PROPOSED PLAN FOR EVALUATION AND REMEDIATION, IF NECESSARY, OF PROPERTY PURSUANT TO LIMITED ADMISSION

Harold J. Guidry, et al.
v. BP America Production Company, et al.
16th Judicial District Court, Division "G", Docket No. 82537
LDNR OC Legacy Project No. 016-001-001
Anse La Butte Oil and Gas Field
Section 72; Township 09 South; Range 05 East
St. Martin Parish, Louisiana
April 27, 2017

Prepared for

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PROPOSED PLAN FOR EVALUATION AND REMEDIATION, IF NECESSARY, OF PROPERTY PURSUANT TO LIMITED ADMISSION

April 27, 2017

Hydro-Environmental Technology, Inc. (HET) is submitting this plan to the law firm of Liskow & Lewis, on behalf of BP America Production Company, and the Environmental Division of the Office of Conservation, Louisiana Department of Natural Resources (LDNR), to present the most feasible plan for evaluation and, if necessary, remediation, regarding the investigations of the Harold J. Guidry, Natalie G. Guidry, Sheree Blanchard, and Robert J. Campbell, III, property located along Louisiana Highway 94, near Breaux Bridge, St. Martin Parish, Louisiana. The plan was prepared to evaluate or remediate the environmental damage within the Limited Admission soil and groundwater areas defined herein in accordance with the requirements of the applicable rules and regulations of the LDNR or the Louisiana Department of Environmental Quality (LDEQ) as applicable through the LDNR. Where applicable or relied upon, rules and regulations of the LDEQ are cited in the plan. This plan was prepared in adherence to Hydro-Environmental Technology, Inc.'s strict quality assurance/quality control procedures to ensure that the plan meets the highest standards in terms of the methods used to obtain the information presented.

This plan is based on field data collected and information received from the client, other parties associated with the client and other third parties during the period of January 15, 2016 to April 27, 2017. All conclusions and recommendations are based on available information cited herein, and should be reviewed within this context. Should conditions at the site in question change, or additional information become available, especially with regard to prior site conditions, it may be necessary to modify these conclusions and recommendations accordingly in the future. The contents of this plan are proprietary, and text, illustrations, and/or any other parts of this plan may not be reproduced without the express written permission of Hydro-Environmental Technology, Inc.

Should you have any questions or need further information, please feel free to call.

Sincerely,

HYDRO-ENVIRONMENTAL TECHNOLOGY, INC.
Project #1009.A34

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BTP/SLS/eop

This Proposed Remediation Plan was additionally prepared with support and authorship contributions from the following experts, on behalf of BP America Production Company (BP):

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Dr. Robert Cox, M.D., Ph.D.
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EXECUTIVE SUMMARY

Site Status

This plan is submitted in connection with a Limited Admission made on behalf of BP in the matter styled *Guidry et al. v. BP America Production Company, et al.* The case is currently set for trial beginning on December 04, 2017. The Limited Admission pertains only to the groundwater found in the saturated zone at fifty (50) to eighty (80) feet below land surface (BLS) within the Groundwater Area, and the soil found within the Soil Area (Figure 3). The site is currently undeveloped and only being utilized as a corridor for various flowlines and pipelines servicing surrounding exploration and production operations.

History

The Guidry property and surrounding properties have been subject to exploration and production in the Anse La Butte Oil and Gas Field since the late 1890s, with production now ceased on the Guidry property, with the exception of the presence of pipeline right-of-ways. The plaintiffs filed suit in 2015 against BP and others, alleging environmental damage on their property located in Sections 71, 72, and 73 (formerly designated as Section 121) in Township 09 South, Range 05 East in St. Martin Parish, Louisiana, and sought restoration costs based on reports issued by their consultants, ICON Environmental Services, Inc. (ICON). Hydro-Environmental Technology, Inc. (HET) and other experts subsequently conducted an additional investigation.

Therefore, as per court order, the authors, on behalf of BP, now present this plan to the LDNR under the Office of Conservation Legacy Project No. 016-001-001 to establish the most feasible plan for further evaluation and remediation, as necessary and appropriate.

Reason for Assessment

ICON conducted an assessment of the property, on behalf of the landowner, as part of the litigation in 2015 and 2016 and presented the results in a Report of Environmental Sampling Data dated July 01, 2016, including supplemental information, and the Expert Report and Restoration Plan dated February 24, 2017. Therefore, HET and other experts subsequently conducted further assessment of the site in 2016 to more accurately determine the natural conditions of the property and conduct a more detailed assessment to establish appropriate regulatory status of the site.

Site Characteristics

The site hydrogeology is characterized by a continuous surficial clay confining unit from land surface to depths of twenty-seven (27) and thirty-six (36) feet BLS. This confining unit mainly consists of clay and contains silt content with varying thicknesses, mainly at the ten (10) foot zone. Geotechnical data collected from this unit demonstrated vertical hydraulic conductivity values that ranged from $1.47x10^{-7}$ centimeters/second (cm/sec) to $5.6x10^{-9}$ cm/sec across the site. Underlying the confining unit are the sands of the Atchafalaya aquifer. These sands contain minor silt content on the western side of the property and no silt content on the eastern side of the property. The eastern side of the property beginning approximately at monitor well MW7 contains numerous layers of clay and clay beds at approximately forty-five (45) to fifty-five (55) feet BLS that are not observed on the western side of the property. The facies change in this area represents a change in depositional environment within the upper portions of the Atchafalaya aquifer. Small diameter gravel was encountered in most wells, if not all, at depths of fifty (50) feet on the west side and eighty (80) feet BLS on the east side of the site. For the purposes of this investigation, shallow (35-50' BLS), intermediate (50-80' BLS), and deep (80-120' BLS) zones have been designated.

From information obtained from the Environmental Regulatory Code (LAC 33.IX.1123), the site is located within the Breaux Bridge Swamp-Forested wetlands in subsegment number 060805. Surface water bodies, including tributaries and drainage canals, within this subsegment are not utilized as sources of drinking water. Surface water quality with regard to salinity has not been established for this subsegment, which is designated as naturally dystrophic waters.

Release Source

No on-going sources have been identified, and the release source is unknown at this time. Based on information obtained, the source area appears to be limited in extent within the intermediate zone.

Soil Type

According to the United States Department of Agriculture (USDA) Soil Survey of St. Martin Parish (1977 and updated via the online database), the soil types for Guidry property include Acy Silt Loams, Coteau Silt Loams, Fausse Association, and Sharkey Clays (both rarely flooded and frequently flooded). The Acy and Coteau Silt Loams are located on Terrace Uplands and are gently sloping, somewhat poorly drained soils. The Sharkey Clays (rarely flooded) are located on broad, level areas associated with the natural levee and back swamp deposits of clayey alluvium within the overall Atchafalaya Basin and are poorly drained. The Sharkey Clays (frequently flooded) are located in back swamps and flood plains, while the Fausse Association soils are located in flood plains, both being poorly drained soils.

High/Low Concentrations (Soil)

Select elevated concentrations of electrical conductivity (EC), sodium absorption ratio (SAR), and exchangeable sodium percentage (ESP) above the Statewide Order 29-B upland criteria were detected in the surface soils within the pipeline right-of-way within the Limited Admission area in soil boring ICON GH-7 at depths between two (2) and ten (10) feet BLS and in soil borings MP&A SB12 and SB13 at depths less than three (3) feet BLS. In addition, HET identified elevated EC concentrations in monitor well MW5 (also referred to as deep boring DB5) at depths between fifty-six (56) and sixty-four (64) feet BLS within clay lenses associated with the intermediate groundwater zone. The elevated EC concentrations range between 5.01 mmhos/cm [GH-7(8-10')] and 21.2 mmhos [MW5(55-58')]. The concentrations of chloride related parameters in the soil demonstrate that the subsurface concentrations of chloride and sodium are considered below the threshold to continue to result in cross media transfer (soil to groundwater).

With regard to hydrocarbons and metals, all of the concentrations detected within the Limited Admission area (Figure 3) are reported below the Statewide Order 29-B standards, with the exception of arsenic at concentrations upward of 11.9 parts per million (ppm) [GH-7(8-10')] to 12.8 ppm [SB-4(4-6')]. However, the elevated concentration of arsenic is below the LDEQ statewide background concentrations of twelve (12) ppm once the above concentration is converted to a wet-weight concentration and confirmatory sampling could be conducted to confirm the concentrations above the Statewide Order 29-B standard of ten (10) ppm as the sampling data differs between the sampling parties if desired. Furthermore, total barium concentrations detected at a dry-weight concentration of 693 ppm [SB4(0-2')] are below the RECAP, Management Option 1 standards and the True Total Barium concentration detected in the same sample was less than the Statewide Order 29-B standard of 40,000 ppm.

High/Low Concentrations (Groundwater)

Laboratory analytical results from groundwater samples collected report varying concentrations of chlorides, with natural tolerances of chlorides reporting concentrations upward of 241 ppm based on a review of the data. Elevated chloride and TDS concentrations above background tolerances range upward of 7,260 ppm and 12,300 ppm, respectively, in groundwater samples collected from ICON monitor well GC8D (50-60'). Hydrocarbon concentrations reported in total petroleum hydrocarbons were not confirmed in the fraction and indicator compound analyses in the groundwater. However, elevated concentrations of barium upward of 4.72 ppm above the RECAP screening standard of 2 ppm and radium upward of 10.74 Picocuries per liter (pCi/L) above the EPA Secondary Drinking Water standard of five (5) pCi/L were detected in the intermediate zone. However, Dr. Frazier determined that the radium concentrations were indicative of natural conditions. Remaining concentrations of the metals in the groundwater were not confirmed in the dissolved analyses. Concentrations of iron and manganese appear to be associated with the overall deposition environment and conditions within the aquifer itself.

Free Product Conditions

No phase separated hydrocarbons were identified during the investigations conducted by HET and ICON.

Potential Receptors

The Atchafalaya aquifer is a source of domestic and public supply in the vicinity of the Anse La Butte salt dome at depths of eighty (80) feet BLS and greater. However, no potable water supplies are being used on the Guidry property, which is undeveloped, and regional water supply samples collected by ICON did not identify use of contaminated groundwater as a result of the BP areas of operation outlined in the Limited Admission areas (Figure 3).

Problem Evaluation

In connection with the litigation, ICON proposed a soil and groundwater restoration plan that includes a sliding scale of options based on different scenarios, including different comparative standards (i.e. either background or regulatory standards) and disposal options (i.e. off-site disposal or local injection of wastewater). However, the soil remedy in each of the scenarios is consistent in proposing excavation of elevated EC values to depths upward of twenty-four (24) feet BLS and treatment of SAR with soil amendments. Similarly, the costs associated with the ICON proposed plan vary widely from $11,825,481 to $249,154,558 and include additional delineation assessment of the aquifer in the amount of $172,166.00.

Therefore, experts retained, on behalf of BP, propose a comprehensive plan for management and restoration of soil and groundwater within the Limited Admission areas. Soil will be handled by monitored natural attenuation with observations of vegetative growth and possible confirmatory sampling as concentrations do not impede the intended uses of the property and are protective of groundwater. Groundwater within the intermediate zone will be managed initially by further evaluation of constituents of concern and, if necessary, aquifer feasibility studies conducted in a series with the Monitored Natural Attenuation (MNA) program. During the MNA program, should water supplies be necessary, contingency plans are in place to install water wells in the lower portion of the aquifer that are not impacted. Finally, should the MNA program need enhancement, a contingency groundwater withdrawal program has been prepared with local disposal through an injection well for a period of one (1) year. The anticipated costs associated with the most feasible plan is approximately $1,004,198.58.

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Appendices

1.0: INTRODUCTION

Hydro-Environmental Technology, Inc. (HET) has prepared the following plan for further evaluation and remediation, if necessary and appropriate, regarding selected portions of the Harold J. Guidry, Natalie G. Guidry, Sheree Blanchard, and Robert J. Campbell, III, property located along Louisiana Highway 94, near Breaux Bridge, St. Martin Parish, Louisiana. This plan constitutes, in the opinion of the authors, the most feasible plan for evaluation and, if necessary, remediation in compliance with the rules of the Louisiana Department of Natural Resources, Office of Conservation ("the Department") governing proceedings in connection with a Limited Admission made by BP America Production Company (BP) in the case titled *Harold J. Guidry, et al. v. BP America Production Company, et al.*, 16th Judicial District Court for the Parish of St. Martin, Docket No. 82537, Division "G". This plan includes an evaluation of all data generated during separate assessments conducted by multiple consultants, including HET, on behalf of BP; ICON Environmental Services, Inc. (ICON), as representatives of the landowners; and Michael Pisani and Associates, Inc. (MP&A), on behalf of Devon Energy Production, L.P. and BP.

This plan includes information provided by the following experts: 1) Mr. Stewart "Smokey" L. Stover, Jr., Principal Hydrogeologist with HET, 2) Mr. Brent T. Pooler, Principal Risk Analyst and Senior Hydrogeologist with HET, 3) John Frazier, Ph.D., a Health Physicist, 4) Bruce K. Darling, Ph.D., a Geochemist, 5) B.H. Kueper, Ph.D., a Hydrogeologist with B. Kueper & Associates, Ltd., 6) Mr. Don Bazer, a licensed Petroleum Engineer and Senior Advisor with DOR Lease Service, Inc., 7) Mr. B. Arville Touchet, Soil Scientist with Bayou Cajun Environmental, Soil, and Wetland Services, Inc., 8) Luther Holloway, Ph.D., Botanist with Holloway Environmental Services, Inc., 9) Barry Gillespie, Ph.D., Environmental Toxicologist, Biologist, and Partner with Environmental Resources Management (ERM), and 10) Dr. Robert Cox, a medical doctor and Toxicologist at the University of Mississippi Medical Center. More detailed information on the qualifications of these experts is outlined in Section 1.6 below, with the resumes included in Appendix A.

The investigations conducted by the experts retained on behalf of BP were done in accordance with applicable and appropriate regulations to determine the most feasible plan for the site, including

Statewide Order 29-B per the LDNR regulations (LAC 43:XIX Chapter 3) and the Risk Evaluation/Corrective Action Program (RECAP), as promulgated by the Louisiana Department of Environmental Quality (LDEQ) under the most recent guidance document dated October 20, 2003 (LAC 33:1 Chapter 13). In addition, the evaluation and remediation plan presented below contains and considers options for compliance with past agency requests for plans addressing remediation of groundwater to background conditions, as further explained below, and is being submitted as part of administrative requirements only. Note that the application of RECAP standards is included in response to soil and groundwater data collected on behalf of the plaintiffs during their investigation and to evaluate the groundwater conditions and of the site pursuant to the memorandum of understanding between the LDNR and the LDEQ dated February 2011.

1.1: Site Description

The Guidry property is located along Louisiana Highway 94, approximately 1.5 miles east of the boundary between Lafayette and St. Martin parishes within the Anse La Butte Oil and Gas Field, west of Breaux Bridge, Louisiana. The property is geographically located in Sections 71, 72, and 73, Township 09 South, Range 05 East in St. Martin Parish, Louisiana, formerly designated as Section 121 in the same Township and Range. Figure 1 contains a topographic map illustrating the location of the Guidry property as determined from the St. Martin Parish Assessor's Office, as well as a portion of the Bundrick property investigated separately by HET as part of litigation (Vincent Charles Bundrick and Cajun Pride, Inc. v. Anadarko Petroleum Corporation, et al., 16th Judicial District Court for the Parish of St. Martin, Docket No. 70353, Division "A") and in response to a compliance order issued by the LDNR based on a review of the data generated under Legacy Project No. 016-001-001. Note that the Guidry property located east of Bergeron Road depicted in the figures was not included within the lawsuit, however, was subject to investigations by both HET and ICON.

The property is located in a rural portion of St. Martin Parish on the southeastern flank of the Anse La Butte Salt Dome and adjacent to a back-swamp environment east of Bergeron Road along the eastern banks of the Vermilion River that forms the boundary between Lafayette and St. Martin parishes. Property usage in the area includes a mixture of rural residential and commercial properties. The predominant land

use closest to the property is oil and gas production. The Guidry property itself is currently undeveloped and heavily wooded, with the exception of maintained utility and pipeline right-of-ways located along the northeast and southwest portions of the property. The Guidry property has historically been utilized for oilfield exploration and production purposes, with active oilfield production by others ongoing in the area, including on the adjacent Bundrick property. Figure 2 contains a 2015 aerial photograph of the Guidry and Bundrick properties for reference purposes.

1.2: Litigation Status and Limited Admission Areas

This plan is submitted in connection with a Limited Admission made on behalf of BP in the matter styled *Guidry et al. v. BP America Production Company, et al.* The case is currently set for trial in December 2017. Figure 3 contains a 2015 aerial photograph illustrating the boundaries of the Limited Admission areas for soil and groundwater. The Limited Admission pertains only to the groundwater found in the saturated zone at fifty (50) to eighty (80) feet below land surface (BLS) within the Groundwater Area and the soil found within the Soil Area, both illustrated on Figure 3.

Based on the extent of the Limited Admission areas, soil boring GH-7 installed by ICON and soil boring SB12 and SB13 installed by MP&A on behalf of Holloway fall within the Limited Admission soil area. With regard to groundwater, ICON monitor wells GC-8 and GC-12 and HET monitor wells MW5 and MW7 fall within the horizontal extent of the Limited Admission groundwater area. Soil boring SB15 installed by MP&A on behalf of Holloway is also located within the soil overlying the Limited Admission groundwater area; however, no exceedances of Statewide Order 29-B standards were detected in samples collected from this boring.

1.3: Qualifications of Experts

The group of experts that jointly prepared this most feasible plan has had numerous plans and reports submitted and approved by regulatory agencies, including the LDNR and LDEQ. Copies of the resumes of the key personnel involved in preparation of this plan are included in Appendix A.

Stewart "Smokey" L. Stover, Jr. with HET holds both Bachelor of Science and Master of Science degrees in Geology and has thirty-one (31) years of experience as a Hydrogeologist. Mr. Stover has been an expert witness in litigation involved in, but not limited to, environmental site assessment, remediation, landfill assessment and design, hazardous waste, surface water impacts, and groundwater supplies and currently conducts project oversight for HET in the states of Louisiana, Mississippi, Alabama, Texas, Wyoming, and

Colorado. He also holds several professional licenses in the field of Geology in the states of Alabama, Arkansas, Mississippi, Tennessee, Texas, and Louisiana.

Brent T. Pooler with HET holds a Bachelor of Science in Geology with a concentration in environmental geology from Louisiana State University (LSU) and has over twenty (20) years of experience in conducting hydrogeologic investigations and implementation of soil and groundwater restoration plans. Additionally, Mr. Pooler has over seventeen (17) years of experience in conducting risk assessments in the states of Louisiana and Texas and has been qualified as an expert in the fields of geology, hydrogeology, remediation, and implementation of RECAP and risk assessments. Mr. Pooler holds professional licenses in the field of Geology in both Louisiana and Texas.

B.H. Kueper, Ph.D., P Eng. is a hydrogeologist and civil engineer with expertise in the area of soil and groundwater contamination, groundwater hydraulics, and subsurface remediation. He received his Ph.D. in hydrogeology from the University of Waterloo in 1989 and joined the faculty at Queen's University in 1990 where he is employed at the rank of Professor and teaches undergraduate and graduate courses in groundwater flow and contaminant hydrogeology. Dr. Kueper is the former Associate Editor for the Journal of Ground Water, the Journal of Contaminant Hydrology and the Canadian Geotechnical Journal. Dr. Kueper has provided professional short courses and training seminars on the topics of soil and groundwater contamination, groundwater hydraulics, and subsurface remediation to various regulatory agencies including the U.S.E.P.A., the State of Maine, the State of Texas, CETESB (Sao Paulo), FEEMA (Rio de Janeiro), TIKTVF (Hungary), the province of Ontario, the province of British Columbia, as well as for various licensing bodies, including the Massachusetts LSPA and the Connecticut LEPA. In addition, he has taught in several professional short courses open to groundwater practitioners in Australia, England,

Denmark, Switzerland, Canada and the United States. In addition to being employed at Queen's University, Dr. Kueper has provided services as a technical consultant for over twenty-five (25) years. This work has included providing technical expert testimony in court and at public hearings, meetings with U.S.E.P.A. and state/provincial agencies, oversight of site investigation activities, and the preparation of a variety of technical documents. Specific work assignments have included, but are not limited to, assessment of capture zones, design of field sampling plans, delineation of source zones and plumes, assessment of remedial options, numerical simulation of groundwater flow and contaminant migration through unconsolidated deposits and fractured clay and rock, analysis of the performance of horizontal drain systems, examination of allocation models, vadose zone leaching analyses, assessment of vapor migration above the water table, writing of technical workplans, and review of field sampling plans.

Dr. John Frazier is an expert in health physics - the scientific discipline of measuring radiation and protecting people from the harmful effects caused by high doses of radiation. His academic degrees include a B.A. in physics, M.S. in physics, and Ph.D. in physics with emphasis in health physics and radiation protection. Dr. Frazier has over thirty-nine (39) years of professional experience in health physics, primarily in the areas of environmental dose assessments, external and internal radiation dosimetry, environmental sampling and analysis, and radiation detection and measurement. He has earned Comprehensive Certification by the American Board of Health Physics (ABHP) and is past president and a Diplomat of the American Academy of Health Physics. The term "Certified Health Physicist" is a certification mark that may only be used by individuals who have received Comprehensive Certification by the ABHP. Certification in health physics by the ABHP is the same as professional certification by other recognized professional organizations, such as certification in diagnostic radiological physics by the American Board of Radiology. He is a distinguished emeritus member of the National Council on Radiation Protection and Measurements (NCRP) and a Fellow and a Past-president of the Health Physics Society and has extensive experience performing radiological characterization surveys of property, assessing external and internal radiation doses from natural and man-made radiation sources, and reviewing/assessing operational data generated by facilities that are licensed to possess and use radioactive materials and other radiation sources. Over the past twenty-two (22) years, Dr. Frazier has performed numerous radiological assessments of soil and

groundwater on properties for oilfield naturally occurring radioactive materials (NORM) and has evaluated current and past radiation exposure conditions on properties impacted by oilfield NORM. Finally, Dr. Frazier has been qualified by numerous courts as an expert in health physics.

Bruce K. Darling, Ph.D., is the owner of Groundwater & Geochemical Consulting, LLC in Austin, Texas. His primary fields of expertise are geology, hydrogeology, and geochemistry. More specifically, his area of specialization encompasses the integration of hydrogeology and geochemistry to address matters related to the understanding of groundwater flow systems and the origin, transport, and fate of inorganic solutes in groundwater. He earned an M.S. in geology from the University of Louisiana at Lafayette, an M.A. degree in energy & mineral resources (mineral economics), and Ph.D. in geology from the University of Texas at Austin. He is a licensed Professional Geoscientist in Louisiana (P.G. #16) and Texas (P.G. #57), and he has served as President of the Texas Section of the American Institute of Professional Geologists. Don Bazer holds a BS Degree in Petroleum Engineering from LSU and more than fifty (50) years of experience in the oil and gas industry in Louisiana. He is a registered Professional Engineer in the states of Louisiana and Texas and has testified numerous times before the LDNR on matters of petroleum engineering.

Arville Touchet is a consultant soil scientist and the President of Bayou Cajun Environmental, Soil, and Wetland Services, Inc. He earned his B.S. in Agronomy from Southwestern Louisiana Institute (SLI) in 1959 and his Soils Science Institute Certificate from Cornell University in 1967. Mr. Touchet is a Certified Soil Scientist with the National Society of Consulting Soil Scientists. He has over fifty-eight (58) years of experience as a soil scientist, which includes Soil Survey Party Leader with the United States Department of Agriculture (USDA) Soil Conservation Service, completing the soil survey of Evangeline and St. Martin Parishes and the western Atchafalaya Basin. Mr. Touchet was also the Soil Correlator for the southeastern United States and later the State Soil Scientist, completing the soil survey for the entire State of Louisiana.

Luther Holloway, Ph.D., is President of Holloway Environmental Services, Inc. He has expertise in botany and plant ecology, agronomy, and assessment of petroleum production impacts to agriculture and floral-fauna components. Dr. Holloway earned his B.S. in Wildlife Management from Louisiana Tech University in 1966, his M.S. in Fisheries Biology (emphasis in Estuarine Ecology) from Louisiana State

University in 1969, and his Ph.D. in Plant Pathology from Louisiana State University in 1971. Throughout his career, Dr. Holloway has provided extensive services for the Army Corps of Engineers, including in the area of plant impact assessment, and he has been accepted as an expert in both Federal and Louisiana courts, among others.

W. Barry Gillespie, Jr., Ph.D., is a Senior Consultant with Environmental Resources Management (ERM) with over sixteen (16) years of experience in aquatic and sediment ecotoxicology, wetlands design/construction and restoration, ecological risk assessments, permitting, natural resource damage assessments, oil spill response and project management. He has his B.S. in Biology, and M.S. and Ph.D. in Biological Sciences. He has worked on risk based studies concentrating on the fate and effects of materials (i.e., surfactants, metals, pesticides, non-metal inorganics, etc.) in aquatic systems. Dr. Gillespie has managed numerous large projects addressing concerns associated with watershed based issues (nutrient and sediment loading), pulp and paper mill effluents, chemical manufacturing and petroleum refinery effluents, and agricultural run-off (insecticides, herbicides and dairy waste). Dr. Gillespie has worked on numerous natural resource damage assessment claims, and he has extensive experience preparing Ecological Risk Assessments for properties across the Southern United States.

Dr. Robert Cox holds board certifications in Medical Toxicology and Emergency Medicine through the American Board of Medical Specialties, and a certification in Toxicology through the American Board of Toxicology. He earned a doctorate in Analytical Chemistry from the University of Iowa in 1980 and a doctorate in Medicine from the University of Texas Southwestern Medical School in 1987. He has practiced and taught medicine and toxicology for over twenty-five (25) years, including in Mississippi for the past twenty-one (21) years and in Georgia for the preceding five (5) years. Dr. Cox is currently employed as a professor in the School of Medicine at the University of Mississippi Medical Center. He is the Director of the Mississippi Poison Control Center and the Medical Toxicology Clinical Service at the University of Mississippi Medical Center.

1.4: Exploration History

Stanolind Oil and Gas Company ("Stanolind") and its successors operated pursuant to a lease from Edmond Bergeron in the Anse La Butte Field, St. Martin Parish, Louisiana. Stanolind started leasing property on the south flank of the Anse La Butte Dome to conduct oil and gas exploration and production operations in the late 1930s. An Oil, Gas and Mineral Lease on 59.5 arpents (approximately 50.6 acres) in three (3) contiguous tracts was taken from Edmond Bergeron on April 08, 1936; this was a six (6) year paid-up lease. Stanolind spudded its Edmond Bergeron No. 1 well (Serial No. 24169) on May 10, 1940, and completed it as an oil producer later that month; the well was found to be productive in three (3) different sands. At that time, there was a high degree of drilling activity on the south flank of Anse La Butte, and Stanolind drilled a confirmation well on each of three (3) adjacent leases. The Edmond Bergeron No. 1 well was placed on production on a lease basis in May 1940. Figure 4 illustrates the locations of the Stanolind Edmond Bergeron wells and related salt water disposal wells (SWDs).

A public hearing was held on August 07, 1940, by the Department of Conservation, Minerals Division, to establish special rules governing oil and gas drilling and production operations in the Anse La Butte Field. As a result of that hearing, Order No. 21 was issued, which set the development acreage for the south flank at five (5) acres per well and two (2) acres per well for shallower sands closer to the dome. In addition to the acreage requirements, Order No. 21 set out rules for drilling, production, testing, reporting, allowables, gas/oil ratio limits, etc.

Pursuant to Order No. 21, Stanolind proceeded to develop its Edmond Bergeron Lease on a five (5) acre spacing and drilled and completed the Edmond Bergeron Nos. 2, 3, 4, 5, 6, and 7 in 1941. The production equipment on the lease started out with one (1) separator, one (1) treater, and three (3) 500 barrel tanks near the Edmond Bergeron No. 1 wellsite, but by the end of 1941, there were three (3) 1,000 barrel tanks in service and one (1) or more additional separators. By 1951, the Edmond Bergeron Lease tank battery had been expanded to four (4) 1,000 barrel tanks.

Also, in keeping with provisions in Order No. 21 included for reference in Appendix J, Stanolind prepared one (1) small unloading pit or "duck nest" pit in the northwest corner of the Edmond Bergeron Lease, near the tank battery. Based on aerial photographs, this pit had been closed by 1955. In addition

to the Stanolind operations on the Edmond Bergeron Lease, there was much drilling and production activity by Stanolind and others on adjacent and nearby leases, as shown on Figure 5.

Stanolind never dug or operated any production or saltwater pits on the Edmond Bergeron Lease. The first reported saltwater production from the Edmond Bergeron Lease was in January 1943, when 196 BSW/D was reported from the Bergeron No. 3 well. That well was recompleted by August 1944 and the water cut was reduced to 0.2%. The next onset of saltwater production started in September 1945 when the Bergeron wells No. 2 and No. 4 were reporting 30 and 47 BSW/D, respectively. From that point on until the abandonment of the lease, saltwater production with the oil and gas production was a regular operating condition.

Based on well data from the Office of Conservation SONRIS System for Well Serial No. 26264 and correspondence from Stanolind to the Department of Conservation included for reference in Appendix J, there was a saltwater disposal ("SWD") well in service on the Stanolind Rycade Fee Lease as early as 1942; however, the well serial number or exact location cannot be determined from the documents presently available. Stanolind converted its J.J. Martin "B" No. 3 (Serial No. 25805) to SWD service in September 1945; that is also a Stanolind Fee Lease. Stanolind went on to convert its Rycade Fee No. 3 (Serial No. 26264) to SWD service in November 1948. Pan American Petroleum Corporation ("Pan Am") became the successor to Stanolind in February 1957 and converted its J.J. Martin "B" No. 4, Serial No. 26931 to SWD service in June 1963. Amoco Production Company ("Amoco") became the successor to Pan Am in February 1971 and converted its Rycade Fee No. 1 (Serial No. 25828) to SWD service in June 1975. At no time since the onset of first saltwater production from the Edmond Bergeron Lease did Stanolind or its successors not have a viable SWD system in service in the Anse La Butte Field.

Stanolind dually completed its Edmond Bergeron No. 6 and No. 7 wells in November 1943, and shortly thereafter, the No. 7 well was placed on gas lift. Many additional Edmond Bergeron wells were placed on gas lift by 1950 and all remaining Edmond Bergeron wells were on gas lift by 1971. In addition, Stanolind performed many recompletions on the Edmond Bergeron wells as the water cut increased to an unacceptable level, or the existing completion otherwise depleted. The only non-associated gas production on the Edmond Bergeron Lease was from the No. 7 well which produced briefly as a gas well in 1958.

In September 1946, Edmond Bergeron executed a surface lease with Walter McDonald for 2.74 acres along the northern boundary of the above mentioned Edmond Bergeron Tract for the construction of a gasoline plant to be owned and operated by Anse La Butte Gasoline Company. There was one (1) small earthen pit within this gasoline plant that can be seen on aerial photos as early as 1951. In September 1957, the lease was renewed with Anse La Butte Gasoline Company adding an additional 1.38 acres south of the original surface lease (Appendix J).

Pan Am drilled and completed its Edmond Bergeron No. 8 in 1957 and drilled and dually completed its Edmond Bergeron No. 9 and No. 9D wells in 1958. The Pan Am-Edmond Bergeron No. 10 and No. 10D wells were directionally drilled under the above mentioned gasoline plant and dually completed in March 1960, and the No. 11 well was drilled and completed as a single in February 1961.

Also in 1961, application was made to commingle all of the Edmond Bergeron wells into the L.D. Bergeron Battery No. 2 (Appendix J). The application was approved and by 1963 the Edmond Bergeron Tank Battery had been removed as all of the wells were flowing to the commingling facility.

The last wells drilled on the Edmond Bergeron Lease were the Pan Am-Edmond Bergeron No. 12 and No. 12D which were also directionally drilled under the gasoline plant and dually completed in January 1966.

Pan Am had a practice of plugging and abandoning ("P&A") its wells soon after they were depleted. The first Edmond Bergeron well to be plugged and abandoned was the No. 3 well in November 1957 after it had been unsuccessfully recompleted in January of that year. The Edmond Bergeron No. 1 and No. 2 wells were plugged and abandoned in December and August 1969. The last well to be plugged and abandoned with Pan Am as the operator was the No. 4 well in December 1970.

When Amoco became the successor to Pan Am in February 1971, it continued the program of recompleting the remaining wells, as necessary, and plugging them upon depletion. The No. 6 well was plugged and abandoned in February 1972, and the No. 9 and No. 9D wells were plugged and abandoned in November 1973. The No. 12 side of that dual well was abandoned by squeezing off the perforations in April 1973, but the No. 12D side remained on production.

In November 1983, Amoco sold its interest in the Anse La Butte Field to Vernon E. Faulconer which included the Edmond Bergeron Lease with its two (2) remaining wells, No. 10 and No. 12D. In the Assignment and Bill of Sale for this transaction, Vernon E. Faulconer assumed all liability for plugging and abandonment.

1.5: Review of Previous Investigations and Plaintiffs' Plan

The areas of the Guidry property addressed in the Limited Admission are a portion of larger tracts comprising approximately twenty-five (25) total acres. Environmental media on the entire site have been sampled in a series of efforts by ICON, MP&A, and HET. The following discussion provides an overview of sampling across the entire property, including the Limited Admission area. In addition, ICON and HET have performed certain sampling on the "Bundrick" property, immediately adjacent to a portion of the Guidry tract. Copies of the reports prepared by ICON or other parties may be provided separately by counsel or at the request of the Department.

ICON conducted separate investigations of the Guidry and Bundrick properties, on behalf of the plaintiffs in each of the cases, as part of the separate litigations brought against BP. In response to court ordered deadlines, ICON issued the Report of Environmental Sampling Data in a letter dated July 01, 2016, and the Expert Report and Restoration Plan dated February 24, 2017. In addition, ICON provided supplemental information, including revised figures and tables, as well as additional laboratory analytical reports in correspondence dated July and October of 2015.

The ICON investigation included the installation of a series of soil borings (GH-4, GH7, GH8, GC1-GC16, and SB1-SB8) for the collection of soil samples, with sixteen (16) boring locations converted into monitor wells, several of which included nested wells, for the collection of groundwater sampling within the ICON designated shallow (35-50'), intermediate (50-80'), and deep (80-120') zones. HET conducted oversight and collected split samples during those sampling events conducted in 2016, however, was not present for the initial sampling event conducted in 2015. In addition, ICON previously installed a total of nine (9) soil borings on the adjacent Bundrick property in 2011, four (4) of which were converted into monitor wells for the collection of groundwater samples. Figure 6 contains a 2015 aerial photograph of the Guidry

and Bundrick properties depicting the locations of borings and monitor wells installed on the site by ICON. Tables 1 and 2 contain soil analytical summaries of 29-B and RECAP parameters, respectively, collected during the course of ICON's investigation of the Guidry property. Tables 3 and 4 contain soil analytical summaries of 29-B and RECAP parameters, respectively, collected during the course of ICON's investigation of the Bundrick property. Tables 5 through 7 contain groundwater analytical summaries of samples collected from the shallow, intermediate, and deep zones, respectively, during the course of ICON's investigation of the Guidry property, while Table 8 contains a groundwater analytical summary of samples collected during the course of ICON's investigation of the Bundrick property. Each of the above referenced tables includes split sample results for those samples analyzed at the request of HET. Appendix D contains a copy of geological boring logs generated during oversight of ICON's investigation. Appendix E contains a copy of the laboratory analytical reports.

In addition, ICON sampled selected regional water wells, either domestic or otherwise, in the vicinity of the Anse La Butte Salt Dome during the course of the investigation conducted of the adjacent Bundrick property in 2013. Michael Pisani and Associates (MP&A), on behalf of the defendants, conducted oversight and collected split samples for analyses during the sampling of the regional water wells. HET was also on-site to conduct oversight of the sampling events. Figure 7 illustrates the locations of those regional water wells sampled by ICON. Table 9 contains a groundwater analytical summary, including split sample results from MP&A, of samples collected from the regional water wells.

In connection with the litigation, ICON has proposed a soil and groundwater restoration plan that covers the Limited Admission areas and other portions of the Guidry property. The ICON plan includes a sliding scale of options based on different scenarios, including different comparative standards (i.e. either background or regulatory standards) and disposal options (i.e. off-site disposal or injection of wastewater). However, the soil remedy in each of the scenarios is consistent in proposing excavation of elevated electrical conductivity (EC) values to depths upward of twenty-four (24) feet BLS and treatment of sodium adsorption ratio (SAR) with soil amendments. Similarly, the costs associated with the ICON proposed plan vary widely from $11,825,481 to $249,154,558 and include additional delineation assessment of the aquifer in the amount of $172,166.00. As a whole, the ICON plan is premature and not feasible, particularly in its

suggestion of large scale transport of groundwater for off-site disposal. The ICON plan is also flawed in its determination of appropriate background standards.

1.6: Introduction to the Plan

As discussed and defined below, this plan provides for evaluation and remediation, if necessary, of soil within the Limited Admission soil area. It also provides for evaluation of the groundwater in the intermediate zone in the Limited Admission groundwater area, and, if necessary, monitored natural attenuation and the installation of a useable water well.

To satisfy anticipated regulatory requests, and as a contingency, the plan presents a discussion of potential active remediation through groundwater recovery and subsequent local injection of recovered fluids. These cost estimates are submitted for the Department review only and are not necessary based on the nature and extent of groundwater conditions at the site, nor is active remediation endorsed by the authors.

2.0: GEOLOGICAL SITE SETTING

The Guidry property is situated within a rural to semi-rural portion of St. Martin Parish and on the edge of the Anse La Butte salt dome. The elevated topography of the site as a result of the dome controls the overall depositional features, both at surface and subsurface depths.

2.1: Topography and Drainage

Natural ground elevations for the site property, as determined by MP Mayeux Surveying and Boundary Consulting, L.L.C. and in the portions of the properties investigated, ranged from over nine (9) feet east of Bergeron Road to over twenty (20) feet above mean sea level. Figure 8 contains a LIDAR map of the property illustrating the changes in elevation across the investigation area. Appendix F contains a copy of the surveys conducted by M.P. Mayeux Surveying and Boundary Consulting, LLC.

According to the United States Department of Agriculture (USDA) Soil Survey of St. Martin Parish (1977 and updated via the online database), the soil types for Guidry property include Acy Silt Loams, Coteau Silt Loams, Fausse Association, and Sharkey Clays (both rarely flooded and frequently flooded). The Acy and Coteau Silt Loams are located on Terrace Uplands and are gently sloping, somewhat poorly drained soils. The Sharkey Clays (rarely flooded) are located on broad, level areas associated with the natural levee and back swamp deposits of clayey alluvium within the overall Atchafalaya Basin and are poorly drained. The Sharkey Clays (frequently flooded) are located in back swamps and flood plains, while the Fausse Association soils are located in flood plains, both being poorly drained soils. Figure 9 illustrates the soil types on the properties as defined by the USDA.

From information obtained from the Environmental Regulatory Code (LAC 33.IX.1123), the site is located within the Breaux Bridge Swamp-Forested wetlands in subsegment number 060805. Surface water bodies, including tributaries and drainage canals, within this subsegment are not utilized as sources of drinking water. Surface water quality with regard to salinity has not been established for this subsegment, which is designated as naturally dystrophic waters. Figure 10 illustrates the extent of the regional subsegments, including number 060805 in which the site is situated.

2.2: Depositional Environment

The site is located on remnants of the Prairie Terrace uplands of Pleistocene time which were not eroded by meandering of the Paleo-Mississippi River, possibly due to the topographic high caused by the underlying Anse La Butte salt dome that contains salt or cap rock within 137 feet of land surface. The site was isolated from the Prairie Terraces of Lafayette Parish to the west, being surrounded by the more recent alluvium and natural levee deposits of Holocene time. Shallow sediments of Pleistocene time and younger are draped across the salt dome evidenced by erosion and depositional patterns of shallow water deposits. Near surface clay units with thickness of thirty (30) to forty (40) feet on top of the salt dome and as much as 120 feet in the near vicinity of the salt dome are documented in the area of the site. Figure 11 contains a geologic map of the area.

2.3: Regional Geology

The regional surface and subsurface geology in the vicinity of the site is controlled by formation of the Anse La Butte salt dome. The formation of this "butte" established flat lake on the south side of the butte and marsh and swamp around the other portions of the butte. In the early 1900s, oil and gas were observed at the surface, gas was reported migrating out of the swamp, and oil was reported bubbling out of a spring at the surface (Harris 1910). Early subsurface geological maps indicated faulting to the surface and oil and gas deposits within forty (40) feet of land surface. The top of the salt occurs at 137 feet BLS and is covered by Quaternary deposits (Halbouty 1979).

Regional cross sections that begin north of the salt dome to south of the salt dome across the site indicate that early Pleistocene deposits consist of sands and clay units to approximately 800 feet BLS. These units contain commercial and non-commercial deposits of oil, gas, and associated formation fluids from oil migration process around the salt dome. Faulting and fracturing in and around the dome have allowed migration of these deposits into shallow portions of the Pleistocene sediments. (Figure 12). The underlying Pliocene aged deposits are separated by a clay unit and consist of fine sands, as well as large clay deposits.

Regional geologic cross sections presented by ICON estimated water quality based on electric log responses. However, no actual electric log measurements were presented in the cross section to determine the resistivity of the formation (Ro). The actual Ro was misinterpreted from the logs, and the actual temperature factor was not calculated in Ro determination. Ro numbers correlated by ICON do not match actual laboratory analysis at selected depths. No horizontal scale is presented on the cross section, and numerous logs were omitted along the line section across the Guidry site. Most important, the formation factor is based on a clay free formation and the formation evaluated contains numerous clay unit and limited porosity. Additionally, no mud cake calculations were considered and the electric log data presented varies in time from 1940 to 2015.

2.4: Regional Hydrogeology

2.4.1: Description of Atchafalaya Aquifer

The Atchafalaya aquifer (AA) was first named and described (Jones 1954) as the gravelly aquifer composed of the deposits that filled the late Pleistocene to Holocene scours of the Holocene Mississippi River flood plain (Milner 2009). Jones (1956) further defined the AA as occurring only beneath the recent flood plain of the Mississippi River, with the western margin being occupied by the Atchafalaya River. Saucier (1994) indicated that the westernmost portion of AA did extend west of the Bayou Teche (USGS fact sheet 2014). Sargent (2004) reported that the Chicot aquifer and the confining unit of the Chicot aquifer system occurred in Sections 21, 62, 64, 69, 71, and 72 in Township 09 South, Range 05 East, in St. Martin Parish, Louisiana. The Western boundary of the Atchafalaya aquifer is described as occurring into eastern Lafayette Parish (Nyman, 1989). The LDNR registered these wells occurring on the site and surrounding areas as within the Atchafalaya aquifer.

Figure 12 illustrates the hydrogeological setting across the area, including the site. As shown in this regional cross section that begins north of the Anse La Butte salt dome and extends south of the salt dome and across the site, the near surface confining units are continuous across

the area and the first sand encountered below this confining unit comprises the Atchafalaya aquifer. These sands of the AA vary in grain size and contain multiple lenses of clay. Gravel is encountered in different portions of these sands and in varying sizes. Thickness of the AA across the area is less than 150 feet. Underlying the AA is the upper portion of the Chicot aquifer. This portion of the aquifer contains sand and clay deposits and is encountered at approximately 150 to 200 feet BLS. Clay units separate the upper Chicot aquifer from the lower Chicot aquifer. The lower portion of this aquifer contains sands of limited thickness, while clay deposits are more numerous and thicker in sequence. The thickness of the Chicot aquifer system ranges between 500 and 600 feet. Underlying the Chicot aquifer system is the Evangeline aquifer. These two (2) aquifer systems are separated by a clay unit, and sands encountered in the Evangeline are typically more finely grained. The thickness of this aquifer is not determined, nor presented in this cross section.

2.4.2: Background Concentrations of Constituents

Background chloride concentrations in the Atchafalaya aquifer and upper portion of the Chicot aquifers will vary with depth and proximity to the salt dome and variability in geologic conditions. At the site, ICON designates and separates these water bearing zones by depth, being the upper, middle, and lower portions. Background locations are dependent on proximity to sources, the location of groundwater movement and recharge to the aquifer. Density separated groundwater based on natural total dissolved solids must be considered in an environment associated with a salt dome located in the middle of the aquifer. The regional water wells installed within the fifty (50) to eighty (80) foot zones are currently being used and are un-impacted.

With regard to background concentrations, groundwater data provided by ICON in Table 3 of ICON's Expert Report include data from currently operating and usable water wells in a wide regional area away from the site at varying depths. Chloride concentrations from ICON's selected water wells in the fifty (50) to eighty (80) foot zone in this region ranged from eleven (11) to 241 mg/L, while chloride concentrations from other wells in the eighty (80) to 120 foot zone ranged from 147 to 163 mg/L. Figure 13 illustrates the locations of ICON's designated wells regionally located

in relation to the Guidry property boundary. Figure 14 illustrates those monitor or water wells considered by BP as background in the vicinity of the Guidry property.

Furthermore, review of geochemical profiles for sampled groundwater confirms that these levels are consistent with background and that natural levels may range to a level in excess of 500 mg/L. Review of the geochemical data indicates that sodium-chloride (Na-Cl) brine from Anse la Butte production wells is not widely distributed in the shallow, intermediate, and deep sands of the Guidry site. The influence of this brine is apparent at the GC-8, GC-12, and GC-4 clusters and at GC-10. Beyond those clusters, the geochemical composition of groundwater becomes more variable and unrelated to mixing with produced water. This is strongly indicated by factors not considered by ICON, specifically the concentrations of strontium and calcium (Figure 15). This figure indicates at least two (2) sources of saline water – one (1) of which is consistent with produced water documented for this area (Bergeron and USGS data). The other source of saline water, other than that represented by the Bergeron Na-Cl brine, is unknown at this time but could be attributed to the upward movement of saline water with significant components of calcium (Ca), magnesium (Mg), and bicarbonate (HCO3). The geochemical data from the Guidry site have been evaluated based on other geochemical plots, such as Figure 16 (Schoeller diagrams). These figures indicate not only different sources of saline water at the Guidry site but also the lack of site-wide mixing of known produced Anse la Butte brine with local groundwater. These geochemical plots also help to establish the background locations (Figures 16). Based on these data, background concentrations are at least consistent with US EPA secondary drinking water level standards for chlorides (250 mg/L).

With regard to barium concentrations in the intermediate zone, laboratory analytical results report only one (1) location with concentrations above the RECAP screening standard of two (2) ppm considering a GW1 aquifer, being ICON monitor well GC-8D (50-60'). Based on regional data collected, naturally occurring barium concentrations range between 0.05 mg/L and 0.523 mg/L. Tables 7 and 9 contain groundwater analytical summaries from samples collected from the intermediate and regional water wells, respectively.

Finally, as discussed by Dr. Frazier in his Expert Report dated January 13, 2017, radium 226 and 228 concentrations detected in groundwater samples collected during the course of the investigations conducted by HET and ICON are not attributed to oilfield activity and are, in fact, naturally occurring. Appendix K contains a copy of Dr. Frazier's full Health Physics analysis.

2.4.3: Aquifer Utilization

Review of the LDNR water well registration online database identified a total of 237 wells within a one (1) mile radius of the property, of which twenty-eight (28) are either plugged or abandoned. The uses of the wells include public supply, irrigation, industrial, monitoring, oil and gas rig supply, and unknown. Only one (1) of the wells listed above is listed as installed within the Chicot aquifer with a depth of 240 feet BLS, with the remaining wells installed within the Atchafalaya alluvial aquifer or equivalent. Figure 17 illustrates the locations of registered water wells within a one (1) mile radius of the site and the location of the newly discovered historic metal water well.

2.5: Surficial Confining Unit Water Bearing Zones

The surficial confining unit is composed of deposits that contain mostly clays and silty clays that form an aquitard over the Atchafalaya and Chicot aquifer systems. Selective silts containing some fine-grained sand deposits occur locally to form water bearing units, which are discontinuous and occur at various depths within this confining unit. Regional depositional patterns will control the extent, thickness, and distribution of these water bearing units.

2.6: Site Hydrogeology

The near surface hydrogeologic and depositional environments at the site were determined by geologic cross sections that utilized various data generated during the course of this investigation. Figure 18 contains the lithologic cross section A-A' (Also Figure 12 from HET's Data Report) which is an east to west section that illustrates the near surface hydrogeology at the site, the location of which is illustrated in Figure 19.

A continuous surficial clay confining unit exists from land surface to depths of twenty-seven (27) and thirty-six (36) feet BLS. This confining unit mainly consists of clay and contains silt content with varying thicknesses, mainly at the ten (10) foot zone. Geotechnical data collected from this unit demonstrated vertical hydraulic conductivity values that ranged from 1.47×10^{-7} centimeters/second (cm/sec) to 5.6×10^{-9} cm/sec across the site. Underlying the confining unit are the sands of the Atchafalaya aquifer. These sands contain minor silt content on the western side of the property and no silt content on the eastern side of the property. The eastern side of the property beginning approximately at monitor well MW7 contains numerous layers of clay and clay beds at approximately forty-five (45) to fifty-five (55) feet BLS that are not observed on the western side of the property. The facies change in this area represents a change in depositional environment within the upper portions of the Atchafalaya aquifer. Small diameter gravel was encountered in most wells, if not all, at depths of fifty (50) feet on the west side and eighty (80) feet BLS on the east side of the site. For the purposes of this investigation, shallow (35-50' BLS), intermediate (50-80' BLS), and deep (80-120' BLS) zones have been designated.

Table 3 contains the results of the geotechnical laboratory analysis. Appendix D contains a copy of geologic boring logs. Appendix E contains a copy of laboratory analytical results from geotechnical samples.

3.0: INVESTIGATION DESCRIPTION

Between July 25, 2016 and December 16, 2016, HET conducted an investigation of the Guidry property. The investigation performed by HET included the installation of a series of deep soil borings and monitor wells within the shallow, intermediate, and deeper zones within the overall upper sands beneath the property. The investigation conducted by HET included the collection of groundwater samples from both the ICON and HET installed monitor wells, aquifer testing, and water level measurements to assist the defense group in determining groundwater flow directions and establishing the regulatory conditions of the property. Separately, HET conducted an investigation of the Bundrick property which is also included within the data contained within this report and Michael Pisani & Associates, Inc. (MP&A) installed a series of shallow soil borings on the Guidry property to evaluate surface salinity concentrations to assist in the root zone study conducted by Luther Holloway, Ph.D., of Holloway Environmental Services, Inc. ICON, as representatives of the plaintiffs in this litigation, observed all field work and collected split samples for selective analyses during the course of HET's investigation of the property. Supporting information is contained within the reports dated January 13, 2017, prepared by HET, John Frazier, Ph.D. (Appendix K), and B.H. Kueper, Ph.D. (Appendix L). MP&A submitted its Data Report on behalf of Devon in a letter dated January 13, 2017.

All wells were installed by HET in accordance with the Louisiana Department of Transportation and Development (LADOTD)/LDEQ regulations regarding soil boring and monitor well installation and under HET's water well contractor's license (WWC-416) or the license of its drilling contractor, Walker-Hill Environmental, Inc. (WWC-574) in the State of Louisiana.

3.1: Boring and Monitor Well Installations

HET installed seven (7) deep soil borings (DB1-DB7) and seven (7) monitor wells (MW1-MW7) on the Guidry and Bundrick properties as part of the overall evaluation of the Guidry property. Four (4) of the monitor well locations were installed as clusters with separate boreholes and multiple screened intervals, being MW2 (50-60', 80-90'), MW3 (50-60', 80-90'), MW6 (55-65', 80-90'), and MW7 (58-63', 80-90'). MP&A

separately installed a series of shallow soil borings (SB1-SB19). Figure 20 illustrates the locations of the monitor wells and soil borings installed by HET. Figure 21 illustrates the locations of those soil borings installed at the site by MP&A.

The borings and monitor wells were installed to evaluate site conditions, with respect to historical oilfield exploration and production related activities based on a review of previous assessments and historical data to evaluate areas of potential concern and/or to further evaluate the information presented by ICON during its investigation of the site and determine the appropriate regulatory status. During each boring installation, appropriate field screening, lithologic descriptions of the geological setting, and the collection of soil and groundwater samples for subcontracted laboratory analyses were conducted, as appropriate. The complete geologic logs with photoionization detector (PID) and electrical conductivity (EC) meter field readings for borings and monitor wells installed are contained in Appendix D.

The monitor wells and soil borings were installed by sonic drilling technology which uses a combination of high frequency resonant vibrations and water to drill to the desired depths with interior sample core barrel with dedicated acetate liner for each sample interval. The monitor wells were constructed of a two (2) inch outer diameter schedule 40 PVC pipe consisting of either a five (5) or ten (10) foot section of 0.010 inch slotted screen pre-packed with a 20/40 grade silica sand attached to an appropriate section of solid PVC riser. The borehole annulus outside of the pre-pack screen was filled with a 20/40 grade silica sand to above the screened interval, and a two (2) foot bentonite seal was placed on top of the sand pack and allowed to hydrate. The remaining annulus of the monitor wells was grouted to land surface utilizing a cement/bentonite slurry. The monitor wells were completed with aboveground protective casings with well seals and a concrete pad to allow for future sampling, as necessary.

All core barrels, bits, and sampling equipment utilized in the boring installations were properly decontaminated and cleaned prior to each drilling activity. In addition, new, disposable nitrile gloves were utilized during sample collection.

Figure 22 contains a generalized monitor well schematic. Table 10 contains the monitor well construction and groundwater sampling data. The monitor well registration forms for monitor wells MW1-

MW5 are contained in Appendix F. Field notes generated during the course of both ICON and HET assessments of the Guidry property are contained in Appendix H.

3.2: Soil Sample Collection

Continuous soil samples were obtained from a direct push core during the installation of select borings via direct push core barrel with dedicated, interior liners for each interval sampled. Each core was observed in the field for lithologic description and field screening by head space analysis via PID. In addition, each interval was screened in the field for chloride concentrations by a field EC meter. The complete geologic boring logs with PID and EC readings for all borings and monitor wells are contained in Appendix D.

Representative soil samples were obtained from the core and retained for subcontracted laboratory analyses on selected two (2) foot intervals based on field observations. All soil samples were properly containerized, labeled, chilled, and transported under chain-of-custody records to Waypoint Analytical, Inc. in Memphis, Tennessee; SGS Accutest Laboratories in Lafayette, Louisiana; or Burns Cooley Dennis, Inc. in Ridgeland, Mississippi, for the selected composite or discrete analyses of the parameters listed below. All laboratories hold current LDEQ Louisiana Environmental Laboratory Accreditation Program (LELAP) accreditation for the analyses performed and any Statewide Order 29-B analyses were done in accordance with the latest edition of the LDNR "Laboratory Procedures for Analysis of Exploration and Production Waste." Appropriate detection limits were obtained by laboratory personnel on all parameters for application to LDNR Statewide Order 29-B or RECAP, as appropriate.

1. LDNR Statewide Order 29-B parameters (EC/SAR/ESP, oil and grease, True Total Barium, pH)
2. cation exchange capacity (CEC) by Environmental Protection Agency (EPA) SW-846 Method 9081
3. total chlorides and sulfates by EPA SW-846 Method 9056A
4. synthetic precipitation leachate procedure (SPLP) by Extraction Method 1312
5. metals by EPA SW-846 Method 6010C/7471A

6. bicarbonate (as CaCO3) by Method 2320B
7. percent moisture by Method 2540G
8. select geotechnical parameters (Atterberg Limits, dry density, moisture content, organic matter, permeability, specific gravity, and total porosity)

Additional parameters were selected for analyses of soil samples based on field observations during the course of ICON's investigation for the following parameters:

1. LDNR Statewide Order 29-B parameters (oil and grease)
2. volatile and extractable range hydrocarbon fractions by Texas 1006 Method
3. poly cyclic aromatic hydrocarbons (PAH) by EPA SW-846 Method 8270C

Tables 1 and 2 contain soil analytical summaries of 29-B and RECAP parameters, respectively, collected during the course of HET's and MP&A's investigations of the Guidry property. Tables 3 and 4 contain soil analytical summaries of 29-B and RECAP parameters, respectively, collected during the course of HET's investigation of the Bundrick property. Table 11 contains a summary of the geotechnical parameters. Appendix D contains a copy of geologic boring logs for boreholes installed by HET during this investigation. Appendix E contains a copy of laboratory analytical results from soil samples collected, including geotechnical parameters.

3.3: Groundwater Sample Collection

Groundwater samples were collected from all HET monitor wells upon completion of the monitor well installations and selected ICON monitor wells. Tables 5 through 7 contain groundwater analytical summaries of samples collected from the shallow, intermediate, and deep zones, respectively, during the course of HET's investigation of the Guidry property, while Table 8 contains a groundwater analytical summary of samples collected during the course of HET's investigation of the Bundrick property. Table 10 contains the HET monitor well construction and groundwater sampling data.

Prior to all sampling events, the monitor wells were developed of three (3) to five (5) standing well volumes or dryness utilizing either a submersible or low flow pump with dedicated tubing for each location from the center portion of each screened interval unless volume requirements necessitated a different withdrawal depth. During purging activities, the field parameters of pH, temperature, conductivity, and turbidity were collected periodically prior to and during purging to ensure that the groundwater samples collected were representative of groundwater conditions and not conditions within the well itself.

Once conditions had stabilized, samples were collected from each well. All samples were properly containerized, labeled, chilled, and transported under chain-of-custody records to SGS Accutest Laboratories in Lafayette, Louisiana, with radiological analyses contracted to Eberline Analytical Corporation in Oak Ridge, Tennessee, for the following analyses:

1. chlorides, sulfates, and bromides by SW-846 Method 9056A
2. total dissolved solids (TDS) by Method 2540C (SGS Accutest and Eberline)
3. specific conductance by Method 2510B
4. benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA SW-846 Method 8260B
5. total petroleum hydrocarbons (gasoline, diesel, and oil range organics) by EPA SW-846 Method 8015C
6. extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH) by the Massachusetts Method
7. total and dissolved metals by EPA SW-846 Method 6010B/6020/7470A
8. PAH by EPA SW-846 Method 8270D
9. bicarbonate and carbonate alkalinity by Method 2320B
10. radium 226/228 by EPA Modified Methods 903.0 and 904.0

Quality control/quality assurance was conducted in the following manner during groundwater sampling events: one (1) field duplicate per twenty (20) samples and one (1) equipment blank were collected for laboratory analyses, as well as a trip blank and field blank for volatile parameters. Appropriate

detection limits were obtained by laboratory personnel on all parameters for application to the RECAP document, as appropriate. Appendix E contains a copy of the laboratory analytical results.

Sample collection was conducted utilizing dedicated tubing for each well, and new, disposable latex gloves were used for each sample collection. All groundwater generated during purging events was appropriately containerized and stored until disposal arrangements were made.

3.4: Water Level Measurements

HET, in consultation with B. Kueper & Associates, Ltd., oversaw the survey and measurement of water levels in monitoring wells for purposes of evaluating groundwater elevation gradients at the site. The elevations of the tops of casings of each monitor well were determined by a registered land surveyor upon completion and monitor well constructions utilizing a global positioning device and adjusted to MSL based on the National Geodetic Vertical Datum (NGVD). Water level measurements of all monitor wells installed at the site by HET were taken on the following dates: October 03, 2016, November 02, 2016, and November 21, 2016. Additionally, HET measured water levels of all of the ICON monitor wells on June 23, 2016, August 22, 2016, and November 21, 2016. Table 10 presents the monitor well construction and groundwater sampling data.

The water level elevation in a piezometer or monitoring well is a measure of the hydraulic head in the geologic formation at the screen midpoint elevation. Water level elevations are typically measured either manually using a water level tape, or in an automated fashion using pressure transducers. In a flow system where the groundwater has variable density due to salinity effects, measured water level elevations can be used to compute a density adjusted water level elevation as follows:

$$h_f = z + \frac{\rho}{\rho_f}\psi \qquad (1)$$

where h_f is the density adjusted water level elevation (head), z is the elevation head set equal to the distance from the datum to the screen midpoint elevation, ρ is the density of the water in the piezometer or monitoring well, ρ_f is the fresh water density, and ψ is the pressure head set equal to the distance from the screen

midpoint elevation to the water level in the piezometer or monitoring well. Groundwater flows from areas of high density adjusted water level elevation to areas of low density adjusted water level elevation.

The density of the groundwater at the Site was calculated for each well utilizing the method described by Millero and Huang (2009). This calculation utilized the laboratory measured specific conductance at each well. The measured groundwater temperature was utilized if available, and if not, an average temperature was utilized. The calculated density was then utilized to calculate a density adjusted water level elevation using Equation (1). Details of the calculations are presented in Table 12.

Figures 23 through 25 present contoured water level elevations for the shallow zone (well screen midpoints between 0 and -25 foot elevation; approximately twenty-four (24) to forty-five (45) feet BLS), the intermediate zone (well screen midpoints between -25 and -60 foot elevation; approximately forty-five (45) to seventy-eight (78) feet BLS) and the deep zone (well screen midpoints between -60 and -100 foot elevation; approximately seventy-eight (78) to 118 foot BLS) for the August 22, 2016 gauging event. Figure 23 illustrates that the overall direction of groundwater flow in the shallow zone is from northeast to southwest, with a north to south flow component in the vicinity of monitoring well ICON GC-2. Figure 24 illustrates that the overall direction of groundwater flow in the intermediate zone is from northeast to southwest, with a local high groundwater elevation at monitoring well ICON GC-8D. Figure 25 illustrates that the overall direction of groundwater flow in the deep zone is from northeast to the southwest. Similar conclusions as the above are drawn from other gauging events, although there is variability amongst the gauging events as is expected in any transient groundwater flow system.

3.5: Aquifer Characteristics

HET conducted aquifer tests (slug tests) of the following monitor wells: MW2 (50-60', 80-90'), MW6 (55-65', 80-90'), and MW7 (58-63', 80-90') on November 02 and 03, 2016. The slug tests performed by HET were conducted by introducing a solid stainless steel slug into the well and then recording the changes in water level through time using a submersible data level logger, with the data retrieved from the logger upon the completion of each test. The introduction of the slug was done several times for each monitor

well, and the HET data can be evaluated for both rising and falling head tests. Appendix G contains the above referenced aquifer test data with supporting documentation contained in Appendix L.

The slug test field data were analyzed using the software package AQTESOLV with automated best fit. The geometric mean hydraulic conductivities of the intermediate and deep zones were 92.7 feet/day (feet/day) and 164.7 feet/day, respectively. These hydraulic conductivity values are representative of an aquifer comprising fine to medium grained sand. In addition to performing slug tests, HET collected seven (7) soil samples from twenty-two (22) feet to twenty-six (26) feet BLS (within the silty/clayey confining unit) for geotechnical analysis of vertical hydraulic conductivity (K_v). The resulting geometric mean (K_v) was 1.98E-8 cm/s (5.6E-5 feet/d), which is consistent with the low hydraulic conductivity of a confining unit.

Based on a review of the data, the Atchafalaya aquifer beneath the property is classified as GW_1 in accordance with RECAP, Section 2.10. The classification is based on the following criteria and site specific information: 1) the aquifer is utilized as a source of drinking water in the vicinity of the site and 2) salinity and other constituent concentrations that are consistent with EPA Drinking Water Standards. As a result, the groundwater classification also results in a soil protective of groundwater standard of $soil_{GW1}$ in accordance with RECAP.

The Atchafalaya aquifer typically contains water that is poorly suited for domestic use (Nyman, 1984.). As with other alluvial aquifers in the state, the LDNR suggests treatment prior to use. Recharge to this aquifer is mainly from the Atchafalaya River and in areas is hydraulically connected to the upper sands of the Chicot aquifer.

4.0: RESULTS OF INVESTIGATIONS

Based on a review of samples collected to date, as well as the geological setting of the site, the following results of the investigations are presented. All information obtained to date was considered in the evaluation of the data, including the data obtained during the course of the HET, MP&A, and ICON investigations, as discussed further below. As discussed above, the Limited Admission is focused on the areas identified on Figure 3. Therefore, review of data is focused on that data contained within or in the vicinity of the Limited Admission areas.

4.1: Soil Investigation Results

In review of the results, laboratory analytical results from soil samples collected during the course of the investigation were initially compared to LDNR Statewide Order 29-B criteria for upland criteria for reference purposes only. In addition, soil results were compared to either RECAP screening or Management Option 1 standards under a non-industrial scenario. The application of RECAP standards was done after a determination of compliance with Statewide Order 29-B was made to evaluate whether the site conditions were protective of human health and the environment as proof of good cause and to potentially establish a more feasible remediation plan pursuant to LAC 43:XIX.319 and the memorandum of understanding between the LDNR and the LDEQ dated February 2011.

The use of RECAP screening standards is not appropriate to be utilized as remediation goals as the screening standards take into consideration certain exposure pathways and additivity calculations that are overly conservative and are not site specific. The more appropriate standards are those site-specific RECAP goals met under a higher tier of RECAP, either Management Option 1 (MO-1) or higher. Likewise, the Statewide Order 29-B standards are not site specific and alternative standards would allow for the determination of a more feasible plan for the site.

4.1.1: Evaluation of Compliance with Statewide Order 29-B

Laboratory analytical results from soil samples collected during the course of the investigation were initially compared to LDNR Statewide Order 29-B criteria for upland criteria for soil. The data demonstrate that the overall elevated constituent concentrations in the soil are limited in extent both within the Limited Admission soil area and on the remaining portions of the site.

Within the Limited Admission soil area, laboratory analytical results from soil samples collected by ICON, MP&A, and/or HET report elevated EC values identified within the pipeline right-of-way within the Limited Admission area in soil boring ICON GH-7 at depths between two (2) and six (6) feet BLS. EC data from soil samples collected from ICON GH-7 varied by laboratory in the eight (8) to ten (10) foot intervals, with elevated EC values reported only in ICON's results. MP&A conducted subsequent sampling, with soil boring locations SB12 and SB13 located within the Limited Admission soil area, for the analyses of ESP and SAR only at depths less than three (3) feet. Laboratory analytical results reported elevated concentrations of ESP and SAR above the respective Statewide Order 29-B standards of twelve (12) and fourteen (14), respectively.

Laboratory analytical results from ICON soil borings SB4 and SB6 located immediately east and west of the Limited Admission soil area had no salt-based exceedances, except a single ESP measurement of 12.7 percent, compared to the standard of twelve (12), in a single interval in SB4 only. Therefore, it appears that chloride-based exceedances are confined to the Limited Admission soil area. Further evaluation to confirm vertical delineation at GH-7 below ten (10) feet could be conducted where laboratory results differed between the sampling parties.

Based on a root zone study conducted by Luther Holloway, Ph.D., an effective root zone (ERZ) of eight (8) inches would be more than adequate for the Limited Admission soil area. Therefore, for satisfaction of the agronomic purposes of Statewide Order 29-B, further delineation may not be necessary, particularly given the limited horizontal extent of findings. Appendix M contains a copy of the root zone evaluation conducted by Luther Holloway, Ph.D.

With regard to hydrocarbons and metals, no elevated concentrations above the Statewide Order 29-B oil and grease standard of one (1) percent were identified on-site. The elevated concentrations of arsenic ranged from 11.9 parts per million (ppm) [GH-7(8-10')] to 12.8 ppm [SB-4(4-6')]. However, the elevated concentrations of arsenic were below the LDEQ statewide background concentrations of twelve (12) ppm once the above concentration is converted to a wet-weight concentration and confirmatory sampling could be conducted to confirm the concentrations above the Statewide Order 29-B standard of ten (10) ppm as the sampling data differs between the sampling parties if desired. Furthermore, the total barium concentration detected at a dry-weight concentration of 693 ppm [SB4(0-2')] was below the RECAP, Management Option 1 standards and the True Total Barium concentration detected in the same sample was less than the Statewide Order 29-B standard of 40,000 ppm. Therefore, further evaluation of metals in the soil is not necessary and would not be the driving factor for assessment or remediation at the site.

Appendix I contains the concentration maps illustrating the extent of constituent concentrations in the soil and groundwater at the site as it relates to the Limited Admission areas in exceedance of either Statewide Order 29-B or RECAP screening standards.

4.1.2: Evaluation of Compliance with RECAP

RECAP evaluates chlorides under Appendix D as a non-traditional parameter with the following considerations: 1) applicable or relevant and appropriate requirements, 2) protection of resource aesthetics, 3) environmental fate and transport pathways, 4) protection of vegetation, and 5) background conditions. Additional guidance published by LDEQ and approved on other sites by both agencies established methods to consider chloride concentrations in a typical risk assessment methodology as sodium chloride concentrations do not pose a threat to human health. Both sets of regulatory standards, as promulgated by the LDNR and LDEQ, are taken into consideration by HET to evaluate site conditions. The agriculturally derived standards of EC, SAR, and ESP are typically evaluated within the root zone for the ability to support vegetation growth, and observations made by HET and other experts of the property have documented healthy and overgrown grasses,

trees, and shrubs across the property. Subsurface concentrations of chloride are evaluated for protection of the Point of Exposure (POE), as defined by RECAP, either being the protection of groundwater or the nearest surface water body capable of receiving discharge after consideration of the additional risk assessment methodology promulgated under RECAP.

Samples collected beneath the ERZ during the course of the investigations were analyzed for total chlorides and electrical conductivity, as well as SPLP analyses, to evaluate the potential for cross media transfer (soil to groundwater). The concentrations of chloride related parameters in the soil demonstrate that the subsurface concentrations of chloride and sodium are considered below the threshold to result in cross media transfer (soil to groundwater). Therefore, the chloride, EC, and sodium concentrations are considered to be protective of the shallow water bearing zones by conservatively multiplying the EPA secondary drinking water standards of 250 milligrams per liter (mg/L) for chlorides and sixty (60) mg/L for sodium by a default dilution and attenuation factor (DAF) of twenty (20) in accordance with RECAP (Table 1). The highest concentration of SPLP chloride was determined as 248 ppm in ICON boring GC-4 along the western portion of the site. Alternatively, ICON utilizes the Statewide Order 29-B standard of Leachate Chlorides to determine the potential for cross media transfer; however, the Leachate Standard is applicable under 29-B to on-site burial requirements only that are not applicable here. Moreover, the SPLP analyses are considered more appropriate by the regulatory agency and are specifically referenced and included in the methods outlined necessary to complete a risk assessment in RECAP.

Based on a review of the hydrocarbon and metal concentrations in the Limited Admission soil area, hydrocarbons were not a constituent of concern and metals were detected at concentrations below the respective RECAP screening standards. Appendix I contains the concentration maps illustrating the extent of constituent concentrations in the soil and groundwater at the site as it relates to the Limited Admission areas in exceedance of Statewide Order 29-B and/or RECAP screening standards.

4.2: Groundwater Investigation Results

Groundwater results were collected from three (3) distinctive zones at the Guidry property, being the shallow (35-50'), intermediate (50-80'), and deep (80-120') zones. In addition, regional water wells were sampled by ICON as part of the assessment of the adjacent Bundrick property and are included as part of this assessment, especially with regard to background conditions. The groundwater results were initially compared for evaluation purposes to either RECAP screening standards, EPA Secondary Drinking Water Standards, and to background as understood for the site.

Based on a review of laboratory analytical results, groundwater samples collected during the course of HET's and ICON's investigation from wells within the Limited Admission groundwater zone (the intermediate zone) reported elevated concentrations above the EPA Secondary Drinking Water Standards for chlorides and/or TDS in three (3) wells. Combined radium 226/228 also exceeded EPA Drinking Water Standards in the Limited Admission groundwater zone wells, although Dr. Frazier has determined that these radiological concentrations are consistent with natural findings. Levels of barium in one (1) well [GC-8D (50-60')] also exceeded drinking water standards.

In addition, HET identified elevated EC concentrations in soil samples collected during the installation of monitor well MW5 (also referred to as deep boring DB5) at depths between fifty-six (56) and sixty-four (64) feet BLS within clay lens associated with the intermediate groundwater zone. Additional delineation of EC in the soil at depth would be needed to the north and, possibly, south of HET monitor well MW5 as part of the further evaluation of the site.

ICON reported exceedances of screening standards for petroleum hydrocarbon ranges in groundwater samples from the Limited Admission groundwater zone wells. The hydrocarbon concentrations detected by ICON in the total petroleum hydrocarbon range were not confirmed by HET in the hydrocarbon fractions analyses. Additionally, elevated concentrations of iron and manganese were reported but are not characteristic of E&P waste and appear to be consistent with natural conditions.

Finally, the review of groundwater defined above remains the same under RECAP considering the classification of the groundwater as GW_1. The plan defined below proposes further assessment for better site understanding and as part of the natural attenuation remedy. No further risk evaluation is presented

here, other than comparison to the GW_1 standards per Table 3 of RECAP as the screening standards taking into certain additivity calculations, such as the hazard quotient of 0.1 that is not appropriate for the site conditions.

Appendix I contains the concentration maps illustrating the extent of constituent concentrations in the soil and groundwater at the site as it relates to the Limited Admission areas in exceedance of Statewide Order 29-B and/or RECAP screening standards.

4.3: Toxicology Report

Dr. Cox analyzed all the available data, including data collected by the plaintiffs, identified as ICON samples and analytical data collected for BP, identified as HET and MP&A samples, in determining any threats to human health in the Limited Admission areas. Dr. Cox determined that no constituents of concern located within the Limited Admission areas (for soil or groundwater) posed a risk to human health. Details of Dr. Cox's analysis are contained in Appendix N.

4.4: Environmental Toxicology

Barry Gillespie, Ph.D., conducted an ecological risk assessment (ERA) in accordance with LDEQ (2003) and U.S. Environmental Protection Agency (e.g., USEPA 1993, 1997, and 1998) guidance and data collected on March 22, 2017 and April 11, 2017. Those guidance documents establish a tiered approach to evaluate whether site constituents of potential ecological concern (COPECs) present an unacceptable risk to ecological receptors. Appendix O contains supporting documentation to the ERA, including an ecological checklist.

The Guidry property is a highly functioning upland habitat with a diverse vegetated understory and stand of overstory vegetation dominated largely by Chinese tallow. Based on historical imagery, the Guidry property was predominately open pasture or non-forested land prior to 2000. Around 2008/2009, the property appears to have been allowed to revegetate without grazing or mowing. In this geographical location, it is not unusual for open areas to be colonized quickly by Chinese tallow initially and then the more robust understory to develop over time. Numerous pipeline/utility corridors traverse the property and

these corridors appear routinely maintained and dominated with grasses while other areas of the site are dominated by woody vegetation. The Limited Admission soil area is located within one (1) of these corridors and represents an area dominated by grasses and smaller organisms, such as small invertebrates, mammals and birds. Numerous wildlife and wildlife signs [e.g., foraging birds, reptiles, invertebrates, and mammal sign (footprints, scat)] were observed on site and numerous food sources (fruits and seed heads) were prevalent in the dense understory and open grassy areas. This is all indicative of a highly functioning ecosystem that is being utilized by each feeding guild represented within our ecological assessment models.

Due to the presence of COPECs in selected site soils and the proximity of sensitive habitat (i.e., bottomland hardwood area to the east) near the site, the tier 1 screening-level assessment was performed to screen constituents detected in soil samples on site against relevant ecological screening benchmarks. Maximum site concentrations for Total Arsenic (As), Total Barium (Ba), True Total Barium (True Total Ba), Total Cadmium (Cd), Total Chromium (Cr), Total Lead (Pb), Total Mercury (Hg), Total Selenium (Se), Total Silver (Ag), Total Strontium (Sr) and Total Zinc (Zn) were screened against the following soil screening benchmarks:

- Ecological Soil Screening Levels (Eco-SSLs) (USEPA, 2005, 2006, 2007);
- Oak Ridge National Laboratory toxicological benchmarks (Efroymson et al., 1997); and
- USEPA Region 5 Ecological Screening Levels (USEPA, 2003).

Maximum concentrations of As, Cr, Ag and Zn in reported site soil did not exceed the screening level benchmarks and were not carried forward for further ecological evaluation. Maximum concentrations of Ba, True Total Ba, Cd, Pb, Hg, Se and Sr exceeded established screening level benchmark values and were carried forward for further evaluation in a site-specific assessment utilizing more realistic and site-specific data and parameters.

For this ERA, the following receptors were selected as representative of upper-trophic level feeding guilds utilizing this property:

- Mammalian species – Eastern Cottontail, Raccoon, and Least Shrew and
- Avian species – American Robin and American Woodcock.

Potential risks to these representative receptors were modeled using a hazard quotient (HQ) approach and reasonably conservative exposure scenarios and exposure factors. The estimated HQs for each COPEC and representative receptor were less than 1.0, indicating that under reasonably conservative exposure scenarios, concentrations of COPECs reported in soils at the site do not adversely impact representative populations of birds and mammals which may utilize the site for foraging and nesting.

5.0: POTENTIAL RECEPTORS

RECAP considers potential receptors associated with potentially impacted media (soil and groundwater). The water bearing zones on the property and within the Limited Admission area are not currently utilized as a source of groundwater. However, the intermediate to deep zones regionally are used as sources of groundwater, with water wells installed in the vicinity of the site as shallow as eighty (80) feet BLS.

Review of the LDNR water well registration online database identified a total of 237 wells within a one (1) mile radius of the property, of which twenty-eight (28) are either plugged or abandoned. The uses of the wells include the following: 1) sixteen (16) public supply wells at depths between seventy (70) and 180 feet BLS; 2) seventy-nine (79) domestic wells at depths between fifty-four (54) and 140 feet BLS; 3) eleven (11) industrial wells at depths between sixty-six (66) and 205 feet BLS; 4) three (3) irrigation wells at depths between eighty (80) and ninety (90) feet BLS; 5) eighty (80) monitor wells at depths between twenty-four (24) and 168 feet BLS; 6) fifteen (15) oil and gas well rig supply wells at depths between 100 and 176 feet BLS; and 7) three (3) unknown wells at depths between seventy (70) and 240 feet BLS. Only one (1) of the wells listed above is listed as installed within the Chicot aquifer with a depth of 240 feet BLS, with the remaining wells installed within the alluvial aquifer or equivalent. Based on this information, as well as the lithology determined during the course of the assessments conducted on the property, these USDWs are in hydraulic communication with the Chicot aquifer beneath the site investigated as part of this litigation. Figure 17 illustrates the locations of registered water wells within a one (1) mile radius of the site and the location of the newly discovered historic metal water well.

6.0: SUMMARY OF FINDINGS TO BE ADDRESSED BY A PLAN

Substantial soil and groundwater investigations on the Guidry property have characterized environmental conditions and have documented no toxicological risk to human health or any adverse impact on ecosystem function within the Limited Admission areas.

The site investigation found that the surface of the property within the Limited Admission soil area was well vegetated with no visible signs of impact. Soil analytical results demonstrated no exceedances of applicable standards for metals or hydrocarbons in the Limited Admission soil area. Elevated chloride parameters of EC, SAR and/or ESP in the shallow soil depths within that area were not affecting vegetation and were detected at concentrations considered protective of the underlying groundwater zones. The potential for any further evaluation or remediation is addressed in the plan that follows below.

The site investigation found that groundwater within the Limited Admission groundwater area exceeds applicable regulatory standards and background levels with respect to certain constituents. The plan that follows below provides for further evaluation to fully understand those constituents and, if necessary, to remediate conditions within the Limited Admission groundwater area.

The following sections of this document reflect the consideration of the necessity and content of further evaluation needed for the Limited Admission areas. This document then presents and considers potential remedial options and recommends the most feasible plan for remediation to the extent such a recommendation can be made prior to completion of further evaluation.

7.0: MOST FEASIBLE PLAN

Before deciding whether remedial options should be considered, Louisiana Revised Statute 30:29 provides for creation, when necessary, of the most feasible plan for evaluation to determine the necessity and scope of remediation. The need for further evaluation is addressed in this section. With respect to soil, further evaluation could be performed but is not necessary to obtain site closure as set forth below. For groundwater, however, further evaluation is clearly required and a plan for evaluation is presented as the most feasible plan, with respect to groundwater in the Limited Admission groundwater area. As set forth in Section 8.0, active groundwater remediation is not part of the most feasible plan for this site.

7.1: Further Evaluation of Soil

As documented in the foregoing discussion, chloride parameters have been evaluated in the Limited Admission soil area. Available data horizontally limit and define the extent of salt parameter exceedances to within the Limited Admission soil area. The vertical extent of chloride related exceedances of the parameters of Statewide Order 29-B have not been fully delineated, and one (1) sample at depth for EC slightly exceeded 29-B levels but was not verified in split sample. Additional evaluation could be undertaken through a confirmatory soil boring within the Limited Admission soil area, but due to the limited ERZ and prior guidance of the Department, should not be necessary because delineation of split sample results did not confirm and the subsurface concentrations have been determined to be protective of groundwater. A proposal for installation of a deeper confirmatory boring at the ICON GH-7 location is included at an approximate cost of $25.00 per foot depending on the depth of the boring, should the department require that evaluation. However, based on existing data and the ERZ, the most feasible plan for soil at this site is no further action with options for continued monitoring of the vegetation to ensure uninhibited growth within the Limited Admission soil area based on the remedy selection process discussed below.

7.2: Further Evaluation of Groundwater

The area of groundwater covered by the Limited Admission represents an area of recognized elevated constituents on property covered by a pending lawsuit. The source and ultimate legal/regulatory responsibility for those findings have not been determined. The elevated constituents found at GC-8D (50-60') were determined by ICON as limited in extent in its reports issued to date. The investigation conducted by HET provided additional detail. Geochemical analysis shows the impact associated with GC-8D and GC-12D to be distinct from constituents or impact in adjacent vertical and horizontal samples. Additional evaluation is necessary in order to fully understand the intermediate zone and the interface of constituents found within the Limited Admission area and surrounding portions of the intermediate zone. A plan for additional evaluation is provided below.

7.2.1: Groundwater Evaluation

HET proposes to expand the existing network of monitor wells from that previously installed during the HET and ICON investigations at the site. Figure 26 illustrates the locations of the proposed monitor wells to be installed in both the shallow and intermediate zones, as well as the existing wells installed to date for the further evaluation of the constituents of concern. Two (2) of those wells will be installed to evaluate the source of the Limited Admission groundwater area. Once all proposed monitor wells are installed, quarterly groundwater monitoring events will occur for a three (3) year period to evaluate the groundwater conditions and determine the need for further evaluation and assessment, if necessary. Based on findings in these wells, additional wells and/or borings may be installed in consultation with the department to properly understand and evaluate the site. In addition, groundwater elevations will be measured during certain sampling event to determine any variability in groundwater flow directions and quality over time. Additional aquifer testing can be done to assist in the further evaluation of the intermediate zone, as necessary and appropriate, and assess the viability or progress of the MNA or other remedial options.

Prior to all sampling events, monitor wells will be developed of three (3) to five (5) standing well volumes or dryness one (1) time with a dedicated or decontaminated hand bailer or other approved bailing method. The wells will be purged so that the groundwater samples collected will be representative of groundwater conditions and not conditions within the wells themselves. Once the well conditions have stabilized, samples will be collected from each well, properly containerized, labeled, chilled to 4°C ± 2°C, and transported under chain-of-custody records to an LDEQ accredited laboratory. Groundwater samples will be analyzed for the following parameters by an accredited laboratory, as necessary and appropriate based on previous data collected:

1. chlorides, sulfates, and bromides by SW-846 Method 9056A
2. total dissolved solids (TDS) by Method 2540C (SGS Accutest and Eberline)
3. specific conductance by Method 2510B
4. total and dissolved metals by EPA SW-846 Method 6010B/6020/7470A
5. bicarbonate and carbonate alkalinity by Method 2320B
6. radium 226/228 by EPA Modified Methods 903.0 and 904.0

Quality control/quality assurance will be conducted in the following manner during groundwater sampling events: one (1) field duplicate and one (1) equipment blank per twenty (20) samples will be collected for laboratory analyses. In addition, a trip and field blank will be collected for each day of sampling in the event that volatile parameters will be analyzed on the samples. Appropriate detection limits will be obtained by laboratory personnel on all parameters for application to the RECAP document, as appropriate. Sample collection will be conducted utilizing dedicated tubing for each well, and new, disposable latex gloves were used for each sample collection. All groundwater generated during purging events will be appropriately containerized and stored until disposal arrangements are made.

8.0: EVALUATION OF SOIL REMEDY ALTERNATIVES

8.1: No Further Action

As part of this Limited Admission, no further action is considered a viable alternative for soil remediation as the property is being used for its intended purposes and all concentrations meet applicable comparative standards that both allow for vegetative growth and are protective of groundwater. Furthermore, the extent of the soil concentrations that exceed the Statewide Order 29-B standards within the Limited Admission area are largely located within a pipeline right-of-way that would restrict or preclude the scope of remediation, including potential interference with pipeline operations supporting active production in the area. No further action is the recommended option for the site.

8.2: Vegetation Monitoring

As a reasonable alternative and in support of no further action, it is possible to conduct observations of vegetation growth within the Limited Admission soil area over time with confirmatory sampling, as necessary and appropriate, to document either steady or declining conditions. This option is supportive of no further action and is also a recommended option as requested by the Department as further explained above in Section 8.1.

8.3: On-Site Soil Mixing and Blending

Soil mixing and blending and/or land treatment is an effective option that eliminates the need for off-site transport and disposal. The soil mixing and blending option is often enhanced by the use of off-site clean and inert backfill and the application of soil amendments, such as gypsum, to achieve compliance with regulatory standards. In addition, source removal can also eliminate certain areas to aid in the mixing process, resulting in a greatly reduced excavation total. However, this option was not considered to be necessary or feasible due to the fact that the concentrations do not affect the intended use of the property, coupled with the presence of the active pipelines within the right-of-way.

8.4: Excavation and Off-site Disposal

Soil excavation as the only remediation option is typically a last resort as it both causes the most disruption on-site, requires the use of landfill space, and results in damaging another property that would be necessary to be used as backfill material. This option was not selected due to its large, wasteful, and invasive scope and costs in addition to the facts that the concentrations detected in the soil do not affect the overall use of the property, the presence of the active pipelines, and the other options listed above as being more effective. However, in consideration of the administrative requirement for presentation and consideration of full compliance with Statewide Order 29-B and removal of E&P constituents, this option was fully evaluated. Additional detail and costs are presented in Appendix P.

8.5: Soil Remedy Selection

Based on the alternatives considered above, no further action with the option for observation of vegetation monitoring over time is the most feasible plan for the site. Further discussion and presentation of this plan is offered below.

9.0: EVALUATION OF GROUNDWATER REMEDY ALTERNATIVES

Final selection of a groundwater remedy for the Limited Admission groundwater area should not be made prior to execution of the most feasible plan for further evaluation of the Limited Admission area and/or adjacent areas, as the Department may order. In order to address any possibility that the Department may want presently to consider remedial options, however, the following analysis is provided based on available information.

9.1: Evaluation of Groundwater Remedy Alternatives, if Necessary

As set forth above, further evaluation of groundwater at this site is necessary. For the reasons set forth below, monitored natural attenuation is the most feasible plan for remediation of conditions that have been documented to date. Furthermore, monitored natural attenuation is consistent with the additional evaluation set forth above. In order to meet potential requirements of the Department for consideration of the most feasible plan of remediation, a discussion of all remedial alternatives and potential utilization is provided.

9.2: No Further Action

As part of this Limited Admission, no further action is not considered a viable alternative for groundwater remediation as this process does not allow for evaluation of the aquifer over time for determination of risk and variations in water quality within the aquifer.

9.3: Monitored Natural Attenuation

Monitored natural attenuation (MNA) through the process of groundwater monitoring is a preferred remedial alternative to provide additional support and information of the aquifer system. Groundwater monitoring is the directive of LDNR 29-B regulation, Section 309 for determining if former pit contents have impacted an aquifer. MNA is also supported and recommended by the Louisiana Department of Environmental Quality RECAP programs for groundwater evaluations on site across the state of Louisiana.

Furthermore, monitoring of the shallow, intermediate zones at this site will provide data and information necessary to assure that the site groundwater is protected consistent with its current use and reasonably anticipated future uses. This program will be effective in both the short and long term and will allow for continued improvement of water quality in the aquifer. This is a cost effective alternative.

9.4: MNA with Water Well Installation

MNA supplemented with water well installation at a depth of eighty (80) feet or greater in the Limited Admission area will allow for future utility of the property. In this area, the deeper zone is not impacted and is capable of being utilized for its intended purpose. As part of this Limited Admission, water wells have been designed to withdraw water from the deeper zones and will have complete operational equipment, including pump, water softener equipment, and air pressurized holding tanks. This alternative is cost effective and allows the landowner to use the deeper portion of the aquifer in conjunction with ongoing MNA.

9.5: Active Groundwater Remediation

Active groundwater remediation is not recommended for this site because more feasible alternatives are available and particularly because site evaluation indicates that groundwater impacts have declined markedly from their presumed origin in produced brine with a concentration of 77,000 ppm chlorides and will continue to attenuate without impairment of utility or environmental disruption because there are no apparent active sources. Active remediation is presented as a remedial option in this case as a matter of technical rigor in remedy selection and as a contingency plan in connection with proposal of monitored natural attenuation. Costs of a potential active remedial plan are presented in Appendix Q.

9.5.1: Feasibility Study

Prior to the implementation of any groundwater removal plan, a feasibility study should be conducted in accordance with recognized environmental remediation practices. That work is necessary and customary to adequately understand the aquifer characteristics over time and is

required for actual scoping and any reliable cost estimate of a potential pump and treat plan. Work for the feasibility study would include, but would not be limited to, installation of additional wells to evaluate rate and effects of potential groundwater withdrawal and recharge, as well as step draw down tests, groundwater sampling, and horizontal and vertical gradient determinations. That work would yield specific capacity, transmissivity, and storativity, among other important hydrogeological information. A feasibility study would be necessary for an understanding of the geologic environment and aquifer capabilities, to allow for possible design of an active remediation system.

Pilot test activities would be performed prior to full scale operation of the groundwater extraction system. Specifically, step drawdown tests will be performed to evaluate well capacity. Additional monitoring wells will be installed to refine the delineation of chloride. These monitoring wells will also be used to monitor water levels during twenty-four (24) hour pumping tests to be performed individually using each extraction well. The pumping tests will be evaluated to provide estimates of aquifer hydraulic conductivity. The three-dimensional groundwater flow model will be updated accordingly and used to predict the flowrates required to achieve the necessary spatial extent of capture. Any necessary adjustments to the design flowrates will be made prior to full scale operation and longer term testing may be required prior to implementation of the system installation.

9.5.2: Active Groundwater Withdrawal with On-site Disposal

Once data from the RI/FS is acquired and evaluated, the design of an active groundwater withdrawal program could be considered and/or implemented. An active groundwater withdrawal program would require installation of at least one (1) groundwater recovery well with related piping and infrastructure, operation, and maintenance over the life of the recovery. The safest and most feasible method for disposal of the recovered groundwater would be through local, underground injection. The installation and operation of such a system and its related costs outweigh the benefit when compared with MNA and the ready availability of useable water in the next underlying zone.

9.5.3: Active Groundwater Withdrawal with Off-site Disposal

Active groundwater remediation with off-site disposal would present the disadvantages noted in Section 9.5. Most significantly, however, it would entail trucking recovered groundwater, presenting public risks that outweigh the benefit of off-site disposal. It would also wastefully utilize commercial disposal capacity for water that does not present a risk to human health. This alternative is not recommended.

9.6: Groundwater Remedy Selection

It is emphasized that selection of an active remedial option prior to the completion of further evaluation is premature. Based on a review of laboratory analytical results, HET suggests that groundwater monitored natural attenuation with the placement of water wells in the deeper zone, if required if use of the aquifer on-site is desired, is the preferred groundwater plan.

10.0: MOST FEASIBLE PLAN FOR SOIL

Based on laboratory analytical results, elevated soil concentrations within the Limited Admission areas are limited to either the near surface soils within the bounds of the pipeline right-of-way or at depth associated with the clay lenses within the intermediate zone in HET monitor well MW5 pending additional delineation to the north of MW5. Therefore, the following option is offered for soil restoration as the most feasible plan.

10.1: Most Feasible Plan for Soil

Elevated chloride parameters above comparative standards under Statewide Order 29-B only are either within the pipeline right-of-way associated with active off-site oil and gas production activities or at depths associated with the clay lenses identified along the eastern portion of the property, west of Bergeron Road associated with the intermediate zone. No other constituent concentrations were determined to exceed the appropriate regulatory standards for the site. Therefore, excavation is not a feasible option, especially since the surface and subsurface chloride concentrations have been determined to be protective of the intended use of the property and/or the underlying water bearing zones. As a result, the ICON option for excavation and/or application of amendments have/has been rejected. Based on the fact that the elevated chloride concentrations do not change the overall intended use of the property or result in distressed vegetation, HET proposes to monitor the soil during the course of the groundwater plans offered below, both from a visual standpoint to ensure vegetative support at surface and through groundwater sample results to ensure that the subsurface chlorides do not warrant unstable groundwater conditions. Costs associated with potential observations of vegetation growth as a contingency to no further action are included within the groundwater plan as personnel will be on-site periodically during MNA.

10.2: Confirmation Sample Collection Procedures

Confirmation sampling will be conducted over time and at the request of the Department to monitor the concentrations of chloride related parameters in the surface soils within the bounds of the pipeline right-of-way. Soil samples will be analyzed for the following parameters by an accredited laboratory, as necessary and appropriate, based on previous sampling data:

1. LDNR Statewide Order 29-B parameters (EC/SAR/ESP, Oil and Grease, True Total Barium)
2. total chlorides by Method 9056A
3. synthetic precipitation leachate procedure (SPLP) by Extraction Method 1312
4. metals by EPA SW-846 Method 6010B/7471B
5. percent moisture by Method D2216

Appropriate detection limits were obtained by laboratory personnel on all parameters for application to LDNR Statewide Order 29-B or RECAP, as appropriate.

11.0: MOST FEASIBLE PLAN FOR GROUNDWATER

Based on a review of laboratory analytical results, HET suggests that groundwater MNA with the placement of water wells in the deeper zone, if required, is the most feasible plan for remediation of groundwater at this site. Statewide Order 29-B provides for the monitoring of impacted groundwater and avoidance of further contamination and has been approved by the agency at other sites.[1] There are no identified on-going sources affecting groundwater in the Limited Admission zone, and further contamination is not anticipated. MNA is, therefore, appropriate under Statewide Order 29-B. As discussed above, the affected area does not present risks to human health or the ecosystem at the Guidry property. MNA will further document declining conditions for the affected zone.

The existence of these conditions and available information clearly indicate that constituent concentrations can be expected to decline to levels that are protective of human health and the ecosystem. Existing levels have already dramatically declined from their presumed origin in produced brine with a concentration of 77,000 ppm chlorides. The ready availability of useable groundwater in the Limited Admission area further supports the feasibility of this option, and the plan includes a provision for a well to the underlying zone to allow full utility of the property. This plan is the least disruptive, most cost effective, and does not impair the intended use of the property. The potential for other, active remediation remains an available contingency plan if future monitoring does not indicate a satisfactory decline in constituent concentrations consistent with the intended use of the property and other principles of feasibility and environmental protection.

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[1] The regulations call for a plan submitted under La. R.S. 30:29 to include a plan for compliance with Statewide Order 29-B, without exception, as a predicate to proposal of a feasible plan that utilizes RECAP or an exception as provided in Statewide Order 29-B. MNA complies with terms of Statewide Order 29-B and therefore satisfies the requirement for a submission of a 29-B compliant plan. However, the authors are aware that in some instances the Department has required submission of a plan for remediation of groundwater to background levels. A plan for active groundwater remediation has been considered and is presented for agency reference based on that past guidance and as a contingency for MNA as an attachment in Appendix Q.

11.1: Groundwater Monitoring

The purpose of the groundwater monitoring is to ensure that constituent concentrations are declining over time and pose no risk to human health and ecosystems. Monitoring over time is required to develop an understanding of seasonal fluctuations and recharge to the aquifer and to document constituent fate and transport. The following monitoring plan is the most feasible method for remediating the elevated constituents in the Limited Admission zone. In addition, HET proposes an option to install a water well or wells, if necessary, into the lower portions of the aquifer should a requirement of water be necessary in the vicinity of the Limited Admission groundwater area.

MNA will build upon the further evaluation proposed for this site. Monitoring of the proposed network of wells will be undertaken as proposed in the additional evaluation plan submitted above. Additional evaluation of monitor wells or sampling and aquifer testing techniques will be developed, as necessary, based on the result of the evaluation process. The physical protocols for installation and sampling of wells are as set forth for the evaluation plan above.

Figure 26 illustrates the locations of the previously installed monitor wells at the site, proposed monitor well network, and those additional wells proposed for further definition of conditions in both the shallow and intermediate zones. The nested cluster of wells will aid in determining groundwater flow velocities, as well. Appendix I contains the concentration maps illustrating the extent of constituent concentrations in the soil and groundwater at the site as it relates to the Limited Admission areas in exceedance of either Statewide Order 29-B and/or RECAP screening standards.

12.0: FINAL RECOMMENDATION, TIMEFRAME, AND ESTIMATED COSTS

All field work will be completed under the direction of the LDNR with regulatory reporting and notification procedures implemented to keep all parties up to date on the progress of the proposed work.

12.1: Final Recommendation of Most Feasible Plan

The most feasible plan to address soil conditions for compliance with applicable regulatory standards at this site is no further action at this time. The only regulatory standards implicated through environmental sampling of soil in the Limited Admission soil area are those related to salt. Electrical conductivity findings in the root zone are within regulatory limits. Parameters addressing sodicity are not affecting plant growth or utility of the site. Existing levels are, therefore, consistent with the intended use of the property and comply with Section 309 of Statewide Order 29-B without further action.

The most feasible plan for groundwater is implementation of the proposed plan for further evaluation submitted herewith. That plan is necessary to understand the site fully for any future management option and is consistent with the monitored natural attenuation remedy discussed in the foregoing text. A contingency provision for installation of water well(s) to available underlying groundwater zones in the event of property development is recommended to the extent any remedial option is selected at this time.

12.2: Anticipated Remediation Time Frame

An anticipated time frame of six (6) months to one (1) year will be required from the time the plan is submitted to the regulatory agencies until the time for regulatory approval. HET estimates that the length of the project to complete the soil and groundwater monitoring program to be a total of three (3) years upon completion of permitting and regulatory agencies' approval. The final length of time will be based upon confirmation sampling and may be affected by the inclement weather and other unforeseen potential delays. Timelines are presented in Appendix R utilizing reasonably feasible start dates. Actual time frames will depend upon plan approval, site access, and litigation procedures.

12.3: Reporting Requirements

A written report will be formulated and submitted to the LDNR upon receipt of all field data on an annual basis during the course of excavation and/or groundwater monitoring process. The report will include complete documentation of areas of remediation, field methodology, description of soil and groundwater sampling protocol, current site conditions, extent of contaminant plume, laboratory analyses, and chain-of-custody records, as well as conclusions and any recommendations. The report will be structured to include a summary of all field activities and will include all documentation necessary to petition the LDNR for site closure. Upon approval of the site closure request, HET will proceed with plugging and abandonment of the on-site monitor wells.

12.4: Cost Estimate

Associated costs with the implementation of the most feasible plans for soil and groundwater, including monitoring of both soil and groundwater concentrations over time, are outlined below in Text Table 1. Appendix R contains a copy of the estimates prepared/obtained by the defense group.

Text Table 1
Proposed Remediation Costs
Guidry Property
Anse La Butte Oil and Gas Field

Proposed Remediation Option	Proposed Cost Estimates
Surface Soil and Vegetation Monitoring	Included in the MNA Plan
Further Evaluation of Groundwater	$79,761.66
Groundwater Monitored Natural Attenuation, Sampling, and Reporting (Three Years)	$998,918.58
Water Well Installed to Deep Zone on Guidry Property, Including Pump and Tankage	$5,280.00 per well

ATTORNEY CERTIFICATION

I, George Arceneaux III, have reviewed the information submitted herewith and hereby attest that to the best of my knowledge, information and belief it is true and correct and is based on scientific data that has been obtained in a manner compliant with all applicable regulations.

George Arceneaux III (La. Bar No. 17442)

APPENDIX A

RÉSUMÉS

APPENDIX B

FIGURES

APPENDIX C

TABLES

APPENDIX D

GEOLOGICAL BORING LOGS

APPENDIX E

LABORATORY ANALYTICAL RESULTS

APPENDIX F

MONITOR WELL REGISTRATIONS, LDNR 1-MILE RADIUS WATER WELL SURVEY, AND MAYEUX SURVEY

APPENDIX G

AQUIFER TEST DATA

APPENDIX H

FIELD NOTES

APPENDIX I

CONCENTRATION MAPS

APPENDIX J

HISTORICAL EXPLORATION DOCUMENTS IN SUPPORT OF EXPLORATION HISTORY

APPENDIX K

ADDITIONAL EXPERT ANALYSIS – HEALTH PHYSIC (JOHN FRAZIER, PH.D.)

APPENDIX L

ADDITIONAL EXPERT ANALYSIS – HYDROGEOLOGY AND REMEDIES (B.H. KUEPER, PH.D.)

APPENDIX M

ROOT ZONE STUDY (LUTHER HOLLOWAY, PH.D.)

APPENDIX N

ADDITIONAL EXPERT ANALYSIS – TOXICOLOGY (DR. ROBERT COX)

APPENDIX O

ADDITIONAL EXPERT ANALYSIS – ENVIRONMENTAL TOXICOLOGY (BARRY GILLESPIE, PH.D.)

APPENDIX P

SOIL EXCAVATION AND OFF-SITE DISPOSAL CONTINGENCY PLAN

APPENDIX Q

DESCRIPTION OF MODELING AND GROUNDWATER RECOVERY/DISPOSAL CALCULATIONS AND COST ESTIMATES FOR ACTIVE REMEDIATION OF GUIDRY LIMITED ADMISSION GROUNDWATER AREA

APPENDIX R

COST ESTIMATES AND SUPPORTING DOCUMENTATION FOR FEASIBLE PLAN

APPENDIX S

REFERENCES