limits were averaged and the average is considered not detected at the averaged detection limit.
  - Parameters analyzed in only one of the split samples: the result (detection or nondetect) for the parameter was identified in the "average" column for that sample.
  - Parameters that were detected in one split but not detected in the other split: the detection limit was used as a proxy concentration and averaged with the detected concentration.

Once the result was identified as outlined above, two other considerations were made:

- If TPH fractions are available, they were utilized as the most representative results. In these instances, the note "FRACT" is inserted for TPH mixture results.
- Dissolved metals, when available, were used in lieu of total metals for samples with a turbidity greater than 40 NTU. In these instances, the note "DISS" is inserted for total metals results. Total metals results for these samples are shaded grey to indicate the results are not included in the quantitative risk evaluation.

GWss for strontium is not provided in RECAP; the risk-based values were calculated in accordance with Appendix H of RECAP 2003.

GWss for iron and manganese are not provided in RECAP; the EPA Secondary MCLs were used as the GWss for iron and manganese.

TABLE A-3

GROUND WATER ANALYTICAL RESULTS - FEBRUARY 2016

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	Zone	**70-90' Zone**	**90-250' Zone**	**>250' Zone**		
	Sample ID	TBA-2	MC-2	BC-2	BC-3	BC-4
	Sample Interval (ft)	69-79'	139-159'	279-299'	279-299'	269.5-289.5
	Sample Date	2/2/2016	2/1/2016	2/3/2016	2/9/2016	2/4/2016
	Sampled By	MPA	MPA	MPA	MPA	MPA
Parameter	**GWss**					
Dissolved Metals (mg/L)						
Arsenic	0.01	<0.005	0.006	<0.013	0.0097	<0.005
Barium	2	2.56	1.07	21.0	3.32	4.71
Cadmium	0.005	<0.02	<0.01	<0.05	<0.01	<0.02
Chromium	0.1	<0.02	<0.01	<0.05	<0.01	<0.02
Iron	0.3	3.43	< 1.00	13.5	<1.00	8.71
Lead	0.015	<0.02	<0.01	<0.05	<0.01	<0.02
Manganese	0.05	0.47	0.16	1.50	0.27	1.06
Mercury	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Strontium	2.2	3.67	1.11	31.3	3.6	4.59
Zinc	1.1	<0.4	<0.20	<1.0	<0.20	<0.4
Total Metals (mg/L)						
Arsenic	0.01	<0.005	0.01	<0.013	0.011	<0.005
Barium	2	2.66	1.35	22.5	3.53	4.97
Cadmium	0.005	<0.02	<0.01	<0.05	<0.01	<0.02
Calcium	-	270	152	1,430	352	477
Chromium	0.1	<0.02	0.021	<0.05	<0.01	<0.02
Iron[1]	0.3	9.20	16.6	17.3	1.22	9.43
Lead	0.015	<0.02	0.013	<0.05	<0.01	<0.02
Magnesium	-	84.2	46.3	384	135	170
Manganese [1]	0.05	0.56	0.51	1.62	0.3	1.08
Mercury	0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Potassium	-	10.5	7.82	41.5	8.82	7.94
Sodium	-	1,560	785	8,720	1,650	1,650
Strontium	2.2	3.45	1.26	29.6	4.61	4.37
Zinc	1.1	<0.4	<0.20	<1.00	<0.2	<0.4
BTEX (mg/L)						
Benzene	0.005	<0.005	<0.005	0.2 E	<0.005	<0.005
Ethylbenzene	0.7	<0.005	<0.005	0.00932	<0.005	<0.005
Toluene	1	<0.005	<0.005	<0.005	<0.005	<0.005
Xylene (total)	10	<0.015	<0.015	<0.015	<0.015	<0.015
TPH Fractions (mg/L)						
Aliphatic C6-C8	3.2	<0.030	<0.030	0.636	<0.030	<0.030
Aliphatic >C8-C10	0.15	<0.020	<0.020	0.141	<0.020	<0.020
Aliphatic >C10-C12	0.15	<0.100	<0.100	<0.100	<0.100	<0.100
Aliphatic >C12-C16	0.15	<0.100	<0.100	<0.100	<0.100	<0.100
Aliphatic >C16-C35	7.3	<0.150	<0.150	<0.150	<0.150	<0.150
Aromatic >C8-C10	0.15	<0.030	<0.030	0.405	<0.030	<0.030
Aromatic >C10-C12	0.15	<0.100	<0.100	<0.100	<0.100	<0.100
Aromatic >C12-C16	0.15	<0.100	<0.100	<0.100	<0.100	<0.100
Aromatic >C16-C21	0.15	<0.150	<0.150	<0.150	<0.150	<0.150
Aromatic >C21-C35	0.15	<0.100	<0.100	<0.100	<0.100	<0.100
TPH Mixtures (mg/L)						
Gasoline Range Organics	0.15	<0.100	<0.100	0.425	<0.100	<0.100
Diesel Range Organics	0.15	<0.125	<0.125	0.340	-	<0.125
Oil Range Organics	0.15	<0.125	<0.125	<0.125	-	<0.125
Water Quality (mg/L)						
Bromide	-	3.87	1.84	20.3	<4.00	4.39
Chloride [1]	-	3,060	1,220	16,600	2850	3,690
Sulfate [1]	-	3.42	30.0	5.11	57.6	7.36
Bicarbonate Alkalinity	-	429	320	319	251	361
Carbonate Alkalinity	-	<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids [1]	-	4,840	2,270	22,200	4860	5,920

Notes:
GW_{SS} = RECAP Screening Standard from Table 1 of RECAP 2003.
Yellow highlighting indicates a detected concentration exceeds the screening level.
[1] Secondary Maximum Containment Level
As of the production of this report, the sample results in this table are considered preliminary from the laboratory. Samples are splits of ICON samples collected in February 2016. ICON results have not been received.
- Indicates no standard in the RECAP standard column, or parameter not analyzed in the data section
< ##, not detected at limit presented
All screen intervals as reported by ICON
E - Estimated, outside calibration range
GWss for strontium is not provided in RECAP; the risk-based values were calculated in accordance with Appendix H of RECAP 2003.
GWss for iron and manganese are not provided in RECAP; the EPA Secondary MCLs were used as the GWss for iron and manganese.

TABLE A-4

MUD PIT CONTENTS - ANALYTICAL RESULTS

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Parameter	MUD PIT CONTENTS 12/7/2015
TPH Fractions (mg/kg-wet)	
Aliphatic C6-C8	<29.5
Aliphatic >C8-C10	<29.5
Aliphatic >C10-C12	<6.00
Aliphatic >C12-C16	12.9
Aliphatic >C16-C35	37.5
Aromatic >C8-C10	<29.5
Aromatic >C10-C12	<6.00
Aromatic >C12-C16	7.7
Aromatic >C16-C21	7.16
Aromatic >C21-C35	7.76
TPH Mixtures (mg/kg-wet)	
TPH-GRO	<4.91
TPH-DRO	23.6
TPH-ORO	<6.64
PAHs (mg/kg-wet)	
Acenaphthene	0.478
Acenaphthylene	<0.33
Anthracene	<0.33
Benzo(a)anthracene	<0.33
Benzo(a)pyrene	<0.33
Benzo(b)fluoranthene	<0.33
Benzo(k)fluoranthene	<0.33
Chrysene	<0.33
Dibenz(a,h)anthracene	<0.33
Fluoranthene	0.625
Fluorene	0.448
Indeno(1,2,3-cd)pyrene	<0.33
2-Methylnaphthalene	0.336
Naphthalene	1.11
Phenanthrene	1.58
Pyrene	0.614

RECAP Form 3

Appendix B

Project No. 0116008
UNOCAL
Vermilion Parish, Louisiana

Environmental Resources Management Southwest, Inc.
3838 North Causeway Boulevard, Suite 3000
Metairie, Louisiana 70002
(504) 831-6700

RECAP FORM 3
ANALYTICAL DATA EVALUATION

Date February 15, 2016

Facility Name East White Lake oil and Gas Field

Agency Interest (AI #) 91357

Physical Site Location Vermilion Parish, Louisiana

Operation Address Not applicable

Owner/Responsible Party Address UNOCAL contact: Jennifer Ferratt
100 Northpark Boulevard
Covington, LA 70433

1. Data Generation

1.A All sample collection was done in accordance to applicable RECAP collection guidelines. [ ] Yes [X] No

Exceptions were identified in the data quality review section of the RECAP Report, Section 2.2. Primary deviations included the following: ICON installation of a well (TBB-3D) following drilling through a creosote-treated piling using mud-rotary method, with documented cross contamination of the drilling mud and target ground water sampling zone; improper casing and well development procedures following drilling through hydrocarbon impacted surface material (through former suspected pits) in the Tank Battery B area; well construction, development, and sampling issues at location BC-2. The results associated with well TBB-3D were rejected (as not representative) due to documented cross-contamination of the target sampling zone. The data associated with the other deficiencies noted are identified as warranting confirmation (see Section 2.2 of text).

1.B All generated data was obtained using EPA Methodology, RECAP approved methodology (as found in text), or methodology pre-approved by the Department. Any modifications to methodology have been noted, explained and pre-approved by the Department. [ ] Yes
[X] No

The use of the 29-B sample preparation method requested by ICON for metals analysis of sediment samples differs from the RECAP approved methodology by the addition of a pulverizing step before extraction. The subsequent analysis of the extract is consistent with RECAP-recommended methods. Split samples collected by MP&A utilized the appropriate sample preparation methods.

1.C All Data are analyte-specific and the identity and concentration are confirmed. [X] Yes [ ] No

1.D All data were generated by a LDEQ certified laboratory. [X] Yes [ ] No

2. Data Evaluation and Usability

2.A Methods used are appropriate for analyzed constituents:

1. Analysis used is specific for COCs. [X] Yes [ ] No

2. Results are produced with the most appropriate sensitive method. (e.g. not using portable field analytical instruments). [X] Yes [ ] No

2.B Sample Quantitation Limits (SQL)

Note: The SQL is not synonymous with the IDL (instrument detection limit) or the MDL (minimum detection limit). The SQL is derived after considering the effects of dilutions, loss of instrument sensitivity, matrix interferences, and other interferences effecting the lower-end accuracy of analysis, and therefore resulting in the elevation of the method detection limit. The SQL will be the only detection limit considered for comparison to limiting standards.

1. All SQLs are less than reference concentrations (RS or SS). [ ] Yes [X] No (If yes, proceed to Section 2C, Qualifiers and Codes).

2. Samples with SQLs greater than the limiting standard are not being reported as non-detected. (If yes, proceed to Item # 3 of this section). [ ] Yes [X] No

SQLs for aliphatics and aromatics in the >C10-C12 range exceeded the SS in one sediment sample (SS-26 0-2') but were below final limiting RS. SQLs exceeded SS in ground water for arsenic, cadmium, and lead in the following sample results from GCAL: TBB-1S, TBB-2M, TBA-2, BC-2, BC-4. Where available, detection limits for the split samples from Element Laboratory were less than SS.

If the SQL is higher than the limiting standard, and a non-detect is being reported, data may still be considered by the Department if all the below conditions are met:

(a) The non-detect results make up less than 5-10 percent of a sample set for a considered individual COC.

Considering the dataset available for the study area (including all data prior to this supplemental event), the non-detects with elevated detection limits for sediment or ground water make up well below 5-10 percent of data for any constituent.

(b) The ND is not classified as being from a key sampling location (e.g. drinking water well).

(c) Documentation provided by a LDEQ accredited laboratory (with supporting evidence) is included in the document demonstrating that a practical quantitation limit was not achievable due to site or sample-specific conditions.

The laboratory identified that the limited number of elevated detection limits in sediment resulted from elevated concentrations of other constituents in the same sample and, in ground water, from elevated TDS (salt) levels than can cause interference with metals detections.

Have the above three conditions been met? [X] Yes [ ] No

Note: If one or more of the above conditions cannot be met, the total (100%) value of the PQL may be reported as a positive detected result.

Will this option be used and annotated in the Report? [ ] Yes [ ] No

Not applicable.

Note: If all answers in this item are "no," analytical results will be rejected and re-sampling will be required.

3. Are sample results higher than both the PQL and the limiting standard? [ ] Yes [ ] No
(If so, results may be used despite elevated PQL).

See discussion above.

2.C Qualifiers and Codes

1. All qualifiers and codes for flagged data have been noted on form 3 and supporting documentation has been included in the laboratory information package. [X] Yes [ ] No

2. All data with a qualifier of "R" (unusable data) do not come from critical sample points (if so, resample will be required). [X] Yes [ ] No

Data rejected due to field method deficiencies (ground water samples for TBB-3D) have been identified for confirmation sampling. No data were rejected due to laboratory performance deficiencies.

3. All data with a qualifier of "J" (estimated concentrations) have been included as positive results. [X] Yes [ ] No

The benzene concentration reported for ground water sample BC-2 by GCAL laboratory was qualified "E" as exceeding the calibration range. This is equivalent to a J-qualifier, meaning the result is an estimated value. This sample location has been identified for confirmation sampling and the result was used in the RECAP evaluation, pending confirmation.

2.D Blank Samples

1. Field and laboratory blanks showed no signs of contamination, and no constituents were detected in blanks. (If no constituents or contaminants were detected, proceed to 2E, Tentatively Identified Compounds). [ ] Yes [X] No

2. Contaminants or constituents found in blanks can be considered common laboratory contaminants as defined by EPA (acetone, 2-butanone, methylene chloride, toluene, or phthalates); and the same contaminants found in site samples are present at quantities less than 10 times the levels found in blanks. (If no, constituents are to be reported as detected COCs). [ ] Yes [X] No

These constituents were not detected in blank samples.

3. Contaminants or constituents found in blanks are not considered common laboratory contaminants as defined by EPA; and the same contaminants found in site samples are present at quantities less than 5 times the levels found in blanks (If no, constituents are to be reported as detected COCs). [X] Yes [ ] No

The Element Laboratory (ICON data) method blank associated with sample TBA-1D 8015 DRO/ORO analysis contained low level detections for TPH-DRO and TPH-ORO. The TPH-DRO result was 1.6 times the concentration detected in the laboratory blank.

2.E Tentatively Identified Compounds (TIC)

All possible TIC have been identified, evaluation is supported with documentation in the text, and information conforms to the requirements as listed in Section 2.5 of the RECAP. [ ] Yes [ ] No

TIC Identification not applicable.

2.F Historical Data

1. All quantitative historical data has been reviewed by current QA/QC guidelines, and all applicable supporting information is justified and included in the report. [ ] Yes [ ] No

Not applicable, as no newly produced historical data are associated with this submittal.

2. All qualitative historical data is verifiable, has not been used quantitatively, and has only been used in the development of a conceptual model. [ ] Yes [ ] No

Not applicable.

3. Documentation

3.A Laboratory information package assembled as follows [X] Yes [ ] No:

1. Sample documentation (chains of custody, preparation time, time of analysis).
2. Sample and analyte identification and quantification.
3. Determination and documentation of sample quantitation limits (SQLs).
4. Initial and continuing calibration.
5. Performance evaluation samples (external QA or laboratory control samples)
6. Matrix spike recoveries.
7. Analytical error determination (determined with replicate samples).
8. Total measurement error determination summary. (Evaluates overall precision of measurement system from sample acquisition through analysis. Determined with field duplicate and matrix spike with matrix spike duplicate).
9. Explanation and supporting documentation for flagged data.

3.B All methods used in all analysis have produced tangible raw data (e.g. chromatograms, spectra, digital values), and are available to the Department upon request. [X] Yes [ ] No

1. Representative data is included in documentation as examples of method procedures. [X] Yes [ ] No

2. All flagged data is supported with complete associated tangible raw data. (e.g. depiction of matrix interferences, spiked recoveries reported outside of control limits, evidence for need for dilution etc.). [X] Yes [ ] No

Note: Any "no" answer must be explained at the conclusion of this form. Items not applicable should be left unmarked.

4. Submitter Information

Date February 15, 2016

Name of Person submitting this evaluation Angela Levert

Affiliation Environmental Resources Management

Signature  Date February 15, 2016

Additional Preparers Alyson Hubbs

Examination of Potential Background Levels for Chlorides

Appendix C

Project No. 0116008
UNOCAL
Vermilion Parish, Louisiana

Environmental Resources Management Southwest, Inc.
3838 North Causeway Boulevard, Suite 3000
Metairie, Louisiana 70002
(504) 831-6700

Appendix C
Examination of Potential Background Levels for Chlorides in Chicot Aquifer Confining Unit

An option recommended by USEPA for establishing a background concentration, to which site data can be compared, is the development of a Background Threshold Value. Current guidance (USEPA 2013) recommends comparing the means of site and background datasets using hypothesis tests (e.g., a t-test) when datasets are large enough, or use of Background Threshold Values (BTVs) when it is desirable to perform point-by-point comparisons, such as when performing delineation. Site-specific BTVs are defined as the upper 95 percent confidence limit on the 95th percentile. This BTV represents a value below which 95 percent of the natural (background) population values are expected to fall, with 95 percent confidence. BTVs were developed for chlorides for the Confining Unit Sand Layers to aid in the identification of sample results that are above the natural population range, with 95 percent confidence.

The ProUCL software tool is recommended by LDEQ for statistical analysis in support of RECAP, and was used for this analysis. ProUCL specifically provides BTV development techniques, which include constituent distribution testing and calculation of various potential BTVs based on distributions such as normal, lognormal, gamma, and no discernable distribution (nonparametric). BTVs were developed for the East White Lake study area using methods appropriate to the chlorides data distribution as recommended in USEPA guidance.

To develop BTVs for the study area, a potential background data set was selected by MP&A through examination of water quality indictors as well as examination of E&P indicator concentrations (MP&A, 2016). A minimum of ten samples are recommended to support statistical evaluation, and were available for the study area. Stiff diagrams and Piper diagrams for the selected background dataset were developed and confirmed the population for chlorides. Concentrations of the barium, strontium, and hydrocarbons were also examined in the selection of potential background wells (see discussion provided in MP&A, 2016). The following locations were identified as likely to represent natural conditions at the site:

AB-1 (40-50′)	HP-MPA-06 T (42-45′)
MW-4D (75-77′)	HP-MPA-06 I (72-75′)
Purvis Hebert Well (TD 41′)	HP-MPA-07 T (42-45′)
Crouch Well (TD 34′)	HP-MPA-07 I (72-75′)
HP-MPA-05 T (42-45′)	HP-MPA-10 T (42-45′)
HP-MPA-05 I (72-75′)	HP-MPA-10 I (72-75′)

Because the objective was to compute BTVs based upon the majority of the dataset representing the dominant background population, without influence by a few, low probability, high outliers (e.g., coming from extreme tails of the data distribution), the presence of outliers was examined using statistical techniques available in ProUCL (Dixon's test). The chlorides results for the Crouch well were identified as statistical outliers. The water chemistry for this well, most notably the elevated sulfate level, suggests significant influence from surface water infiltration. Consistent with the USEPA and ProUCL guidance, the BTV calculations were performed with and without the Crouch well results for full information, and the results excluding the Crouch well were used as final BTVs. Additionally, because locations MPA-HP-05, MPA-HP-06, and MPA-HP-07 are located closest to AOIs identified within the 40 to 60 Foot Zone (Figure 6-3), the BTV calculations were performed including and excluding these results. The full dataset is identified in Table C-1. Results of BTV estimates were found to be similar using average or individual split results, and the results using individual splits are provided herein.

Selection of BTVs

When many onsite values need to be compared with a BTV, USEPA recommends calculation of an Upper Tolerance Limit (95-95 UTL) or upper simultaneous limit (USL) as the BTV, and ProUCL offers a number of different techniques for calculating 95-95UTLs and USLs. The selection of the appropriate technique depends on the distribution of the underlying population. Accordingly, a goodness of fit test was conducted to determine the distribution type, and the appropriate BTV was then selected as follows:

1. If the dataset was normally distributed, the Normal Studentized t 95UTL or USL was selected;
2. If the dataset was gamma distributed, the 95% WH Approx. Gamma UTL with 95% Coverage or gamma USL was selected. This represents the most conservative (lowest) of the gamma BTVs.
3. If the data was neither normal nor gamma distributed, the non-parametric UTL or USL was used. Lognormal distributions are known to have BTVs that are biased high, so non-parametric BTVs are preferred for these distribution types (USEPA 2013).

A summary of the calculated UTLs and USLs are provided in Table C-2. Considering the recommended UTLs and USLs, as both are acceptable BTVs according to USEPA Guidance (2013), a range was identified for the potential chlorides threshold value. A rounded range of 1100 to 1200 mg/L chlorides is identified as the potential threshold level below which 95 percent of the natural chlorides levels are expected to fall.

RECAP Methods

The methods described in RECAP Section 2.13 (Identification of a Background Concentration) are a simplified version of hypothesis testing, as RECAP calls for the comparison of means of the background data set and the AOI compliance dataset. The section focuses on soil characterization methods, and provides for use of alternative and more rigorous methods, noting "Statistical methods used to establish background concentrations are subject to

Department approval." Based upon the desired use of the background levels to evaluate impact at individual locations, to establish delineation, and to do so at a known and defensible confidence level, the BTVs provide the most useful statistical metric for the ground water chlorides assessment. For complete information, the RECAP-method provides the following range of chlorides values for comparison to mean site concentrations: 872 mg/L to 1124 mg/L. More robust and defensible hypothesis testing (e.g., using statistical software) is recommended if analyses regarding mean concentrations are desired.

REFERENCES

U.S. Environmental Protection Agency (USEPA). 2006. Data Quality Assessment: Statistical Methods for Practitioners. EPA/240/B-06/003. Office of Environmental Information, Washington, D.C

U.S. Environmental Protection Agency (EPA). 2013. ProUCL Version 5.0.00 Technical and Users Guide: Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. Publication EPA/600/R-07/041, September 2013.

U.S. Navy. 2002. Guidance for Environmental Background Analysis. Volume I: Soil. UG-2049-ENV. Naval Facilities Engineering Command (NAVFAC). Washington, D.C.

TABLE C-1

POTENTIAL BACKGROUND WELLS
CHLORIDES DATA

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Sample Interval (ft)	Sample Date	Sampled By	Chlorides (mg/L)
AB1	40-50	11/10/2006	ICON	888
HP-MPA-05-T	42-45'	9/30/2010	ICON	890
HP-MPA-05-T	42-45'	9/30/2010	MPA	831
HP-MPA-06-T	42-45'	9/30/2010	ICON	1100
HP-MPA-06-T	42-45'	9/30/2010	MPA	957
HP-MPA-07-T	42-45'	10/1/2010	ICON	834
HP-MPA-07-T	42-45'	10/1/2010	MPA	808
HP-MPA-10-T	42-45'	10/1/2010	ICON	820
HP-MPA-10-T	42-45'	10/1/2010	MPA	850
Purvis Hebert Well (in use)	est. 41ft	9/1/2010	ICON	824
Purvis Hebert Well (in use)	est. 41ft	9/1/2010	MPA	851
Purvis Hebert Well (in use)	est. 41ft	4/21/2014	MPA	555
A. Crouch Well (abandoned)	est. 34ft	9/1/2010	ICON	1630
A. Crouch Well (abandoned)	est. 34ft	9/1/2010	MPA	1570
MW-4D	75-77	5/12/2010	MPA	447
MW-4D	75-77	5/12/2010	ICON	426
HP-MPA-05-I	72-75'	10/6/2010	ICON	760
HP-MPA-05-I	72-75'	10/6/2010	MPA	629
HP-MPA-06-I	72-75'	10/6/2010	ICON	900
HP-MPA-06-I	72-75'	10/6/2010	MPA	851
HP-MPA-07-I	72-75'	10/5/2010	ICON	850
HP-MPA-07-I	72-75'	10/5/2010	MPA	696
HP-MPA-10-I	72-75'	10/6/2010	ICON	690
HP-MPA-10-I	72-75'	10/6/2010	MPA	613

TABLE C-2
SUMMARY OF ProUCL OUTPUT FOR BACKGROUND THRESHOLD VALUES

East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

							Normal		Gamma			Lognormal		No Discernable Distribution						
Analyte	Dataset	n	Mean	SD	Max	Distribution N G L NDD	Normal 95% UTL with 95% Coverage	Normal 95% USL	95% WH Approx. Gamma UTL with 95% Coverage	95% HW Approx. Gamma UTL with 95% Coverage	95% WH USL	Lognormal 95% UTL (t)	Lognormal 95% USL	Nonparametric 95% UTL with 95% Coverage	95% Percentile Bootstrap UTL with 95% Coverage	95% BCA Bootstrap UTL with 95% Coverage	Non-parametric 95% USL	Recommended UTL	UTL Type	Recommended USL	USL Type
Chloride	Full Background Data Set	24	844.6	279.8	1630	X	1491	1584	1564	1580	1700	1644	1823	1630	1630	1630	1630	1630	Nonparametric 95% UTL with 95% Coverage	1630	Non-parametric 95% USL
Chloride	Background Excl. Crouch Well	22	775.9	162.5	1100	X	1158	1199	1245	1261	1307	1317	1398	1100	1100	1093	1100	1158	Normal 95% UTL with 95% Coverage	1199	Normal 95% USL
Chloride	Background Excl. Crouch Well and HP-MPA-5, 6, 7	10	696.4	175.8	888	X X X	1208	1079	1367	1397	1164	1509	1231	888	888	888	888	1208	Normal 95% UTL with 95% Coverage	1079	Normal 95% USL

Notes:

Full Background Data Set:

- AB-1 (40-50')
- MW-4D (75-77')
- Purvis Hebert Well (TD 41')
- Crouch Well (TD 34')
- HP-MPA-05 T (42-45')
- HP-MPA-06-T (42-45')
- HP-MPA-07 T (42-45')
- HP-MPA-10 T (42-45')
- HP-MPA-05 I (72-75')
- HP-MPA-06-I (72-75')
- HP-MPA-07 I (72-75')
- HP-MPA-10 I (72-75')

Distribution:

N= Normal
G= Gamma
L= Lognormal
NDD= No Discernable Distribution

ProUCL Output Sheets

Outlier Tests for Selected Uncensored Variables

User Selected Options

Date/Time of Computation 2/14/2016 10:14:09 PM

From File CI Bkg Data_Indiv.xls

Full Precision OFF

Dixon's Outlier Test for CI_Indiv_all

Number of Observations = 24

10% critical value: 0.367

5% critical value: 0.413

1% critical value: 0.497

1. Observation Value 1630 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.493

For 10% significance level, 1630 is an outlier.

For 5% significance level, 1630 is an outlier.

For 1% significance level, 1630 is not an outlier.

2. Observation Value 426 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.191

For 10% significance level, 426 is not an outlier.

For 5% significance level, 426 is not an outlier.

For 1% significance level, 426 is not an outlier.

Dixon's Outlier Test for CI_Indiv_xcrouch max

Number of Observations = 23

10% critical value: 0.374

5% critical value: 0.421

1% critical value: 0.505

1. Observation Value 1570 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.604

For 10% significance level, 1570 is an outlier.

For 5% significance level, 1570 is an outlier.

For 1% significance level, 1570 is an outlier.

2. Observation Value 426 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.243

For 10% significance level, 426 is not an outlier.

For 5% significance level, 426 is not an outlier.

For 1% significance level, 426 is not an outlier.

Background Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation	2/6/2016 9:11:26 PM
From File	C:\Users\Alyson.Hubbs\Documents\ERM\00_Work\Lit\EWL 116008\GW\Chloride Bkg Calc _RECAP\BG well dat
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
New or Future K Observations	1
Number of Bootstrap Operations	2000

CI_Indiv_all

General Statistics

Total Number of Observations	24	Number of Distinct Observations	22
Minimum	426	First Quartile	694.5
Second Largest	1570	Median	832.5
Maximum	1630	Third Quartile	888.5
Mean	844.6	SD	279.8
Coefficient of Variation	0.331	Skewness	1.502
Mean of logged Data	6.692	SD of logged Data	0.309

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.309	d2max (for USL)	2.644

Normal GOF Test

Shapiro Wilk Test Statistic	0.826	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.916	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.255	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.181	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with	95% Coverage	1491	90% Percentile (z)	1203
	95% UPL (t)	1334	95% Percentile (z)	1305
	95% USL	1584	99% Percentile (z)	1496

Gamma GOF Test

A-D Test Statistic	1.077	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.211	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.178	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.84	k star (bias corrected MLE)	9.516
Theta hat (MLE)	77.89	Theta star (bias corrected MLE)	88.75
nu hat (MLE)	520.5	nu star (bias corrected)	456.8
MLE Mean (bias corrected)	844.6	MLE Sd (bias corrected)	273.8

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	1354	90% Percentile	1209
95% Hawkins Wixley (HW) Approx. Gamma UPL	1359	95% Percentile	1339
95% WH Approx. Gamma UTL with 95% Coverage	1564	99% Percentile	1608
95% HW Approx. Gamma UTL with 95% Coverage	1580		
95% WH USL	1700	95% HW USL	1725

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.916	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.181	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	1644	90% Percentile (z)	1197
95% UPL (t)	1383	95% Percentile (z)	1339
95% USL	1823	99% Percentile (z)	1653

Nonparametric Distribution Free Background Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	24	95% UTL with 95% Coverage	1630
Approximate f	1.263	Confidence Coefficient (CC) achieved by UTL	0.708
95% Percentile Bootstrap UTL with 95% Coverage	1630	95% BCA Bootstrap UTL with 95% Coverage	1630
95% UPL	1615	90% Percentile	1057
90% Chebyshev UPL	1701	95% Percentile	1500
95% Chebyshev UPL	2090	99% Percentile	1616
95% USL	1630		

Note: The use of USL to estimate a BTV is recommended only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

Background Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation	2/6/2016 9:29:58 PM
From File	C:\Users\Alyson.Hubbs\Documents\ERM\00_Work\Lit\EWL 116008\GW\Chloride Bkg Calc _RECAP\BG well data
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
New or Future K Observations	1
Number of Bootstrap Operations	2000

CI_Indiv_xcrouch

General Statistics

Total Number of Observations	22	Number of Distinct Observations	20
		Number of Missing Observations	2
Minimum	426	First Quartile	691.5
Second Largest	957	Median	827.5
Maximum	1100	Third Quartile	851
Mean	775.9	SD	162.5
Coefficient of Variation	0.209	Skewness	-0.621
Mean of logged Data	6.63	SD of logged Data	0.236

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.349	d2max (for USL)	2.603

Normal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.215	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.189	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with	95% Coverage	1158	90% Percentile (z)	984.1
	95% UPL (t)	1062	95% Percentile (z)	1043
	95% USL	1199	99% Percentile (z)	1154

Gamma GOF Test

A-D Test Statistic	1.11	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.185	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	20.71	k star (bias corrected MLE)	17.92
Theta hat (MLE)	37.46	Theta star (bias corrected MLE)	43.3
nu hat (MLE)	911.4	nu star (bias corrected)	788.5
MLE Mean (bias corrected)	775.9	MLE Sd (bias corrected)	183.3

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	1109	90% Percentile	1018
95% Hawkins Wixley (HW) Approx. Gamma UPL	1118	95% Percentile	1100
95% WH Approx. Gamma UTL with 95% Coverage	1245	99% Percentile	1265
95% HW Approx. Gamma UTL with 95% Coverage	1261		
95% WH USL	1307	95% HW USL	1326

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.871	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.911	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.189	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	1317	90% Percentile (z)	1024
95% UPL (t)	1146	95% Percentile (z)	1116
95% USL	1398	99% Percentile (z)	1310

Nonparametric Distribution Free Background Statistics

Data appear Approximate Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	22	95% UTL with 95% Coverage	1100
Approximate f	1.158	Confidence Coefficient (CC) achieved by UTL	0.676
95% Percentile Bootstrap UTL with 95% Coverage	1100	95% BCA Bootstrap UTL with 95% Coverage	1100
95% UPL	1079	90% Percentile	899
90% Chebyshev UPL	1274	95% Percentile	954.2
95% Chebyshev UPL	1500	99% Percentile	1070
95% USL	1100		

Note: The use of USL to estimate a BTV is recommended only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

Background Statistics for Uncensored Full Data Sets

User Selected Options

Date/Time of Computation	2/6/2016 11:00:02 PM
From File	C:\Users\Alyson.Hubbs\Documents\ERM\00_Work\Lit\EWL 116008\GW\Chloride Bkg Calc _RECAP\BG well data
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
New or Future K Observations	1
Number of Bootstrap Operations	2000

Cl_Indiv_xHPxCrouch

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	14
Minimum	426	First Quartile	569.5
Second Largest	851	Median	755
Maximum	888	Third Quartile	843.5
Mean	696.4	SD	175.8
Coefficient of Variation	0.252	Skewness	-0.521
Mean of logged Data	6.514	SD of logged Data	0.277

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.871	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.259	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with	95% Coverage	1208	90% Percentile (z)	921.7
	95% UPL (t)	1034	95% Percentile (z)	985.5
	95% USL	1079	99% Percentile (z)	1105

Gamma GOF Test

A-D Test Statistic	0.646	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.272	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.266	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	15.59	k star (bias corrected MLE)	10.98
Theta hat (MLE)	44.67	Theta star (bias corrected MLE)	63.42
nu hat (MLE)	311.8	nu star (bias corrected)	219.6
MLE Mean (bias corrected)	696.4	MLE Sd (bias corrected)	210.2

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	1099	90% Percentile	975.6
95% Hawkins Wixley (HW) Approx. Gamma UPL	1110	95% Percentile	1074
95% WH Approx. Gamma UTL with 95% Coverage	1367	99% Percentile	1276
95% HW Approx. Gamma UTL with 95% Coverage	1397		
95% WH USL	1164	95% HW USL	1179

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.855	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.26	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	1509	90% Percentile (z)	961.2
95% UPL (t)	1148	95% Percentile (z)	1063
95% USL	1231	99% Percentile (z)	1284

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	888
Approximate f	0.526	Confidence Coefficient (CC) achieved by UTL	0.401
95% Percentile Bootstrap UTL with 95% Coverage	888	95% BCA Bootstrap UTL with 95% Coverage	888
95% UPL	888	90% Percentile	854.7
90% Chebyshev UPL	1249	95% Percentile	871.4
95% Chebyshev UPL	1500	99% Percentile	884.7
95% USL	888		

Note: The use of USL to estimate a BTV is recommended only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

Professional Profile

Appendix D

Project No. 0116008
UNOCAL
Vermilion Parish, Louisiana

Environmental Resources Management Southwest, Inc.
3838 North Causeway Boulevard, Suite 3000
Metairie, Louisiana 70002
(504) 831-6700

Angela M. Levert

Directs risk assessment practice for Gulf Coast offices of Environmental Resources Management (ERM). Over twenty five years experience in environmental impact assessments and risk assessments for waste sites.

Experienced in the fields of human health and ecological risk assessment and multi-media cleanup level development. Managed the development and implementation of investigation plans in support of risk-based closures. Ms. Levert has performed, and directed performance of, complex baseline risk assessments for sites having affected soil, sludge, surface water, and ground water. Projects included modeling constituent transport through various media to estimate exposure point concentrations, estimating risk using site-specific exposure considerations and available toxicological literature, and communicating resulting risk estimates to stakeholders including regulatory agencies and the public. Established cleanup levels and exposure control measures for environmental media (soil, ground water, sediment) at CERCLA, RCRA, state Superfund, voluntary program, and other sites, and presented and negotiated risk-based corrective action plans with state and federal agencies in multiple EPA regions. Analyzed risk reduction vs. remediation cost to support cost-benefit analysis in feasibility studies and corrective action decision-making.

Provided litigation support related to environmental impact and related risk/health impact claims. Prepared expert opinions and provided deposition and court testimony on risk-based evaluations, particulalry for upstream oil and gas exploration and production sites. Ms. Levert is a qualified expert in the areas of environmental data evaluation and environmental risk assessment.

Fields of Competence

- Human health and ecological risk assessment
- Risk-based closures
- Environmental chemistry
- Fate and transport of chemicals
- Technical data validation
- Statistical methods for data analysis

Education

- M.S. Environmental Chemistry, The University of North Carolina (1990)
- B.S. Chemistry, Spring Hill College (1988)

Professional Affiliations

- American Chemical Society
- Society for Risk Analysis
- Society for Environmental Toxicology and Chemistry
- Air & Waste Management Association

Honors and Awards

- Summa Cum Laude graduate
- Spring Hill College Presidential Award for Outstanding Chemistry Student
- University of North Carolina Department of Environmental Sciences and Engineering, Achievement Award for Outstanding Academic and Professional Potential

Publications

Miller, Pedit, Levert and Rabideau. "Investigation of Multicomponent Sorption and Desorption Rates in Saturated Ground Water Systems." Report No. 263 of the Water Resources Research Institute. March 1992.

Key Projects

- Managed the development and implementation of investigation plans in support of risk assessment and risk-based closures in Texas, Louisiana, Tennessee, Alabama, Mississippi and other southeastern locations.
- Prepared risk-based closure demonstrations for over 100 sites under Texas Risk Reduction Program, Louisiana RECAP program and other state-specific RBCA-type programs.
- Developed risk-based assessment programs for RCRA Facility Investigations (RFIs) at refineries in Louisiana, Texas, Kansas, and Montana. Presented and resolved complex technical issues with regulators.
- Developed risk-based cleanup levels and supported risk-based remediation programs for hydrocarbon spills, fuel manifolds and pumping stations, terminals and refineries, specialty chemical manufacturers, caustic releases and waste disposal facilities.
- Developed site-specific TPH cleanup levels utilizing fraction and surrogate methods at refineries, bulk terminals, railyards, and other hydrocarbon release sites.
- Proposed and negotiated health-based cleanup levels for a former metal galvanizing site in Ohio (NPL site). Developed a model in spreadsheet form to be used during remediation (real time) to re-evaluate cleanup levels based on confirmatory samples.
- Evaluated appropriateness of National Ambient Water Quality Criteria for nickel and silver in the State of Mississippi for the purpose of developing an alternate wastewater discharge limit for a photo processing site. Developed a Mississippi-specific database of toxicity data and recalculated the acute water quality criterion according to EPA-approved methodology. Assisted in design of a bioassay study for site-specific criterion modification.
- Managed the multi-media RECAP evaluation and Corrective Measures Study for a large chemical facility in southern Louisiana. Chlorinated solvent and hydrocarbon impacts to ground water, soil, and sediment were identified to require risk management or corrective action. Numerous potential remedial alternatives were evaluated in detail, and the final corrective measures were selected based upon ability to meet risk-based standards and technical and economic feasibility. The final approved remedy included a combination of active remedy and risk management through engineering and administrative controls.
- Presented and resolved complex technical and strategic risk-based issues in EPA Regions 4, 5, 6,7, 8 and 9 as well as many states.
- Selected to serve as technical expert on risk assessment issues for the U.S. Army Corps of Engineers, Nashville District.
- Actively provided review of Draft RECAP regulation at each promulgation. Prepared written comments on Draft RECAP regulations and presented comments in meetings with LDEQ.
- Prepared human health risk evaluations for oil and gas exploration and production (E&P) sites, natural gas processing facilities, and other sites under the jurisdiction of the Louisiana Department of Natural Resources (LDNR). These assessments were utilized by LDNR as supplements to the Statewide Order 29-B regulations in closure activities for E&P sites. Interacted with LDNR in support of site evaluation and closure determinations.
- Prepared expert opinions and provided testimony on human health risk issues for oil and gas E&P sites across Louisiana. Qualified as an expert in environmental data evaluation, human health risk assessment, and LDEQ RECAP regulation. Impacts evaluated have included brine and petroleum hydrocarbons from historical production activities. Opinions were focused on claims of impact/risk, and claims for requisite cleanup.