APPENDIX N

ADDITIONAL EXPERT ANALYSIS - ECOTOXICOLOGY (ERM)

Ecological Risk Assessment

August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company, Grand River Oil & Gas Field, Iberville Parish, Louisiana

November 2, 2022

Project No.: 0645446

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Ecological Risk Assessment

August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company, Grand River Oil & Gas Field, Iberville Parish, Louisiana

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EXECUTIVE SUMMARY

An ecological risk assessment (ERA) was performed by Dr. Helen Connelly for the August Levert Property (Property), located in the Grand River Oil and Gas Field, Iberville Parish, Louisiana. This ERA has been prepared in accordance with U.S. Environmental Protection Agency (USEPA) and Louisiana Department of Environmental Quality (LDEQ) guidance (e.g., USEPA, 1997, 1998; LDEQ, 2003). The ERA evaluates whether oilfield exploration and production (E&P) operations within the Property have damaged the ecology (flora and fauna) on the Property. The ERA demonstrates that there are no unacceptable risks to ecological receptors on the Property from E&P operations and that remedial action based on ecological risk is not required. This conclusion is supported by the following information and evidence:

- Field inspections and evaluations performed by Dr. Helen Connelly (2022), ICON (2022), HET (2022), Dr. Wade Bryant (2022), and Dr. Bernard Kueper (2022);
- Data from 2019 and 2022 investigations of soils, groundwater, wildlife, and vegetation (ERM, 2022; ICON, 2022; HET, 2022; Bryant, 2022; Keuper, 2022); and,
- The results of a Screening Level Ecological Risk Assessment (SLERA) and Baseline Ecological Risk Assessment (BERA) of the Property, which includes a comparison of soil COPEC concentrations with ecological screening values (ESVs) and calculation of potential for ecological risk.

The Property supports aquatic and terrestrial habitats important to the Inland Swamps Ecoregion, in which the Property is located, and includes emergent and forested wetlands, canals, and lakes. Vegetation on the Property is very diverse (87 vegetative taxa observed) and includes 52 different forbs/herbs/grasses and 37 trees and shrubs, of which 15 trees are ones commonly associated with forested bottomland hardwood and swamp wetlands in Louisiana.

The vegetative diversity at the Property was compared to similar habitat within a reference location, Sherburne Wildlife Management Area (WMA), 18.5 miles northwest of the Property. The comparison shows that the Property has a community structure of grasses, forbs, herbs, trees, and shrubs similar to the WMA, and that the species present at the Property are typical and representative of the region. This favorable comparison to a protected area is a line of evidence that the ecosystem is thriving appropriately and is as expected for the region.

The Property supports an intact food web, including 22 species of birds and 46 non-avian taxa, including insects, aquatic invertebrates, reptiles, amphibians, and mammals. The Property bird population compares favorably to the avian trophic structure at the WMA and includes 4 birds listed as Species of Greatest Conservation Need (SGCN) by the Louisiana Department of Wildlife and Fisheries (LDWF). The structure of the avian population, from herbivores to top predators is as expected for forested wetlands in Louisiana and is a line of evidence that the food chain is balanced and functioning on the Property. The observations of all trophic levels of the terrestrial and aquatic food webs on the Property are a line of evidence of a functioning ecosystem.

The Property is providing ecological services that are expected of forested wetland habitats in the Inland Swamps Ecoregion. The forested wetlands provide ecosystem services including the dissipation of storms, soil stabilization, erosion and flood control, water purification, biological productivity and diversity, carbon sequestration, and provision of habitat. These services were observed during the field investigations and are a line of evidence that the wetlands on the Property are functioning as expected for comparable forests in south Louisiana.

The Property is within an ecological hub, as identified by USEPA, and is connected to the WMA and the rest of the Atchafalaya Basin through ecological wildlife hubs, corridors, and auxiliary connections. The Property is a diverse and valuable ecosystem within the larger landscape and ecoregion.

The ecological risk assessment was completed for this Property, per USEPA guidelines, as a SLERA, which includes the first two steps of the 8 step USEPA ERA process, and a BERA, which includes steps 3 through 8 of the process. The Property has three Limited Admissions Areas (LAAs) that include former E&P operational areas. LAA2 and LAA3 include Soil Remediation Areas (SRAs). The Soil Remediation Areas (SRAs) within the Property are evaluated, but due to planned remediation in these areas to meet regulatory (29-B) standards, the SRAs are not included in the SLERA and BERA. The portions of the Property that are not planned for soil remediation (i.e., portions of the Property that are outside of the SRAs) are included in the SLERA and the BERA.

Cadmium, mercury, and zinc were retained as Constituents of Potential Ecological Concern (COPECs) for a more in-depth assessment in a site-specific BERA, based on the results of the SLERA and comparison to conservative ESVs. These COPECs were identified by screening the soil analytical data collected from Property soils located outside of the SRAs (referred to as Property Excluding SRA). These COPECs were further assessed in the BERA.

Soils within the SRAs are planned for remediation (to meet regulatory guidelines) and were not included in the quantitative screening level or subsequent baseline ecological risk assessment. Average surface soil concentrations in the SRAs were evaluated and reviewed separately to determine if ecological risk is expected in these areas. The SRA soils, planned for remediation, are not predicted to be a source of adverse impact to the ecology, based on the evidence of soil analytical data demonstrating limited bioavailability of constituents in the SRAs and concentrations below ecological risk levels, as well as strong field evidence of diverse and thriving vegetation and abundant wildlife, without evidence of ecological impact. The soils in the SRAs are not proposed for remediation for ecological reasons, due to there being no evidence of ecological risk, but are planned for remediation to meet regulatory guidelines.

The BERA for the Property Excluding SRAs was completed using site-specific analytical data, region-specific wildlife receptor factors, and USEPA protocol. Five bird and three mammal wildlife receptors, representing the ecological populations observed and expected on the Property, were evaluated for potential exposure to site constituents. The BERA quantitatively confirms that historical E&P activities by defendants on this Property do not pose an unacceptable risk to wildlife and the environment.

1 INTRODUCTION

Dr. Helen Connelly of Environmental Resources Management (ERM) has prepared this ecological risk assessment (ERA) pertaining to the August J. Levert, Jr., et al. matter, in which ERM was retained by BP America Production Company (BP). The August Levert Property (Property) consists of approximately 55 acres of bottomland hardwood and swamp forested wetlands within Section 15, Township 10 South, Range 11E, in the Grand River Oil & Gas Field, Iberville Parish, Louisiana (Figure 1).

The Property contains former operational areas that were historically used for oil and gas exploration and production (E&P) activities, and evaluation and remediation is planned in these operational areas to meet state regulatory requirements (HET, 2022). The areas on the Property planned for evaluation and remediation are within three Limited Admission Areas (LAAs) LAA1, LAA2, and LAA3. Within LAA2 and LAA3, there are three areas planned for soil remediation (SRAs). There is not an SRA in LAA1. The SRAs are not included in the risk calculation portion of the ecological risk assessment due to the remediation planned for these areas, however, the observed ecology and habitat assessment in the SRAs is included in the ERA. The risk calculation portion of the ERA includes all soil data from the Property that is outside of the SRAs (referred to as Property Excluding SRAs).

The Property supports a variety of aquatic and terrestrial habitats important to the Inland Swamps Ecoregion, including both emergent and forested wetlands (Figures 2 and 3). Two canals traverse the Property, and Willow Lake intersects the Property from north to south (Figure 4). The habitats on the Property support a wide variety of wildlife, including wading birds, passerine birds, and raptors, terrestrial mammals, such as rabbits and armadillo, and aquatic species such as crawfish and American alligator (*Alligator mississippiensis*).

This ERA has been performed to evaluate whether historical oilfield E&P operations have damaged the ecology (flora and fauna) at the Property and whether remediation is required to protect the ecology. An ERA evaluates the ecological effects of chemical, physical or biological actions on an ecosystem by quantifying adverse effects on individuals, populations, communities, or ecosystems. This ERA has been performed in accordance with U.S. Environmental Protection Agency (USEPA) and Louisiana Department of Environmental Quality (LDEQ) guidance (e.g., USEPA, 1997; USEPA, 1998; LDEQ, 2003).

ERA, per USEPA guidance, begins with a screening level assessment and progresses to a more site-specific ecological risk assessment, if needed, to assess if there is unacceptable risk to ecological receptors due to exposure to COPECs in Property media.

The conclusions in this ERA are supported by the following data:

- Field inspections and evaluations performed by Dr. Helen Connelly (2022), ICON (2022), HET (2022), Dr. Wade Bryant (2022), and Dr. Bernard Kueper (2022);
- Data from 2019 and 2022 investigations of soils, groundwater, wildlife, and vegetation (ERM, 2022; ICON, 2022; HET, 2022; Bryant, 2022; Keuper, 2022); and
- The results of a Screening Level Ecological Risk Assessment (SLERA) and Baseline Ecological Risk Assessment (BERA) of the Property, which includes a comparison of soil COPEC concentrations with ecological screening values (ESVs) and calculation of potential for ecological risk.

The purpose of this ERA is to determine if 1) additional investigation and studies are needed, 2) remediation is needed, or 3) no further action is required.

1.1 Purpose of Report and Sources of Information

This report documents the ecological conditions of the Property and provides: 1) a review of Property background information and data; 2) an ERA; and 3) recommendations for a scientifically reliable course of action for the Property.

Fundamental principles of toxicology have been used to evaluate the Property and prepare this report. Basic principles of toxicology that govern the evaluation process include: 1) there must be an exposure to elicit a sufficient dose, response, and subsequent risk; and 2) an implemented remedy, if any, should not cause harm to a functioning ecosystem.

Information reviewed to prepare this report, other than the data in this report and the literature cited, include an expert report and restoration plan from ICON (2022), an expert report from Dr. William J. Rogers (2022), a report from HET (2022), a wetland delineation report from Dr. Wade Bryant (2022), a groundwater report from Dr. Bernard Keuper (2022), and audio/video/photographic recordings taken by third parties, including Neon Media.

Additional information may be reviewed and added to this report if additional information becomes available.

2 PROPERTY ECOLOGY

The condition, physical structure, and ecology of the Property ecosystem was assessed during field investigations of vegetation and wildlife performed by Dr. Helen Connelly on May 5, 2022, and August 17, 2022. There is sufficient ecological field data (2022), soil concentration data (2019 and 2022), and support from the scientific literature to evaluate the Property's ecosystem health.

2.1 Ecoregion

The Property is situated within the Inland Swamps Ecoregion of Louisiana, which is a freshwater region, north of the coastal marshes. The Inland Swamps ecoregion covers a large portion of the Atchafalaya Basin, where swamp forest communities are dominated by bald cypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*).

The Property is within the Atchafalaya Basin, which is the largest bottomland hardwood forest swamp in North America. The Property is within a globally designated Important Bird Area (IBA) (Audubon, 2015), the Mississippi Flyway for bird migration (Audubon, 2022a), and an ecological hub for wildlife connectivity in the region (USEPA, 2022b). The Property, by these measures, is important to local and regional ecology.

2.2 Ecological Communities

The Property contains emergent and forested/shrub wetlands and waterbodies (canals and Willow Lake) (Figures 3 and 4). Biota expected to occur in these types of ecological habitats and biota observed at the Property during the May 5 and August 17, 2022 field investigations are discussed in in detail in Section 3.

2.2.1 Wetlands

The Property is characterized as submerged wetlands (Bryant, 2022) based on elevation, wetland plants, and soils documented throughout the Property. The Property is dominated by freshwater forested/shrub wetlands with a small area of freshwater emergent wetland along the western Property boundary, per U.S. Fish and Wildlife (USFWS) National Wetlands Inventory (NWI) (Figure 2). The emergent wetlands are categorized by the NWI as persistent and semi-permanently flooded, indicating that the wetlands are dominated by species that normally remain standing until the beginning of the next growing season, and that surface water is persistent through the growing season in most years.

Per USFWS NWI, the forested/shrub wetlands are seasonally and semi-permanently flooded needle- and broad-leaved deciduous communities, represented by bald cypress and tupelo species (*Nyssa* spp.). These wetland communities and others were observed and documented during the 2022 field investigations. The wetland vegetation at the Property is further discussed in Section 3.1 below.

Wetlands provide important habitat and support a complex food web that includes the detrital food chain. At this Property and in many wetlands, the detrital food chain begins with detritus and the small invertebrates that feed on detritus. Aquatic invertebrates, such as crawfish, consume the organisms that feed on detritus. Then, the aquatic invertebrates are eaten by secondary consumers, such as snakes, frogs, and many species of birds, which are then diet for higher trophic level species, such as hawks (*Buteo* spp.) and American alligator. All levels of this detrital trophic food chain have been observed and documented at the Property. The presence of a functioning food chain is evidence of ecosystem function, as well as evidence that the Property is providing the ecosystem service of habitat for many species of wildlife.

Documentation of the expected trophic levels, as performed for this ERA, is part of the ecological risk assessment process (USEPA, 1997). Further discussion of the avian and wildlife communities at the Property is presented in Section 3.2 and 3.3.

2.2.2 Waterbodies

The USFWS NWI indicates the presence of riverine and lake features on the Property (Figure 2). The two canals on the Property are characterized as lower perennial (low gradient), permanently flooded channels. The lake feature on the Property, named Willow Lake, intersects the Property from north to south, and is categorized as permanently flooded (Figures 2 and 4). Based on the documented thriving ecology at the Property there is no indication that these waterbodies have been impacted by E&P operations.

2.3 Ecosystem Services

As part of the ERA, the Property has been evaluated for evidence of ecological services and functions and found to be providing services that are expected for wetlands and waterbody habitats (Barbier, 2013).

The expected and observed ecological services provided by the emergent and forested wetland habitats on the Property include: dissipation of storms (trees provide buffering), soil stabilization (roots hold soil in place), erosion and flood control (soils absorb water), water purification (surface water is cleaned via interactions with plants), biological productivity and diversity (habitat produces diverse vegetative and animal biomass), carbon sequestration (carbon stored in abundant vegetation), and provision of habitat (presence of diverse vegetative species). The waterbodies on the Property provide ecosystem services such as breeding grounds and habitat for aquatic and semi-aquatic species.

The observations of the expected ecosystem functions and services documented on the Property are a line of evidence supporting the conclusion of no adverse impacts to species or their habitats from historical E&P activities.

3 PROPERTY INSPECTIONS AND OBSERVATIONS

Dr. Helen Connelly performed field investigations and collected wildlife and vegetation data on May 5 and August 17, 2022. These data, along with wildlife and vegetation data collected by Mr. Jody Shugart (ERM, May 5, 2022), Ms. Emily Martin (ERM, May 5, 2022), and Dr. Wade Bryant (2022) were used to prepare the ERA.

Property, off-site, and reference area locations investigated during vegetation/wildlife surveys are shown on Figure 5A and Figure 5B, respectively. Habitat photographs that are representative of the locations investigated are shown in Figure 3. Photographs taken of habitat, vegetation, and wildlife are included in Attachment A and field notes are in Attachment B. LDEQ's Risk Evaluation/Corrective Action Program (RECAP) Form 18 is included in Attachment C.

3.1 Vegetation Characterization and Assessment

Vegetation is diverse throughout the bottomland hardwood forests and swamps at the Property. Eighty-seven (87) vegetative taxa were observed and recorded at the Property. This is excellent diversity for habitats in the region and is a line of evidence of good ecosystem function. The abundance of representative forested wetland species indicates that soils and conditions are offering a productive and non-toxic setting for ecological habitats.

A complete list of vegetative taxa observed at the Property is included in Table 1. Photographs of the natural communities, vegetation survey areas, and flora at the Property and at the reference area are provided in Attachment A.

3.1.1 Property Vegetation

The wetland natural communities at the Property are characterized as bottomland hardwood forests and swamps (LDWF, 2009). These areas are dominated by hydrophytic species, which are plants adapted to living in aquatic and semi-aquatic environments.

The forested wetlands at the Property are primarily bottomland hardwood forests and swamps. The mosaic of small-scale changes in relief and elevation (berms) throughout the Property allows for a mixed vegetative community of species that flourish in saturated soils, such as sugarberry (*Celtis laevigata*) and possumhaw (*Ilex decidua*), and species that can thrive in standing water, such as bald cypress and water tupelo. The mid- and under-story vegetative communities at the Property contain a variety of hydrophytic shrubs, herbs, forbs, grasses, including alligatorweed (*Alternanthera philoxeroides*), butterweed (*Packera glabella*), creeping primrose-willow (*Ludwigia repens*), green flatsedge (*Cyperus virens*), Kunth's maiden fern (*Thelypteris kunthii*), ravenfoot sedge (*Carex crus-corvi*), and Virginia dayflower (*Commelina virginica*), as well as floating aquatic plants such as water spangles (*Salvinia minima*).

The Louisiana Department of Wildlife and Fisheries' (LWDF) Natural Heritage Program (NHP) documents 68 types of natural communities in Louisiana, along with the plant and animal species that regularly or often occur in these settings (LDWF, 2009). The vegetative species are described as occurring in a continuous mosaic of communities, rather than in separate discrete communities (LDWF, 2009). The Property and surrounding areas can be characterized as a mosaic of wetland forest communities, including species typical of bottomland hardwood forests and swamps (LDWF, 2009).

Inset Table 3-1, below, lists the trees found at the Property that are commonly associated with and/or dominant in Louisiana bottomland hardwood forests and swamp natural communities (LDWF, 2009). The U.S. Forest Service determines plant community associations based on characteristic range or habitat conditions, and defines a dominant plant as a species with a strong community influence due to size, abundance, or coverage (USFS, 2021).

Table 3-1: Trees Observed at the Property that are Associated with Louisiana Bottomland Hardwood Forest and Swamp Natural Communities

Common Name	Scientific Name	Natural Community Characterization
Bottomland Hardwood Forests[a]		
American elm	*Ulmus americana*	Dominant or Associate
Green ash [†]	*Fraxinus pennsylvanica*	Dominant or Associate
Sugarberry	*Celtis laevigata*	Dominant or Associate
Water hickory	*Carya aquatica*	Dominant or Associate
Water oak	*Quercus nigra*	Dominant or Associate
Boxelder	*Acer negundo*	Associate
Eastern swampprivet	*Forestiera acuminata*	Associate
Planertree [†]	*Planera aquatica*	Associate
Possumhaw	*Ilex decidua*	Associate
Red maple [†]	*Acer rubrum*	Associate
Red mulberry	*Morus rubra*	Associate
Water locust [†]	*Gleditsia aquatica*	Associate
Swamps[b]		
Bald cypress	*Taxodium distichum*	Dominant
Water tupelo	*Nyssa aquatica*	Dominant
Red maple	*Acer rubrum*	Associate
Water locust	*Gleditsia aquatica*	Associate
Black willow	*Salix nigra*	Associate
Green ash	*Fraxinus pennsylvanica*	Associate
Planertree	*Planera aquatica*	Associate
Total Taxa	15	

Notes

[a] Includes bottomland hardwood tree species from Overcup Oak-Water Hickory Bottomland Forest, Hackberry-American Elm-Green Ash Bottomland Forest, and Sweetgum-Water Oak Bottomland Forest natural communities (LDWF, 2009).

[b] Includes swamp tree species from Cypress-Tupelo Swamp and Cypress Swamp natural communities (LDWF, 2009).

[†] Species occurs in both swamps and bottomland hardwood forests in Louisiana. Duplicates have been subtracted from the total taxa count.

Associate species are common in the setting based on characteristic range or habitat conditions.

Dominant species have a strong influence in a community due to size, abundance, or coverage.

Source

LDWF. 2009. Natural Communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife & Fisheries.

Fifteen (15) tree species associated with bottomland hardwood forest (BLH) and swamp natural communities in Louisiana are present at the Property, which is evidence that the forested wetlands on the Property are supporting trees that are expected in the region (Inset Table 3-1). The total count of tree species (25 species total) documented during the field investigations includes the 15 trees that are representative of BLH and swamp settings in Louisiana, as well as other trees that are native to the region, such as common persimmon (*Diospyros virginiana*), honey locust (*Gleditsia triacanthos*), roughleaf dogwood (*Cornus drummondii*), Shumard's oak (*Quercus shumardii*), pecan (*Carya illinoinensis*), nutall oak (*Quercus texana*), and elderberry (*Sambucus* spp.).

The excellent tree species diversity (25 different species) is an important line of evidence that the Property is supporting the trees expected in the region in wetland swamps and bottomland hardwood forests.

3.1.2 Reference Area Vegetation

Sherburne Wildlife Management Area (WMA) is a protected area that is owned by the LDWF and managed together with the USFWS Atchafalaya National Wildlife Refuge, and another adjacent area owned by the U.S. Army Corps of Engineers. The WMA is located approximately 18.5 miles northwest of the Property within the Atchafalaya Basin and is situated in a similar setting to the Property (LDWF, 2022). The WMA contains a mix of bottomland hardwood forest and swamp communities, similar to those at the Property and provides an appropriate comparison. The mix of bottomland hardwood and swamp forested wetlands observed at the Property and reference area is also consistent with the mix of forested wetlands documented throughout the surrounding Atchafalaya Basin (USFWS, 2022). Photographs of the vegetation and natural communities observed in the reference area are provided in Attachment A.

During a reference site investigation on May 5, 2022, Dr. Helen Connelly (ERM) and Mr. Jody Shugart (ERM) identified 39 plant species in the WMA (Figure 5B). Tree species observed in the reference area included: bald cypress, black willow (*Salix nigra*), boxelder (*Acer negundo*), Chinese tallow (*Triadica sebifera*), common persimmon, eastern swampprivet (*Forestiera acuminata*), oak (*Quercus* spp.), red maple (*Acer rubrum*), roughleaf dogwood, Shumard's oak, sugarberry, sweetgum (*Liquidambar styraciflua*), water hickory (*Carya aquatica*), and water tupelo. Grasses and forbs observed included butterweed, dallisgrass (*Paspalum dilatatum*), Carolina geranium (*Geranium carolinianum*), copper iris (*Iris fulva*), eastern bluestar (*Amsonia tabernaemontana*), looseflower water-willow (*Justicia ovata*), and ravenfoot sedge.

Of the 39 total plant taxa observed at the Sherburne WMA, 29 (74%) were also observed at the Property, indicating a strong similarly between the vegetation composition of the Property and the nearby protected area. This similarity to a protected area is evidence that the Property is supporting the expected vegetation. A comparative list of vegetative taxa present at Sherburne WMA is included as Attachment D-1.

A comparison of the wetland classification and growth habit of the plant species observed at the Property and WMA reference area are shown in Inset Figure 3-1. The results indicate that wetland species (including obligate wetland, facultative wetland, and facultative species) similarly dominate both the Property (65%) and the reference area (79%). The community structures between the two areas are also similar, with non-woody (grasses, forbs/herbs, and subshrubs) vegetation comprising 64% of the Property and 54% of the reference area. Trees at the Property are 29% of the observed taxa and trees at the WMA are 36% of the vegetative community, which is excellent tree species diversity for both areas. Both the Property and the WMA habitats have a high percentage of trees, as compared to other forested wetlands throughout south Louisiana. The forests in the region are a treasure and the Property forests are a beautiful example of wetland forests in the Atchafalaya Basin.

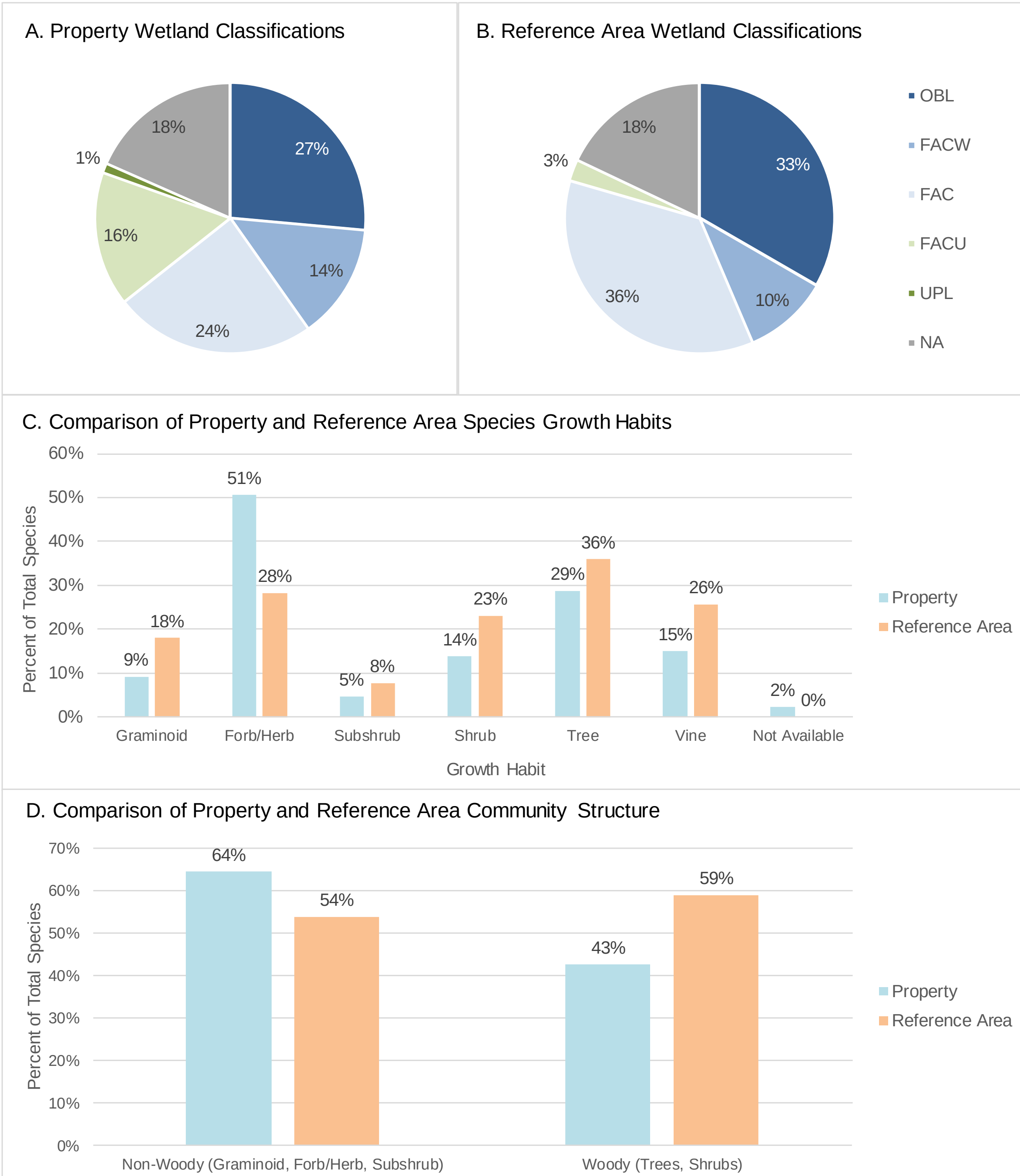

Figure 3-1: Comparison of Wetland Classifications at the Property (A) and Sherburne Wildlife Management Area (B), Growth Habits (C), and Community Structure (D)

Property and WMA taxa include all those identified during field investigations of the Property (ERM 2022 and Bryant 2022, as described above) and of the reference area (ERM, 2022). In the wetland classification graphs (Figures 3-1A and B), the hydrophytic wetland species (Obligate [OBL], Facultative Wetland [FACW], and Facultative [FAC]) are shown in shades of blue, and non-hydrophytic upland species (Facultative Upland [FAC], Upland [UPL]) are shown in shades of green (USDA, 2012). In Figures 3-1C and D, the community structure of the Property is shown in blue and

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the Reference area in orange. As some species have multiple growth habits, percentages in the species growth habits and community structure figures may add up to greater than 100. Vines can be categorized as woody or non-woody species and have therefore been excluded from Figure 3-1D. Taxa identified only to the genus level have a status that is considered "Not Available" as species within genera may vary in wetland classification.

These favorable comparisons of the Property to an analogous protected area, including similar proportions of wetland and upland species, similar percentages of trees, and similarity in the specific species present, demonstrate that the vegetation at the Property is as expected for swamps and bottomland hardwood forested wetlands in the Atchafalaya Basin. These similarities are lines of evidence that the ecosystem is functioning as expected, and that the vegetation at the Property is as expected for the region.

3.2 Avian Community Characterization and Assessment

The entirety of the Property and the reference area are contained within the Atchafalaya Basin IBA (Attachment D-2). Important Bird Areas are defined as distinct areas that provide essential habitat for one or more species of birds during breeding, wintering, or migrating (Audubon, 2015). With over 11 million acres designated as IBA throughout the state, Louisiana has one of the greatest concentrations of IBA surface area in the country (Audubon, 2022a). The Atchafalaya Basin IBA is known to support over 270 species of birds, including birds of prey, wading birds, neotropical migrants, and many more. The presence of the Property within the IBA makes the Property a valuable habitat for conservation of bird species.

The Property and the reference area are also within the Mississippi Flyway, which is a major bird migration route from central Canada to the Gulf of Mexico. The flyway covers 13 U.S. states and includes sources of water and food for migrating birds. Property habitat plays a role in the larger flyway as a source of food and refuge for migrating birds.

The location of the Property within both the IBA and the Mississippi Flyway makes it a valuable stopover habitat for millions of migratory birds each season (Audubon, 2022b). By providing nourishing and intact habitat, the Property is playing a role in conservation of species.

3.2.1 Property Avian Community

Twenty-two (22) species of birds were documented on the Property during the May 5, 2022 ERM field investigation. Species observed on the Property that have specific fidelity to forested wetlands, specifically swamps, in Louisiana include Barred Owl (*Strix varia*), Little Blue Heron (*Egretta caerulea*), Prothonotary Warbler (*Protonotaria citrea*), Red-shouldered Hawk (*Buteo lineatus*), and Tricolored Heron (*Egretta tricolor*) (USFWS, 2013).

Four of the bird species observed on the Property are listed as Species of Greatest Conservation Need (SGCN) by the LDWF (LDWF, 2020a; Inset Table 3-2). Species listed on the LDWF list of SGCN are selected based on global and state rarity ranks, threats to the population, extent of historical range, percent of habitat remaining, and amount of data available (Holcomb et al., 2015). The SCGN species observed on the Property range in state rarity from S3, or vulnerable in the state, to S5, very low risk of expiration in the state. The presence of SCGN species observed on the Property is a line of evidence that the Property ecosystem is providing habitat for protected species and helping to preserve avian biodiversity in Louisiana.

A complete list of birds observed on the Property is included in Table 2. Photographs of birds observed during ERM (2022) field investigations are included in Attachment A.

Table 3-2: Louisiana Bird Species of Greatest Conservation Need Observed on the Property

Common Name	Scientific Name	Diet[a]	Global Rank[b]	State Rank[c]
Chimney Swift	*Chaetura pelagica*	Insects	G5	S5B
Little Blue Heron	*Egretta caerulea*	Fish	G5	S3N, S4B
Prothonotary Warbler	*Protonotaria citrea*	Insects	G5	S5B
Yellow-throated Vireo	*Vireo flavifrons*	Insects	G5	S4B

Ranks
G = Global
S = State

B = Breeding
N = Non-breeding

3 = Vulnerable
4 = Apparently Secure
5 = Secure

Notes
[a] Diets as listed by The Cornell Lab (2022a) Bird Guide.
[b] Global ranks are designated by NatureServe (2022).
[c] State ranks are determined by the LDWF under Title 56 of the Louisiana Revised Statutes (LDWF, 2020a).

Sources
The Cornell Lab. 2022a. All About Birds: Bird Guide. Available: https://www.allaboutbirds.org/guide/. Accessed September 2022.
LDWF. 2020a. Louisiana's Animal Species of Greatest Conservation Need (SGCN) – Rare, Threatened, Endangered Animals – 2020. Louisiana Department of Wildlife and Fisheries, Wildlife Diversity Program.
NatureServe. 2022. NatureServe Explorer. Available: https://explorer.natureserve.org/. Accessed September 2022.

Functioning cypress-tupelo swamp and bottomland hardwood forest ecosystems support avian communities in which all trophic levels are represented (LDWF, 2009). The trophic level of each bird is defined by its diet, and on the Property, all levels of the avian trophic food chain have been observed.

Herbivorous birds, which predominately consume plants and plant material (i.e., nuts, seeds, nectar) are primary consumers. Primary consumers are lower trophic level species, as compared to the secondary and tertiary consumers with omnivorous and carnivorous diets. An example of a primary consumer observed on the Property is the Northern Cardinal (*Cardinalis cardinalis*), which feeds predominately on seeds. Common seed species consumed by the Northern Cardinal include those produced by dogwood, wild grape, grasses, sedges, sugarberry, and blackberry (The Cornell Lab, 2022a), all of which were observed on the Property (Table 1). This observation of thriving vegetation and an abundance of primary consumers on the Property is a line of evidence that the bottom of the food chain is flourishing and available to support higher trophic species .

Secondary consumers are organisms that consume primary consumers, and their diets may be omnivorous or consist predominately of insects and aquatic invertebrates. Examples of avian secondary consumers observed at the Property include Acadian Flycatcher (*Empidonax virescens*), American Crow (*Corvus brachyrhynchos*), Carolina Chickadee (*Poecile carolinensis*), Carolina Wren (*Thryothorus ludovicianus*), Red-eyed Vireo (*Vireo olivaceus*), and Yellow-billed Cuckoo (*Coccyzus americanus*). Secondary consumers typically make up the largest portion of the avian food chain, and this is true at the Property (see inset Figure 3-2), demonstrating that the Property food chain that is structured as expected. Three avian secondary consumers that are SGCN were observed on the Property: Chimney Swift (*Chaetura pelagica*), Prothonotary Warbler, and Yellow-throated Vireo (*Vireo flavifrons*). The presence of these species of greatest conservation need is a line of evidence that the Property is protecting avian diversity by providing protective forested habitat.

The 16 secondary consumers observed on the Property are also evidence that the ecosystem can support multiple avian species with similar diets. For example, the Property supports three insectivorous woodpecker species with varying insect diets. The diet of the Red-bellied Woodpecker (*Melanerpes carolinus*) includes a wide variety of beetles, bees, wasps, ants, grasshoppers, and crickets (The Cornell Lab, 2022b), whereas the larger Pileated Woodpecker (*Dryocopus pileatus*) has a diet that consists primarily of wasps, bees, and ants (Bull et al. 1992, Raley and Aubry 2006). The smaller Downy Woodpecker (*Dryobates pubescens*) also consumes wasps, bees, ants, and beetles, but also eats moths and butterflies (Beal 1911). The Property is providing a sufficient insect diet for three different species of woodpeckers, which is a line of evidence that the wetlands can support a diversity of insectivorous birds with varying diets, such as woodpeckers, that are dedicated to forested habitats.

Tertiary consumers, or top predators, occupy the highest trophic levels of the food chain, and have primarily carnivorous diets comprising of carrion (animal carcasses), medium and small mammals, fish, and other birds. Birds of prey observed on the Property include Barred Owl and Red-shouldered Hawk. Scavengers include the Turkey Vulture (*Cathartes aura*) and piscivores include the Tricolored Heron as well as the Little Blue Heron, which is a SCGN. The presence of a diversity of predators with carnivorous diets indicates that the food resources throughout the Property are sufficient to support the hunting needs and high calorie diets of the top trophic levels of the avian food chain. The presence of tertiary consumers at the top of the food chain is evidence that the entire food web at the Property is functioning and intact, and can support the high calorie demands of predatory birds.

In summary, Property habitat is documented as supporting avian species with specific fidelity to forested wetlands, a balanced food chain including birds that are top predators, and birds characterized as in need of greatest conservation efforts (SGCN). All of these findings are evidence that the forested wetland habitat on the Property is supporting a diverse and regionally valuable avian community.

The complete list of birds observed on the Property is included in Table 2. A discussion of the Property and reference area bird community trophic structures is provided in Section 3.2.2.

3.2.2 Reference Area Avian Community

The cypress-tupelo swamps and bottomland hardwood forest habitats of Sherburne WMA provide similar bird habitat to habitat on the Property and are appropriate as a reference area (LDWF, 2022).

During a reference site investigation on May 5, 2022, Dr. Helen Connelly, Mr. Jody Shugart, and Ms. Emily Martin (all with ERM), observed 15 bird species in forested wetland habitats at the WMA. In addition to observations made by ERM, 50 bird species were observed in the WMA by bird enthusiasts (eBird database, May, 2022). These eBird observations were from location #L727380 in the WMA, which is a known public birding location with recorded species data. Thirty-three (33) of the 50 bird species recorded within location #L727380 in the WMA were birds dedicated to forest habitat and 17 were birds that use marsh and field habitats. Of the 50 total eBird observations, the forest species birds (33) were included in the reference list for comparison to the Property, and the marsh and field birds (17) were not, due to the absence of comparable marsh and field habitats on the Property. The complete list of 48 bird species documented at the WMA by ERM (15 species) and in eBird (33 species), that utilize forest habitats similar to those on the Property, is included in Attachment D-3.

The species richness and trophic structure of the Property avian community was compared to the Sherburne WMA avian community (reference). Nineteen (19) of the 22 species observed at the Property were also observed at Sherburne WMA or were reported by ebird.org, indicating that the Property is supporting the expected birds for the region, as compared to these references (Attachment D-3).

The trophic structure of the avian population at the Property is similar to the trophic structure at the WMA reference area (Inset Figure 3-2). At the both the Property and Sherburne WMA, 23-25% of birds observed are tertiary consumers (carnivorous and piscivorous), which is expected for bird populations in forested wetlands in southern Louisiana. The presence of carnivorous and piscivorous birds on the Property is a line of evidence that the Property ecosystem is providing lower trophic level small animals and fish in sufficient quantities to support the high calorie diet of the upper trophic level birds of prey.

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At both the Property and reference area, the majority of observed species (60-73%) are secondary consumers, with diets consisting of insect, aquatic invertebrate, or mixed (omnivorous) food sources. The percentage of primary consumers, or herbivorous species, is small in both the Property and the reference area populations (5-15%) and is typical of bird populations in south Louisiana wetland forested areas, where the percentage of herbivores is the smallest trophic feeding group.

The similarity between the bird population feeding groups at the Property and at the reference area is a line of evidence that the Property's ecosystem is functioning as expected for the region.

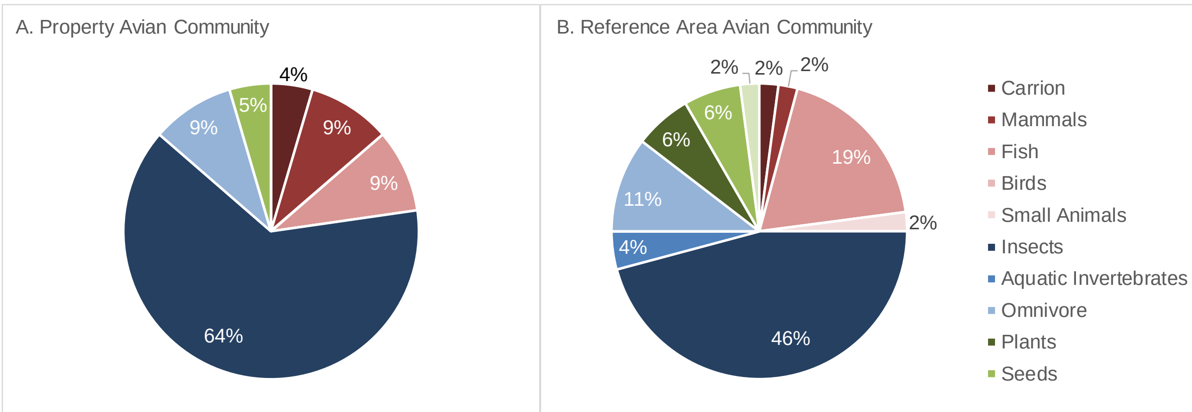

Figure 3-2: Comparison of the Avian Food Web between the Property (A) and a nearby Protected Area, Sherburne Wildlife Management Area (B)

Property bird species include those identified during the May 5, 2022 ERM field investigation (as described above). Reference area bird species include those observed during the May 5, 2022 ERM reference area survey and those species with appropriate habitat associations (e.g., swamp, forest, forest edge) included on the May 2022 eBird list for the Sherburne Wildlife Management Area (location #L727380) (eBird, 2022). Primary consumers, or herbivores, are shown in green. Secondary consumers, including insectivores, aquatic invertebrate consumers, and omnivores are shown in blue. Scavengers and top predators are shown in shades of red and orange.

3.3 Non-Avian Fauna Characterization and Assessment

3.3.1 Property Non-Avian Fauna Community

A total of 46 non-avian taxa were observed during the May 5 and August 17, 2022 ERM field investigations. Herbivorous primary consumers observed on the Property include pollinating insects (bees [Family Apidae], mosquitos [*Anopheles* spp.], and butterflies, moths, and caterpillars [Order Lepidoptera]), beetles (flea beetle [*Disonycha* sp.] and fourteen spotted leaf beetle [*Cryptocephalus guttulatus*]), oblong-winged katydid (*Amblycorypha oblongifolia*), snails (including Apple snail [*Promacea maculata*]), and ants (Family Formicidae), as well as grazing mammals such as beavers (*Castor canadensis*) and Eastern gray squirrel (*Sciurus carolinensis*), the latter of which are hunted on the Property. The diversity of herbivorous species present on the Property is evidence that the seeds, nuts, nectar, fruits, and berries available on the Property as diet are providing sufficient calories for a variety of primary consumers. Primary producers (plants) are the base of the food chain, and the abundance of plant-eating animals on the Property, including mammals such as beavers and squirrels, is a line of evidence that plants are thriving on the Property.

Secondary consumers observed at the Property include aquatic invertebrates (crawfish [Family Cambaridae]), and terrestrial invertebrates such as dragonflies (Eastern pondhawk [*Erythemis simplicicollis*] and great blue skimmer [*Libellula vibrans*]), short horned grasshopper (Family Acrididae), spiders (six-spotted fishing spider [*Dolomedes triton*] and harvestman [Order Opiliones]), and wasps (Suborder Apocrita), as well as a variety of reptiles and amphibians. Gulf coast toad (*Incilius nebulifer*) and southern leopard frog (*Lithobates sphenocephalus*) were observed at the Property, in addition to anoles (*Anolis* spp.), common five-lined skink (*Plestiodon fasciatus*), and little brown skink (*Scincella lateralis*). The diversity of insectivorous secondary consumers on the Property is a line of evidence that the insect populations (supported by vegetation) are sufficient to support a variety of wildlife with similar diets. Also, the presence of frogs and toads is evidence that Property water and soil are of sufficient quality to support animals that depend on both aquatic and terrestrial habitats.

In addition to the carnivorous and piscivorous birds of prey (tertiary consumers) described in Section 3.2.1, the tertiary non-avian consumers observed on the Property include a variety of snakes (cottonmouth [*Agkistrodon piscivorus*], diamondback water snake [*Nerodia rhombifer*], and western ratsnake [*Pantherophis obsoletus*]), as well as the American alligator. The presence of cottonmouth snakes at the Property indicates that there are fish (which are the preferred diet of cottonmouths) in the standing water in the forest. Cottonmouths eat fish, frogs, and other snakes. Their preferred habitat is bottomland hardwood forest, as found at the property. The fact that the snakes have a fish diet available, indicates that the soil and water quality on the Property are sufficient to support a fish population. The observation of several terrestrial and aquatic top predators on the Property is a line of evidence that terrestrial and aquatic food webs are functioning to provide a diet for species at the top of the food chain that require a high calorie diet.

All trophic levels of the terrestrial and aquatic food webs (primary to apex) were directly observed on the Property, which is a line of evidence supporting good ecosystem health (USEPA, 1997). See Inset Figure 3-3 below for an example of a terrestrial food chain observed at the Property. A complete list of non-avian fauna observed on the Property is provided in Table 3.

Figure 3-3: Example of a Terrestrial Food Chain Observed at the Property

In this example, the oblong-winged katydid (*Amblycorypha oblongifolia*), an herbivore, is the primary consumer (left). The Gulf Coast toad (*Incilius nebulifer*) (center) is an insectivorous secondary consumer, known to hunt arthropods. The tertiary consumer in this food chain is the cottonmouth (*Agkistrodon piscivorus*) (right), which is a known predator of frogs and toads. Multiple complete food chains such as this one observed on the Property indicate the health of the ecosystem. Photos by Mr. Jody Shugart (May 5, 2022).

3.3.2 Reference Area Non-Avian Fauna Community

A total of 19 non-avian species were observed at the Sherburne WMA during ERM's May 5, 2022 reference area investigation. Similar to the Property, a number of terrestrial insects were observed, including spiders, crickets, mosquitos, ants, wasps, and dragonflies, as well as amphibians (southern leopard frog), and mammals (rabbit [*Sylvilagus* sp.], raccoon [*Procyon lotor*], and feral hog [*Sus scrofa*]), and apex predators (American alligator). The variety of mammals, reptiles, and amphibians observed on the Property and at the reference area represents the three major feeding groups (herbivores, omnivores, and carnivores), as well as keystone species, such American alligator. This is a line of evidence that the Property is functioning as expected for the region, by providing similar wildlife habitat to the nearby protected WMA.

The Property and surrounding area are in an ecological setting that is recognized by USEPA as important to ecological diversity. The Property, the reference area, and areas between the Property and the reference area, all include USEPA ecological hubs and ecological auxiliary connections, as identified by the National Ecological Framework (NEF) (USEPA, 2022a; Attachment D-4). The NEF is a Geographic Information Systems (GIS) based model that identifies ecological hubs, corridors, and auxiliary connections that connect natural landscapes throughout the contiguous United States (USEPA, 2022b). Based on the proximity of the Property to the WMA reference area (approximately 18.5 miles), and the presence of NEF hubs and auxiliary connections between the two locations, it is likely that mobile species on the Property (e.g., birds) could travel to and from the WMA and the Property for foraging, resting, and nesting. Because the Property is ecologically connected to the larger landscape (USEPA, 2022b), it is a location that wildlife can use to establish new colonies (NRCS, 1999). The existing ecological connections between the Property and the reference area are evident, based on the similarities between habitats and species in the two areas. These similarities between ecologically connected areas are a line of evidence that the Property is playing a role in supporting biodiversity in the larger connected region.

3.4 HA-3 (Off-Site) Vegetation and Wildlife

The HA-3 off-site survey area is characterized as forest and right-of-way. During the HA-3 vegetation survey on May 5, 2022, Dr. Connelly (ERM) and Mr. Shugart (ERM) observed a total of 38 plant taxa, including trees, such as American elm, black willow, boxelder, Chinese tallow, common persimmon, dwarf palmetto (*Sabal minor*), planertree (*Planera aquatica*), and red maple, herbs and forbs, including butterweed, Canadian black snakeroot (*Sanicula canadensis*), carrot (Family Apiaceae), copper iris, spider lily (*Hymenocallis occidentalis*), and spiny sowthistle (*Sonchus asper*), and grassess, such as basketgrass (*Oplismenus hirtellus*), Savannah-panicgrass (*Phanopyrum gymnocarpon*), and shortbristle horned beaksedge (*Rhynchospora corniculata*). The HA-3 area vegetation is predominately hydrophytic, which is also true of the Property and the reference area, and the 12 trees documented in the HA-3 area are also all found on the Property and in the reference area.

In addition to the vegetation observed in the HA-3 off-site area, ERM (2022) also documented 8 species of birds (Great Egret [*Ardea alba*], Great Blue Heron [*Ardea herodias*], Prothonotary Warbler, Blue-gray Gnatcatcher [*Polioptila caerulea*], Neotropic Cormorant [*Nannopterum brasilianum*], Northern Parula [*Setophaga americana*], Tufted Titmouse [*Baeolophus bicolor*], and White-eyed Vireo [*Vireo griseus*]), as well as 13 non-avian taxa. The non-avian taxa observed in the HA-3 area include crawfish (recreational traps were observed in the area), lovebugs, dragonflies, snails, butterflies, mussels, and various skinks (Broad-headed skink [*Plestiodon laticeps*] and Common five-lined skink).

The off-site HA-3 area biota data is included here for reference, but because it is not on the Property, it is not further assessed. Photographs of the flora and fauna observed in the HA-3 off-site area is included in Attachment A.

3.5 Soil Salinity and Vegetation

There is no evidence on the Property of impact to the ecology due to salt or salinity. During the field investigations, efforts were made to identify any signs of impact due to salt or other E&P constituents (USEPA, 1997; USEPA, 1998; RECAP, 2003).

There is no evidence of salinity damage to vegetation in the form of stunting or leaf burn. There were no areas denuded of vegetation or areas with salt crusts on the ground. There were no vegetative species identified on the Property that indicate the presence of salt.

Vegetation at the Property is consistent with freshwater wetlands that are not salt-impacted. Of all 87 plant species observed at the Property, 24 have no tolerance for elevated salinity. In LAA1 specifically, 12 of the 21 plant species identified have no tolerance for elevated salinity. In the SRAs in LAA2 and LAA3, 16 of the 64 plant species identified have no tolerance for elevated salinity. The presence of these plants that have no tolerance for elevated salt is a strong indication that salinity is not elevated on the Property, as these plants would not be present in a saline setting.

Soil EC in the top 0-4' of soil is low, ranging from 0.31 – 4.4 mmhos/cm (average of 1.17mmhos/cm) and is below levels of concern for vegetation (Table 4). Soil sample locations are shown on Figures 7A and 7B.

There is no evidence that salt or salinity are an issue in soils (0-4') in any portion of the Property.

3.6 Habitats in Areas Planned for Soil Remediation and in Other Areas

Ecological field surveys of vegetation and wildlife were performed throughout the Property, including in the SRAs (Figure 19). Observations in the SRAs included observations at:

- HA-1, located in Limited Admission Area 2 - Soil Remediation Area (LAA2-SRA);
- HA-2a, located in Limited Admission Area 3 – Western Pit Soil Remediation Area (LAA3-WP SRA); and
- HA-2b, located in Limited Admission Area 3 – Eastern Pit Soil Remediation Area (LAA3-EP SRA).

As per the Limited Admission (HET, 2022), soil in SRAs within the LAAs are planned for remediation for regulatory compliance. Remediation has not been recommended for these areas for ecological reasons, as the ecosystems in these locations were observed and documented to be thriving, diverse, and without evidence of impact from E&P operations (Inset Figure 3-4).

The habitat in HA-1, which is planned for soil remediation (LAA2-SRA), is primarily bottomland hardwood wetland forest. During the May 5, 2022 ERM field investigation, 33 total plant species were observed at this vegetation observation location, including 9 species of trees: bald cypress, red maple, boxelder, common persimmon, Chinese tallow, sugarberry, Shumard's oak, water hickory, and elm. This represents excellent vegetative diversity and good tree species diversity for wetland forests. At HA-1, a variety of birds were observed, including the carnivorous Barred Owl and Turkey Vulture, and the insectivorous, Red-eyed Vireo, Tufted Titmouse, Carolina Chickadee, Red-bellied Woodpecker, and Yellow-throated Video. Non-avian fauna observed include mammals, such as beavers, reptiles and amphibians, such as western ratsnake, diamondback water snake, and Gulf coast toad, and various invertebrates, such as crawfish, katydid, grasshoppers, and dragonflies. The presence of predators at LAA2-SRA, such as owls and snakes, indicates that the top of the food chain is finding a diet from the lower levels of the food chain at this location. The ecosystem is thriving at LAA2-SRA, and there is no evidence of toxicity or other adverse effects from E&P operations at this location. Although soil remediation is planned for LAA2-SRA to meet regulatory guidelines, there is no evidence that remediation is needed in this area for ecological reasons, due to the documented presence of a thriving ecology.

The habitat in the HA-2a area, which is planned for soil remediation (LAA3-WP SRA), is primarily bottomland hardwood forest and cypress swamp. A total of 31 plant species were observed in the HA-2a area during the May 5, 2022 ERM field investigations, including 12 species of trees and shrubs. This represents very good tree species diversity, as well as excellent overall vegetative diversity. Tree species associated with bottomland hardwood and swamp forested wetland natural communities, such as bald cypress, boxelder, planertree, red maple, sugarberry, and possumhaw were all observed in the HA-2a area, demonstrating that the soils on the Property are providing a non-toxic environment for these species to grow. The HA-2a area also hosts a variety of wildlife, including primary consumers, such as the Prothonotary Warbler and Eastern gray squirrel, secondary consumers such as frogs, toads, and spiders, and apex predators, such as the American alligator. The wetland forest community at HA-2a includes all trophic levels of the food chain, including recreational species and a diversity of birds. The ecosystem at HA-2a (LAA3-WP SRA) is observed to be thriving, and there is no evidence of adverse ecological effects. Soil remediation is planned for LAA3-WP SRA for regulatory reasons, however there is no evidence that remediation is required in this area for ecological reasons.

The HA-2b area, which consists primarily of bottomland hardwood forest and swamp natural communities, is also planned for soil remediation (LAA3-EP SRA). Very diverse flora and fauna were observed in this area during the May 5, 2022, ERM field investigation. Forty-six (46) vegetative taxa were documented in the HA-2b area, including 12 species of trees and shrubs. In addition to forested wetland tree associates such as bald cypress, red maple, sugarberry, water locust, and water oak, the HA-2b area also supports a variety of other species with fidelity to wetland environments, including alligatorweed, butterweed, Eastern marsh fern (*Thelypteris palustris*), looseflower water-willow, spider lily, and swamp smartweed (*Polygonum hydropiperoides*). Birds in the HA-2b area are predominately insectivorous and include such birds as Acadian Flycatcher and Chimney Swift. Omnivorous species, such as American Crow and Fish Crow were also observed. Non-avian fauna recorded in the HA-2b area includes species across multiple trophic levels, such as herbivores and detritivores (apple snail and grasshoppers) and insectivores (dragonflies, frogs, toads, and skinks). There is no evidence in this location of adverse ecological effects and the ecosystem is thriving. The soil remediation planned for the HA-2b (LAA3-EP SRA) area is for regulatory compliance purposes and there is no evidence that remediation is needed for ecological reasons.

The HA-5 area, located in LAA1, is primarily bottomland hardwood forest with mixed areas of cypress swamp. During the May 5, 2022, ERM field investigation, a total of 21 plant species were observed, including 11 species of trees and shrubs (American elm, bald cypress, pecan, planertree, red maple, and water hickory, among others), as well as herbs and forbs (creeping primrose-willow [*Ludwigia repens*], marsh seedbox [*Ludwigia palustris*], resurrection fern [*Pleopeltis polypodioides*], stiff marsh bedstraw [*Galium tinctorium*], swamp smartweed [*Polygonum hydropiperoides*], and bedstraw [*Galium* spp.]). This is very good vegetative and tree species diversity for wetland forests in the region. Bird observations in this area included the Prothonotary Warbler, which is a dedicated resident of swamps and forests in Louisiana, other insectivores such as Red-bellied Woodpecker, Red-eyed Vireo, White-eyed Vireo, and Yellow-billed Cuckoo, and the Red-shouldered Hawk, a carnivorous bird of prey. Other wildlife observed include terrestrial invertebrates, such as spiders, flea beetles, katydid, dragonflies, and grasshoppers, aquatic invertebrates such as crawfish, and higher trophic level reptiles, such as snakes. Specifically, the cottonmouth was observed in this area, which indicates the presence of standing water and fish, the preferred diet of cottonmouths in bottomland hardwoods. There is no soil remediation planned in the HA-5 area, and based on the presence of a balanced and diverse vegetative community and the evidence of functioning food webs, including all trophic levels, there is no evidence that soil remediation is needed for any ecological reason in the HA-5 area.

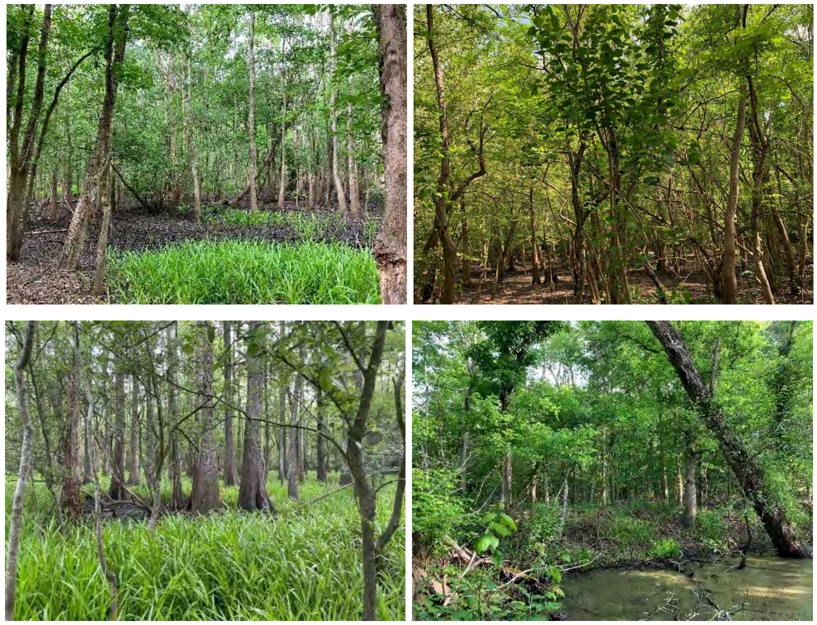

Figure 3-4: Ecological Habitat in HA-1, HA-5, HA-2a, and HA-2b

The photos illustrate the thriving vegetative communities present in the HA-1 (top left), HA-5 (top right), HA-2a (bottom left) and HA-2b (bottom right) areas. Photos were taken by Dr. Helen Connelly (ERM) and Ms. Emily Martin (ERM) on May 5, 2022.

3.7 Ecological Observation Summary

The multiple lines of evidence investigated in this ERA support the finding that the habitats and food webs on the Property, including in the LAAs and SRAs, are functioning and providing services as expected for the region. Vegetation community structure on the Property, including the percentage of trees and percentage of hydrophytic plant species dedicated to wetlands, is as expected for the region based on comparison to similar habitats in a nearby protected area, Sherburne WMA (LDWF, 2009). Vegetative diversity throughout the Property is very good, and the wetland forests on the Property support a diversity of trees, such as the bald cypress, that are representative of swamps and bottomland hardwood forests in the region (LDWF, 2009).

The avian community trophic structure is as expected for the region, with the expected percentages of observed insectivores (largest percentage), omnivores, herbivores (smallest percentage), and top predators, typically found in wetland forests in Louisiana. Birds that are dedicated to forests, such as woodpeckers and warblers were identified on the Property, indicating that the forested wetlands support the expected species of birds found in Louisiana forests. The Property supports 4 birds listed as SGCN by the LDWF, demonstrating that the Property is supporting conservation of species. Birds of prey, such as owls, and apex predators, such as alligators, that depend on a sufficient diet of mammals, fish, and birds were observed on the Property, indicating that the top of the food chain is supported by the lower levels of the food chain.

Water snakes and frogs are present on the Property, which is an indication of good water quality, as these species depend on aquatic habitat. No indicators of effects from salt or other evidence of toxicity were observed in the plants thriving on the Property, and the Property supports 24 plants that have no tolerance for salinity, which indicates an absence of elevated salt in the surface soil. Based on these findings and all lines of field evidence, the aquatic and terrestrial ecosystems on the Property are functioning as diverse and productive habitat (Inset Figure 3-5).

Based on analysis of field observations and data, ecological populations on the Property, including the LAAs and SRAs, do not show evidence of adverse impact by E&P activities. The Property is biologically diverse and functioning as expected for forested wetlands in the region.

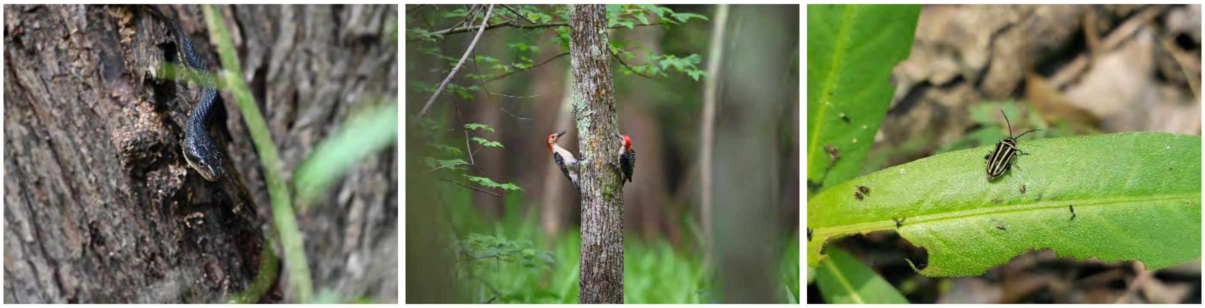

Figure 3-5: Observed Wildlife Diversity

The photos illustrate examples of the diversity of wildlife observed at HA-1 (Western ratsnake [*Pantherophis obsoletus*]), HA-2a (Red-bellied Woodpecker [*Melanerpes carolinus*]), and HA-5 (Alligatorweed flea beetle [*Agasicles hygrophila*]), respectively. Photos were taken by Mr. Jody Shugart on May 5, 2022.

4 SCREENING-LEVEL ECOLOGICAL RISK ASSESMENT (SLERA)

4.1 ERA Step 1

This ERA includes a screening level ecological risk assessment (SLERA) and a BERA. The SLERA includes the first two steps of the eight-step ecological risk assessment guidance (USEPA, 1997): 1) screening-level problem formulation and ecological effects evaluation, and 2) preliminary exposure estimates and risk calculations. The SLERA process is described in the following sections and shown on Figure 6.

4.1.1 Screening Level Formulation

The screening-level portions of an ERA (Step 1 and Step 2) are problem formulation and ecological effects evaluation. At the end of Step 2, the decision is made whether: 1) risks are negligible or 2) to proceed to the site-specific BERA.

This SLERA focuses on potential chemical stressors in soils on the Property. Soil data are presented in Table 4 and sample locations are presented on Figures 7A and 7B. It is appropriate to focus on soils as the primary pathway of concern for Property wildlife (USEPA, 1997), as there is no exposure pathway at the Property for contact with groundwater for wildlife or other animals. Groundwater is not in communication with surface water at the Property (HET, 2022). Surface water ingestion is a minor pathway in mammals and birds, as compared to soil, and is not included in the BERA quantitative risk assessment.

Considered in the problem formulation portion of the screening assessment are information on the environmental setting, known contaminants, fate and transport mechanisms on the Property, ecotoxicity of potential contaminants, likely categories of receptors, complete exposure pathways, and identification of endpoints. Information gathered for Step 1 of the SLERA is discussed in the following Sections 4.1.1.1 through 4.1.2.

4.1.1.1 Environmental Setting

Sampling was performed in former E&P operational areas, which are wetland environments (Figure 2). The Property is traversed by two canals, and Willow Lake intersects the Property from north to south (Figure 2, Figure 4).

Property vegetative habitats are primarily bottomland hardwood and swamp forested wetlands, typical of the Atchafalaya Basin region. The Property habitat is described fully in Sections 2 and 3 of this report.

The Property lies within LDEQ Drainage Basin Subsegment #120107 Upper Grand River and Lower Flat River - From headwaters to Intracoastal Waterway. This subsegment supports primary and secondary contact recreation, and fish and wildlife propagation.

Current land uses of the Property are industrial (former E&P), and recreational hunting and fishing. Land uses in the surrounding area are similar, including E&P activity, and recreational hunting and fishing.

Plaintiffs have alleged that historical E&P activities have left contamination on the Property that is a health risk or a potential health risk to ecological species. The claim made by the plaintiffs is that constituents have been left on the Property in concentrations that could affect ecological populations. This portion of the ERA is a screening level quantitative hazard quotient (HQ) evaluation of the chemical concentrations in soils to determine if risk to the wildlife population is expected.

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4.1.1.2 Contaminant Fate and Transport

The primary transport mechanisms possible on the Property are surface runoff and erosion (soil). The effects of these mechanical and physical actions are assessed in this ERA through chemical analyses of soils and surveys of vegetation and wildlife populations.

4.1.1.3 Ecotoxicity of COPECs

Ecotoxicity of COPECs on the Property has been investigated beginning with collecting soil samples (Table 4). The COPECs screened in this level of assessment are arsenic, barium, cadmium, chromium, lead, selenium, silver, strontium, mercury, zinc, polycyclic aromatic hydrocarbons, and total petroleum hydrocarbons (TPH). The potential for these COPECs to cause adverse effects to survival, growth, or reproduction in ecological receptors only exists if the COPECs are: 1) present and bioavailable in toxic concentrations, 2) a complete exposure pathway exists, and 3) exposure occurs.

For the screening portion of this ERA, soils were compared to conservative (protective) USEPA Eco-SSL soil values (USEPA, 2005a, 2005b, 2005c, 2005d, 2005e, 2006, 2007b, 2007c, 2008), NOAA Screening Quick Reference Tables (SQuiRT) Freshwater Threshold Effects Concentration (TEC) and Probable Effects Concentration (PEC) screening values (Buchman, 2008) and a calculated barium soil screening value (Attachment E). These screening values are protective of mammals, birds, invertebrates, and plants. NOAA SQuiRT screening values have been included in the assessment to account for soils that are inundated with standing water. It should be noted that screening values are used to ensure that risk is not overlooked and that all potential constituents that may contribute to risk are evaluated.

4.1.1.4 Potential Receptors and Routes of Exposure

The receptors selected to represent communities or populations on the Property were selected to represent the species that are present or could potentially be present in the habitat of interest, based on the findings of the field investigations described in Sections 2 and 3 of this report. The representative receptors and routes of exposure used to estimate risk are ones for which there is sufficient ecotoxicity information available. Exposure is assessed via ingestion of COPECs through exposure to soil and diet. This exposure pathway (soil) and exposure route (ingestion) is appropriate for ERA per USEPA guidance (1997). The receptors used in this risk assessment are described in the following sections.

Wildlife (Vertebrates)

Wildlife includes four classes of vertebrates in their natural habitats: amphibians, reptiles, birds, and mammals. Because these vertebrates are not domesticated, they are included in the general category of wildlife.

Vertebrate wildlife are consumers that can be assessed through estimates of COPEC doses in their diets. This estimate assumes that dietary exposure could occur in the Property Excluding SRAs. Wildlife is exposed to COPECs via ingestion of other organisms, soil, or water. Other pathways of wildlife COPEC exposure include dermal and inhalation. Generally, wildlife is protected by their fur or feathers from excessive dermal exposure to COPECs, therefore the dermal pathway is not included in the risk assessment. The inhalation pathway is also not included in the quantitative risk assessment, as volatile compounds were not detected in soils 0-3’ below ground surface (bgs). Therefore, this risk assessment is focused on the ingestion pathway, per USEPA guidance (1997).

Specific wildlife species, based on their feeding behaviors have been selected to be evaluated as representatives of larger wildlife communities. Mammals and birds are used as the representative wildlife species, because more toxicity data is available for these vertebrates, as compared to reptiles, fish, and amphibians.

This BERA is focused on birds and mammals associated with a terrestrial (soil-based) food web.

Invertebrates

The invertebrate population exists in and on soils and sediments. Invertebrate populations include organisms such as worms, crustaceans, gastropods, arthropods, and mollusks. These organisms function in the ecosystem to digest and degrade other biologic matter and to provide a diet for larger invertebrates and vertebrates. Because they are in direct contact with soils and sediments due to their lifestyles, they are dietary sources of COPECs to higher vertebrates.

Nektonic Aquatic Species

Nektonic aquatic species are larger swimming vertebrates such as fish, alligators, and snakes. These categories of nektonic species are assessed qualitatively in the ERA by direct and indirect field observations. For example, direct observations include observations of the American alligator and the cottonmouth at the Property. Examples of indirect observations include observations of predators, such as fish-eating birds on the Property that indicate that surface water on the Property provides fish as diet. Examples of fish-eating birds seen on the Property include Tricolored Heron and Little Blue Heron.

Plants

Plant communities with a variety grasses, forbs, herbs, vines, shrubs, and trees are present in great diversity on the Property. The plants are primary producers and form the base of the food chain by converting the sun's energy to the carbohydrate energy that other invertebrates and vertebrates use. In this risk assessment, the plant population has been assessed through a vegetation survey at locations of maximum constituent concentrations in Property soils throughout the Property (Section 3).

4.1.1.5 Exposure Pathways and Conceptual Site Model

A Conceptual Site Model (CSM) has been developed to evaluate potential ecological exposure pathways at the Property (Figure 8). A CSM (USEPA, 1997) addresses: (1) the environmental setting and COPECs at the Property; (2) COPEC fate and transport mechanisms; (3) mechanisms of ecotoxicity and likely categories of ecological receptors; (4) complete exposure pathways; and (5) selection of endpoints to screen for ecological risk.

The potentially complete exposure pathways at the Property are through shallow surface soil. The biologically active zone of soils at the Property are assumed to be from ground surface to three feet deep (LDEQ, 2003). To be inclusive of 0-3' data, soil samples collected in the 0-2' and 2-4' depth intervals were included in the evaluation. The depth of 0-3' includes the effective root zone of trees on the Property of up to 24 inches (HET, 2022) and the recommended sampling depth for the biologically active zone for terrestrial species of 25-30 cm (up to 12 inches, USEPA, 2015).

4.1.2 Effects Evaluation

Following the screening level problem formulation is a preliminary evaluation of ecological effects. Ecological effects are estimated using thresholds values for soil and sediment that are referred to as ecological screening values (ESVs). ESVs are COPEC concentrations that are estimated to pose no risk of adverse effects to exposed wildlife. The screening level values are not used as predictors of the occurrence of ecotoxicity, but rather to protectively include all potential COPECs in the risk assessment.

The ESVs used in the SLERA are based on peer reviewed publications of field studies or laboratory studies in which no adverse effects were observed. The ESV is therefore based on the highest observed exposure concentration that does not produce adverse effects. This "no observed adverse effect level" is

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referred to as the NOAEL. ESVs can also be based on a LOAEL, which is the lowest observed adverse effect level shown to produce adverse effects (reduced growth, impaired reproduction, increased mortality) in a receptor species. Therefore, the ESV is a dose or a concentration at or below which risk is not expected to occur.

The fact that an ESV is exceeded does not indicate the need for remediation or that there is ecological risk. ESVs are not site-specific and are intended to be overly protective. When ESVs are exceeded, a more specific ecological risk analysis can be performed. A concentration that exceeds a soil screening level (SSL) does not identify that there is risk or that there are soil concentrations that require remediation. Screening is the process of identifying and defining areas, contaminants, and conditions that do not require further attention. When COPEC concentrations fall below screening values, no further action is needed. When COPEC concentrations exceed ESVs, further evaluation is valuable, but the need for remediation is not assumed.

For the initial screening assessment in this ERA, conservative (protective) screening thresholds for soils such as USEPA Eco-SSLs (USEPA, 2005a, 2005b, 2005c, 2005d, 2005e, 2006, 2007b, 2007c, 2008; USEPA Eco-SSLs) for COPECs present in soil are used. The USEPA Eco-SSL for barium represents the toxicity of extremely bioavailable forms of barium, rather than the toxicity of very poorly bioavailable barium sulfate. Barium sulfate is the form of barium present at legacy oil and gas E&P sites and is the form of barium confirmed to be present at this Property (Table 5). A more appropriate barium soil screening value was calculated for the Property using barium sulfate data (Attachment E). Additionally, NOAA freshwater TECs and PECs (Buchman, 2008) were also used to screen COPECs in soil due to the presence of standing water on the Property. The limitations of the use of screening values have been discussed by the National Research Council (2003). The screening values used for this ERA are based on ecotoxicity studies of plants, birds, invertebrates, and mammals (Inset Table 4-1).

Table 4-1: Ecological Screening Values

Constituent	Eco-SSL Avian USEPA	Eco-SSL Mammal USEPA	Eco-SSL Invertebrate USEPA	Eco-SSL Plant USEPA	Calculated Soil Screening Value	TEC NOAA	PEC NOAA
Arsenic	43	46	N/S	18	N/S	9.79	33
Barium	N/S	2000	330	N/S	2424	N/S	N/S
Cadmium	0.77	0.36	140	32	N/S	0.99	4.98
Chromium	26	34	N/S	N/S	N/S	43.4	111
Lead	11	56	1700	120	N/S	35.8	128
Mercury	N/S	N/S	N/S	N/S	N/S	0.18	1.06
Selenium	1.2	0.63	4.1	0.52	N/S	N/S	N/S
Silver	4.2	14	N/S	560	N/S	N/S	N/S
Strontium	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Zinc	46	79	120	160	N/S	121	459

Notes

Concentrations are in mg/kg-dry weight.

The Soil ESV is the lowest of the Eco-SSLs. For barium, the Soil ESV is the calculated soil screening value.

The Sediment ESVs are freshwater sediment TEC and PEC, NOAA SQRT values.

4.2 ERA Step 2

4.2.1 Screening Level Exposure Estimates

The exposure assumptions used in the SLERA are intentionally overprotective. In the SLERA, receptors are assumed to be exposed to the maximum COPEC concentrations detected in soil samples and that the home range of ecological receptors is 100% on the Property, rather than elsewhere. All COPECs are assumed to be 100% bioavailable to receptors. The receptor diets are assumed to be 100% comprised of the most contaminated food source. By making these overly protective assumptions, the exposure estimates are skewed towards over-predicting risk in the SLERA. The SLERA evaluation identifies COPECs that require no further investigation and identifies COPECs that should be carried forward into the BERA.

Soil concentrations are reported up to depths of 38 feet below ground surface (bgs) (HET, 2022). Per LDEQ RECAP (2003), soil results (0-3 feet bgs) are included in ERA. For this ERA, soil concentrations from 0-4 feet bgs have been included in ordered to be inclusive of the 0-3' depth. Soil concentrations for all sample locations are summarized in Table 4 and are shown on Figures 9A through 18B for reference. See Section 4.1.1.5 for a discussion of sampling depth.

Sample concentration data included in the ERA are from locations on the Property that are outside of the Soil Remediation Areas (SRAs). SRAs are planned for soil remediation. The areas included in the ERA (not planned for remediation) are referred to as "Property Excluding SRAs".

The areas that are planned for soil remediation in the Limited Admission associated with HA-1 (LAA2 - Soil Remediation Area (LAA2-SRA)), HA-2 (LAA3 – Western Pit Soil Remediation Area (LAA3-WP SRA), and LAA3 – Eastern Pit Soil Remediation Area (LAA3-EP SRA)) (Figure 19), and sample locations outside the Property boundary (off-site; Figure 7B) are not included in ERA screening or calculations.

There are samples surrounding the LAAs as well as inside the LAAs that are included in the ERA screening process and ERA calculations, because they are not planned for soil remediation. See Inset Table 4-2 below for sample locations included in ERA screening and calculations and sample locations that are not included in ERA screening and calculations.

Table 4-2: Sample Location Designations

Sample Locations Included in ERA[a,b]			
HA-4	SB-21	SB-13	SB-06
HA-5	SB-22	SB-14	SB-06R
LT-1	SB-23	SB-15	SB-07
LT-4	SB-24	SB-16	SB-07R
	HA-6	LT-3	SB-08
	LT-2	LT-6	SB-25
	LT-5		SB-26
			SB-27

Sample Locations Not Included in ERA[b,c]			
LAA2-SRA Samples	LAA3-WP SRA Samples	LAA3-EP SRA Samples	Off-Site Samples
SB-17	SB-9	SB-01	LT-7
SB-18	SB-10	SB-02	LT-8
SB-19	SB-11	SB-03	LT-9
SB-20	SB-12	SB-04	HA-3
HA-1R	HA-2	SB-05	
HA-1		SB-05R	

Notes

[a] Constituent concentrations 0-4' are included in the ecological risk assessment calculations.

[b] Samples within the Limited Admission Areas are shown in Figure 19.

[c] Constituent concentrations are planned for remediation (Limited Admissions Report, HET, 2022), or are not on the Property (off-site), and are not included in the ecological risk assessment calculations.

Maximum soil COPEC concentrations (0-4') have been used in this screening portion of the ERA. These maximum soil concentrations identified in the Property Excluding SRAs (HA-4, HA-5, HA-6, LT-1, LT-2, LT-3, LT-4, LT-5, LT-6, SB-06, SB-06R, SB-07, SB-07R, SB-08, SB-13, SB-14, SB-15, SB-16, SB-21, SB-22, SB-23, SB-24, SB-25, SB-26, and SB-27) are shown in Inset Table 4-3.

Detected soil metal concentrations in the Property Excluding SRAs are generally within the range of typical soil concentrations in Louisiana in unimpacted soils (USGS, 2013; Attachment F and Table 4) or are of low solubility and low bioavailability.

Maximum soil concentrations were compared to soil ESVs and USGS background (Inset Table 4-4). The following constituents (maximum concentration) exceeded ESV and background soil comparison values: cadmium, mercury, and zinc.

Sediment ESVs were used in addition to soil ESVs to account for soils in standing water on the Property. For this evaluation, maximum soil concentrations were compared to TEC and PEC screening values (Inset Table 4-5). Mercury exceeded the TEC and PEC and is included as a COPEC in the ERA. Cadmium and chromium were below the TEC and PEC; and arsenic, lead, and zinc exceeded the TEC and were below PEC, indicating that Property soil concentrations are protective of aquatic life.

Table 4-3: Maximum Reported Concentrations

Constituent	Maximum Reported Concentration (mg/kg-dry)	Location (Depth feet bgs)	Sample Date
Property Excluding SRAs			
Arsenic	16.6	HA-4 (0-2') HET	8/30/2019
Barium	1370	SB-21 (0-2') ICON	6/23/2022
Cadmium	1.7	SB-06R (0-2')	9/27/2022
Chromium	34	HA-5 (0-2') HET	8/30/2019
Lead	42.8	SB-13 (0-2') HET	6/22/2022
Mercury	1.47	SB-14 (2-4') HET	6/23/2023

Constituent	Maximum Reported Concentration (mg/kg-dry)	Location (Depth feet bgs)	Sample Date
Selenium	ND	-	-
Silver	ND	-	-
Strontium	448	HA-4 (0-2') HET	8/30/2019
Zinc	199	HA-4 (0-2') HET	8/30/2019

Notes
Concentrations are in mg/kg-dry.
ND = Non-Detect.

Table 4-4: Soil Screening Values for Estimation of Potential Ecological Risks

Constituent	Soil Ecological Screening Value	Background USGS	Screening Comparison	
			Soil Concentration [Maximum Value]	Soil Screening Exceedance [Y/N]
Property Excluding SRAs				
Arsenic	18	12[a]	16.6	N
Barium	2424	775	1370	N
Cadmium	0.36	0.8	1.7	Y
Chromium	26	84	34	N
Lead	11	44	42.8	N
Mercury	N/S	0.11	1.47	Y
Selenium	0.52	1.0	ND	N
Silver	4.2	ND	ND	N
Strontium	N/S	203	448	Y
Zinc	46	140	199	Y

Notes
Concentrations are in mg/kg-dry.
ND = Non-Detect.
Soil Ecological Screening Value is the lowest of the available USEPA Eco-SSLs.
Background, USGS: Background Data for Louisiana, 95% Upper Tolerance Limit, United States Geological Survey, 2013.
There are no Eco-SSLs or other reliable ecological screening values for strontium, and strontium is not further assessed.
Mercury is retained for BERA due to exceedance of Louisiana soil background (0.11 mg/kg, USGS)
[a] Arsenic value is LDEQ-approved soil background for Louisiana.

Table 4-5: Sediment Screening Values for Estimation of Potential Ecological Risks

Constituent	NOAA TEC	NOAA PEC	Screening Comparison	
			Soil Concentration [Maximum Value]	Soil Screening Exceedance [Y/N]
Property Excluding SRAs				
Arsenic	9.79	33	16.6	N
Barium	N/S	N/S	1370	N
Cadmium	0.99	4.98	1.7	N

Constituent	NOAA TEC	NOAA PEC	Screening Comparison	
			Soil Concentration [Maximum Value]	Soil Screening Exceedance [Y/N]
Chromium	43.4	111	34	N
Lead	35.8	128	42.8	N
Mercury	0.18	1.06	1.47	Y
Selenium	N/S	N/S	ND	N
Silver	N/S	N/S	ND	N
Strontium	N/S	N/S	448	N
Zinc	121	459	199	N

Notes

Concentrations are in mg/kg-dry.

ND = Non-Detect.

Sediment screening values are included to account for portions of the forest that have standing water.

Sediment Ecological Screening Values are NOAA TEC and NOAA PEC (NOAA SQuiRT, 2008).

Arsenic, Lead, and zinc exceed the TEC and not the PEC.

4.2.2 Screening Level Risk Calculations

The HQ is used to estimate risk in the SLERA (USEPA, 1997). The HQ is estimated by comparing ESVs to exposure concentrations. The HQ is defined as the estimated environmental concentration (EEC) divided by the ESV:

$$HQ = EEC / ESV$$

The EEC is the maximum dry weight concentration detected in soil in mg COPEC/kg soil. The ESV represents the concentration below which no risk is predicted. For HQ values that exceed 1.0, the potential for adverse effects to a receptor cannot immediately be ruled out. For HQs equal to or less than 1.0, the potential for risks due to that COPEC can be considered minor and are dropped from further consideration. An HQ >1.0 does not mean that unacceptable ecological risks exist or that any remediation is needed, only that further analysis, such as a site-specific BERA, are needed.

The screening level HQs calculated by comparison of maximum soil concentrations to screening values are presented in Inset Table 4-6. At this level of the screening assessment, 3 metals in soil are carried forward into the BERA: cadmium, mercury, and zinc. Hazard quotients (HQ) for these metals are low (2.36 – 8.17) and exceed the HQ benchmark of 1.0.

Table 4-6: COPEC Screening Hazard Quotients using Maximum Soil Concentrations

Constituent	Soil Concentration [Maximum Value] (mg/kg dry)	Location (depth feet bgs)	Lowest Ecological Screening Value (mg/kg dry)	Screening Hazard Quotient (HQ) [Based on Lowest ESV]
Single Point Location HA-4				
Zinc	199	HA-4 (0-2') HET	46	4.33
Single Point Location HA-5				
Cadmium	0.85	HA-5 (2-4') ICON	0.36	2.36
Single Point Location SB-06R				
Cadmium	1.7	SB-06R (0-2')	0.36	4.72

Constituent	Soil Concentration [Maximum Value] (mg/kg dry)	Location (depth feet bgs)	Lowest Ecological Screening Value (mg/kg dry)	Screening Hazard Quotient (HQ) [Based on Lowest ESV]
Single Point Location SB-07R				
Cadmium	1.63	SB-07R (0-2')	0.36	4.53
Single Point Location SB-14				
Mercury	1.47	SB-14 (2-4') HET	0.18	8.17

4.2.3 Risk Characterization

Risk characterization combines data for exposures and effects into a statement about risk. If screening values are not exceeded, no risk exists due to COPEC exposures on the Property, and if screening values are exceeded, a more detailed and focused site-specific ecological risk analysis can be initiated. The term site-specific refers to data that is collected from the Property to characterize the environmental conditions present. Examples of site-specific data collected for this ERA include soil constituent concentration data, soil chemistry data (such as pH, CEC, SPLP), barium XRD speciation data, Property vegetation species counts and classifications, root zone depth studies, ecosystem services assessments, wetland delineation analyses, and Property wildlife surveys. These site-specific data support the conclusions made in the ERA.

Metal concentrations in soil in the Property Excluding SRAs are generally similar to concentrations in unimpacted soil throughout Louisiana. TPH fraction concentrations in soil are non-detect or low in concentration and are typical of weathered hydrocarbons of low toxicity (discussed in Section 4.2.3.2 below).

An important part of characterizing potential ecological risk is the assessment of COPEC bioavailability. A discussion of the low bioavailability and related low toxicity of COPECs in the wetland soils is discussed in the following sections.

4.2.3.1 Metals Bioavailability

The majority of soil metal concentrations in the Property Excluding SRAs are not elevated above unimpacted soil concentrations throughout Louisiana (USGS, 2013) and do not require further evaluation in the BERA. Only cadmium, mercury, and zinc in the Property Excluding SRAs are elevated above ESVs, and these are only slightly elevated at five locations. The bioavailability of cadmium, mercury, and zinc cadmium is discussed here.

It should be noted that the metal concentrations being discussed are low. Mercury and zinc only exceed their respective ESVs in one sample location each. Cadmium exceeded the ESV at three sample locations. There are only a total of five exceedances of ESVs (0-4') in the Property Excluding SRAs.

For reference on the low concentrations in the Property Excluding SRAs, the ESV for mercury is 0.11 mg/kg-dw (maximum mercury detected, 1.47 mg/kg-dw); the zinc ESV is 140 (maximum zinc detected 199 mg/kg-dw); and the ESV for cadmium is 0.8 mg/kg-dw (maximum cadmium detected 1.7 mg/kg-dw). These metal concentrations are low by comparison to ESVs but are further analyzed in the BERA. A discussion of the bioavailability of these metals in soil follows.

Zinc

The ecological toxicity of zinc in wetland soils is related to its bioavailability. Zinc may exist in wetlands soils in bioavailable and/or non-bioavailable forms when soils are of a neutral soil pH, such as found at the Property (pH 7.5, average and median) for all depths sampled. At this Property, zinc is demonstrated to be in a form of very low bioavailability and therefore, very low toxicity.

Zinc, although detected above the ESV of 140 mg/kg-dw at location HA-4 (0-2',153 mg/kg-dw/199 mg/kg-dw), is not detected in the SPLP sample at that location. SPLP analysis involves dissolving 100 grams of soil into two liters of water over an 18-hour period, to determine if the zinc detected in that soil can dissolve in water. Zinc was not detected in the SPLP solution water (HA-4, 0-2', <0.10 mg/L), and is therefore very poorly soluble (did not dissolve) and is of very low bioavailability. Zinc in soil that does not dissolve in water, is not in a form that can be absorbed, taken up, or accumulated by living organisms, and therefore is not toxic, because there is no complete pathway of exposure, due to the lack of bioavailability of the form of zinc present.

The BERA is completed for zinc using toxicity factors for forms of zinc that have limited bioavailability, and for reference, toxicity factors for bioavailable forms of zinc are also used in BERA calculations.

The results of the BERA are that no ecological risk is predicted (all HQs < 1.0, see Table 5-2) due to wildlife exposure to zinc in soils, for bioavailable forms of zinc or zinc in forms of limited bioavailability.

Cadmium

The soil geochemistry of cadmium mimics zinc soil geochemistry, in that both cadmium and zinc can be present in bioavailable and non-bioavailable forms in neutral pH soils, such as found at the Property. Because zinc was demonstrated to be in a form of limited bioavailability, via SPLP analysis, cadmium, which has the same predicted geochemistry as zinc (Reddy and DeLaune, 2008), is also predicted to be in a form of limited bioavailability.

Cadmium was detected at three locations (maximum cadmium detected 1.7 mg/kg-dw) above the ESV of 0.8 mg/kg-dw.

Cadmium is evaluated in the BERA calculations using toxicity values for cadmium of limited bioavailability and for reference, bioavailable cadmium.

The results of the BERA are that no ecological risk is predicted (all HQs < 1.0, see Table 5-2) due to wildlife exposure to cadmium in soils, for bioavailable forms of cadmium or cadmium in forms of limited bioavailability.

Mercury

Mercury has the potential to be present, in the neutral pH wetland soils in the Property Excluding SRAs, in either bioavailable or forms of limited bioavailability. That is, bioavailable mercury and non-bioavailable mercury are both possibilities. Mercury was detected above the mercury ESV of 0.18 mg/kg-dw at location SB-14 (0.22 – 1.47 mg/kg-dw) and is further assessed in the BERA.

4.2.3.2 Total Petroleum Hydrocarbons

Total Petroleum Hydrocarbons (TPH) are not carried forward as COPECs for a BERA evaluation, due to being non-detect or in low concentrations in the Property Excluding SRAs.

TPH fraction concentrations in soil are non-detect in 12 of 16 samples (0-4') in the Property Excluding SRAs and are very low concentrations (9-128 mg/kg-dw) in the 4 sample locations where TPH fractions were detected. These TPH concentrations are low and are similar to concentrations of hydrocarbons in non-E&P impacted soils (ERM, 2019). In these four sample locations, the TPH are primarily made up of the C_{16-35} aliphatic compounds typical of weathered hydrocarbons of low toxicity. This aliphatic range of hydrocarbons preferentially binds soils, rather than dissolving in water, and is therefore of low bioavailability to ecological species.

TPH are below levels of ecological concern and are not further assessed in the BERA.

4.2.3.3 Ecology in Areas Planned for Soil Remediation (SRAs)

The Soil Remediation Areas (LAA2-SRA, LAA3-EP SRA, and LAA3-WP SRA) are former pits and are planned for soil remediation (HET, 2022). Soil concentrations in LAA3-WP SRA, and LAA3-EP SRA are elevated for some metals, and soil concentrations in LAA2-SRA are elevated for some hydrocarbons constituents. Although constituents in LAA2-SRA, LAA3-WP SRA, and LAA3-EP SRA are planned for soil remediation, in order to meet regulatory requirements (HET, 2022), there is no evidence of toxicity to vegetation or wildlife in the SRAs, as discussed in Section 3.6.

The habitat in the SRAs planned for soil remediation was observed to be flourishing. In the SRAs, all levels of the trophic food chain were observed, including avian and non-avian species, and very diverse vegetation assemblages were documented to be thriving. Vegetative and wildlife diversity was directly observed at LAA2-SRA, LAA3-WP SRA, and LAA3-EP SRA. Excellent vegetation biodiversity observed in the SRAs included 33 species at LAA2-SRA, 31 species at LAA3-WP SRA, and 46 species at LAA3-EP SRA. Wildlife observed included 9 birds and 10 other taxa at LAA2-SRA, 11 birds and 16 other taxa at LAA3-WP SRA, and 8 birds and 9 other taxa at LAA3-EP SRA. These plant and wildlife observations are very good field evidence of productive ecosystems in the SRAs. The biodiversity in the SRAs is as expected for bottomland hardwood and swamp habitats in the Atchafalaya Basin and is evidence of lack of impact to the ecology from E&P operations.

In addition to the documented vegetation and wildlife health in the three SRAs, the measured soil analytical data in the three SRAs is supportive of limited constituent bioavailability and low toxicity. A discussion of the low bioavailability and low toxicity of soils in the 0-2' interval in the LAAs planned for remediation is included in Attachment G.

4.2.3.4 Risk Characterization Summary

Property Excluding SRAs:

In the Property Excluding SRAs, the three COPECs for further evaluation in the BERA, cadmium, mercury, and zinc, are only slightly elevated and are predicted to be of low bioavailability and/or low toxicity to ecological species.

TPH are non-detect or low in concentration in the Property Excluding SRAs and are present in weathered and degraded forms that are of low ecological toxicity. TPH are not predicted to be a source of ecological risk in the Property Excluding SRAs and are not carried forward as COPECs in the BERA.

SRAs Overview:

The soil constituent concentrations in the LAA2-SRA, LAA3-WP SRA, and LAA3-EP SRA, which are planned for remediation, are not predicted to be a source of risk to ecological species (see Attachment G).

- LAA-SRAs TPH: TPH are assessed as weathered and degraded and of low toxicity. There are not ecological screening values for TPH, and TPH are assessed for ecological risk by evaluating PAH. PAH data in the LAAs are below ecological screening values, and not predicted to be a source of ecological risk.
- LAA2-SRA Metals: Average metal concentrations (0-2') are generally below ESVs and are not predicted to be associated with ecological risk.
- LAA3-WP SRA and LAA3-EP SRA Metals: Average metal concentrations detected in soils planned for remediation (0-2') are of low bioavailability and low toxicity or are below ecological levels of concern. See Attachment G for discussion of SRA soil ecological risk.

SRAs Summary:

Soil metal, TPH, and PAH concentrations in the SRAs are not predicted to be a source of ecological risk. This prediction of lack of ecological impact from SRA soils (0-2') is strongly supported by the evidence of thriving vegetative and wildlife communities at each SRA. The SRAs will be remediated to meet regulatory standards, but there is not evidence that these areas require remediation for ecological reasons (see Attachment G).

5 BASELINE ECOLOGICAL RISK ASSESSMENT (BERA)

5.1 ERA Step 3

Based on the results from Step 2 of the USEPA (1997) ERA process, the following COPECs on the Property exceed conservative screening values and are further investigated in the BERA: cadmium, mercury, and zinc.

At the conclusion of Step 2, a Scientific Management Decision is made to either proceed to a site-specific BERA or to end the risk assessment at the screening level (USEPA, 1997). Based on the screening results, the Scientific Management Decision at the conclusion of Step 2 is to proceed to a site-specific BERA.

The BERA is a site-specific ecological evaluation based on the chemical forms of constituents present, the concentrations of COPECs, the ecotoxicity of chemical species, and complete exposure pathways. The BERA assesses potential toxicological impacts to ecological populations using indicator or surrogate species.

In the BERA, site-specific data are evaluated. The bioavailability of COPECs is evaluated along with fate and transport, potential for bioconcentration, bioaccumulation, and biomagnification in the food chain. Indicator species are selected to assess ecotoxicity of COPECs. To select appropriate indicator species, trophic level relationships and the physical structure of the habitat are considered. The toxicity endpoints used in this stage of the risk assessment are values based on mortality, reproduction, or growth.

In order to assess toxicity via ingestion exposure in a variety of animal populations, several indicator species are assessed. The following factors are considered in the species selection process: 1) ecological relevance to the Property, 2) vulnerability to exposures, 3) sensitivity to toxic effects of COPECs, 4) social and economic importance, 5) protected species status, and 6) availability of species-specific toxicological information.

The following avian and mammalian indicator species were selected for the site-specific BERA: 1) Northern Cardinal, 2) American Robin, 3) Spotted Sandpiper, 3) Mallard, 4) Snowy Egret, 5) Swamp Rabbit, 6) Marsh Rice Rat and 7) American Mink. The following sections discuss the lifestyle of these species.

5.1.1 Northern Cardinal (Cardinalis cardinalis)

The Northern Cardinal was selected to represent birds that eat terrestrial invertebrates and plants. The Northern Cardinal was selected because it has been observed at the Property and is found year-round in semi-open woodlands across the eastern United States.

Northern Cardinals are a common and easily recognized medium-sized songbird throughout Louisiana. Both females and males have a distinctive crest, red-orange bill, and mask on face (The Cornell Lab, 2022b). Males have more distinctive plumage than females with solid bright red feathers with a black mask. Females have a less defined mask and are grayish tan with red tinges in wing, tail, and crest feathers.

Northern Cardinal can be found opportunistically foraging on or near the ground and occasionally from higher branches of a tree or shrub (The Cornell Lab, 2022b). Primarily herbivorous, the Northern Cardinal will feed on vegetable matter such as seeds and fruits and on animal matter such as insects.

Generally, adult Northern Cardinals retain their breeding territories all year-round unless they must move due to food or shelter deficiencies (The Cornell Lab, 2022b). Northern Cardinals are monogamous and nest in denser vegetation with woody plants having a typical clutch size of two to three eggs. Male and female Northern Cardinals are territorial throughout the breeding season and defend their territory through song matching and over-singing, diving, and physical attacks.

5.1.2 American Robin (Turdus migratorius)

The American robin was selected to represent birds that eat terrestrial invertebrates and plants. Common throughout North America, the American robin was selected because it can be found year-round in Louisiana forests and woodlands (The Cornell Lab, 2022b). The American Robin prefers to breed in edge environments that have short grass areas mixed with shrubs and trees.

American robins are sexually dimorphic with the male presenting dark gray to dark brown upper-parts, a red-orange breast, and a black head streaked with black and white on its throat (The Cornell Lab, 2022b). The female counterpart is paler with less stripes; however, both sexes exhibit a bright yellow bill.

The omnivorous American Robin fruits and invertebrates (USEPA, 1993). American Robins generally forage on the ground, for example on soil invertebrates or fruits that have fallen to the ground, as well as on vegetation that produce fruits or have foliage invertebrates (The Cornell Lab, 2022b).

American robins have several complex calls for communication (The Cornell Lab, 2022b). They will often roost in flocks during non-breeding winter months but are less social during the spring/summer months while it defends its breeding territory. Territories are established by male American Robins through mechanisms such as song and aggressive behaviors. The American Robin is socially monogamous and on average produces two broods per breeding season with an average clutch size of three to four eggs (The Cornell Lab, 2022b). Nests are made of mud inner-lined with dead grass and twigs and are built on an array of substrates that provide firm support and shelter from the rain.

5.1.3 Spotted Sandpiper (Actitis macularius)

The Spotted Sandpiper was selected to represent birds that eat benthic invertebrates. The Spotted Sandpiper was selected because it is common throughout Louisiana's coastal zone. Spotted Sandpipers are small, short-billed sandpipers that prefer to forage along the edges of water bodies (Fontenot and DeMay, 2017). The Spotted Sandpiper receptor represents invertivorous (invertebrate-eating) birds on the Property.

Spotted Sandpipers are most often encountered alone or in small groups, where foraging conditions are favorable. Spotted sandpipers are short-billed, short-legged and short-winged and are identifiable by the dark spots on their underbellies during the breeding season (Fontenot and DeMay, 2017). Females tend to have larger spots that extend lower on the belly compared to males, however both sexes lack spotting altogether while sporting non-breeding plumage (Moore, 2002). Spotted sandpipers use both vocalizations and physical displays to communicate. Their calls are typically described as a 'weet' note that is repeated at various pitches, rates, and intensities to communicate different messages, such as predator alarms or courtship practices (Moore, 2002).

Spotted sandpipers have an important role in the ecological pyramid as secondary consumers. In addition to providing an important food source for a variety of mammalian predators such as American mink, American river otters, and other birds, such as raptors and gulls, spotted sandpipers primarily consume flying insects, and are believed to contribute to pest population control (Moore, 2002).

When foraging, spotted sandpipers habitually teeter their posteriors up and down, and fly low along the water's edge with characteristically rapid, shallow wingbeats (Fontenot and DeMay, 2017). They are opportunistic invertivores that forage on the ground by thrusting their head forward and catching prey in their bill (Moore, 2002). Spotted sandpipers are visual hunters, relying primarily on sight to catch their prey.

5.1.4 Mallard (Anas platyrhynchos)

The Mallard was selected to represent birds that eat benthic invertebrates and plants. The Mallard was selected because it represents migrating species that could use the Property as part of the Mississippi Flyway.

In Louisiana, Mallards are abundant and well-recognized ducks. In comparison with other ducks, Mallards are relatively large, dabbling ducks with broad wings. The male Mallard's characteristic and conspicuous green head, grey flanks, and black tail-curl make it readily identifiable. The female Mallard (hen) is marked in a mottled pattern of light and dark brown streaks with a dark brown streak through the eye. Both male and female Mallards have a violet-blue speculum on their wings. Mallards have excellent eyesight and hearing, often providing the duck an escape opportunity when a predator approaches. The Mallard is more vocal than most other ducks and uses a variety of sounds to communicate its actions and moods. Mallards are popular game birds for hunters.

The majority of mallard populations are migratory in North America. Beginning in the fall of the year, Mallards leave nesting sites in the north and fly as far south as northern Mexico. Factors that influence the Mallard's range or alter its patterns include human interference, habitat, food quality and abundance, and lack of a mate. Mallards are omnivorous and opportunistic feeders. They consume benthic invertebrates, acorns, seeds, tubers and vegetative parts of aquatic plants, as well as crops, such as corn, soybeans, rice, barley, and wheat (Delnicki, 1986; Johnson, 2000; Nichols, 1983; Tamisier, 1976).

5.1.5 Snowy Egret (Egretta thula)

The Snowy Egret was selected to represent the category of fish (piscivorous) and aquatic invertebrate-eating birds at the Property. The Snowy Egret was selected as a representative receptor because it uses forested wetlands that are observed on the Property as habitat (Michot, 2001) and because of the abundance of information readily available on Snowy Egret lifestyle.

The Snowy Egret is a common wading bird in Louisiana. It ranges widely in search of food in shallow waters. The snowy egret has been described as a "dashing hunter" by ornithologists because this wading bird employs a gated walking technique that is successful in flushing small prey items in the shallow aquatic habitats where they forage. The Snowy Egret's black legs and yellow feet have been suggested to aid in pursuit of food as the bird wades in shallow water. Small fish are normally prey items for the Snowy Egret. However, farmers raising crayfish have indicated that crayfish are also a preferred food item.

Snowy Egrets nest in colonies in vegetation in somewhat isolated places, such as wetlands, marshes, swamps and even elevated areas. The rookeries and resting sites often change location from year to year. During their breeding season, Snowy Egrets feed in areas that provide a ready source of prey items. Snowy Egrets generally spend the winter months in more protected areas conserving energy.

The diet of the Snowy Egret consists primarily of fish, with smaller portions of benthic invertebrates such as mollusks and crustaceans. These birds use their feet to probe in sediments to find prey items that they secure with their bill. During their feeding activities, snowy egrets may exhibit a variety of behaviors that assist in successful acquisition of prey items. For example, they may stalk prey in shallow water, often running or shuffling their feet, flushing prey into view, as well "dip-fishing" by flying with their feet just above the water. Snowy Egrets may also stand still in order to ambush prey, or hunt for insects mobilized by domestic animals in open fields (Custer, 1991; Custer, 1978; Huner, 2002; King, 1995; Kushlan, 1976).

5.1.6 Swamp Rabbit (Sylvilagus aquaticus)

Swamp rabbits, also known as cane-cutters, are found in marshy lowlands along the Gulf coast from South Carolina to Texas.

Swamp rabbits often feed at dusk, eating emergent aquatic vegetation and succulent herbaceous vegetation, such as grasses, sedges, and cane. Swamp rabbits breed year-round on the Gulf coast and nests are often constructed underneath brush or fences (Wilson and Ruff, 1999).

Swamp rabbits are hunted in Louisiana. Specific population surveys are not conducted for either rabbit species native to Louisiana; however, the Louisiana Department of Wildlife's Louisiana Big and Small Game Harvest Survey for 2019-2020 reported that 12,300 rabbit hunters harvested 71,800 rabbits (LDWF, 2020b).

5.1.7 Marsh Rice Rat (Oryzomys palustris)

The marsh rice rat has a geographical distribution that extends from the Gulf Coast through the southeastern states and north along the Mid-Atlantic coast towards southern New Jersey (Wolfe, 1982). Due to its predisposition to swimming and diving, the preferred habitats of marsh rice rats include the wetlands and coastal marshlands as well as swamps, freshwater marshes, and meadows.

The marsh rice rat is a medium-sized rat with dorsal coloration that varies from gray to grayish brown with lighter chest, underbelly, tail and feet (Wolfe, 1982). The average total length of the marsh rice rat in the geographic area of Louisiana is 237 millimeters. The marsh rice rat is primarily nocturnal.

In Louisiana, the marsh rice rat's diet is omnivorous, and is primarily comprised of plants and benthic invertebrates (Wolfe, 1982).

Breeding of the marsh rice rat may occur anytime throughout the year with a potentially greater offspring production rate in the spring and a lower production rate in the summer months (Wolfe, 1982). Nests of the marsh rice rat are described to be grapefruit-sized made up of woven grasses and sedges found at the base of shrubs or under vegetative debris. Average litter sizes range from 4-6 young with a gestational period of approximately 21 to 28 days. The marsh rice rat reaches sexual maturity for both sexes at approximately 50 to 60 days.

The marsh rice rat can cohabitate with other small mammals without exhibiting a competitive relationship. Barn Owls are the predominant predator of the marsh rice rat in Louisiana (Wolfe, 1982). Additional predators include hawks, water snakes, and raccoons.

5.1.8 American Mink (Neovison vison)

The fur of American mink is usually deep brown or black in color, although they also have white markings on their chests as well as some other parts of their bodies. These smooth-furred mammals have short limbs, slender bodies, tiny ears, and lengthy necks. Adult males range in total length from 19 to 29 inches and females can grow to lengths of 18 to 28 inches. American mink males are approximately twice the size of females.

American mink inhabit much of Canada and the United States, although they have not colonized a few states and regions like Arizona and Hawaii. These nocturnal mammals usually inhabit forested areas, especially those that are near water sources including ponds, rivers, marshes and swamps. American mink often use rocks and hollow logs for denning purposes.

American mink are carnivorous mammals with their diet comprising primarily of benthic invertebrates such as crawfish, small mammals, and fish (Dolan, 1986). The consumption of larger mammals such as nutria, raccoon, and muskrat are often opportunistic and consumed as carrion as evidenced in samples collected

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from mink digestive tracts. There are both seasonal and annual (temporal) differences in the diet depending on availability of prey. Mammals are the preferred food of American mink in cold weather. The distribution of prey animals such as rabbits or mice may cause American mink to move closer to their food (Basu, 2007; Linscombe, 2000; MacDonald, 2003; Svihla, 1931; Thom, 2004).

5.2 ERA Step 4

5.2.1 Work Plan and Sampling Plan

For assessing wildlife receptor exposures, available soil concentration data and vegetation and wildlife survey data (ERM, 2022; Bryant 2022; HET 2019 and 2022; and ICON 2019 and 2022) for the Property were used. Chemical exposure point concentrations were estimated; chemical environmental fate and transport mechanisms were determined; potentially exposed populations were identified; and ingestion exposure routes were identified (Attachment H).

Under RECAP, an area of investigation (AOI) can be used to evaluate exposure to ecological species in the exposure assessment. Preliminary AOIs for ERA purposes were developed to accurately estimate and evaluate ecological exposures (e.g. through concentration averaging) across a distinct relevant exposure area having similar habitat. Because the soil concentrations that exceeded a screening value are low and are limited to five locations in the Property Excluding SRAs, there are only five single point preliminary AOIs. These preliminary AOIs are location HA-4 (zinc), HA-5 (cadmium), SB-06R (cadmium), SB-07R (cadmium), and SB-14 (mercury). See Figure 20 for Preliminary Ecological AOIs.

For a site-specific BERA, exposure estimates can be based on the 95% UCL of the arithmetic mean of concentrations or average concentrations (USEPA 1997; LDEQ 2003). For this BERA sufficient data were not available to calculate 95%UCL values, and the average concentrations were used to calculate risk (Attachment I). Exposure estimates used in the site-specific BERA are presented below and the maximum value is also shown for each COPEC for comparison (Inset Table 5-1, below).

Table 5-1: Soil Exposure Point Concentrations for Single Point Locations

Single Point Locations	Constituent	95% Upper Confidence Limit (UCL) Concentration	Average Concentration	Maximum Concentration
HA-4	Bioavailable Zinc	NA	124	199
	Zinc, Limited Bioavailability	NA	124	199
HA-5	Bioavailable Cadmium	NA	1.32	0.85
	Cadmium, Limited Bioavailability	NA	1.32	0.85
SB-06R	Bioavailable Cadmium	NA	0.92	1.7
	Cadmium, Limited Bioavailability	NA	0.92	1.7
SB-07R	Bioavailable Cadmium	NA	0.90	1.63
	Cadmium, Limited Bioavailability	NA	0.90	1.63
SB-14	Total Mercury	NA	0.85	1.47

Notes

1. Concentrations are in mg/kg-dw.
2. Zinc and cadmium are assessed as potentially present in bioavailable forms or in forms of limited bioavailability. Analytical and soil data support the presence of limited bioavailability of both metals, but for a conservative approach, zinc and cadmium are also assessed as potentially bioavailable.
3. Sample sizes for each single point location did not have sufficient numbers of observations to perform 95% UCL calculations.
4. The average concentration for cadmium at the Single Point Location HA-5 was calculated using ½ the detection limit for all sample locations that had a non-detect result. The detection limit for the two non-detect cadmium results were higher than the maximum detected cadmium result; and therefore, skewed the average concentration to be higher than the maximum concentration for cadmium.

5.2.2 Measurement Endpoints

Measurement endpoints for the BERA are Toxicity Reference Values (TRVs). TRVs are estimated to be safe doses for the wildlife being assessed (Table 6).

TRVs used in the BERA calculations for cadmium, mercury, and zinc are based on studies that use the most toxic and bioavailable form of the element being assessed. In addition to these TRVs, because cadmium and zinc have been demonstrated to be present in Property soils in compounds of very limited toxicity and bioavailability, TRVs for zinc and cadmium that are of limited bioavailability have also been used in BERA calculations. The BERA conservatively presents an assessment of zinc and cadmium in both bioavailable forms and forms of limited bioavailability. TRVs for cadmium and zinc of limited bioavailability are based on mortality effects. TRVs for bioavailable forms of cadmium, mercury, and zinc are based on mortality, growth, and reproduction effects (USEPA, 2007a).

5.2.3 Study Design

The BERA uses more realistic input values and assumptions than are used in the SLERA. The following sections describe some of the assumptions used in the BERA, as compared to the SLERA.

Bioavailability and Bioaccumulation: Bioavailability of soil contaminants is assumed to be 100 percent in the SLERA. In the BERA, more accurate bioavailability has been estimated from a review of the scientific literature (Table 7 and Table 8).

Dietary composition: In the SLERA, the assumption is made that a species' diet is entirely comprised of the most contaminated food type available. In the BERA, the diet composition of the receptor is based on scientific research and specifically, the diet composition of animals native to Louisiana is used when that information is available (Table 9).

Area-use factor: The assumption used for home range in the SLERA is that an animal's home range is only in the area of contaminated soil and that the animal spends 100 percent of its time in the contaminated area. The area use factor in the BERA more accurately represents the actual percentage of an animal's home range that may be affected and the percentage of time that the receptor would spend in the contaminated area, by incorporating home range and time estimates in the calculations (Table 10).

Life stage: The SLERA uses toxicity data from the most sensitive life stage of the receptor population. For example, if an animal is the most sensitive to a toxin in its juvenile stage of life, then data from the juvenile life stage is used for the SLERA. In the BERA, data from an average receptor age is used to estimate risk. It is an overestimation of risk to assume that the entire population at the Property is at the most sensitive life stage.

Body weight and food ingestion rates: The BERA uses the body weights and food ingestion rates from the primary scientific literature to accurately estimate risk at the Property. Body weights from studies of Louisiana animals are used when available (Table 9).

Toxicity Values: For the SLERA, toxicity is estimated for entire classifications of receptors (example: invertebrates) by comparing soil concentrations to screening values that are calculated to be overly inclusive. The screening values are designed to "not miss" the possibility of risk being present. For the BERA, TRVs are used for calculating risk. TRVs are species specific and are used to calculate a more accurate risk estimate for a representative receptor population.

5.2.4 Data Quality Objectives

Data Quality Objectives are important to the acquisition of reliable data for quantitative risk assessment. Risk-based decisions must be based on data of known quality which meet LDEQ RECAP and USEPA requirements. The data for this risk assessment were determined to be usable for risk assessment.

The soil data collected and discussed in this report were collected by ICON (2019, 2022) and HET (2019, 2022). The chemical analyses of salinity, metals, TPH fractions, and PAHs in soil were performed by Element Materials Technology Lafayette (Element) in Lafayette, Louisiana, Pace Analytical Gulf Coast (Pace) in Baton Rouge, Louisiana, SGS North America Inc. in Scott, LA, and Waypoint Analytical Louisiana, Inc. (Waypoint) in Marrero, Louisiana. Element, Pace, and Waypoint are LDEQ LELAP certified laboratories.

All qualified data have been included in the risk assessment. Data were generated using LDNR 29-B, USEPA SW-846, TPH MADEP VPH and EPH methods. Additional X-Ray Diffraction (XRD) barium speciation analysis was performed by CORE Mineralogy in Broussard, LA. Data meet the definition of definitive data per RECAP guidelines. Samples were appropriately collected and identified in the field by sample identification number, and date and time of collection. Sample quantitation limits were reviewed and found to be acceptable for ERA.

5.3 ERA Step 5

5.3.1 Field Sampling Plan Verification

In Step 5, efforts are made to determine that the field sampling plan is appropriate for Property conditions. That is, the sampling methods and equipment planned should be effective for the media and populations on the Property. Past experience with working in similar Louisiana habitats was used to determine the sampling efforts needed.

5.4 ERA Step 6

5.4.1 Analysis of Ecological Exposures and Effects

A review of the available sampling data (ICON, 2019 and 2022; HET, 2019 and 2022) identified that sufficient data are available to estimate ecological risk at the Property. Site-specific data from this step replace assumptions made during the screening-level analysis in Steps 1 and 2.

5.5 ERA Step 7

5.5.1 Risk Estimation and Characterization

Risk Characterization includes two major steps: risk estimation and risk description. In the risk estimation step of the BERA, risk is estimated and the uncertainties associated with risk assessment methods are evaluated. All input assumptions to the risk estimate are documented.

Potential exposures and ecological effects were evaluated for COPECs and receptors at the Property. The equation used for calculating potential risk (HQs) for COPECs in the site-specific BERA for the Property is as follows (USEPA 2005a):

$$\frac{(\left[\mathbf{Soil\ x\ Ps\ x\ FIR\ x\ AFas}\right] + \left[\sum_{\mathbf{i}}^{\mathbf{N}}\mathbf{Bi\ \ x\ Pi\ x\ FIR\ x\ AFai}\right])\ \mathbf{x\ AUF}}{\mathbf{TRV}} = \mathbf{HQ}$$

HQ	=	Hazard Quotient for analyte/COPEC (unitless)
Soil	=	Concentration of analyte/COPEC in soil (mg/kg dry weight)
N	=	Number of different biota types in diet (food types)
B_i	=	Analyte/COPEC in biota type (i) (mg/kg dry weight)
P_i	=	Proportion of biota type (i) in diet
FIR	=	Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai}	=	Absorbed fraction of analyte/COPEC from biota type (i)

AF_{as} = Absorbed fraction of analyte/COPEC from soil (s)
TRV = Toxicity Reference Value, based on estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor (spatial factor, SF x temporal factor, TF)

Attachments H and I include the HQ calculations, analyses, and input values used to calculate risk estimates.

A summary of the results of the risk assessment and a discussion of uncertainties is included in Sections 5.9 and 6.

5.6 ERA Step 8

5.6.1 Risk Management Decision

Results of the BERA are provided in summary form for the ecological preliminary AOIs (Inset Table 5-2, below). The results of this BERA can be used to support decisions regarding any remediation needed for the ecological preliminary AOIs. The damage caused by any remedy must be considered and weighed against the need for that remedy (USEPA, 1997).

Table 5-2: Results (Hazard Quotients) for Ecological Preliminary AOI

Soil Hazard Quotients (HQs)									
Single Point Locations	COPEC	Avian Receptor Species					Mammalian Receptor Species		
		Northern Cardinal	American Robin	Spotted Sandpiper	Mallard	Snowy Egret	Swamp Rabbit	Marsh Rice Rat	American Mink
Average Concentration as Exposure Concentration									
HA-4	Bioavailable Zinc	0.000192	0.0124	0.00163	0.00000456	0.00000234	0.00015	0.00571	0.0000261
	Zinc, Limited Bioavailability	0.0000142	0.000919	0.000121	0.000000337	0.000000173	0.0000127	0.000481	0.0000022
HA-5	Bioavailable Cadmium	0.000204	0.014	0.000206	0.000000972	0.00000137	0.000249	0.00264	0.00000852
	Cadmium, Limited Bioavailability	0.00000379	0.00026	0.00000384	0.0000000181	0.0000000256	0.00000243	0.0000257	0.000000083
SB-06R	Bioavailable Cadmium	0.000142	0.00973	0.000144	0.000000677	0.000000957	0.000173	0.00184	0.00000593
	Cadmium, Limited Bioavailability	0.00000264	0.000181	0.00000268	0.0000000126	0.0000000178	0.00000168	0.0000179	0.0000000578
SB-07R	Bioavailable Cadmium	0.000139	0.00952	0.00014	0.000000663	0.000000937	0.000169	0.0018	0.00000581
	Cadmium, Limited Bioavailability	0.00000258	0.000177	0.00000261	0.0000000123	0.0000000174	0.00000165	0.0000175	0.0000000566
SB-14	Mercury	0.0000152	0.000942	0.0000464	0.000000176	0.000000942	0.0000556	0.000804	0.00000375
Maximum Concentration as Exposure Concentration									
HA-4	Bioavailable Zinc	0.000308	0.0199	0.00262	0.00000733	0.00000375	0.000241	0.00916	0.000042
	Zinc, Limited Bioavailability	0.0000228	0.00147	0.000194	0.000000542	0.000000277	0.0000204	0.000772	0.00000354
HA-5	Bioavailable Cadmium	0.000131	0.00899	0.000132	0.000000626	0.000000885	0.00016	0.0017	0.00000549
	Cadmium, Limited Bioavailability	0.00000244	0.000167	0.00000246	0.0000000116	0.0000000165	0.00000156	0.0000166	0.0000000535

Soil Hazard Quotients (HQs)

Single Point Locations	COPEC	Avian Receptor Species					Mammalian Receptor Species		
		Northern Cardinal	American Robin	Spotted Sandpiper	Mallard	Snowy Egret	Swamp Rabbit	Marsh Rice Rat	American Mink
SB-06R	Bioavailable Cadmium	0.000262	0.018	0.000266	0.00000125	0.00000177	0.00032	0.0034	0.000011
	Cadmium, Limited Bioavailability	0.00000488	0.000334	0.00000495	0.0000000233	0.0000000329	0.00000312	0.0000332	0.000000107
SB-07R	Bioavailable Cadmium	0.000252	0.0172	0.000255	0.0000012	0.0000017	0.000306	0.00326	0.0000105
	Cadmium, Limited Bioavailability	0.00000468	0.000321	0.00000474	0.0000000223	0.0000000316	0.00000298	0.0000318	0.000000102
SB-14	Mercury	0.0000264	0.00163	0.0000803	0.000000305	0.00000164	0.0000966	0.00139	0.00000651

Note

The appropriate exposure concentrations for BERA are average concentrations (USEPA 1997; LDEQ 2003). The maximum concentration is a hypothetical exposure concentration and shown for reference.

The calculated HQs, based on average and maximum exposure concentrations in soil, are low for all receptors, and all HQs are less than 1.0. Therefore, based on the multiple lines of field evidence demonstrating expected biological diversity for the region, and low HQ values, there is currently no risk identified and no potential for risk to the ecological receptors on the Property.

There is no need for remediation or for further investigation. See Attachment I for HQ calculations using average and maximum exposure concentrations.

No adverse effects to receptors in soil (0-3') are predicted for the Property.

5.7 Current and Future Land Use

5.7.1 Soil

The Property is a thriving forested wetland that can support recreational uses, such as hunting and fishing. There are no data that indicate that Property E&P related constituents are providing ecological risk to wildlife on the Property, or to the people who may consume wildlife. This assessment of land use for hunting and fishing is based on the assumption that wildlife may be exposed to shallow soils on the Property.

Hunting

The forests on the Property can support game animals, such as squirrels and other birds and mammals, for hunting. Constituents in Property soils are not predicted to be an ecological risk to recreational birds and mammals, that may be hunted, per the site-specific BERA for the Property Excluding SRAs and the evaluation of SRA soils (Attachment G). SRA soil concentrations were not included in the BERA, as these soils are planned for remediation for regulatory reasons, but SRA average soil constituent concentrations are not predicted to be a source of ecological risk to game animals.

Game animals from the Property, are predicted to be safe for human consumption, as Property soil metal and hydrocarbon concentrations, that game animals may be exposed to, are on average, similar to typical Louisiana soil concentrations or are in poorly bioavailable forms that are not well absorbed by animals.

Fishing

The canals on the Property may be used for fishing. There are no data that indicate that Property E&P related constituents are providing ecological risk to aquatic life in the canal or to people consuming fish from the canal. Observations on the Property of fish, alligators, and snakes provide evidence of water quality sufficient to support aquatic species. Direct observations on the Property of aquatic species include observations of the American alligator and the cottonmouth. Also observed on the Property are predators that rely on aquatic diets, such as fish-eating birds. These birds rely on water quality that is sufficient to support fish for their diets. Examples of fish-eating birds seen on the Property include Tricolored Heron and Little Blue Heron. Based on these observations of aquatic species and their predators, the Property is supporting the ecological service of providing fish and aquatic habitat.

5.8 Risk of Remedy

There are three locations proposed (HET, 2022) for soil remedial action in the areas of HA-1 and HA-2. These are LAA2-SRA, LAA3-EP SRA, and LAA3-WP SRA. These locations are objectively thriving, diverse, and supporting an abundance of wildlife and vegetation (see Section 3.6). The soil remediation in these areas is proposed for the purpose of meeting regulatory guidelines but is not required for any ecological reason. The proposed footprint of remedial action in the SRAs is small (less than 0.054 acres each, for combined 0.12 acres) and may be performed with minimal disturbance to the habitat. However, the soil remedial action is not needed for the thriving ecology that exists in these locations.

There are no locations, other than within LAA2 and LAA3, that are proposed for soil remediation. This is consistent with the findings of the ecological risk assessment performed for the Property Excluding SRAs, that Property soils are supporting wildlife and vegetation expected for the region, and no action is needed for any ecological reason.

5.9 Uncertainty Evaluation

The uncertainty evaluation is an assessment of the qualitative and quantitative methods used in ERA and the measure of confidence in the risk estimates produced from the ERA. The uncertainty analysis is a required portion of USEPA ecological risk assessment. There are three basic categories of uncertainty: 1) conceptual model uncertainty; 2) natural variation and parameter error; and 3) model error.

Parameter error in general is unavoidable, because all members of a population, all soil present, all habitat features cannot be sampled. If all members of a population could be sampled, the true parameter distribution could be known. However, only a few members of the population can be sampled, leaving uncertainty concerning the true parameter value distribution. We have reduced this uncertainty for soil concentrations by sampling the E&P operational areas, biasing the results towards over estimation of risk.

The uncertainty associated with the conceptual model is related to potentially underestimating the number of routes of exposure. This is counterbalanced by using very conservative screening values to estimate the toxicity of the routes of exposure that are assessed, so this is judged to be a small source of uncertainty.

The initial constituent list is a source of uncertainty. All chemicals present cannot be measured and analyzed. We have addressed this uncertainty by measuring and analyzing the chemicals that have historically been associated with oil and gas production sites and that are required by the LDNR and LDEQ for E&P sites. Uncertainty can arise from making estimates of toxicity based on limited data. We have limited this uncertainty by using conservative estimates of toxicity from the primary scientific literature. There is uncertainty in chemical monitoring data and in dose models. We have addressed this uncertainty by analyzing data at qualified labs, certified to do the analyses. The uncertainty in the dose model is based on limiting the model to ingestion. There are other forms of exposure, but they are minor compared to ingestion, so this portion of uncertainty is judged to be low.

The uncertainty due to environmental variability, which arises from true heterogeneity in the environment and receptors, will be inherent in any calculation. There is uncertainty that could potentially be reduced by additional study, but in the instance of this assessment, there is no indication, based on the collected data and multiple lines of evidence, that further assessment is required. For this reason, that portion of uncertainty is judged to be low.

The effect of the uncertainties in this ERA results in overestimation of risk.

6 SUMMARY AND CONCLUSIONS

The BERA developed for the Property was conducted in accordance with LDEQ (LDEQ 2003) and USEPA (USEPA 1997 and 1998) guidance. Ecological risk assessments evaluate ecological effects caused by human activities or stressors. The term “stressor” is used here to describe any chemical, physical, or biological entity that can induce adverse effects on individuals, populations, communities, or ecosystems. Thus, the ERA process must be flexible while providing a logical and scientific structure to accommodate a broad array of stressors (USEPA, 1998).

USEPA guidance uses a tiered approach (Figure 6) to determine if Property COPECs present an unacceptable risk to ecological receptors. This ERA focused on potential chemical stressors associated with the Property (i.e. in surface soils). The SLERA for the Property conservatively estimated potential risks by comparing maximum detected COPEC concentrations to conservatively-derived ecotoxicity screening values. Per USEPA guidance, site-specific information can be developed and used to accomplish more accurate risk assessment. For the Property, this was accomplished by proceeding with Steps 3-8 of the USEPA ERA process and production of a site-specific BERA.

The conclusions presented in this ERA are based on: 1) data from investigations conducted in 2022 of wildlife and vegetation, and measurements of COPECs in soil data collected in 2019 and 2022; 2) Property investigations; and 3) a site-specific BERA. Multiple lines of evidence including the presence of expected biodiversity in plant and avian populations, observations of functioning terrestrial food chains, calculated hazard quotients below the benchmark of 1.0, and no evidence of damage to wildlife or habitats, demonstrate that there are no unacceptable risks to ecological receptors or their habitats at the Property.

The data, analyses, and lines of evidence presented in the site-specific BERA demonstrate that there are no actual or potential ecological risks for the ecological populations at the Property, and that remedial actions for ecological reasons are not required.

7 REFERENCES

Audubon. 2022a. Important Bird Areas in Louisiana. National Audubon Society. Available: https://www.audubon.org/important-bird-areas/state/louisiana. Accessed October 2022.

Audubon. 2022b. Important Bird Area of Atchafalaya Basin, Louisiana. National Audubon Society. Available: https://www.audubon.org/important-bird-areas/atchafalaya-basin. Accessed September 2022.

Audubon. 2015. Important Bird Areas: A valuable tool for protecting the places more crucial to birds. Available: https://static1.squarespace.com/static/5e8e68295922a6755b0b90e4/t/61f4625a6d99415ee4357263/1643405915561/ibas_policyuse.pdf. Accessed September 2022.

Barbier, E.B. 2013.Valuing ecosystem services for coastal wetland protection and restoration: Progress and challenges. Resources 2: 213-230.

Basu, N., Scheuhammer, A., Bursian, S., Elliott, J., Rouvinen-Watt, K., and H. Chan. 2007. Mink as a sentinel species in environmental health. Environmental Research 103: 130-144.

Beal, F. E. L. 1911. Food of the woodpeckers of the United States. U.S. Department of Agriculture, Biological Survey Bulletin 37.

Bechtel-Jacobs Company. 1998a. Empirical models for the uptake of inorganic chemicals from soil by plants. BJC/OR-133. U.S. Department of Energy, Oak Ridge, TN.

Bechtel-Jacobs Company. 1998b. Biota-sediment accumulation factors for invertebrates: review and recommendations for the Oak Ridge Reservation. BJC/OR-112. Oak Ridge National Laboratory, Oak Ridge, TN.

Beyer, W.N., Pattee, O.H., Sileo, S., Hoffman, D.J., and B.M. Mulhern. 1985. Metal contamination in wildlife living near two zinc smelters. Environmental Pollution (Series A) 38: 63-86.

Beyer, W.N., Connor, E.E., and S. Gerould. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management 58(2): 375-382.

Bleavins, M. and R. Aulerich. 1981. Feed consumption and food passage in mink (mustela vison) and european ferrets (mustela putorius furo). Lab. Anim. Sci. 31: 268-269.

Bond, B.T., Bowman, J.L., Leopold, B.D., Burger, Jr., L.W., Godwin, K.D., and C.M. Class. 2006. Swamp rabbit (Sylvilagus aquaticus) demographics, morphometrics, and reproductive characteristics in Mississippi. Journal of the Mississippi Academy of Sciences 51(2): 123-128.

Brookins, Douglas. 1988. Eh-pH Diagrams for Geochemistry. ISBN 3-540-18485-6.

Bryant, W. 2022. Wetland Delineation Report. August J. Levert Jr. Family, LLC, et al. v BP America Production Co; 18th JDC; Docket #78953 Grand River Field, Iberville Parish, LA.

Buchman, M.F. 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration. 34 pp.

Bull, E. L., R. C. Beckwith and R. S. Holthausen. 1992. Arthropod diet of Pileated Woodpeckers in northeastern Oregon. Northwestern Naturalist 73:42-45.

Chalmers, A. et al. 2013. Characterization of Mercury Contamination in the Androscoggin River, Coos County, New Hampshire, USGS, USEPA, USDOI

August Levert_BP Plan_009533

Chen, M. H., and C. Y. Chen. 1999. Bioaccumulation of sediment-bound heavy metals in grey mullet, liza macrolepis. Marine Pollution Bulletin, Vol. 39, No. 1-12, p. 239-244.

Chibunda, R.T. 2009. Chronic Toxicity of Mercury (HgCl2) to the Benthic Midge Chironomus riparius. Int. J. Environ. Res., 3(3):455-462

Clench, M. and R. Leberman. 1978. Weights of 151 species of Pennsylvania birds analyzed by month, age and sex. Bulletin of Carnegie Museum of National History.

Cooksey, C. 2012. Health Concerns of Heavy Metals and Metalloids. Science Progress, 95(1):

73-88.

Connelly, H. 2022. Ecological Risk Assessment. August J. Levert Jr. Family, LLC, et al. v BP America Production Co; 18th JDC; Docket #78953 Grand River Field, Iberville Parish, LA.

Custer, T. and R. Osborn. 1978. Feeding habitat use by colonially-breeding herons, egrets, and ibises in North Carolina. The Auk 95: 733-743.

Custer, T. and D. Peterson. 1991. Growth rates of great egret, snowy egret and black-crowned night-heron chicks. Colonial Waterbird, Vol. 14, No. 1, pp. 46-50.

Daigle, J.J., Griffith, G.E., Omernik, J.M., Faulkner, P.L., McCulloh, R.P., Handley, L.R., Smith, L.M., and Chapman, S.S. 2006. Ecoregions of Louisiana. U.S. Geological Survey.

Delnicki, D. and K. Reinecke. 1986. Mid-winter food use and body weights of mallards and wood ducks in Mississippi. The Journal of Wildlife Management, Vo. 50, No. 1, pp. 43-51.

Dillon, O.W., Jr. 1959. Food habits of wild ducks in the rice-marsh transition area of Louisiana. Soil Conservation Service, Rosenberg, Texas.

Dolan, A. 1986. Winter food habits of mink in southern louisiana. Master's Thesis. Louisiana State University and Agricultural and Mechanical College. School of Forestry, Wildlife, and Fisheries.

Dunning, J. 1984. Body weights of 686 species of north american birds. Journal of Field Ornithology, Vol. 55, No. 4, p. 514.

eBird. 2022. Sherburne Wildlife Management Area South Farm Unit, Iberville, Louisiana, US. https://ebird.org/hotspot/L727380. Accessed September 2022.

Elner, R. Beninger, P., Jackson, D., and T. Potter. 2005. Evidence of a new feeding mode in western sandpiper (calidris mauri) and dunlin (calidris alpina) based on bill and tongue morphology and ultrastructure. Marine Biology 146: 1223-1234.

ERM. 2019. East White Lake Ecological Risk Assessment, Section 16 Site, East White Lake Oil and Gas Field, Vermilion Parish, Louisiana. September 16, 2019.

ESG International Inc. 2003. Ecotoxicity evaluation of reference site soils amended with barium sulphate. Technical Appendices for Barite Soil Remediation Guidelines. Alberta Environment and Canadian Association of Petroleum Producers. 2009. Appendix VI: 287-328.

Feijtel, T.C. 1986. Biogeochemical Cycling of Metals in Barataria Basin (Diagenesis, Mass Balance, Transport, Louisiana). LSU Historical Dissertations and Theses. 4183. January 1986.

Fernández-Martínez, R., Larios, R., Gomez-Pinilla, I., Gomez-Mancebo, B., Lopez-Andres, S., Loredo, J., Ordonez, A., and I. Rucandio. 2015. Mercury accumulation and speciation in plants and soils from abandoned cinnabar mines. Geoderma 253–254, 30–38.

August Levert_BP Plan_009534

Finerty, M.W., Madden, J.D., Feagley, and R.M. Grodner. 1990. Tissues of Wild and Pond-raised Crayfish in Southern Louisiana, Effect of Environs and Seasonality on Metal Residues. Arch. Environ. Contam. Toxicol. 19: 94-100.

Fontenot, B, and R. DeMay. 2017. "Spotted Sandpiper." In Louisiana Shorebirds. Barataria-Terrebonne National Estuary Program. Available: https://btnep.org/wp-content/uploads/2017/07/Final_Proof_161641_ShorebirdsLR.pdf. Accessed September 2022.Gilmer, D., Ball, I., Cowardin, L., Riechmann, J., and J. Tester. 1975. Habitat use and home range of mallards breeding in Minnesota. The Journal of Wildlife Management, Vol. 39, No. 4, pp. 781-789.

Gould, A. 1974. The home range and habitat preferences of swamp rabbits along a shell road in the intermediate marsh of southwestern Louisiana. Master's Thesis. Louisiana State University and Agricultural and Mechanical College. School of Forestry, Wildlife, and Fisheries.

Halbrook, R. and M. Petach. 2018. Estimated mink home ranges using various home-range estimators. Wildlife Society Bulletin 42:656-666.

Hamilton, M.A., Rode, P.W., Merchant, M.E., and J. Sneddon. 2008. Determination and comparison of heavy metals in selected seafood, water, vegetation and sediments by inductively coupled plasma-optical emission spectrometry from an industrialized and pristine waterway in Southwest Louisiana. Microchemical Journal 88 (2008) 52–55.

HET. 2022. Limited Admission Report. August J. Levert Jr. Family, LLC, et al. v BP America Production Co; 18th JDC; Docket #78953 Grand River Field, Iberville Parish, LA.

Holcomb, S.R, Reid, C.S., Seymour, M.A., Lorenz, N.F., Gregory, B.B., Javed, S.M., and K.F. Balkum. 2015. Louisiana Wildlife Action Plan. Louisiana Department of Wildlife and Fisheries. Available: https://www.wlf.louisiana.gov/assets/Resources/Publications/Wildlife_Action_Plans/Wildlife_Action_Plan_2015.pdf. Accessed September 2022.

Honarvar, S. 1975. Effect of drilling fluid components and mixtures on plants and soils. Utah State University. All Graduate Theses and Dissertations. 3497.

Howell, J. 1942. Notes on the nesting habits of the American robin (turdis migratorius). The American Midland Naturalist, Vol. 28, No. 3, pp. 529-603.

Huner, J. Jeske, C., and W. Norling. 2002. Managing agricultural wetlands for waterbirds in the coastal regions of louisiana. Waterbirds: The International Journal of Waterbird Biology, Vol. 25, Special Publication 2, pp. 66-78.

ICON. 2022. Expert Report and Restoration Plan for the Landowners August J. Levert, Jr. Family, LLC, et al v BP America Production Company; Docket No. 78953; 18th JDC, Division "A"; Grand River Field, Iberville Parish, Louisiana. July 29, 2022.

Johnson, W. and F. Rohwer. 2000. Foraging behavior of green-winged teal and mallards on tidal mudflats in louisiana. Wetlands, Vol. 20, No. 1, pp. 184-188.

Keuper, B. 2022. Groundwater Report. August J. Levert Jr. Family, LLC, et al. v BP America Production Co; 18th JDC; Docket #78953 Grand River Field, Iberville Parish, LA.

King, T. and D. LeBlanc. 1995. Foraging behaviors of snowy egrets (egretta thula) and yellow-crowned night-herons (nyctanassa violacea) in south louisiana. USDA National Wildlife Research Center – Staff Publications, 545.

Kuperman, R., Checkai, R., Phillips, C., Simini, M., and J. Speicher. 2002. Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Soil Screening

August Levert_BP Plan_009535

Levels (ECO-SSL) Using Enchytraeid Reproduction Benchmark Values. U.S. Army Soldier and Biological Chemical Command.

Kuperman, R., Checkai, R., Simini, M., Phillips, C., Speicher, J., and D. Barclift. 2006. Toxicity Benchmarks for Antimony, Barium, and Beryllium Determined Used Reproduction Endpoints for Folsomia candida, Eisenia fetida, and Enchytraeus crypticus. Environmental Toxicology and Chemistry 25: No. 3: 754-762.

Kushlan, J. 1976. Feeding behavior of north American herons. The Auk, Vol. 93, No. 1, pp. 86-94.

Lamb, D.T., Vitukawalu, P.M., Palanisami, T., Megharaj, M., and R. Naidu. 2013. Bioavailability of Barium to Plants and Invertebrates in Soils Contaminated by Barite. Environ. Sci. Technol. 47: 4670-4676.

Langmuir, D. 2003. Issue Paper on the Environmental Chemistry of Metals. USEPA Archive Document

Louisiana Department of Environmental Quality (LDEQ) Corrective Action Group. 2003. Risk Evaluation and Corrective Action Program (RECAP). 129 pp.

LDEQ. 2014. Louisiana Water Quality Ecoregions: For Use in Ecologically-Driven Water Quality Standards.

LDEQ. 2019. Data taken from the LDEQ's Louisiana Environmental Assessment Utility (LEAU) database. https://waterdata.deq.louisiana.gov/

Louisiana Department of Wildlife and Fisheries (LDWF). 2009. The Natural Communities of Louisiana. Louisiana Natural Heritage Program. Available: https://www.wlf.louisiana.gov/assets/Conservation/Protecting_Wildlife_Diversity/Files/natural_communities_of_louisiana.pdf. Accessed September 2022.

LDWF. 2020a. “Louisiana’s Animal Species of Greatest Conservation Need (SGCN) – Rare, Threatened, and Endangered Animals – 2020.” Available: https://www.wlf.louisiana.gov/assets/Conservation/Protecting_Wildlife_Diversity/Files/rare_animals_tracking_list_2020.pdf. Accessed September 2022.

LDWF. 2020b. Louisiana Big and Small Game Harvest Survey for 2019-2020. https://www.wlf.louisiana.gov/assets/Resources/Publications/Hunting/louisiana_big_and_small_game_harvest_survey_2019-2020.pdf . Accessed March 2022.

LDWF. 2021. Rare, Threatened, and Endangered Ranks and Statuses. Available online: https://www.wlf.louisiana.gov/page/rare-threatened-and-endangered-ranks-and-statuses. Accessed September 2022.

LDWF. 2022. Sherburne Wildlife Management Area. https://www.wlf.louisiana.gov/page/sherburne . Accessed September 2022.

Linscombe, G. 2000. An evaluation of the no. 2 victor and 220 conibear traps in coastal louisiana. Louisiana Wildlife and Fisheries Commission. Baton Rouge, Louisiana.

MacDonald, D.W. and L.A. Harrington. 2003. The American mink: The triumph and tragedy of adaptation out of context, New Zealand Journal of Zoology 30: 421-441. Maxson, S. and L. Oring. 1980. Breeding season time and energy budgets of the polyandrous spotted sandpiper. Behavior, Vol. 74, No. ¾, pp. 200-263.

Michot, T., Jeske, C., Mazourek, J., Vermillion, W., and R. Kemmerer. 2001. Atlas and Census of Wading Bird and Seabird Nesting Colonies in South Louisiana. USGS National Wetlands Research Center, Lafayette, Louisiana.Miller, R.W., Honarvar, S., and B. Hunsaker. 1980. Effects of drilling

August Levert_BP Plan_009536

fluids on soils and plants: I. Individual fluid components. Journal of Environmental Quality. Volume 9. Issue 4. 547-552.

Moore, K. 2002. Actitis macularius. Animal Diversity Web. Available: https://animaldiversity.org/accounts/Actitis_macularius/ . Accessed: September 2022.

Nagy, K.A. 2001. Food requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews Series B: Livestock Feeds and Feeding. 71(10): 3R-12R.

National Research Council. 2003. Bioavailability of Contaminants in Soils and Sediments, Processes, Tools and Applications. Division on Earth and Life Sciences, Water Science and Technology Board, Committee on Bioavailability of Contaminants in Soils and Sediments., Washington, D.C.

Natural Resources Conservation Service (NRCS). 1999. “Chapter 4: Corridor Benefits.” In Part 614.4 Conservation Corridor Planning at the Landscape Level Managing for Wildlife Habitat. U.S. Department of Agriculture Natural Resources Conservation Service. Part 190 National Biology Handbook. Available: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_014927.pdf. Accessed March 2022.

NatureServe. 2022. NatureServe Explorer. Available: https://explorer.natureserve.org . Accessed September 2022.

Nelson, A. and A. Martin. 1953. Gamebird weights. The Journal of Wildlife Management, Vol. 17, No. 1, pp. 36-42.

Newell, A., Johnson, D., and L. Allen. 1987. Niagara river biota contamination project: fish flesh criteria for piscivorous wildlife. Division of Fish and Wildlife, Bureau of Environmental Protection. Technical report 87-3.

Nichols, J., Reinecke, K., and J. Hines. 1983. Factors affecting the distribution of mallards wintering in the Mississippi alluvial valley. USFWS Patuxent Wildlife Research Center, Vicksburg, Mississippi.

Oring, L.W., Lank, D.B., and Maxson, S.J. 1983. Population studies of the polyandrous spotted sandpiper. Auk 100: 272-285. Parsons, K. and T. Master. 2000. Snowy Egret (egretta thula). The Birds of North America .

Pfaff, G. 2021. Cadmium sulfide/selenide pigments. Physical Sciences Reviews; Vol. 6 Issue 6, p211-216, 6p.Pitts, D. 1984. Description of American robin territories in northwest Tennessee. The Migrant, Vol. 55, No. 1, pp. 1-6.

Prokop, Z., Cupr, P., Zlevorova-Zlamalikova, V., Komarek, J., Dusek, L., and I. Holoubek. 2003. Mobility, bioavailability, and toxic effects of cadmium in soil samples. Environmental Research 91: 119-126.

Raley, C. M. and K. B. Aubry. (2006). Foraging ecology of Pileated Woodpeckers in coastal forests of Washington. Journal of Wildlife Management 70 (5):1266-1275.

Razavi, R. 2013. Ebullition Rates and Mercury Concentrations In St. Lawrence River Sediments And a Benthic Invertebrate. Environmental Toxicology and Chemistry, Vol. 32, No. 4, pp. 857–865.

Reddy, K.R. and R.D. DeLaune. 2008. Biogeochemistry of wetlands, science and applications. CRC Press.

Ridal, J., Yanch, L.E., Fowlie, A.R., Razavi, N.R., Delongchamp, T.M., Choy, E.S., Fathi, M., Hodson, P.V., Campbell, L.M., Blais, J.M., Hickey, M.B.C., Yumvihoze, E., and D.R.S. Lean. 2010.

Potential causes of enhanced transfer of mercury to St. Lawrence River Biota: implications for sediment management strategies at Cornwall, Ontario, Canada. Hydrobiologia 647:81–98.

Rodriguez, L., Rincon, J., Asencio, I., and L. Rodriguez-Castellanos. 2007. Capability of Selected Crop Plants for Shoot Mercury Accumulation from Polluted Soils: Phytoremediation Perspectives. Journal of Phytoremediation, 9:1–13, 2007.

Rogers, W.J. 2022. Toxicological Evaluation. August J. Levert Jr. Family, LLC, et al. v BP America Production Co; 18th JDC; Docket #78953 Grand River Field, Iberville Parish, LA. Omega EnviroSolutions, Inc. August 16, 2022.

Sample, B.E. and G.W. Suter II. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. Oak Ridge National Laboratory, Tennessee, U.S. Department of Energy.

Sample, B.E., Suter II, G.W., Beauchamp, J.J., and R.A. Efroymson. 1998a. Literature-derived bioaccumulation models for earthworms: development and validation. Environmental Toxicology and Chemistry 18(9): 2110-2120.

Sample, B.E., Suter II, G.W., Beauchamp, J.J., and R.A. Efroymson. 1998b. Development and validation of bioaccumulation models for small mammals. ES/ER/TM-219. Oak Ridge National Laboratory, Oak Ridge, TN.

Seaman, D., Guglielmo, C., and T. Williams. 2005. Effects of physiological state, mass change and diet on plasma metabolite profiles in the western sandpiper calidris mauri. The Journal of Experimetnal Biology 208:761-769.

Shaheen, S., Rinklebe, J., Frohne, T., White, J., and R. Delaune. 2016. Redox effects on release kinetics of arsenic, cadmium, cobalt, and vanadium in Wax Lake Deltaic freshwater marsh soils. Chemosphere 150: 740-748.

Simini, M., Checkai, R., Kuperman, R., Phillips, C., and J. Speicher. 2002. Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Soil Screening Levels (ECO-SSL) Using Earthworm (Eisenia Fetida) Benchmark Values. U.S. Army Soldier and Biological Chemical Command.

Smith, J. 1997. Nesting season food habits of 4 species of Herons and Egrets at Lake Okeechobee, Florida. Colonial Waterbirds 20: 198-220.

Spencer, R.K. and J.A. Chapman. 1986. Seasonal feeding habits of New England and eastern cottontails. Proc. Penn. Acad. Sci. 60: 157-160.

Svihla, A. 1931. Habits of the louisiana mink (mustela vison vilgivagus). Journal of Mammalogy, Vo. 12, No. 4, pp. 366-368.

Swanson, G., Meyer, M., and V. Adomaitis. 1985. Foods consumed by breeding mallards on wetlands of south-central north dakota. Journal of Wildlife Management 49: 197-203.

Tamisier, A. 1976. Diurnal activities of green-winged teal and pintail wintering in louisiana. Wildfowl, 27: 19-32.

The Cornell Lab. 2022a. All About Birds: Bird Guide. Available: https://www.allaboutbirds.org/guide/. Accessed September 2022.

The Cornell Lab. 2022b. Birds of the World. Available: Birds of the World - Cornell Lab of Ornithology Accessed September 2022.

Thom, M., Harrington, L., and D. MacDonald. Why are American mink sexually dimorphic? A role for niche separation. Oikos 105: 525-535.

August Levert_BP Plan_009538

U.S. Department of Agriculture (USDA). 2012. Wetland Indicator Status." Natural Resources Conservation Service PLANTS Database. Available: https://plants.usda.gov/wetinfo.html. Accessed September 2022.

USDA. 2022. Natural Resources Conservation Service. PLANTS Database. https://plants.sc.egov.usda.gov/java . Accessed September 2022.

U.S. Environmental Protection Agency (USEPA). 1988. Recommendations for and Documentation of Biological Values for use in Risk Assessment.

USEPA. 1993. Wildlife Exposure Factors Handbook. Volumes I and II. U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R- 93/187a, b.

USEPA. 1994. Barium Sulfate; Toxic Chemical Release Reporting; Community Right-To-Know, Final Rule. Federal Register Volume 59, No. 123, 40 CFR Part 372.

USEPA. 1997. Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final, EPA 540-R-97-006.

USEPA. 1998. Guidelines for Ecological Risk Assessment, EPA/630/R-95/002F.

USEPA. 1999. Toxicity Reference Values, Screening Level Ecological Risk Assessment Protocol, Multimedia Planning and Permitting Division Office of Solid Waste, Center for Combustion Science.

USEPA. 2005a. Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs). OSWER Directive 92.857-55 and Attachment 1-2 (Assessment of whether to develop ecological soil screening levels for microbes and microbial processes).

USEPA. 2005b. Ecological Soil Screening Levels for Arsenic, Interim Final, OSWER Directive 9285.7-62. Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W. Washington, DC 20460. March 2005.

USEPA. 2005c. Ecological Soil Screening Levels for Barium, Interim Final, OSWER Directive 9285.7-63. Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W. Washington, DC 20460. February 2005.

USEPA. 2005d. Ecological Soil Screening Levels for Cadmium, Interim Final, OSWER Directive 9285.7-65. Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W. Washington, DC 20460. March 2005.

USEPA. 2005e. Ecological Soil Screening Levels for Lead, Interim Final, OSWER Directive 9285.7-70. Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W. Washington, DC 20460. March 2005.

USEPA. 2006. Ecological Soil Screening Levels for Silver, Interim Final, OSWER Directive 9285.7-77. Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W. Washington, DC 20460. September 2006.

USEPA. 2007a. Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs). Review of Background Concentrations for Metals (Attachment 4-1). OSWER Directive 92857-55.

USEPA. 2007b. Ecological Soil Screening Levels for Selenium, Interim Final, OSWER Directive 9285.7-72. Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W. Washington, DC 20460. June 2007.

USEPA. 2007c. Ecological Soil Screening Levels for Zinc Interim Final OSWER Directive 9285.7-73. Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W. Washington, DC 20460. June 2007.

USEPA. 2008. Ecological Soil Screening Levels for Chromium, Interim Final, OSWER Directive 9285.7-66. Office of Solid Waste and Emergency Response, 1200 Pennsylvania Avenue, N.W. Washington, DC 20460. April 2008.

USEPA. 2015. Determination of the Biologically Relevant Sampling Depth for Terrestrial and Aquatic Ecological Risk Assessments EPA/600/R-15/176.

USEPA. 2022a. "Exhibit 1: Ecological hubs and corridors in the contiguous U.S., based on 2001 NLCD." Ecological Connectivity. Report on the Environment: Explore ROE Indicators. Available: https://cfpub.epa.gov/roe/indicator.cfm?i=80. Accessed September 2022.

USEPA. 2022b. National Ecological Framework. Available: https://cfpub.epa.gov/roe/documents/NEF_brochure.pdf. Accessed September 2022.

USEPA. 2022c. ProUCL Software, Version 5.2. https://www.epa.gov/land-research/proucl-software. Accessed September 2022.

U.S. Forest Service (USFS). 2021. Inventory Monitoring and Assessment Community of Practice Glossary. U.S. Forest Service. Available: https://www.fs.usda.gov/emc/rig/documents/data_steward_cop/IMACommunityOfPracticeGlossary-v1-1.pdf. Accessed September 2022.

U.S. Fish and Wildlife Service (USFWS). 1994. Accumulation of Mercury in Sediments, Prey, And Shorebirds of Lavaca Bay, Texas, Phase II Report.

USFWS. 2013. Atchafalaya National Wildlife Refuge Bird List. Available: https://www.fws.gov/sites/default/files/documents/Atchafalaya-birdlist.pdf. Accessed September 2022.

USFWS. 2022. National Wetlands Inventory Wetlands Mapper. Available: https://www.fws.gov/program/national-wetlands-inventory/wetlands-mapper. Accessed September 2022.

U.S. Geological Survey (USGS). 2013. Smith, D.B., Cannon, W.F., Woodruff, L.G., Solano, Federico, Kilburn, J.E. and D.L. Fey. 2013. Geochemical and mineralogical data for soils of the conterminous United States: U.S. Geological Survey Data Series 801, 19 p. http://pubs.usgs.gov/ds/801/.

Wilson, D.E. and S. Ruff. 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press.

Wheelwright, N. 1986. The diet of American robins: an analysis of U.S. biological survey records. The Auk 103: 710-725.

Wolfe. 1982. Oryzomys palustris. Mammalian Species No. 176, pp. 1-5. The American Society of Mammologists.

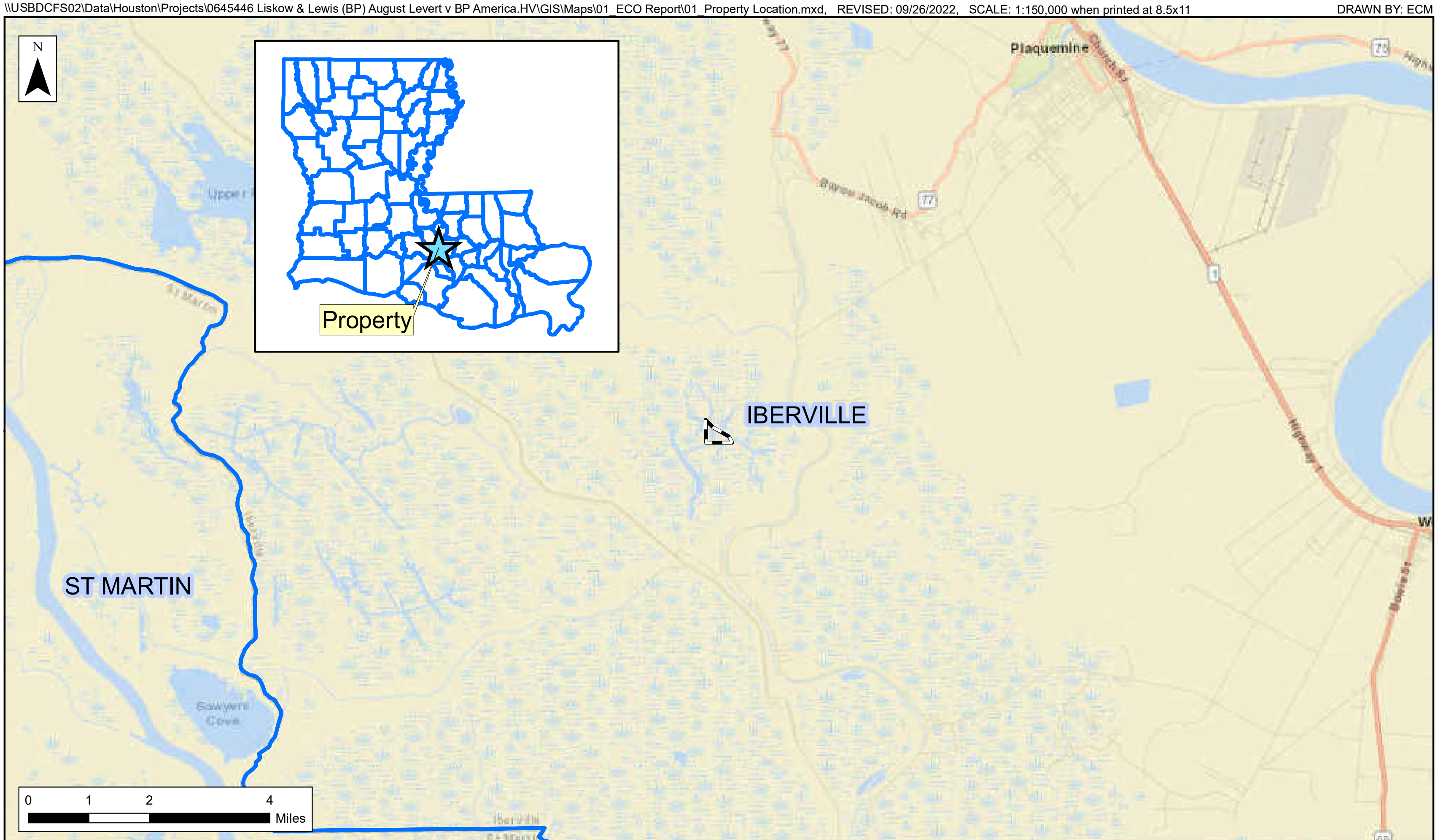
Xu, X., Bryan, A.L., Mills, G.L., and A.M. Korotasz. 2019. Mercury speciation, bioavailability, and biomagnification in contaminated streams on the Savannah River Site (SC, USA), Science of The Total Environment. 668, 261-270.

August Levert_BP Plan_009540

FIGURES

November 2022

\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America.HV\GIS\Maps\01_ECO Report\01_Property Location.mxd, REVISED: 09/26/2022, SCALE: 1:150,000 when printed at 8.5x11 DRAWN BY: ECM



Approximate Property Boundary

Parish Boundaries

Figure 1

Property Location

August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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Notes:
World Street Map via ArcGIS Online.

Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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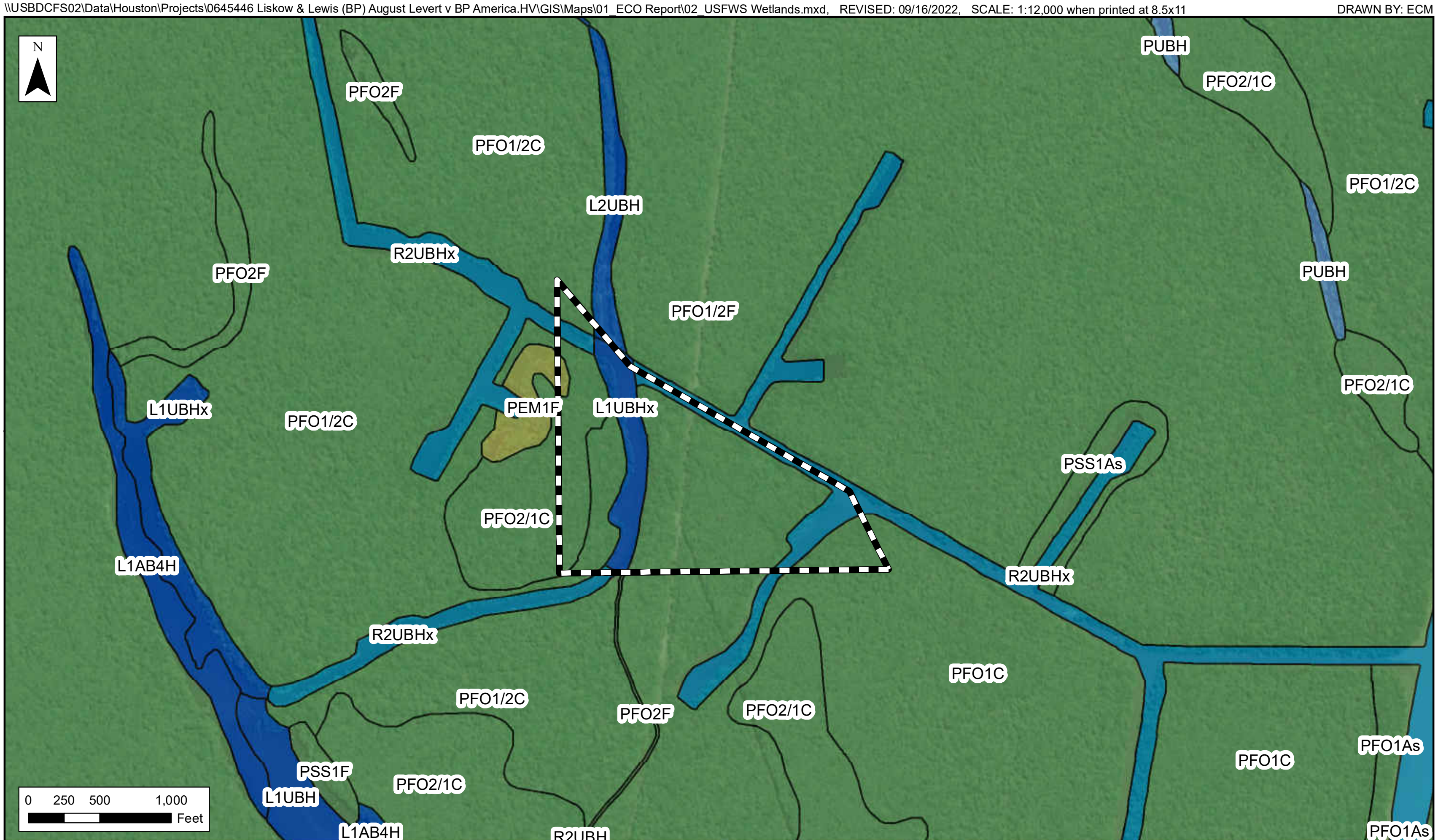
\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America.HV\GIS\Maps\01_ECO Report\02_USFWS Wetlands.mxd, REVISED: 09/16/2022, SCALE: 1:12,000 when printed at 8.5x11 DRAWN BY: ECM



Approximate Property Boundary

Freshwater Emergent Wetland

Freshwater Forested/Shrub Wetland

Freshwater Pond

Lake

River

Notes:
Wetlands data from USFWS Wetlands Mapper (https://www.fws.gov/wetlands/data/mapper.html).
Imagery Basemap via ArcGIS Online.

Figure 2
USFWS Wetlands
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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Approximate Property Boundary

Photo Location and Direction

Vegetation Observation Location

Notes:
Imagery Basemap via ArcGIS Online.

Source: Esri - ArcGIS Online; GCS North American 1983

Figure 3
Observed Habitat
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\03_Observed Habitat.mxd, REVISED: 09/30/2022, SCALE: 1:12,000 when printed at 11x17, DRAWN BY: MMG

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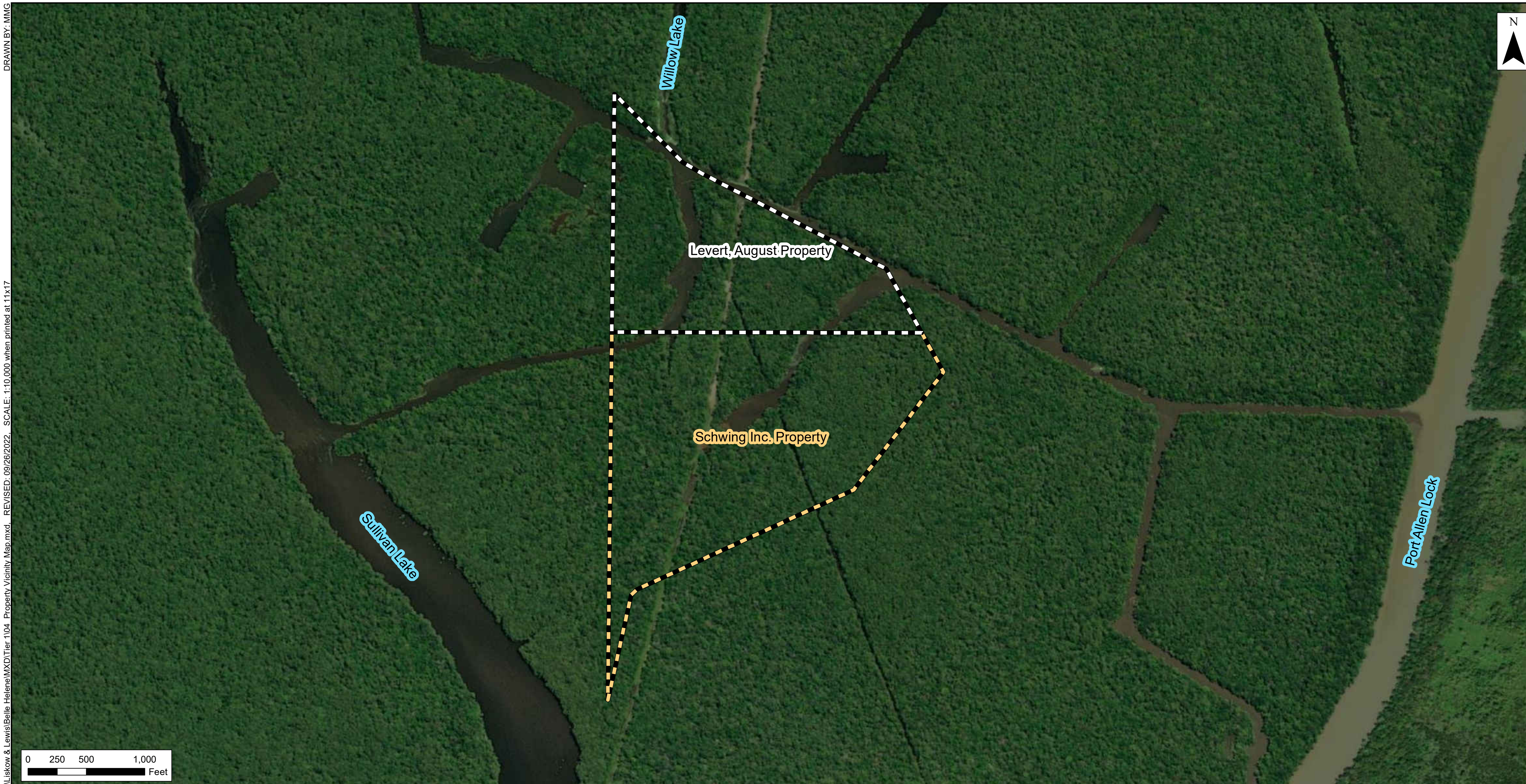

DRAWN BY: MMG

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Levert, August Property

Schwing Inc. Property

Figure 4
Property Vicinity Map
August J. Levert, Jr., et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Imagery Basemap via ArcGIS Online.

Source: Esri - ArcGIS Online; GCS North American 1983

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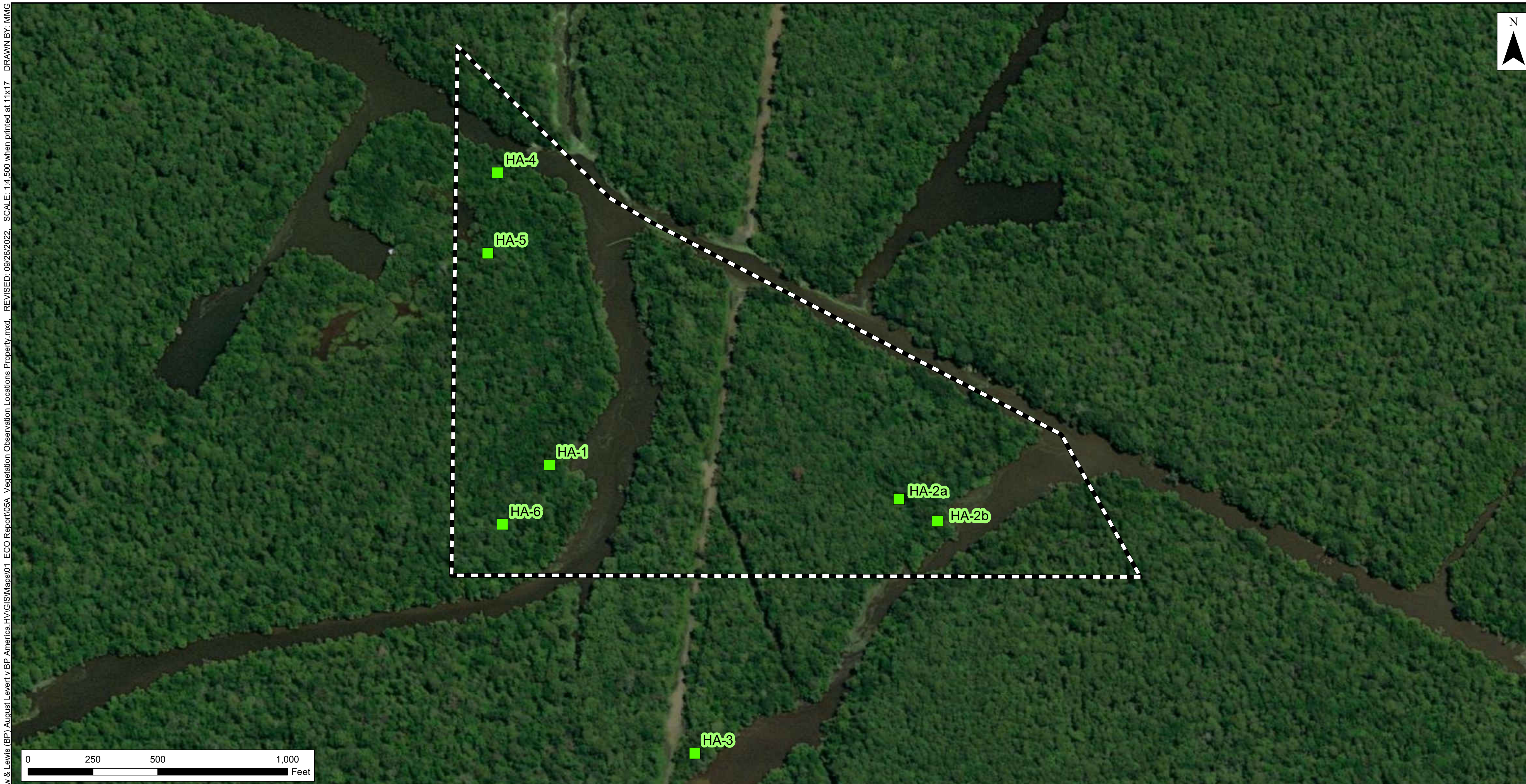

Vegetation Observation Location

Approximate Property Boundary

Figure 5A

Vegetation Observation Locations: Property

August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Imagery Basemap via ArcGIS Online.

Source: Esri - ArcGIS Online; GCS North American 1983

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\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\05A_Vegetation Observation Locations Property.mxd REVISED: 09/26/2022 SCALE: 1:4,500 when printed at 11x17 DRAWN BY: MMG

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Vegetation Observation Location
Sherburne Wildlife Management Area
Approximate Property Boundary

\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\05B_Vegetation Observation Locations Sherburne WMA.mxd REVISED: 09/16/2022 SCALE: 1:4,500 when printed at 11x17 DRAWN BY: MMG

Figure 5B
Vegetation Observation Locations: Sherburne WMA
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Imagery Basemap via ArcGIS Online.

Source: Esri - ArcGIS Online; GCS North American 1983

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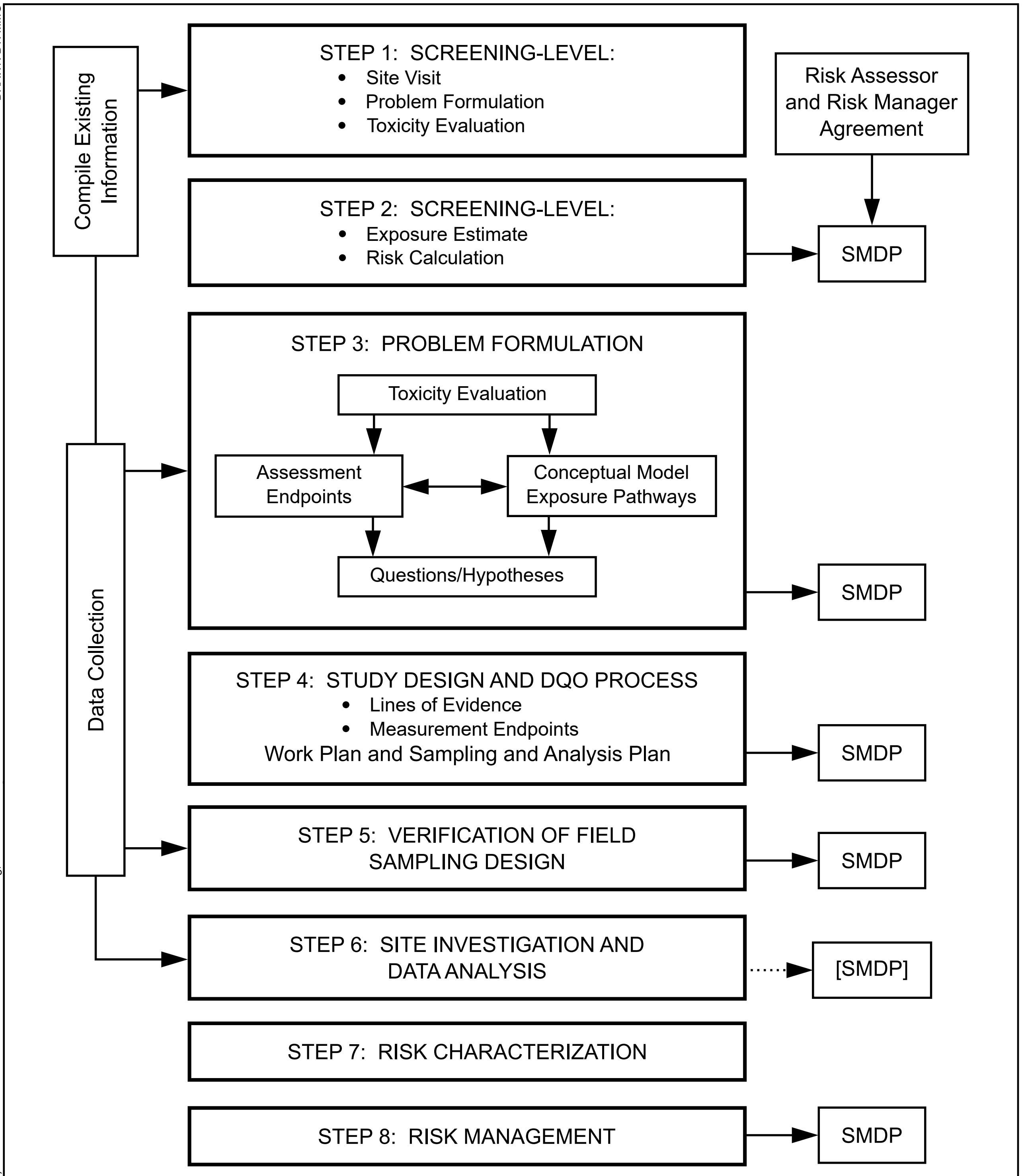

Figure 6

USEPA 8-Step Ecological Risk Assessment Process August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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Notes:
From EPA "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments" June 1997

DRAWN BY: MMG

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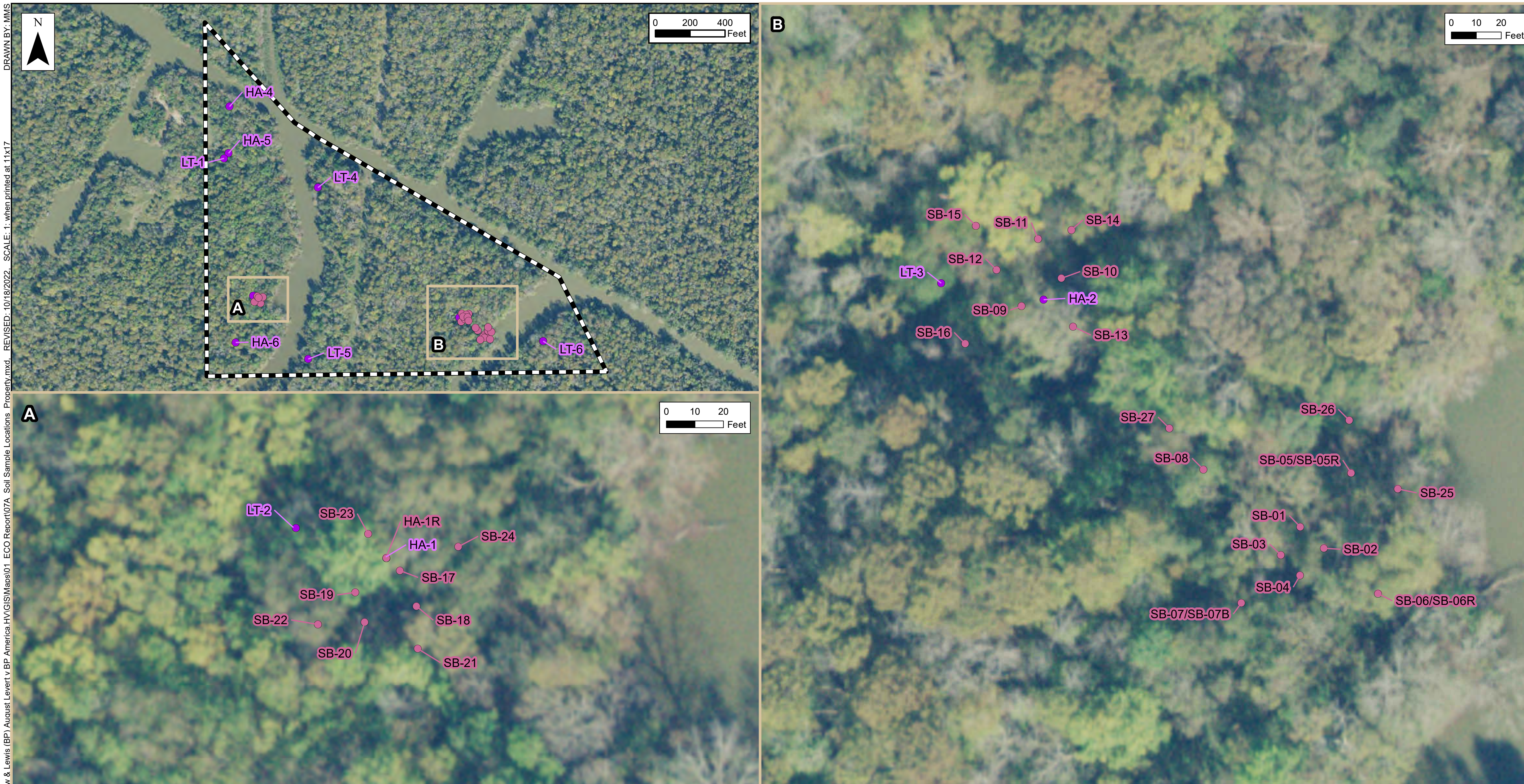

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Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Notes:
2021-11-11 Aerial from USGS Earth Explorer.

Figure 7A
Soil Sample Locations: Property
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N

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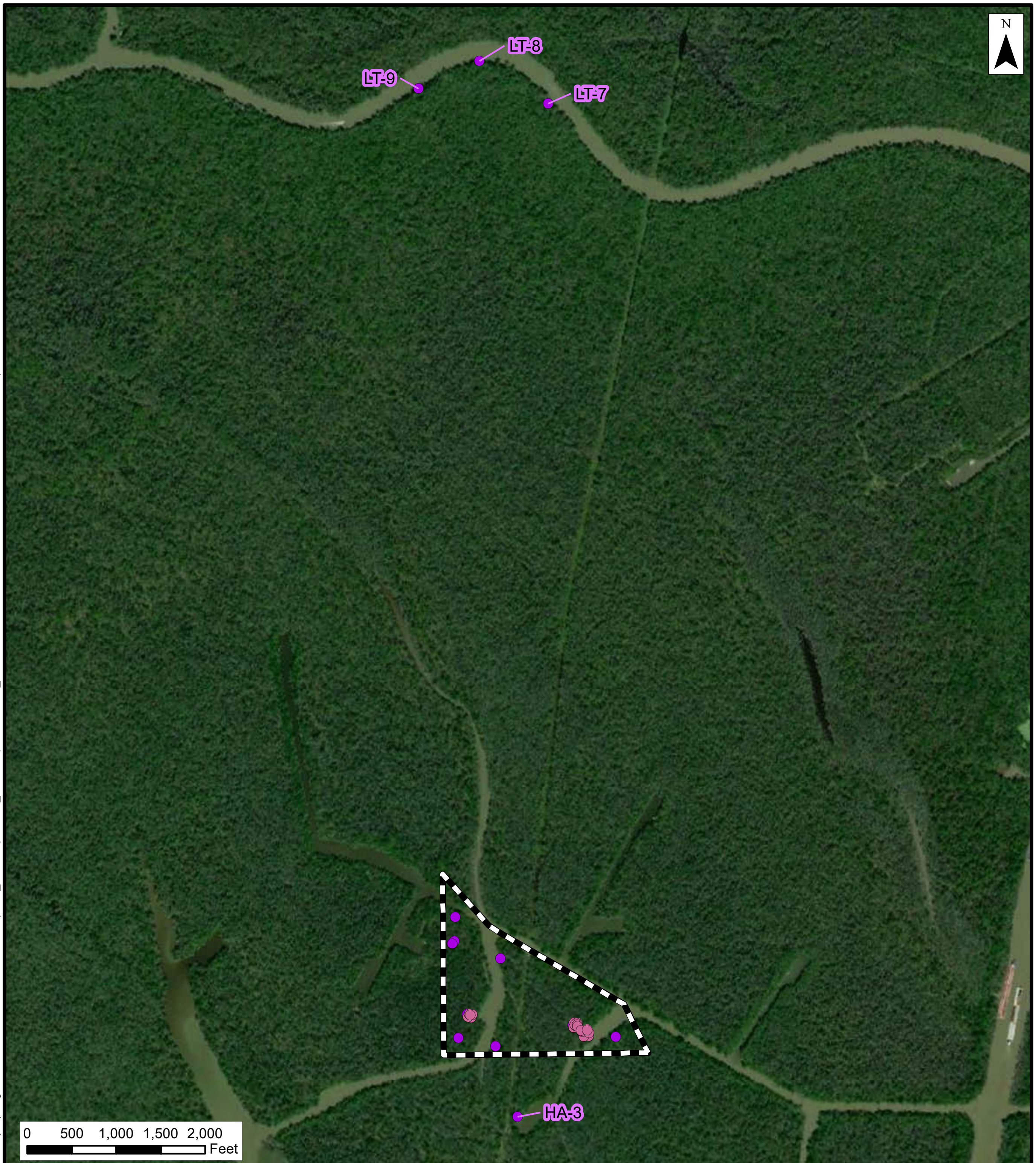

Approximate Property Boundary
HET Soil Boring
ICON Soil Boring

Figure 7B
Soil Sample Locations: Off-Site
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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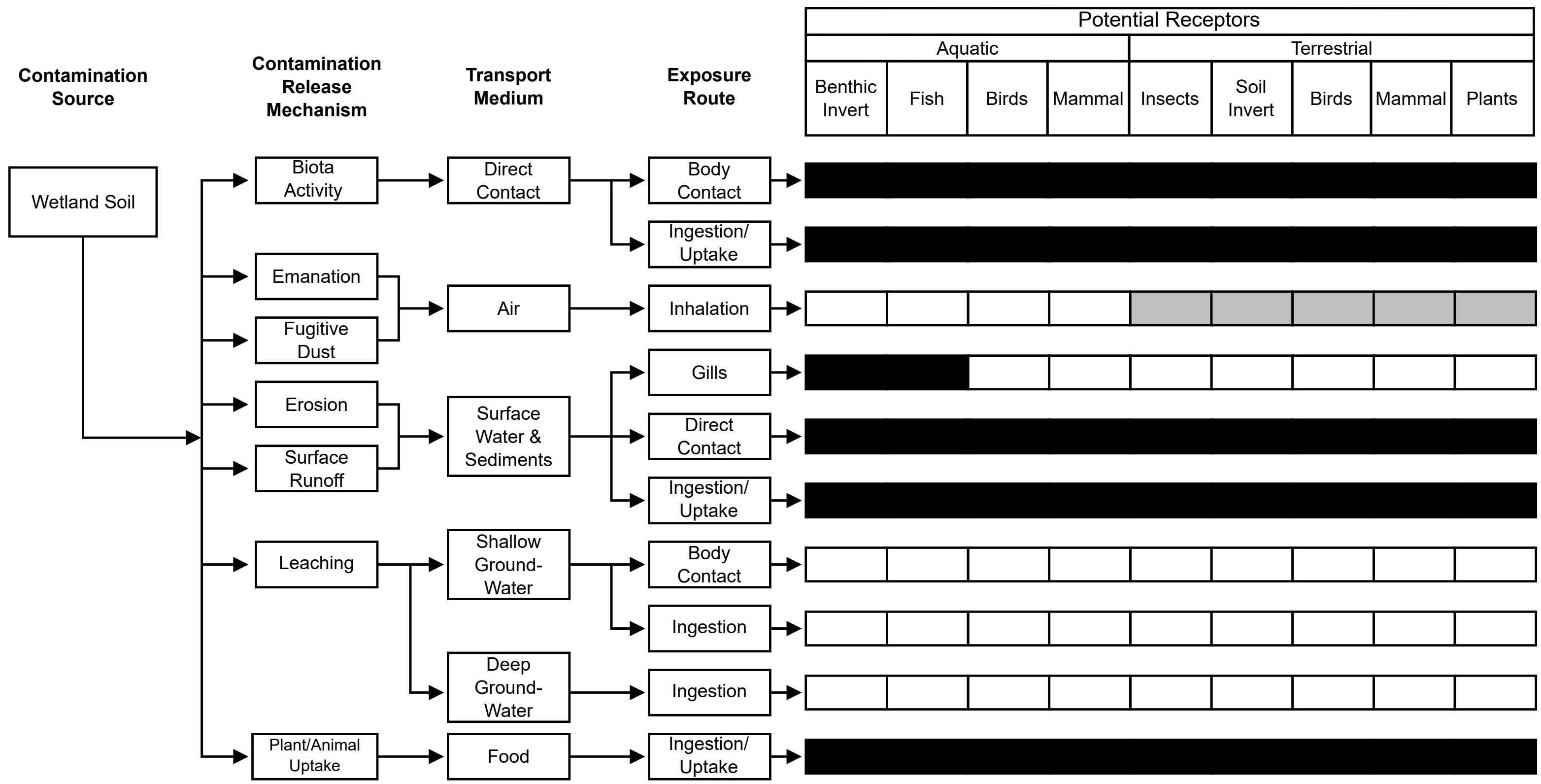
Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N



Major

Minor

Incomplete

Figure 8
Ecological Conceptual Site Model
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company Grand
River Oil & Gas Field
Iberville Parish, Louisiana

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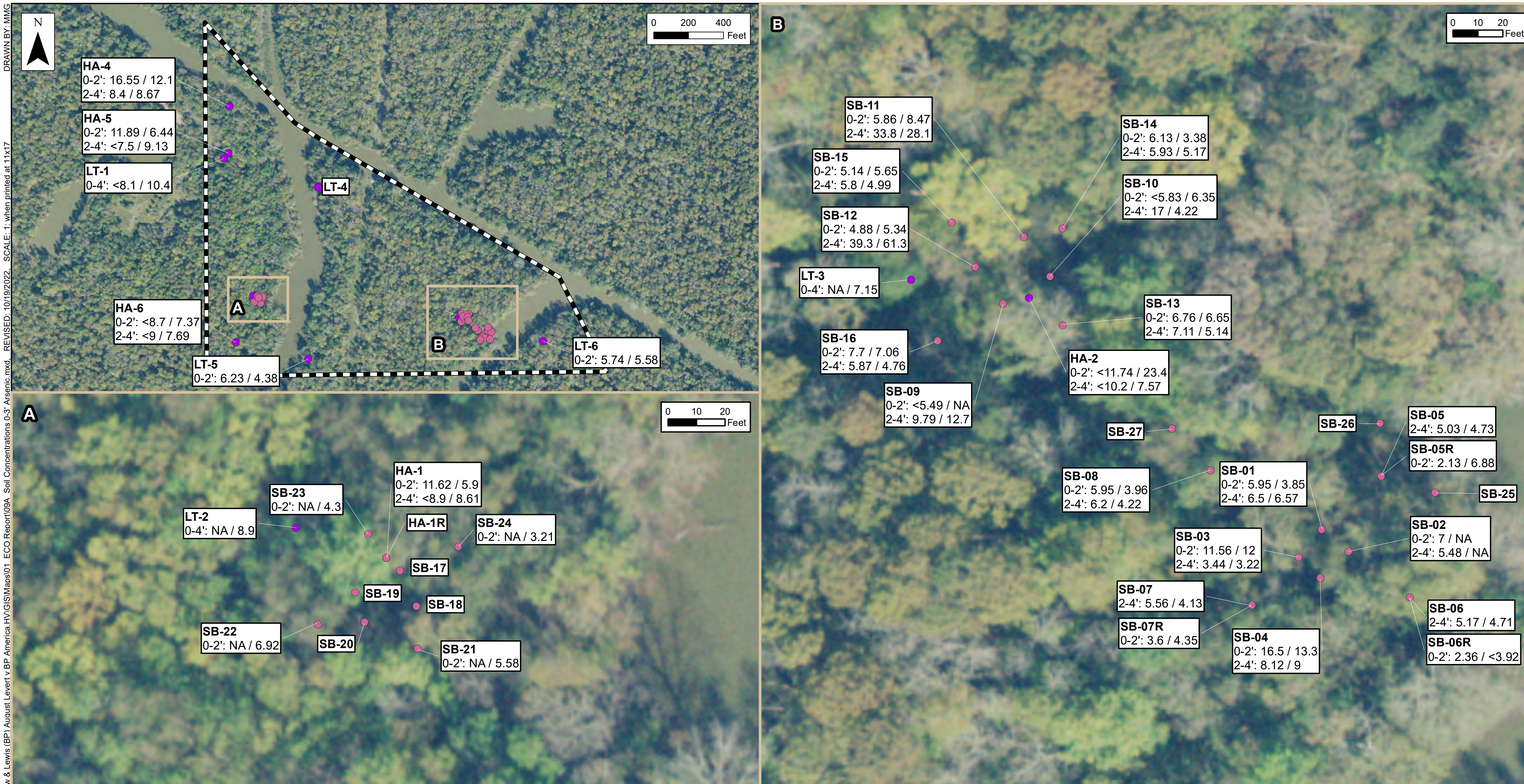

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

Figure 9A
Soil Concentrations 0-3' (Property): Arsenic
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\09A_Soil Concentrations 0-3' Arsenic.mxd REVISED: 10/19/2022 SCALE: 1: when printed at 11x17 DRAWN BY: MMG

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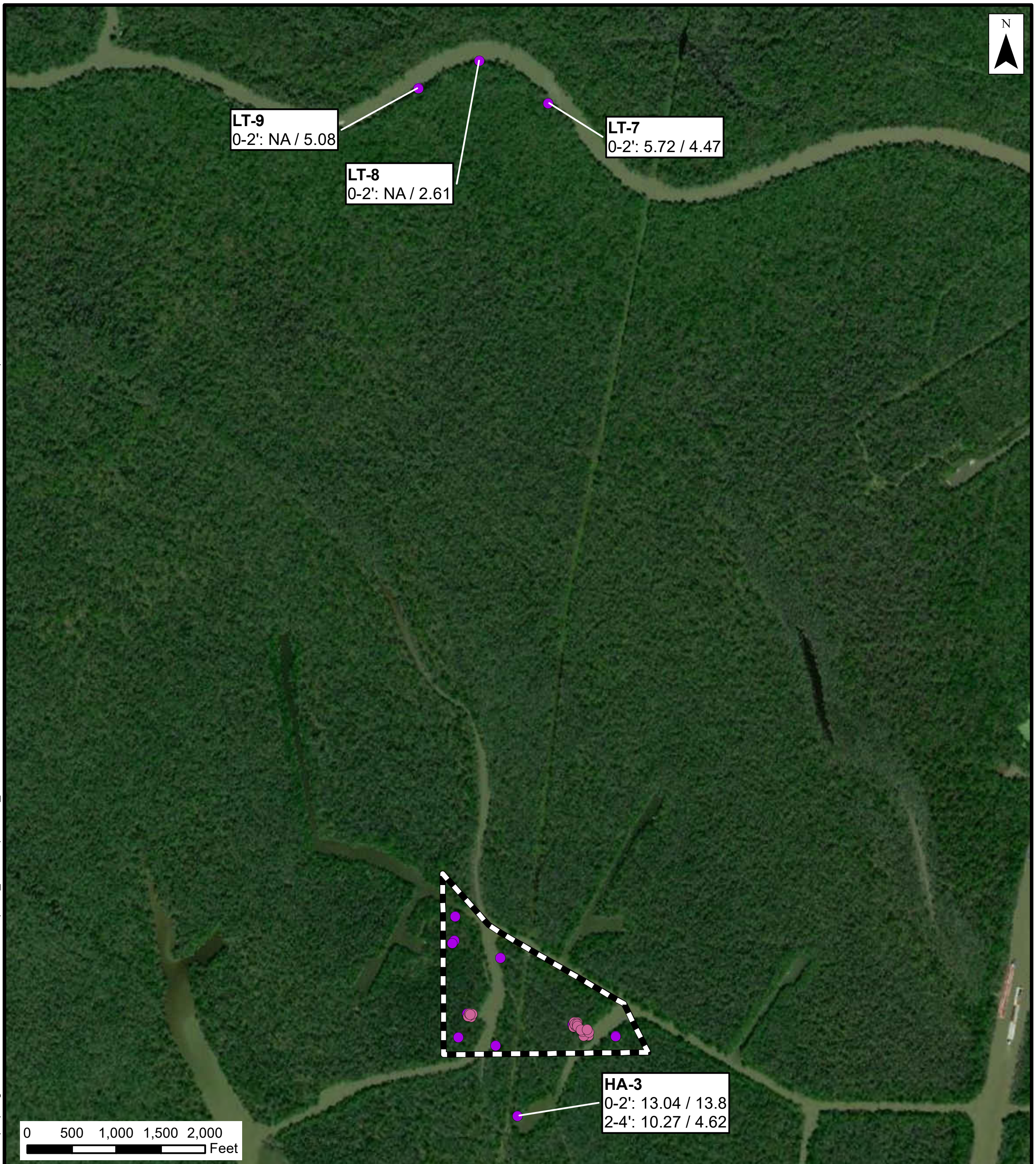

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 9B
Soil Concentrations 0-3' (Off-Site): Arsenic
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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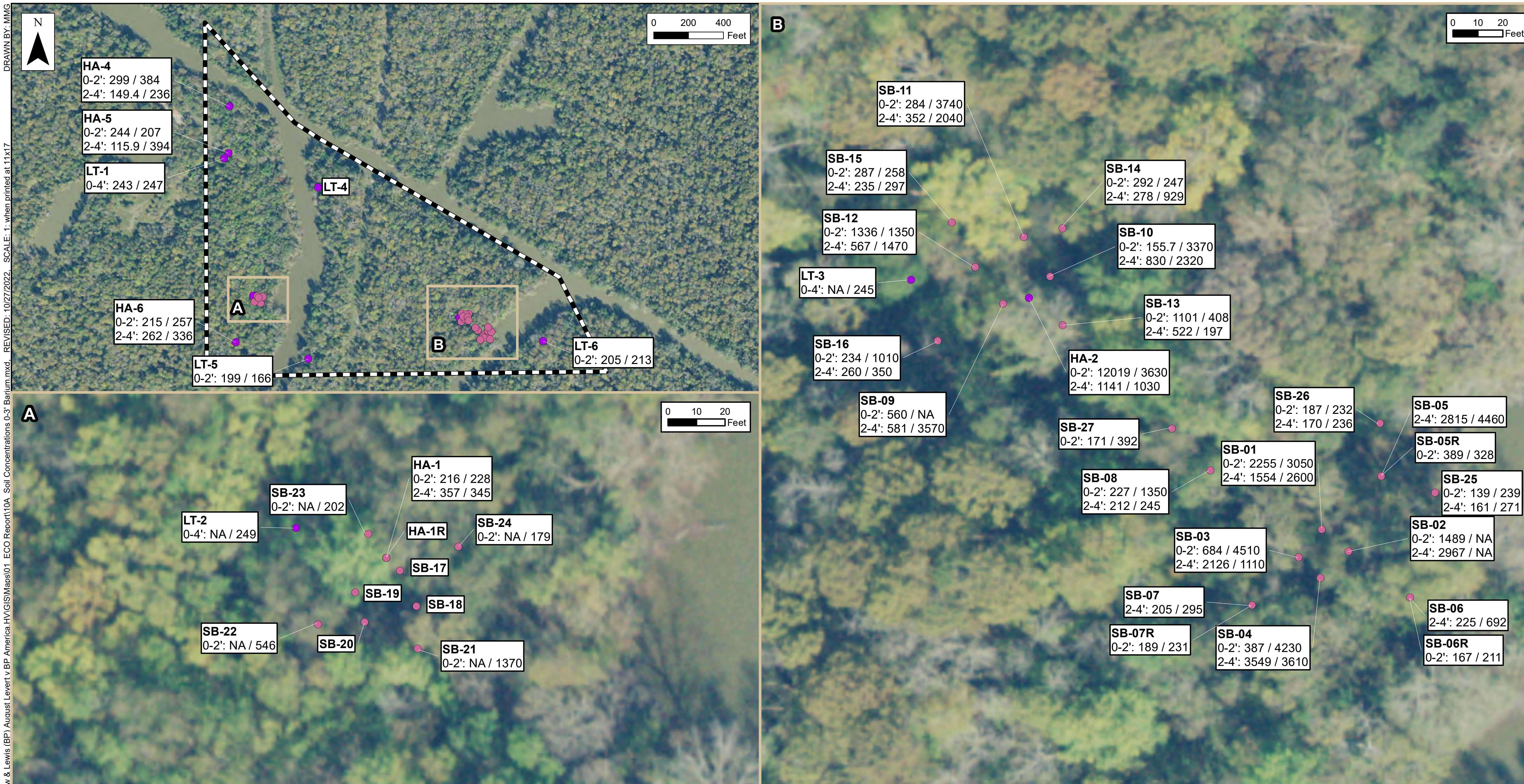
Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N



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Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

Figure 10A
Soil Concentrations 0-3' (Property): Barium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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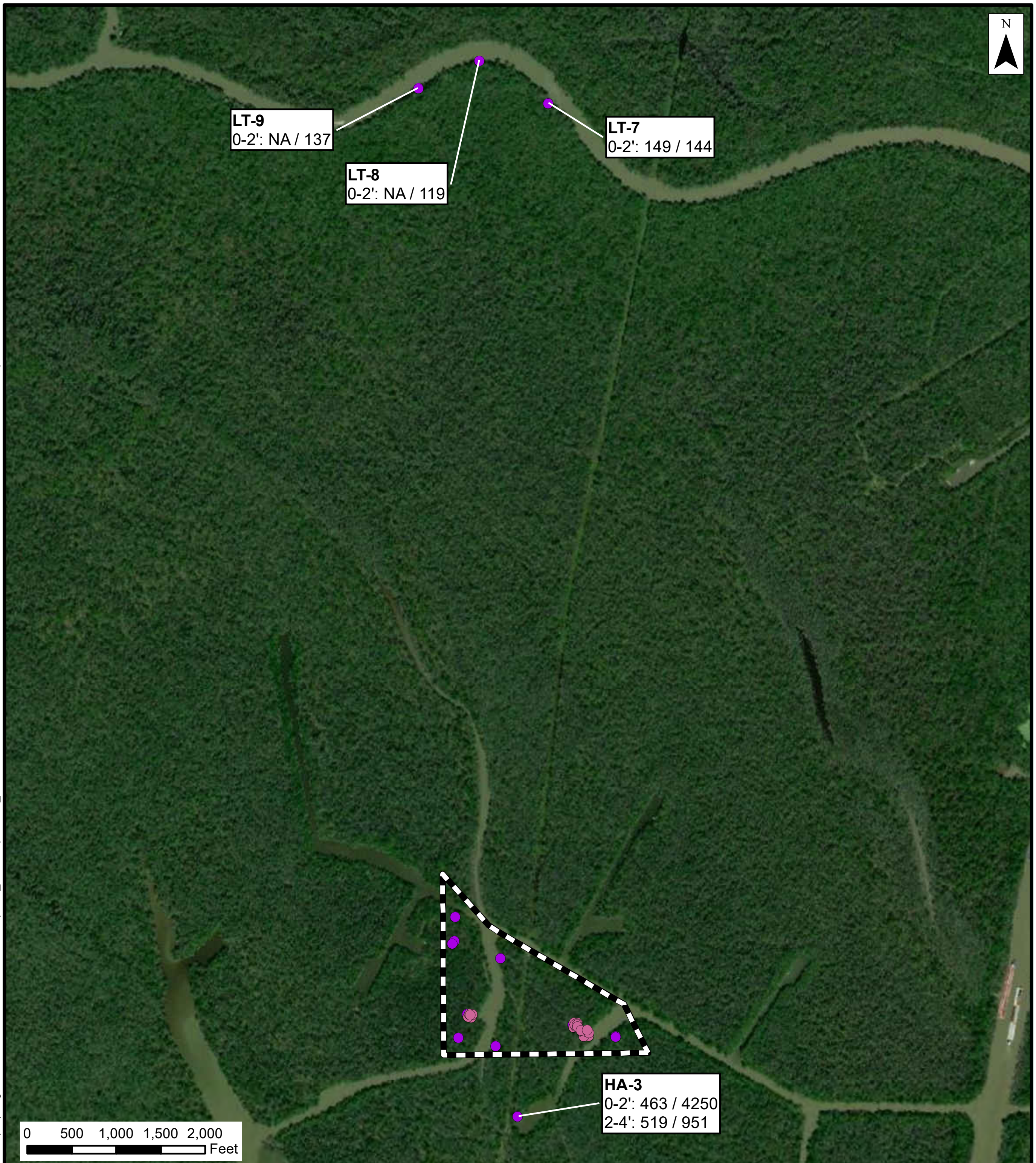

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 10B
Soil Concentrations 0-3'(Off-Site): Barium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N

August Levert_BP Plan_009555

\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\11A_Soil Concentrations 0-3' Cadmium.mxd REVISED: 10/19/2022 SCALE: 1: when printed at 11x17 DRAWN BY: MMG

Legend

Approximate Property Boundary
HET Soil Boring
ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

Figure 11A
Soil Concentrations 0-3' (Property): Cadmium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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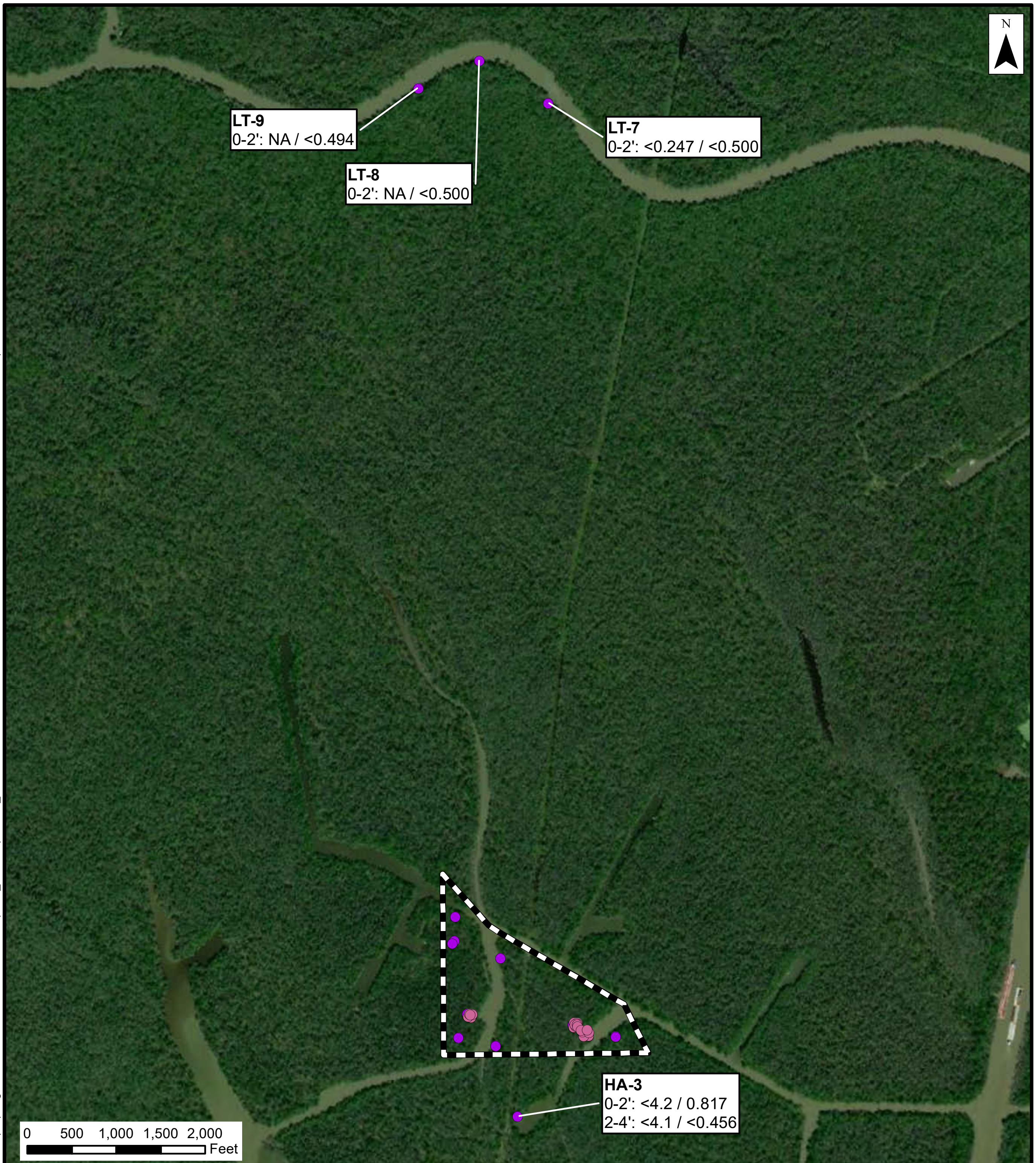

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 11B
Soil Concentrations 0-3' (Off-Site): Cadmium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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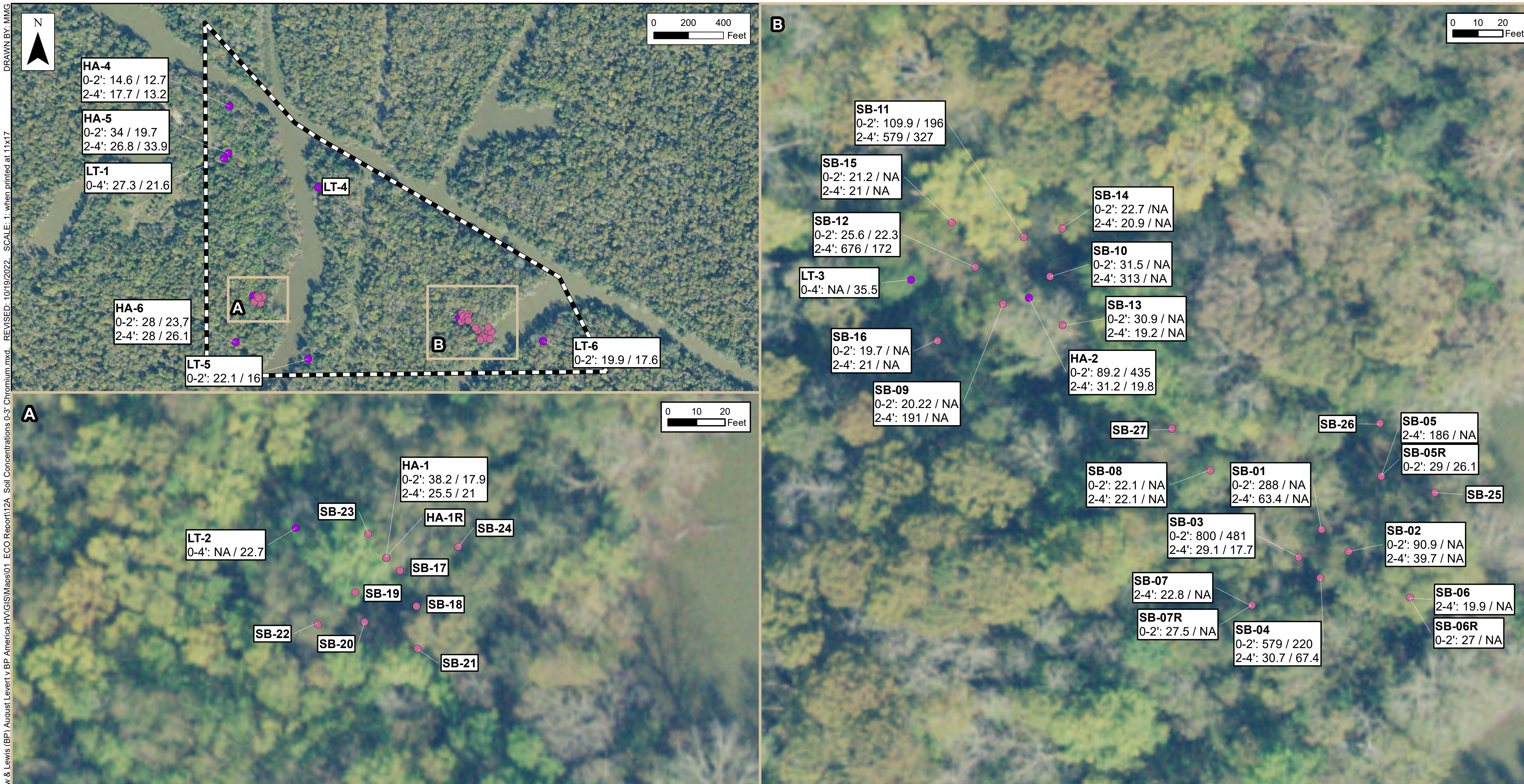
Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N



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Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

Figure 12A
Soil Concentrations 0-3' (Property): Chromium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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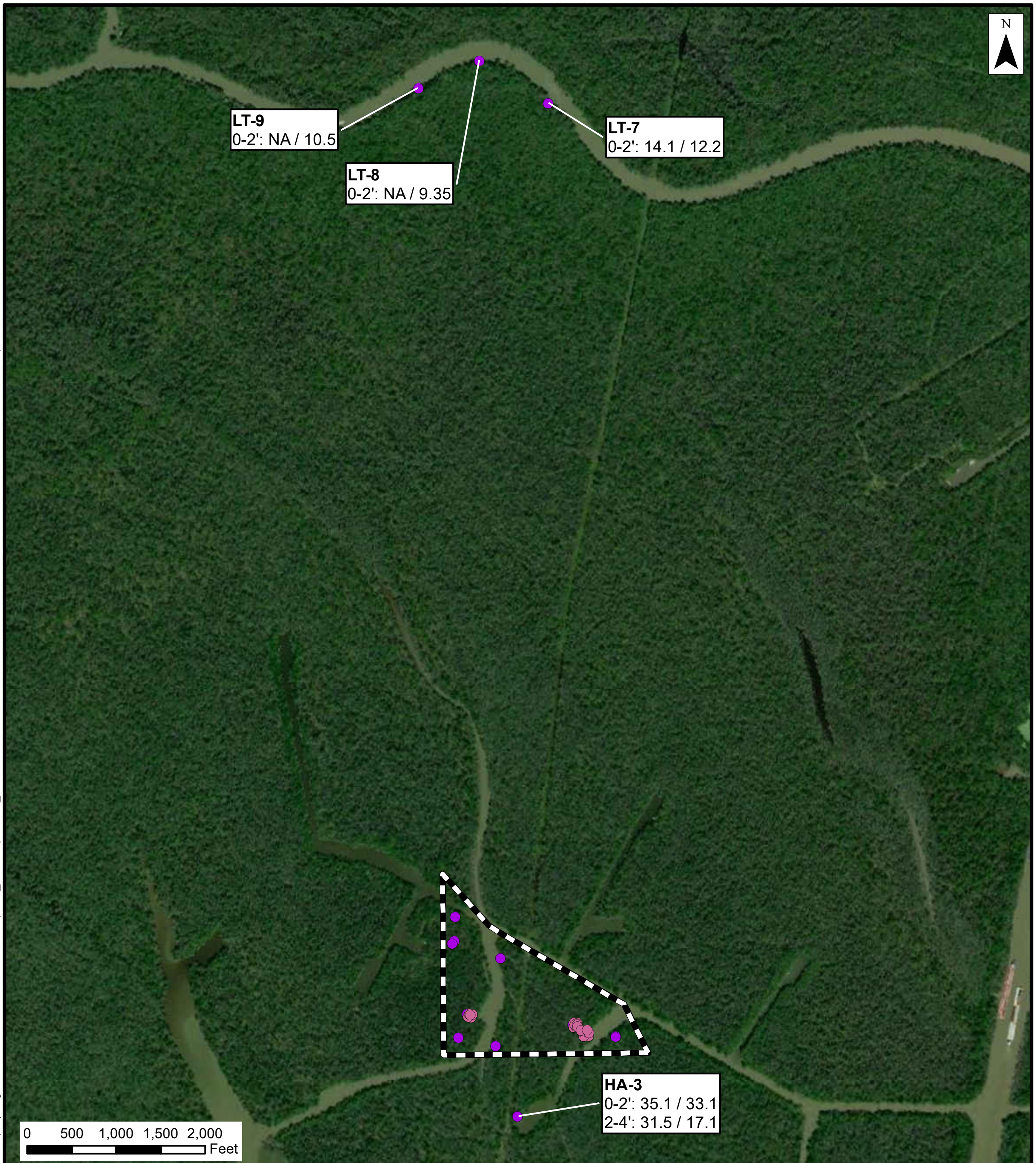

Legend

Approximate Property Boundary
HET Soil Boring
ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 12B
Soil Concentrations 0-3' (Off-Site): Chromium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N

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Legend

Approximate Property Boundary

HET Soil Boring

ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 13A
Soil Concentrations 0-3' (Property): Lead
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

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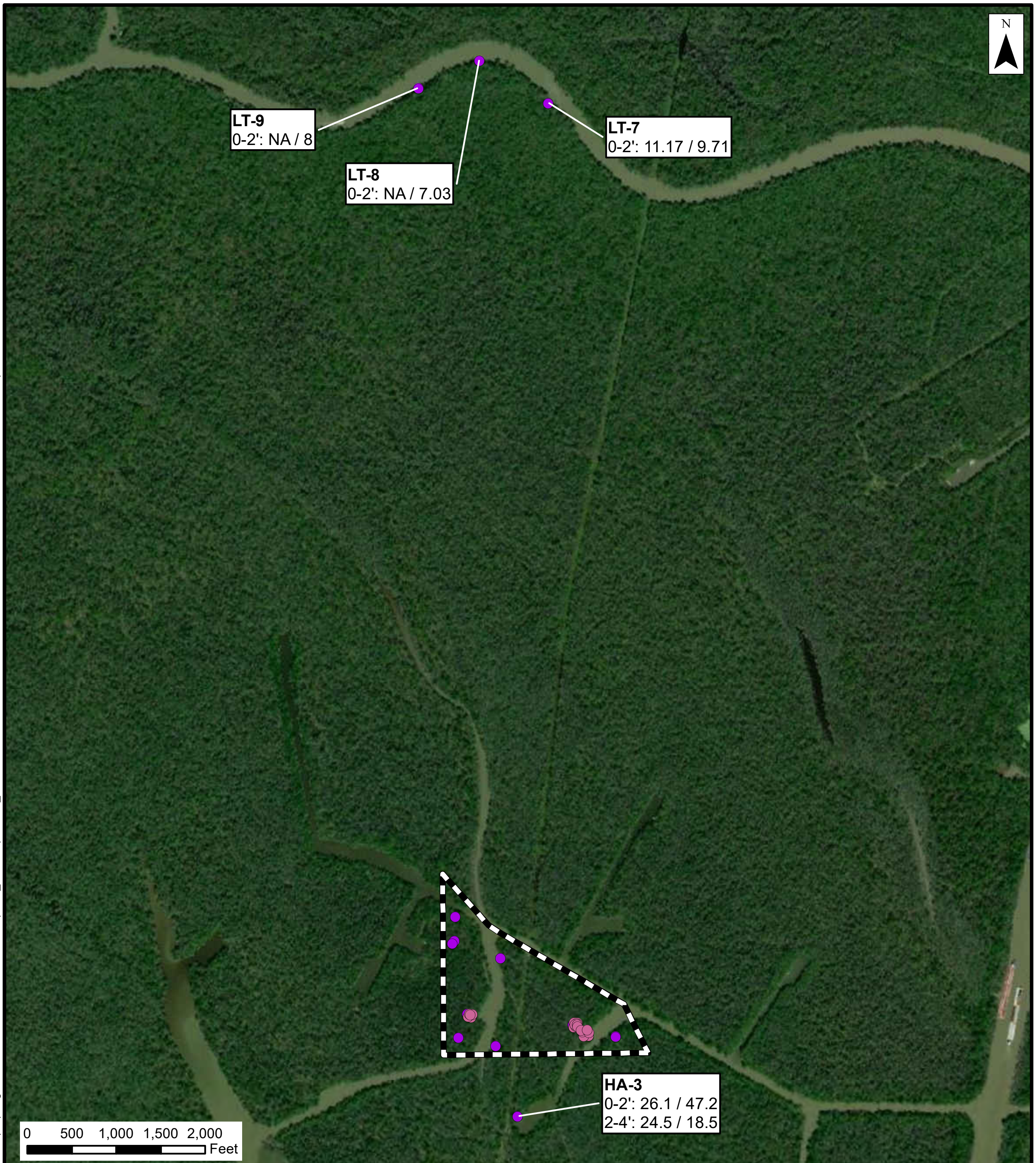

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 13B
Soil Concentrations 0-3' (Off-Site): Lead
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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Legend

Approximate Property Boundary

HET Soil Boring

ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 14A
Soil Concentrations 0-3' (Property): Mercury
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

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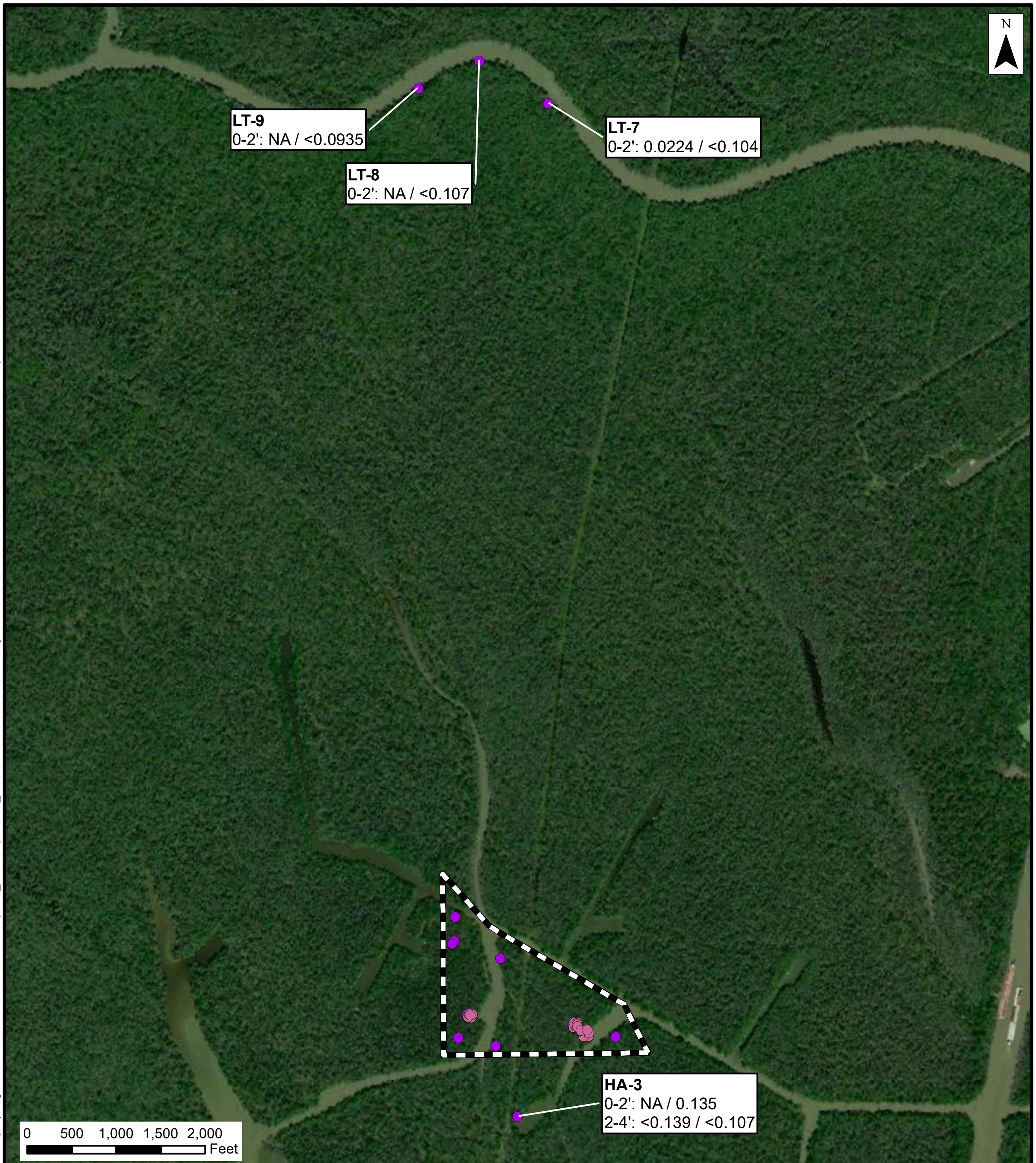

Legend

Approximate Property Boundary

HET Soil Boring

ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 14B
Soil Concentrations 0-3' (Off-Site): Mercury
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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Legend

Approximate Property Boundary
HET Soil Boring
ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

Figure 15A
Soil Concentrations 0-3' (Property): Selenium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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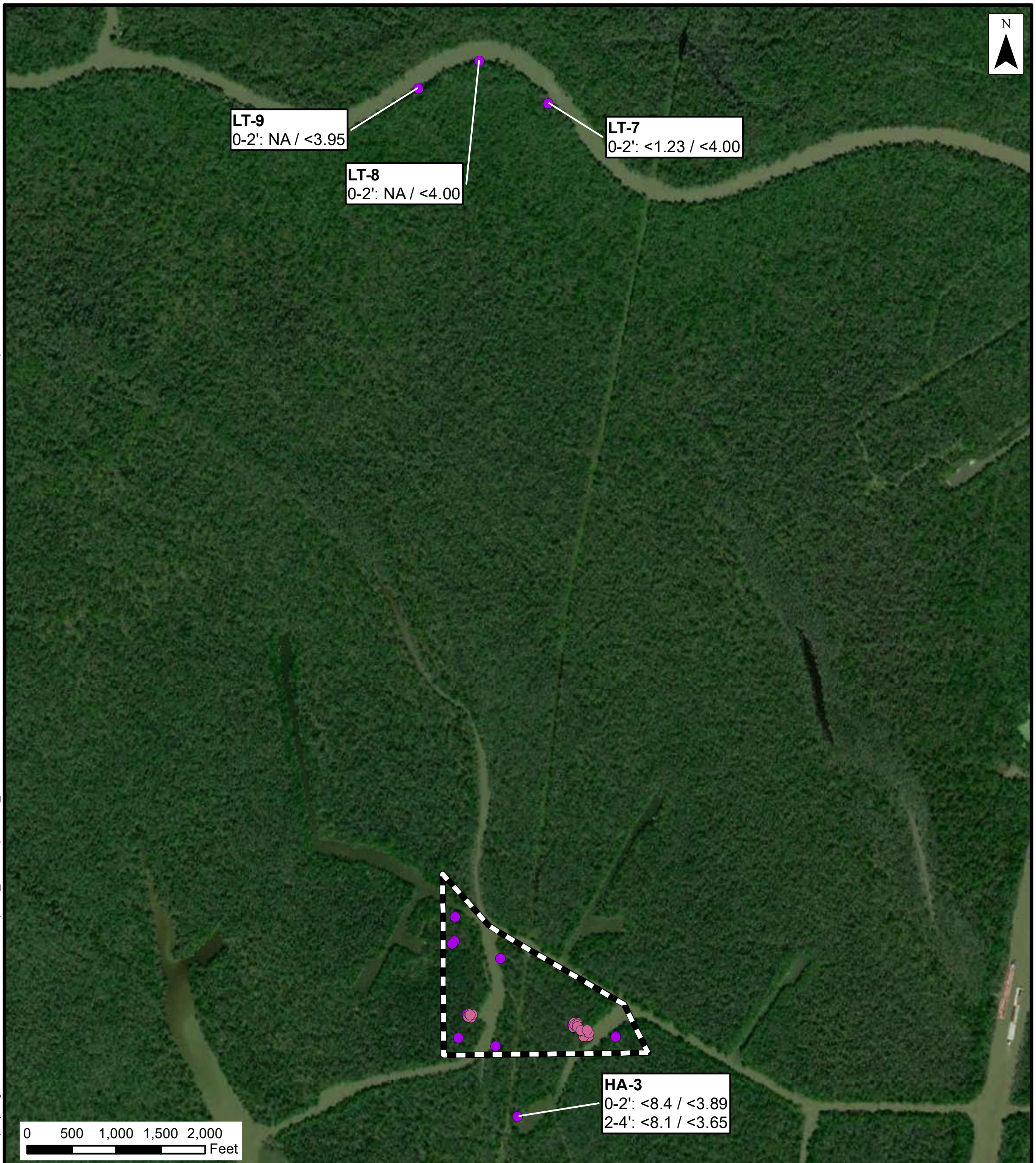

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 15B
Soil Concentrations 0-3' (Off-Site): Selenium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N

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Legend

Approximate Property Boundary

HET Soil Boring

ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 16A
Soil Concentrations 0-3' (Property): Silver
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

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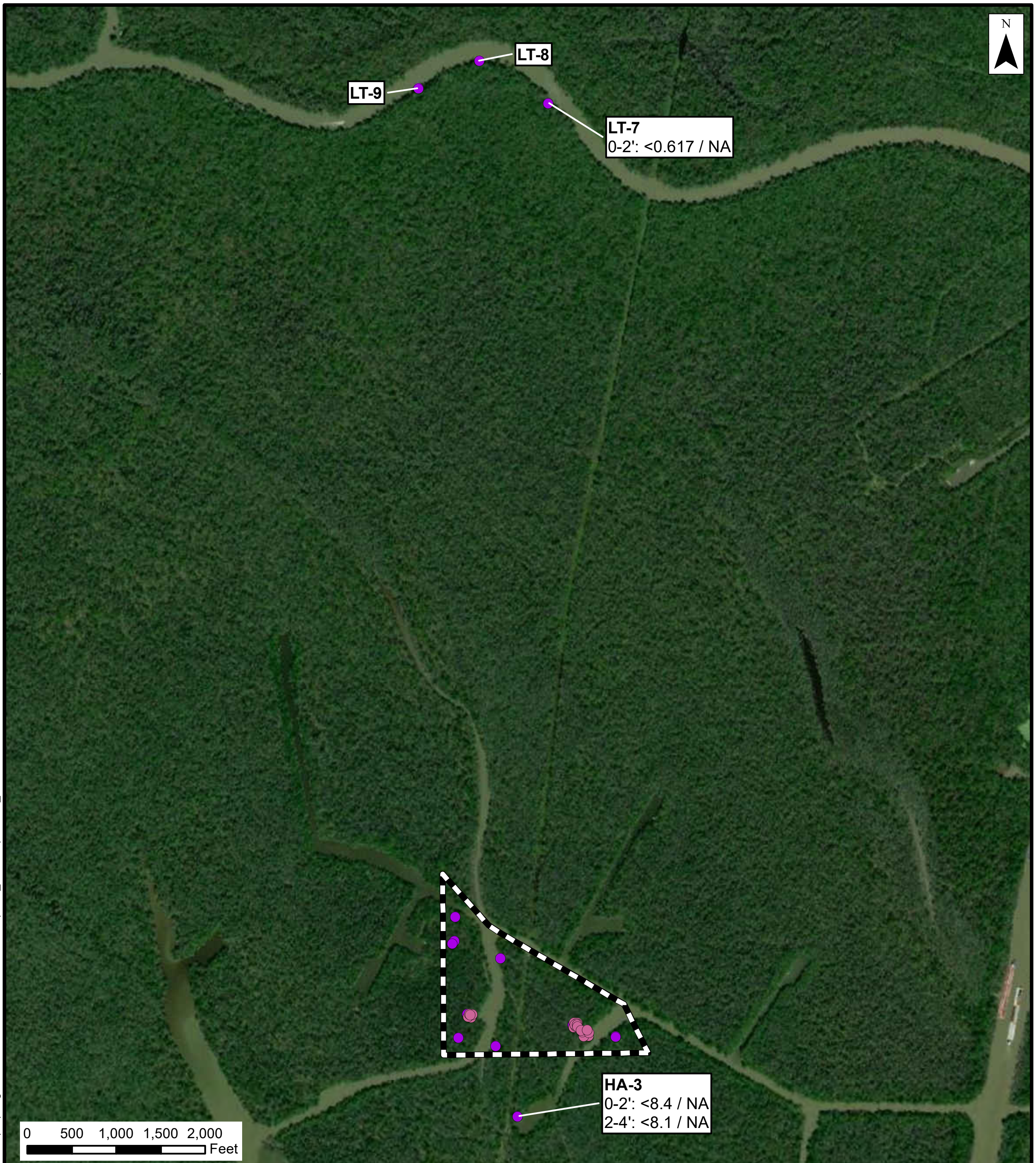

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 16B
Soil Concentrations 0-3' (Off-Site): Silver
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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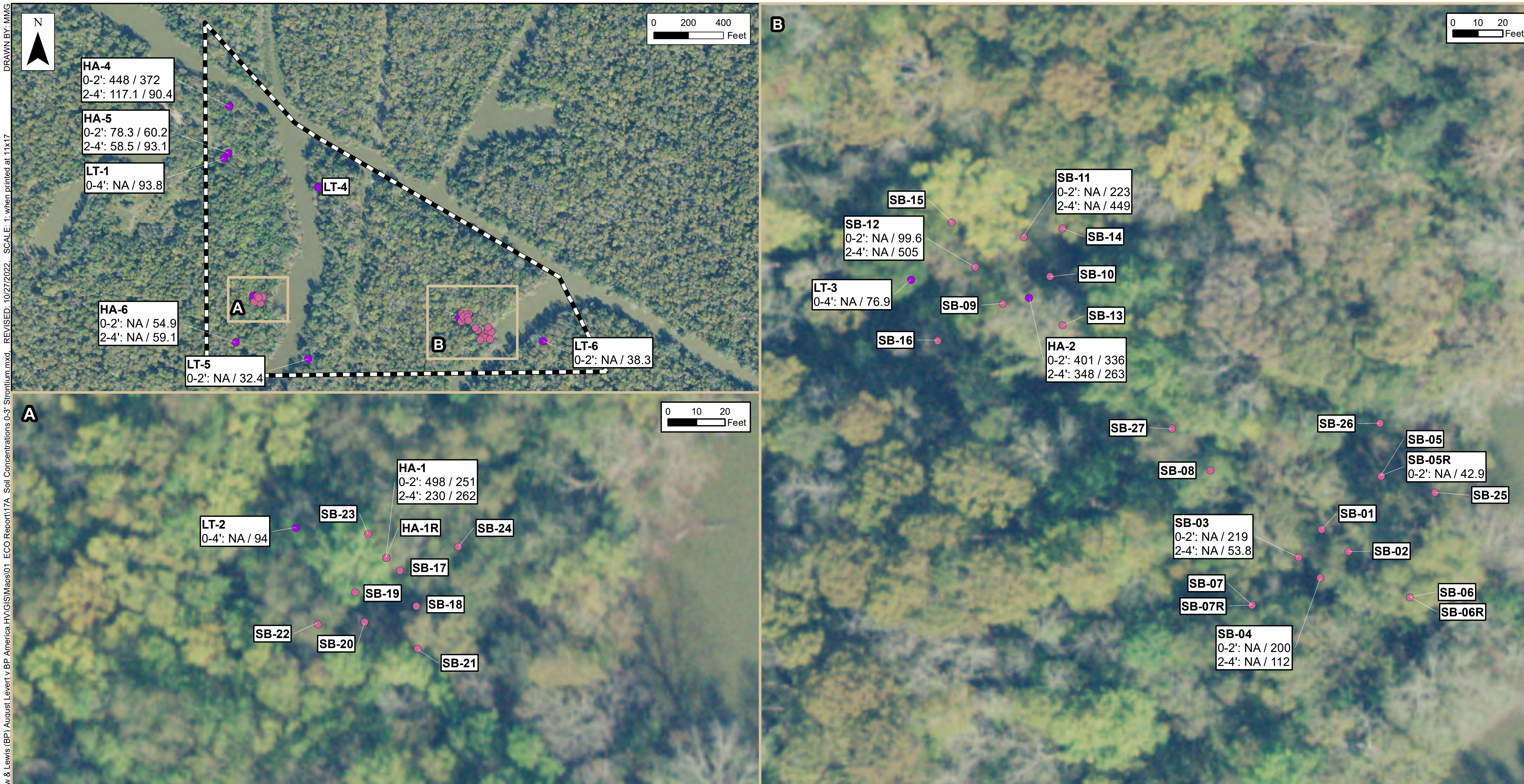
File: Q:\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America.HV\GIS\Maps\01_ECO Report\16B_Soil Concentrations 0-3' Silver.mxd, REVISED: 10/19/2022, SCALE: 1:17,733 when printed at 8.5x11 DRAWN BY: MMS

Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N



DRAWN BY: MMG REVISED: 10/27/2022 SCALE: 1: when printed at 11x17 \\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\17A_Soil Concentrations 0-3' Strontium.mxd

Legend

Approximate Property Boundary
HET Soil Boring
ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

Figure 17A
Soil Concentrations 0-3' (Property): Strontium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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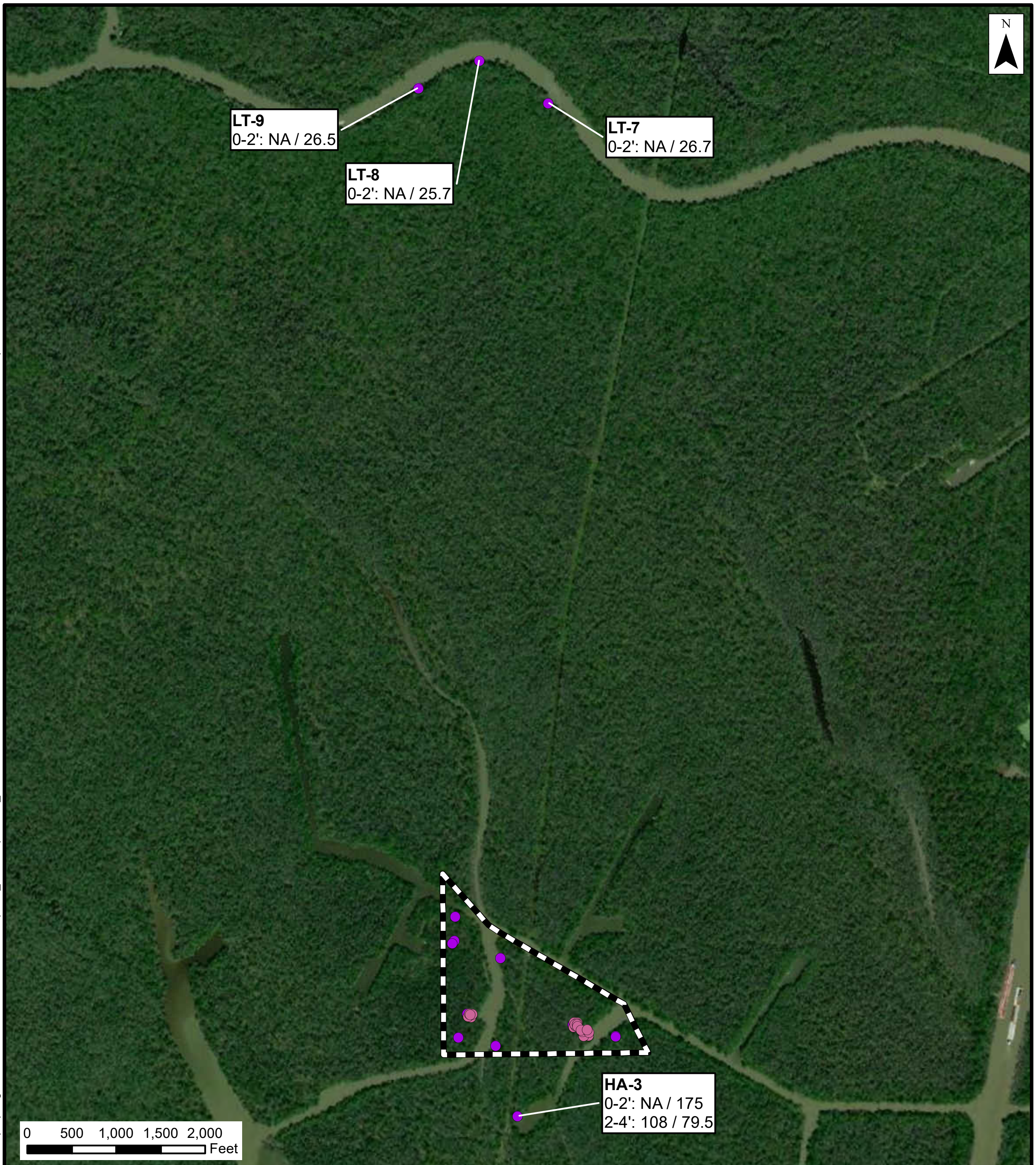

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File: Q:\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America.HV\GIS\Maps\01_ECO Report\17B_Soil Concentrations 0-3' Strontium.mxd, REVISED: 10/19/2022, SCALE: 1:17,733 when printed at 8.5x11

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Figure 17B
Soil Concentrations 0-3' (Off-Site): Strontium
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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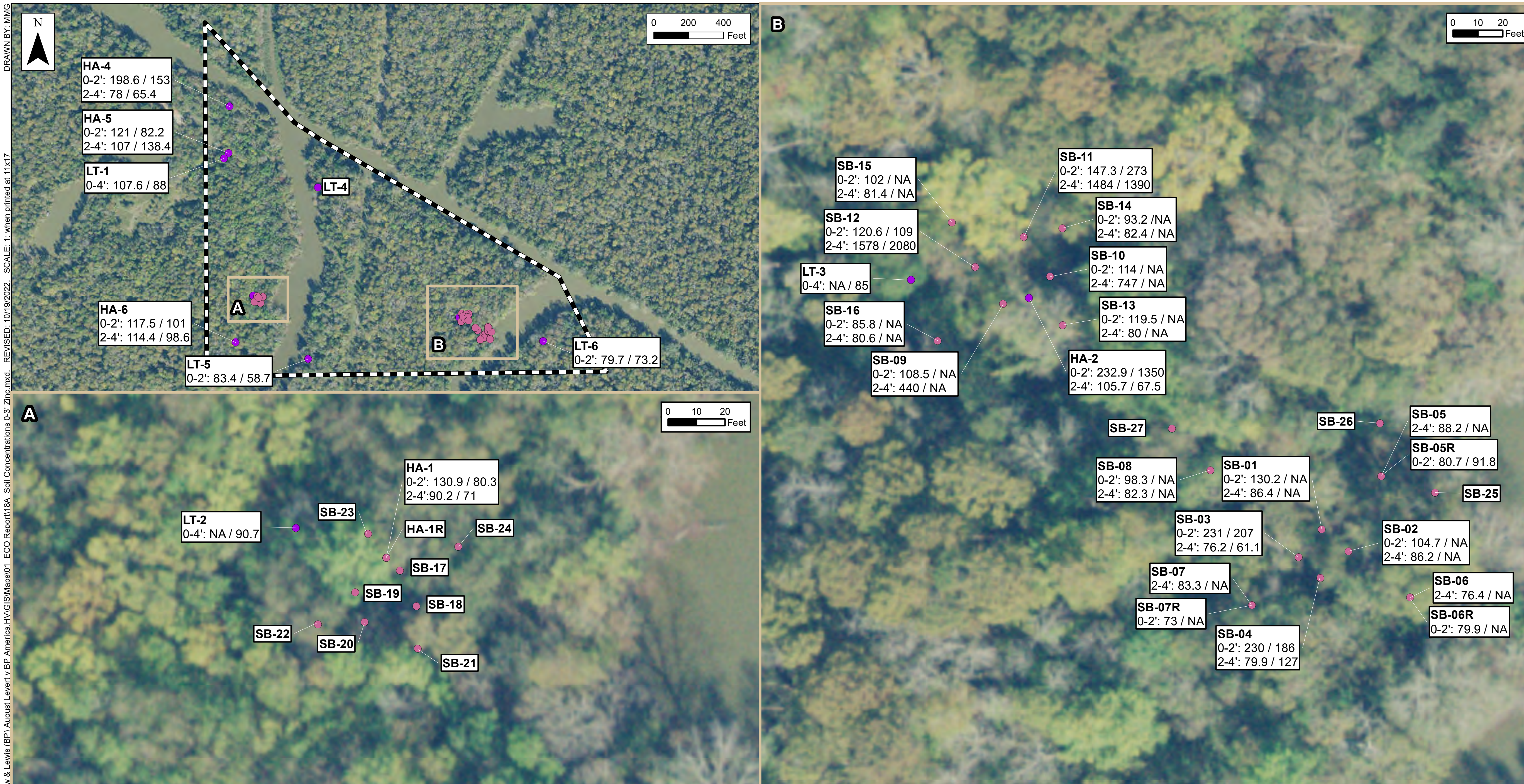
Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N



\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\18A_Soil Concentrations 0-3' Zinc.mxd. REVISED: 10/19/2022. SCALE: 1: when printed at 11x17 DRAWN BY: MMG

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring

Boring ID
Interval: HET Result / ICON Result

Notes:
Units are mg/kg dry weight.
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - ArcGIS Online;

Figure 18A
Soil Concentrations 0-3' (Property): Zinc
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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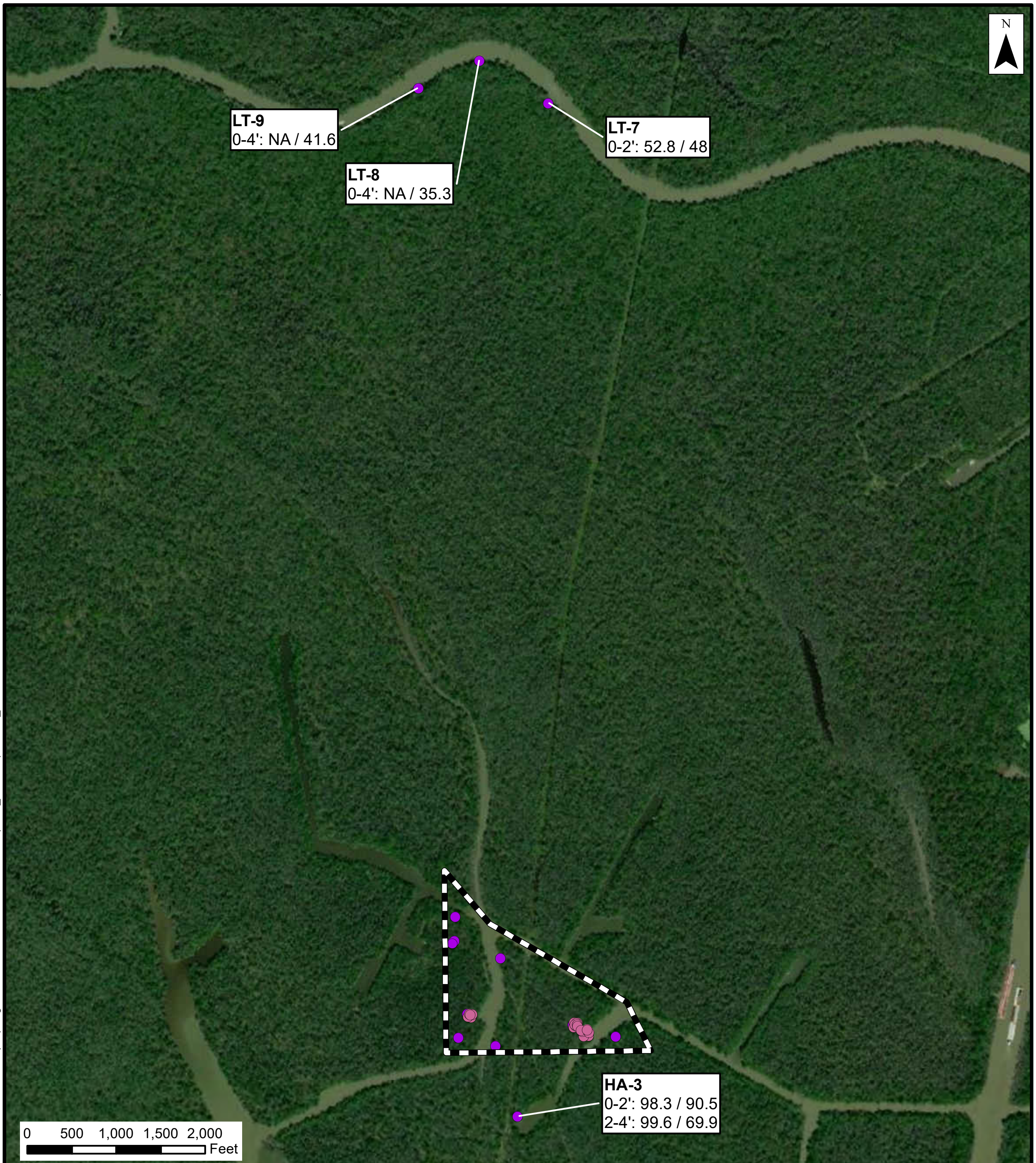

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File: \\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America.HV\GIS\Maps\01_ECO Report\18B_Soil Concentrations 0-3' Zinc.mxd, REVISED: 10/18/2022, SCALE: 1:17,733 when printed at 8.5x11

Figure 18B
Soil Concentrations 0-3' (Off-Site): Zinc
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Units are mg/kg dry weight.

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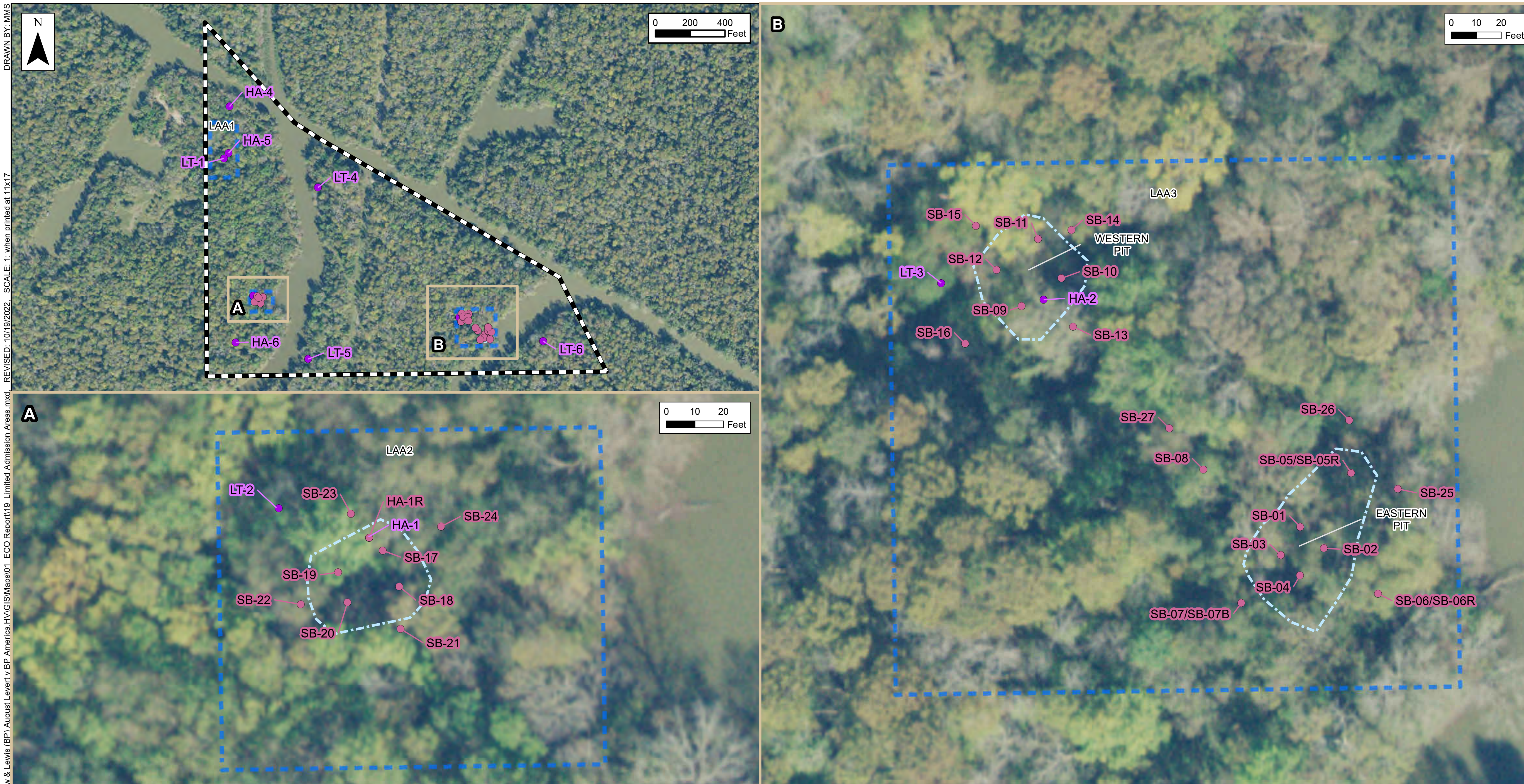
Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N



DRAWN BY: MMS SCALE: 1: when printed at 11x17 REVISED: 10/19/2022 \\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\19_Limited Admission Areas.mxd

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring
- Limited Admission Areas (LAA)
- Soil Remediation Areas (SRA)

Notes:
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N

Figure 19
Limited Admission Areas
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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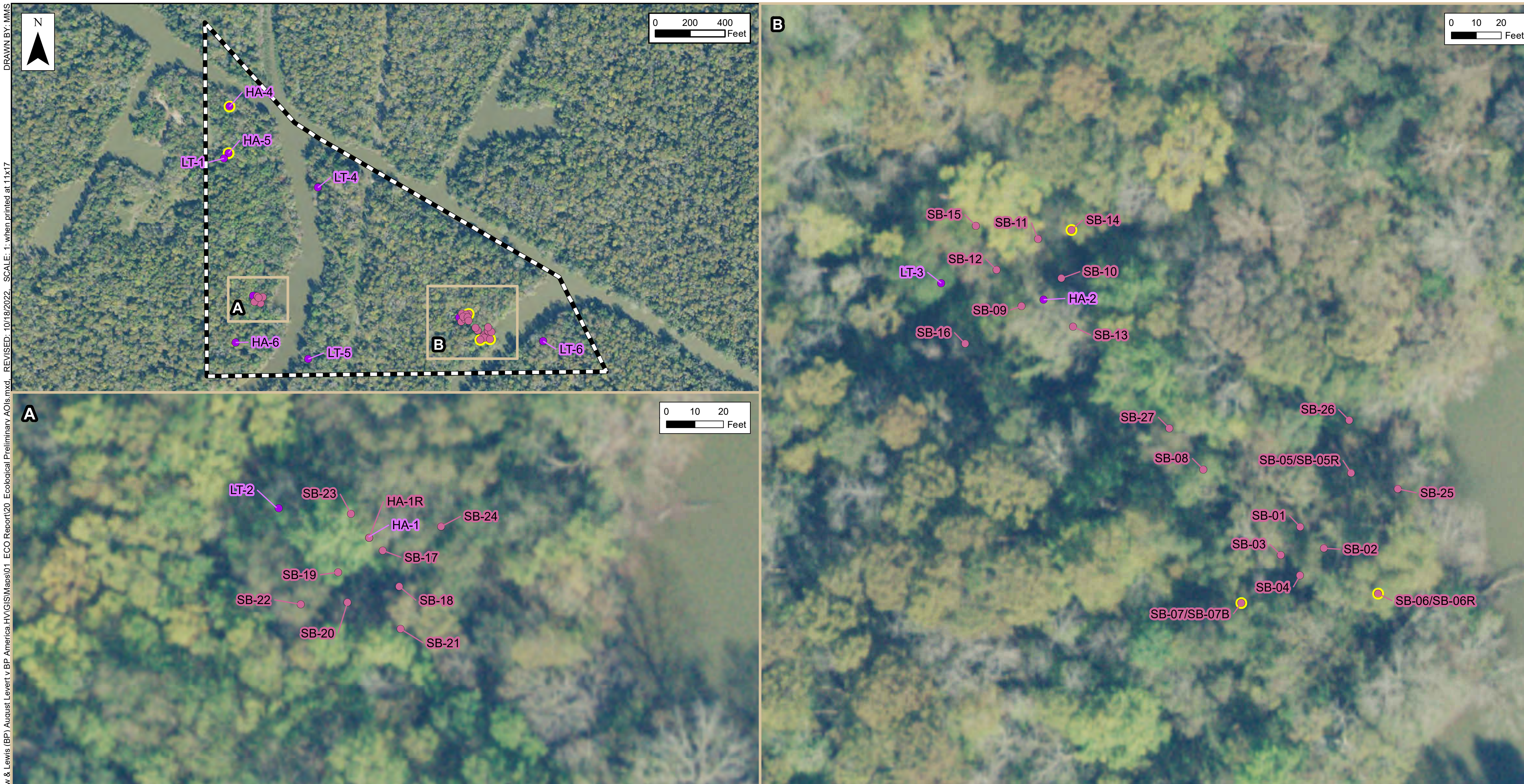

Legend

- Approximate Property Boundary
- HET Soil Boring
- ICON Soil Boring
- Single Point Location Preliminary AOI (Ecological)

Notes:
2021-11-11 Aerial from USGS Earth Explorer.

Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N

Figure 20
Ecological Preliminary AOIs
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\20_Ecological Preliminary AOIs.mxd, REVISED: 10/18/2022 SCALE: 1: when printed at 11x17 DRAWN BY: MMS

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TABLES

November 2022

TABLE 1
List of Vegetation Observed at the Property
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Common Name	*Scientific Name*	Wetland Classification	Growth Habit	Aquatic
Alligatorweed	*Alternanthera philoxeroides*	OBL	Forb/herb	Yes
American buckwheat vine	*Brunnichia ovata*	FACW	Vine	No
American elm	*Ulmus americana*	FAC	Tree	No
American water willow	*Justicia americana*	OBL	Forb/herb	Yes
Bald cypress	*Taxodium distichum*	OBL	Tree	Yes
Basketgrass	*Oplismenus hirtellus*	FAC	Graminoid	No
Bedstraw	*Galium spp.*	NA	Shrub, Subshrub, Forb/herb, Vine	No
Black willow	*Salix nigra*	OBL	Tree	No
Blue mistflower	*Conoclinium coelestinum*	FAC	Forb/herb	No
Bluejacket	*Tradescantia ohiensis*	FAC	Forb/herb	No
Boxelder	*Acer negundo*	FAC	Tree	No
Bulbous bittercress	*Cardamine bulbosa*	OBL	Forb/herb	No
Butterweed	*Packera glabella*	OBL	Forb/herb	Yes
Canada germander	*Teucrium canadense*	FACW	Forb/herb	No
Canadian black snakeroot	*Sanicula canadensis*	FACU	Forb/herb	No
Carolina coralbead	*Cocculus carolinus*	FAC	Vine	No
Carolina geranium	*Geranium carolinianum*	NA	Forb/herb	No
Carrot	*Family Apiaceae*	NA	Forb/herb	NA
Chinese tallow	*Triadica sebifera*	FAC	Tree	No
Clasping Venus' looking-glass	*Triodanis perfoliata*	FACU	Forb/herb	No
Clover	*Trifolium spp.*	NA	Forb/herb	No
Common boneset	*Eupatorium perfoliatum*	FACW	Forb/herb	No
Common chickweed	*Stellaria media*	FACU	Forb/herb	No
Common persimmon	*Diospyros virginiana*	FAC	Tree	No
Common yellow oxalis	*Oxalis stricta*	UPL	Forb/herb	No
Creeping primrose-willow	*Ludwigia repens*	OBL	Forb/herb	No
Duckweed	*Lemna spp.*	NA	Forb/herb	Yes
Eastern marsh fern	*Thelypteris palustris*	OBL	Forb/herb	No
Eastern poison ivy	*Toxicodendron radicans*	FAC	Shrub, Subshrub, Forb/herb, Vine	No
Eastern swampprivet	*Forestiera acuminata*	OBL	Tree, Shrub	No
Elderberry	*Sambucus spp.*	NA	Tree	No
Elm	*Ulmus spp.*	NA	Tree	No
Fern	*Clade Tracheophyta*	NA	Forb/herb	No
Fivelobe cucumber	*Cayaponia quinqueloba*	FAC	Forb/herb, Vine	No
Goldenrod	*Solidago spp.*	NA	Forb/herb	NA
Grape	*Vitis spp.*	NA	Shrub, Vine	NA
Green ash	*Fraxinus pennsylvanica*	FACW	Tree	No
Green flatsedge	*Cyperus virens*	FACW	Graminoid	No
Heartleaf nettle	*Urtica chamaedryoides*	FACU	Forb/herb	No
Honey locust	*Gleditsia triacanthos*	FAC	Tree, Shrub	No
Indian strawberry	*Duchesnea indica*	FACU	Forb/herb	No
Japanese climbing fern	*Lygodium japonicum*	FAC	Forb/herb, Vine	No
Kunth's maiden fern	*Thelypteris kunthii*	FACW	Forb/herb	No
Lateflowering thoroughwort	*Eupatorium serotinum*	FAC	Forb/herb	No
Lizard's tail	*Saururus cernuus*	OBL	Forb/herb	No
Long's sedge	*Carex longii*	OBL	Graminoid	No
Looseflower water-willow	*Justicia ovata*	OBL	Forb/herb	No
Marsh seedbox	*Ludwigia palustris*	OBL	Forb/herb	No
Melon	*Family Cucurbitaceae*	NA	NA	No
Moss	*Bryophyta*	NA	NA	No
Nuttall oak	*Quercus texana*	FACW	Tree, Shrub	No
Oak	*Quercus spp.*	NA	Tree	NA
Panicgrass	*Panicum spp.*	NA	Graminoid	NA
Pecan	*Carya illinoinensis*	FACU	Tree	No
Peppervine	*Nekemias arborea*	FAC	Shrub, Vine	No
Planertree	*Planera aquatica*	OBL	Tree	Yes
Possumhaw (Ilex genus)	*Ilex decidua*	FACW	Tree, Shrub	No
Ravenfoot sedge	*Carex crus-corvi*	OBL	Graminoid	No
Red maple	*Acer rubrum*	FAC	Tree	No
Red mulberry	*Morus rubra*	FACU	Tree	No
Resurrection fern	*Pleopeltis polypodioides*	FACU	Forb/herb, Vine	No
Roughleaf dogwood	*Cornus drummondii*	FAC	Tree, Shrub	No
Savannah-panicgrass	*Phanopyrum gymnocarpon*	OBL	Graminoid	No
Sawtooth blackberry	*Rubus argutus*	FAC	Subshrub	No
Sedge	*Carex spp.*	NA	Graminoid	NA
Shortbristle horned beaksedge	*Rhynchospora corniculata*	OBL	Graminoid	No

TABLE 1
List of Vegetation Observed at the Property
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Common Name	*Scientific Name*	Wetland Classification	Growth Habit	Aquatic
Shumard's oak	*Quercus shumardii*	FAC	Tree, Shrub	No
Sieva bean	*Phaseolus lunatus*	NA	Forb/herb, Vine	No
Slender yellow woodsorrel	*Oxalis dillenii*	FACU	Forb/herb	No
Southern dewberry	*Rubus trivialis*	FACU	Subshrub, Vine	No
Spider lily	*Hymenocallis occidentalis*	OBL	Forb/herb	No
Spiny sowthistle	*Sonchus asper*	FACU	Forb/herb	No
Stiff marsh bedstraw	*Galium tinctorium*	FACW	Forb/herb	No
Sugarberry	*Celtis laevigata*	FACW	Tree, Shrub	No
Swamp smartweed	*Polygonum hydropiperoides*	OBL	Forb/herb	Yes
Trumpet creeper	*Campsis radicans*	FAC	Vine	No
Virginia creeper	*Parthenocissus quinquefolia*	FACU	Vine	No
Virginia dayflower	*Commelina virginica*	FACW	Forb/herb	No
Water hickory	*Carya aquatica*	OBL	Tree	No
Water locust	*Gleditsia aquatica*	OBL	Tree, Shrub	No
Water oak	*Quercus nigra*	FAC	Tree	No
Water spangles	*Salvinia minima*	OBL	Forb/herb	Yes
Water tupelo	*Nyssa aquatica*	OBL	Tree	Yes
West Indian nightshade	*Solanum ptychanthum*	FACU	Forb/herb	No
White clover	*Trifolium repens*	FACU	Forb/herb	No
Whitenymph	*Trepocarpus aethusae*	FACW	Forb/herb	No
Yellow thistle	*Cirsium horridulum*	FAC	Forb/herb	No
Total Species Observed:	87		Total Aquatic Species:	9

NOTES:

Wetland classification and growth habit is provided by the USDA (2022) PLANTS database.

NA : Data not available. Wetland classification, growth habit, and aquatic status data are not always applicable to taxa identified to genus.

Species observed growing in water during ERM site investigations are marked 'Yes' in the aquatic column.

References

U.S. Department of Agriculture (USDA) Natural Resources Conservation Service. 2022. PLANTS Database. Available: https://plants.sc.egov.usda.gov/java/. Accessed August 2022.

TABLE 2
List of Birds Observed at the Property
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Guild	Common Name	*Scientific Name*	Diet	Species of Greatest Conservation Need
Neotropical and Passerine Migrants (i.e., flycatchers, hummingbirds, warblers)	Acadian Flycatcher	*Empidonax virescens*	Insects	
Neotropical and Passerine Migrants (i.e., flycatchers, hummingbirds, warblers)	Chimney Swift	*Chaetura pelagica*	Insects	Yes
Neotropical and Passerine Migrants (i.e., flycatchers, hummingbirds, warblers)	Northern Parula	*Setophaga americana*	Insects	
Neotropical and Passerine Migrants (i.e., flycatchers, hummingbirds, warblers)	**Prothonotary Warbler**	*Protonotaria citrea*	Insects	Yes
Neotropical and Passerine Migrants (i.e., flycatchers, hummingbirds, warblers)	Red-eyed Vireo	*Vireo olivaceus*	Insects	
Neotropical and Passerine Migrants (i.e., flycatchers, hummingbirds, warblers)	Yellow-billed Cuckoo	*Coccyzus americanus*	Insects	
Neotropical and Passerine Migrants (i.e., flycatchers, hummingbirds, warblers)	Yellow-throated Vireo	*Vireo flavifrons*	Insects	Yes
Raptors (i.e., hawks, owls, vultures)	**Barred Owl**	*Strix varia*	Mammals	
Raptors (i.e., hawks, owls, vultures)	**Red-shouldered Hawk**	*Buteo lineatus*	Mammals	
Raptors (i.e., hawks, owls, vultures)	Turkey Vulture	*Cathartes aura*	Carrion	
Resident Passerines (i.e., cardinals, doves, mockingbirds)	American Crow	*Corvus brachyrhynchos*	Omnivore	
Resident Passerines (i.e., cardinals, doves, mockingbirds)	Carolina Chickadee	*Poecile carolinensis*	Insects	
Resident Passerines (i.e., cardinals, doves, mockingbirds)	Carolina Wren	*Thryothorus ludovicianus*	Insects	
Resident Passerines (i.e., cardinals, doves, mockingbirds)	Fish Crow	*Corvus ossifragus*	Omnivore	
Resident Passerines (i.e., cardinals, doves, mockingbirds)	Northern Cardinal	*Cardinalis cardinalis*	Seeds	
Resident Passerines (i.e., cardinals, doves, mockingbirds)	Tufted Titmouse	*Baeolophus bicolor*	Insects	
Resident Passerines (i.e., cardinals, doves, mockingbirds)	White-eyed Vireo	*Vireo griseus*	Insects	
Tree Climbers (i.e., woodpeckers)	Downy Woodpecker	*Dryobates pubescens*	Insects	
Tree Climbers (i.e., woodpeckers)	Pileated Woodpecker	*Dryocopus pileatus*	Insects	
Tree Climbers (i.e., woodpeckers)	Red-bellied Woodpecker	*Melanerpes carolinus*	Insects	
Wading Birds and Upland Waterbirds (i.e., rails, herons, egrets)	**Little Blue Heron**	*Egretta caerulea*	Fish	Yes
Wading Birds and Upland Waterbirds (i.e., rails, herons, egrets)	**Tricolored Heron**	*Egretta tricolor*	Fish	
Total Species Observed:	22		Total SGCN:	4

NOTES:

Diet data provided by the The Cornell Lab (2022).

Louisiana Species of Greatest Conservation Need (SGCN) as per LDWF (2020).

Species listed in **bold** are identified by USFWS (2016) as swamp associates in the Atchafalaya Basin.

References

Louisiana Department of Wildlife and Fisheries (LDWF). 2020. Louisiana's Animal Species of Greatest Conservation Need (SGCN) - Rare, Threatened, and Endangered Animals - 2020. Available: https://www.wlf.louisiana.gov/assets/Conservation/Protecting_Wildlife_Diversity/Files/rare_animals_plants_natural_communities_tracking_list_2020.pdf. Accessed September 2022.

The Cornell Lab. 2022a. All About Birds. Available: https://www.allaboutbirds.org/news/. Accessed September 2022.

U.S. Fish and Wildlife Service (USFWS). 2013. Atchafalaya National Wildlife Refuge Bird List. Available: https://www.fws.gov/sites/default/files/documents/Atchafalaya-birdlist.pdf. Accessed September 2022.

TABLE 3
List of Non-Avian Fauna Observed at the Property
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Common Name	Scientific Name	Trophic Level
Mammals		
Nine-banded armadillo	*Dasypus novemcinctus*	Secondary
Beaver	*Castor spp.*	Primary
Eastern gray squirrel	*Sciurus carolinensis*	Primary
Unknown burrow	Unknown	Unknown
Reptiles		
American alligator	*Alligator mississippiensis*	Apex
Cottonmouth	*Agkistrodon piscivorus*	Tertiary
Diamondback water snake	*Nerodia rhombifer*	Tertiary
Snake	Suborder Serpentes	Tertiary
Western ratsnake	*Pantherophis obsoletus*	Tertiary
Anole	*Anolis spp.*	Secondary
Little brown skink	*Scincella lateralis*	Secondary
Lizard	Order Squamata	Secondary
Amphibians		
Green frog	*Lithobates clamitans*	Tertiary
Gulf coast toad	*Incilius nebulifer*	Secondary
Southern leopard frog	*Lithobates sphenocephalus*	Secondary
Other Frogs and Toads	Order Anura	Secondary
Terrestrial Invertebrates		
Dragonfly	Order Odonata	Secondary
Eastern pondhawk	*Erythemis simplicicollis*	Secondary
Great blue skimmer	*Libellula vibrans*	Secondary
Harvestman spider	Order Opiliones	Secondary
Six-spotted fishing spider	*Dolomedes triton*	Secondary
Spider	Order Araneae	Secondary
Wasp	Suborder Apocrita	Secondary
Alligatorweed flea beetle	*Agasicles hydrophila*	Primary
Ant	Family Formicidae	Primary
Apple snail	*Pomacea maculata*	Primary
Bee	Family Apidae	Primary
Beetle	Order Coleoptera	Primary
Butterfly	Order Lepidoptera	Primary
Crane fly	Family Tipulidae	Primary
Eastern lubber grasshopper	*Romalea microptera*	Primary
Flea beetle	*Disonycha sp.*	Primary
Fourteen spotted leaf beetle	*Cryptocephalus guttulatus*	Primary
Grasshopper	Infraorder Acrididea	Primary
Katydid	Family Tettigoniidae	Primary
Ladybug	*Coccinellidae*	Primary
Mosquito	*Anopheles spp.*	Primary
Moth	Order Lepidoptera	Primary
Oblong-winged katydid	*Amblycorypha oblongifolia*	Primary
Pale-bordered field cockroach	*Pseudomops septentrionalis*	Primary
Short-horned grasshopper	Family Acrididae	Primary
Snail	Class Gastropoda	Primary
Spanish moth	*Xanthopastis timais*	Primary
Spittle Bug	Superfamily Cercopoidea	Primary
Swallowtail	Family Papilionidae	Primary
Aquatic Invertebrates		
Crawfish	Family Cambaridae	Secondary
Total Observed	46	

NOTES:
Trophic levels are defined as follows:
Apex Predator: Carnivores; top predators at the top of the food chain without natural predators.
Tertiary Consumers: Carnivores and omnivores; organisms that consume primary and secondary consumers.
Secondary Consumers: Omnivores and carnivores; organisms that consume primary consumers (herbivores).
Primary Consumer: Herbivores; or organisms that consume plants and plant material (nectar, seeds, nuts, etc.).

TABLE 4A
Soil Analytical Data and Screening - Property Excluding Soil Remediation Areas
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

		Area:	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site
		Location ID:	HA-4	HA-4	HA-4	HA-4	HA-4	HA-4	HA-4	HA-4	HA-5	HA-5	HA-5	HA-5	HA-5	HA-5	HA-5	HA-5	HA-5	HA-5	HA-6	HA-6	HA-6	HA-6
		Sample Depth:	0-2'	0-2'	2-4'	2-4'	4-6'	4-6'	6-8'	6-8'	0-2'	0-2'	2-4'	2-4'	4-6'	4-6') -Accutes	4-6') - Waypoin	6-7'	6-7')-Accutes	6-7') - Waypoin	0-2'	0-2'	2-4'	2-4'
		Sample ID:	HA-4 (0-2')	HA-4 (0-2')	HA-4 (2-4')	HA-4 (2-4')	HA-4 (4-6')	HA-4 (4-6')	HA-4 (6-8')	HA-4 (6-8')	HA-5 (0-2')	HA-5 (0-2')	HA-5 (2-4')	HA-5 (2-4')	HA-5 (4-6')	HA-5 (4-6') -	HA-5 (4-6') -	HA-5 (6-7')	HA-5 (6-7')-	HA-5 (6-7') -	HA-6 (0-2')	HA-6 (0-2')	HA-6 (2-4')	HA-6 (2-4')
		Sample Date:	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	08/30/19	09/25/19	09/25/19	09/25/19	09/25/19
Salinity & Other	**Units**	**Screening Value[a]**	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	HET	ICON	HET	HET	ICON	HET	ICON	HET
% Moisture	%	NS	21.8	27.5	30.6	33.2	28	31.3	34.5	40.3	35.8	38.6	33.3	38.5	35.6	47.7	38	44.9	52.2	48	39.6	45.7	39.3	45.7
% Moisture for Metals Conve	%	NS	21.8	27.5	30.6	33.2	28	31.3	34.5	40.3	35.8	38.6	33.3	38.5	35.6	47.7	38	44.9	52.2	48	39.6	45.7	39.3	45.7
% Moisture for Organics Con	%	NS	21.8	27.5	30.6	33.2	28	31.3	34.5	40.3	35.8	38.6	33.3	38.5	35.6	47.7	38	44.9	52.2	48	39.6	45.7	39.3	45.7
Chloride	meq/L	NS	NA	0.39	NA	12.8	NA	63.2	NA	58.8	NA	24	NA	26	NA	40.4	NA	NA	67.8	NA	NA	1.98	NA	4.43
Chloride	mg/L	NS	NA	<4.00	NA	280	NA	1180	NA	1300	NA	517	NA	587	NA	849	NA	NA	1470	NA	NA	29.7	NA	73.8
SPLP Chloride	mg/L	NS	NA	NA	NA	NA	352*	NA	515*	NA	NA	NA	NA	NA	334*	NA	NA	699*	NA	NA	NA	NA	NA	NA
Bromide (Br)	mg/Kg	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Sat Paste)	meq/L	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC	mmhos/ cm	NS	0.57	0.49	3.67	4.4	6.23	7.59	6.54	6.25	2.94	3.02	2.83	3.08	3.52	4.41	NA	6.12	7.22	NA	0.49	0.58	0.77	0.89
ESP	%	NS	1.15	0.574	11.3	3.42	12.9	NA	7.54	NA	4.74	2.86	5.35	3.55	6.05	NA	NA	5.33	NA	NA	0.58	0.752	1.11	1.21
SAR	N/A	NS	0.85	<0.430	12.9	12.2	15.5	NA	8.55	NA	5.94	6.07	6.02	6.3	5.85	NA	NA	6.37	NA	NA	1.12	1.22	1.75	2.01
Calcium	meq/L	NS	4.1	4.11	5.96	14.7	10.2	18	17.9	18.9	7.81	8.3	7.28	8.67	9.8	13.8	NA	20	13.1	NA	1.94	2.21	2.68	2.77
Magnesium	meq/L	NS	0.62	<0.820	2.61	4.71	5.59	7.54	10.1	9.14	4.47	4.24	4.06	4.56	5.37	7.53	NA	11.2	14.7	NA	1.29	1.24	1.74	1.64
Sodium	meq/L	NS	1.3	0.459	26.8	38.1	43.7	65.2	32	35.4	14.7	15.2	14.3	16.2	16.1	24.7	NA	25.2	30.3	NA	1.43	1.6	2.6	2.98
SPLP Sodium	mg/L	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	NS	44.1	28.7	48.6	37.3	33.3	NA	51.3	NA	59.3	50.4	61.6	54.8	56.6	NA	NA	66	NA	NA	74.1	51.7	78.2	54.3
Alkalinity (Sat. Paste)	meq/L	NS	NA	3.8	NA	1.6	NA	1.2	NA	1.4	NA	1.8	NA	1.2	NA	1.2	NA	NA	0.8	NA	NA	1.6	NA	0.8
Sulfate	meq/L	NS	NA	0.676	NA	35.4	NA	13	NA	2.39	NA	2.79	NA	3.34	NA	3.17	NA	NA	3.68	NA	NA	1.76	NA	2.97
Saturation %	%	NS	NA	82.9	NA	113	NA	80.6	NA	116	NA	127	NA	114	NA	NA	122	NA	NA	125	NA	118	NA	129
pH (Saturated Paste)	s.u.	NS	NA	7.88	NA	7.33	NA	7.3	NA	7.46	NA	7.62	NA	7.42	NA	NA	7.53	NA	NA	7.22	NA	7.01	NA	6.93
SPLP																								
SPLP Arsenic	mg/L	NS	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	NS	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	NS	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NS	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NS	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																								
Arsenic	mg/kg-dry	12	**12.1**	**16.55**	8.67	8.4	10.2	<7.3	6.49	9.72	6.44	11.89	9.13	<7.5	3.99	<9.56	4.16	8.22	<10.25	4.15	7.37	<8.7	7.69	<9
Barium	mg/kg-dry	2424	384	299	236	149.4	210	205	243	206	207	244	394	115.9	397	220	244	267	264	235	257	215	336	262
True Total Barium	mg/kg-dry	NS	754	244	408	430	285	280	431	195	337	354	425	189	892	611	425	402	370	344	365	489	486	311
Cadmium	mg/kg-dry	0.8	0.77	<3.4	0.575	<3.4	0.544	<3.6	0.794	<4.2	0.528	<4.1	**0.85**	<3.7	0.519	<4.8	0.394	<0.472	<5.23	<0.385	<0.479	<4.4	<0.498	<4.6
Chromium	mg/kg-dry	84	12.7	14.6	13.2	17.7	11.8	18.3	19.2	25.5	19.7	34	33.9	26.8	20.1	31	19.7	18.1	24.3	21.9	23.7	28	26.1	28
Lead	mg/kg-dry	44	13.9	16.7	13.7	15.6	12.4	13.2	17.5	21.3	18.2	25.7	26.4	20.7	18.9	21.2	18.5	14.1	16.5	16.13	23.9	27.8	20.8	22.3
Mercury	mg/kg-dry	0.18	<0.108	<0.106	<0.107	<0.12	<0.104	<0.112	<0.108	<0.124	<0.106	<0.121	<0.156	<0.12	<0.101	<0.1415	0.0639	<0.107	<0.1674	0.0606	<0.106	<0.147	<0.0998	<0.127
Selenium	mg/kg-dry	1	<3.71	<6.9	<3.90	<6.7	<3.75	<7.3	<3.83	<8.2	<3.71	<8.1	<5.89	<7.5	<3.84	<9.56	<1.61	<3.77	<10.3	<1.92	<3.83	<8.7	<3.98	<9
Silver	mg/kg-dry	4.2	NA	<6.9	NA	<6.7	NA	<7.3	NA	<8.2	NA	<8.1	NA	<7.5	NA	<9.56	<0.806	NA	<10.25	<0.962	NA	<8.7	NA	<9
Strontium	mg/kg-dry	203	**372**	**448**	90.4	117.1	52.3	64.6	54.5	59.6	60.2	78.3	93.1	58.5	64.5	75.3	NA	68.2	71.3	NA	54.9	NA	59.1	NA
Zinc	mg/kg-dry	140	**153**	**198.6**	65.4	78	54.6	80.8	78.9	94.1	82.2	121	138.4	107	78.4	99.4	77.1	66.5	78	69	101	117.5	98.6	114.4
Hydrocarbons (Dry Weight)																								
Oil & Grease	%	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO (C6-C10)	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28)	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C6-C8 Aliphatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aliphatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aliphatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aliphatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C35 Aliphatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aromatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aromatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aromatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C21 Aromatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C21-C35 Aromatics	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAH (Dry Weight)																								
2-Methylnaphthalene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																								
Sum TPH Mixture	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum TPH Fraction	mg/kg-dry	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Total PAH	mg/kg-dry	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	1.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4A
Soil Analytical Data and Screening - Property Excluding Soil Remediation Areas
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

		On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site
		HA-6	HA-6	LT-1	LT-1	LT-1	LT-1	LT-1	LT-2	LT-2	LT-2	LT-3	LT-3	LT-4	LT-4	LT-4	LT-4	LT-4	LT-4	LT-4	LT-5	LT-5	LT-5	LT-5	LT-5
		4-6'	4-6'	0-4'	0-4'	6-8'	12-14'	12-14'	0-4'	4-8'	12-16'	0-4'	4-8'	8-10'	12-14'	12-14'	16-18'	16-18'	20-22'	20-22'	0-2'	0-2'	4-6'	4-6'	8-10'
		HA-6 (4-6')	HA-6 (4-6')	LT-1 (0-4')	LT-1 (0-4')	LT-1 (6-8')	LT-1 (12-14')	LT-1 (12-14')	LT-2 (0-4')	LT-2 (4-8')	LT-2 (12-16')	LT-3 (0-4')	LT-3 (4-8')	LT-4 (8-10')	LT-4 (12-14')	LT-4 (12-14')	LT-4 (16-18')	LT-4 (16-18')	LT-4 (20-22')	LT-4 (20-22')	LT-5 (0-2')	LT-5 (0-2')	LT-5 (4-6')	LT-5 (4-6')	LT-5 (8-10')
		09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/25/19	09/26/19	09/26/19	09/26/19	09/26/19	09/26/19	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22
Salinity & Other	**Units**	ICON	HET	ICON	HET	ICON	ICON	HET	ICON	ICON	ICON	ICON	ICON	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	ICON
% Moisture	%	42	59.2	33.1	38.2	38.1	21.5	21.3	33.1	42.9	31.1	31.6	38.3	42.2	32.4	28.9	28.1	26.8	47.8	41.5	30	28.3	38.4	37.4	32.7
% Moisture for Metals Conve	%	42	59.2	33.1	38.2	38.1	21.5	21.3	33.1	42.9	31.1	31.6	38.3	42.2	32.4	28.9	28.1	26.8	47.8	41.5	30	28.3	38.4	37.4	32.7
% Moisture for Organics Con	%	42	59.2	33.1	38.2	38.1	21.5	21.3	33.1	42.9	31.1	31.6	38.3	42.2	32.4	28.9	28.1	26.8	47.8	41.5	30	28.3	38.4	37.4	32.7
Chloride	meq/L	NA	5.5	NA	NA	NA	NA	197	NA	NA	NA	NA	NA	NA	1.64	NA	1.46	NA	1.81	NA	3.66	NA	3.72	NA	NA
Chloride	mg/L	NA	124	NA	NA	NA	NA	1830	NA	NA	NA	NA	NA	83.8	27.8	33.6	22.8	34.4	48.1	49.7	93.4	146	84.9	153	88.7
SPLP Chloride	mg/L	NA	NA	NA	NA	632*	NA	92.9	NA	152*	NA	NA	37.9*	NA	NA	NA	NA	NA	NA	21.6*	NA	NA	NA	NA	NA
Bromide (Br)	mg/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Sat Paste)	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC	mmhos/ cm	1.16	1.03	2.08	NA	6.58	17.2	19	1.25	2.62	6.01	0.61	0.67	0.72	0.502	0.81	0.503	0.67	0.635	0.77	0.76	0.96	0.729	1.02	0.71
ESP	%	1.62	NA	5.29	NA	7.82	NA	NA	6.28	7.38	NA	6.11	6.81	1.02	NA	NA	NA	NA	NA	NA	1.55	2.24	NA	1.72	1.26
SAR	N/A	2.41	NA	7.87	NA	12	NA	NA	8.51	11.1	NA	6.05	6.94	1.14	NA	NA	NA	NA	NA	NA	2.46	1.96	NA	1.57	1.19
Calcium	meq/L	3.85	3.5	3.46	NA	13.3	NA	57.5	1.33	3.27	NA	0.68	0.61	2.79	2.94	NA	2.53	NA	2.93	NA	2.46	2.82	2.41	3.43	2.28
Magnesium	meq/L	2.24	2.01	1.99	NA	7.02	NA	27.4	0.87	1.81	NA	0.43	0.4	1.4	1.12	NA	1.03	NA	1.28	NA	1.28	1.71	1.28	1.94	1.34
Sodium	meq/L	4.21	3.2	13	NA	38.2	NA	97.6	8.93	17.7	NA	4.52	4.92	1.66	1.23	NA	1.62	NA	2.34	NA	3.36	2.96	2.93	2.57	1.61
SPLP Sodium	mg/L	NA	NA	NA	NA	NA	NA	56.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	73.4	NA	70.5	NA	84.5	NA	NA	109	135	NA	86.1	72.7	68.3	NA	NA	NA	NA	NA	NA	63	71.6	NA	81.2	51.3
Alkalinity (Sat. Paste)	meq/L	NA	1.2	NA	NA	NA	NA	1.6	NA	NA	NA	NA	NA	NA	1.8	NA	2.5	NA	2.9	NA	1.8	NA	2	NA	NA
Sulfate	meq/L	NA	2.72	NA	NA	NA	NA	4.43	NA	NA	NA	NA	NA	NA	1	NA	0.574	NA	0.996	NA	1.51	NA	0.919	NA	NA
Saturation %	%	NA	140	NA	NA	NA	NA	33.5	NA	NA	NA	NA	NA	NA	68.5	NA	81.2	NA	163	NA	152	NA	155	NA	NA
pH (Saturated Paste)	s.u.	NA	7.45	NA	NA	NA	NA	7.17	NA	NA	NA	NA	NA	NA	7.95	NA	8.08	NA	7.98	NA	7.75	NA	7.91	NA	NA
SPLP																									
SPLP Arsenic	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																									
Arsenic	mg/kg-dry	6.42	<12	10.4	<8.1	5.05	NA	NA	8.9	5.77	NA	7.15	8.59	2.18	4.3	4.06	NA	NA	NA	NA	6.23	4.38	7	5.67	4.36
Barium	mg/kg-dry	460	748	247	243	353	NA	NA	249	277	NA	245	573	192	238	265	NA	NA	NA	NA	199	166	195	200	447
True Total Barium	mg/kg-dry	614	348	394	340	408	NA	NA	360	365	NA	361	1240	375	<500	409	NA	NA	NA	NA	<500	411	<500	341	691
Cadmium	mg/kg-dry	0.482	<6.1	0.628	<4	<0.480	NA	NA	<0.489	0.697	NA	<0.465	<0.490	<0.496	<0.296	<0.498	NA	NA	NA	NA	0.49	<0.497	0.456	<0.498	<0.478
Chromium	mg/kg-dry	20.1	35.3	21.6	27.3	21.6	NA	NA	22.7	17.2	NA	35.5	21.9	14	13.45	11.2	NA	NA	NA	NA	22.1	16	19.2	16.4	12.5
Lead	mg/kg-dry	20.4	29.7	19.2	20.7	17.1	NA	NA	19.9	17.4	NA	18.8	18.7	12.1	11.02	9.42	NA	NA	NA	NA	18.1	14.2	17.7	15.3	11.6
Mercury	mg/kg-dry	<0.103	<0.164	<0.103	<0.112	<0.109	NA	NA	<0.103	<0.101	NA	<0.101	<0.106	<0.0998	0.0507	<0.0946	NA	NA	NA	NA	0.0467	<0.104	0.056	<0.0962	<0.0947
Selenium	mg/kg-dry	<3.78	<12	<3.92	<8.1	<3.84	NA	NA	<3.91	<3.93	NA	<3.72	<3.92	<3.97	<1.48	<3.98	NA	NA	NA	NA	<1.43	<3.97	<1.62	<3.99	<3.83
Silver	mg/kg-dry	NA	<12	NA	<8.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.74	NA	NA	NA	NA	NA	<0.714	NA	<0.812	NA	NA
Strontium	mg/kg-dry	61.3	NA	93.8	NA	82	NA	NA	94	94.5	NA	76.9	97	39.2	NA	35.9	NA	NA	NA	NA	NA	32.4	NA	41.9	44.3
Zinc	mg/kg-dry	86	148.3	88	107.6	76	NA	NA	90.7	68.2	NA	85	77.1	48	50.4	45	NA	NA	NA	NA	83.4	58.7	71.8	65	50.5
Hydrocarbons (Dry Weight)																									
Oil & Grease	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO (C6-C10)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C6-C8 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C35 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C21 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C21-C35 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAH (Dry Weight)																									
2-Methylnaphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																									
Sum TPH Mixture	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum TPH Fraction	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Total PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4A
Soil Analytical Data and Screening - Property Excluding Soil Remediation Areas
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

		On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site
		LT-5	LT-5	LT-5	LT-5	LT-6	LT-6	LT-6	LT-6	LT-6	LT-6	LT-6	LT-6	SB-06R	SB-06R	SB-06	SB-6	SB-06	SB-6	SB-07R	SB-07R	SB-07	SB-7	SB-07	SB-08
		16-18'	16-18'	22-24'	22-24'	0-2'	0-2'	4-6'	4-6'	6-8'	16-18'	24-26'	24-26'	0-2'	0-2'	2-4'	2-4'	4-6'	4-6'	0-2'	0-2'	2-4'	2-4'	4-6'	0-2'
		LT-5 (16-18')	LT-5 (16-18')	LT-5 (22-24')	LT-5 (22-24')	LT-6 (0-2')	LT-6 (0-2')	LT-6 (4-6')	LT-6 (4-6')	LT-6 (6-8')	LT-6 (16-18')	LT-6 (24-26')	LT-6 (24-26')	SB-06R (0-2')	SB-06R (0-2')	SB-06 (2-4')	SB-6 (2-4')	SB-06 (4-6')	SB-6 (4-6')	SB-07R (0-2')	SB-07R (0-2')	SB-07 (2-4')	SB-7 (2-4')	SB-07 (4-6')	SB-08 (0-2')
		06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	09/27/22	09/27/22	06/21/22	06/21/22	06/21/22	06/21/22	09/27/22	09/27/22	06/21/22	06/21/22	06/21/22	06/21/22
Salinity & Other	**Units**	HET	ICON	HET	ICON	HET	ICON	HET	ICON	ICON	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	HET
% Moisture	%	25.2	20.6	36.9	31.7	32.6	25.6	33.1	28.8	33.4	51.7	30.6	33.2	29.8	24.6	31.5	26.2	39.7	34.1	33.7	29.9	39.4	34.9	47.5	30.9
% Moisture for Metals Conve	%	25.2	20.6	36.9	31.7	32.6	25.6	33.1	28.8	33.4	51.7	30.6	33.2	29.8	24.6	31.5	26.2	39.7	34.1	33.7	29.9	39.4	34.9	47.5	30.9
% Moisture for Organics Con	%	25.2	20.6	36.9	31.7	32.6	25.6	33.1	28.8	33.4	51.7	30.6	33.2	29.8	24.6	31.5	26.2	39.7	34.1	33.7	29.9	39.4	34.9	47.5	30.9
Chloride	meq/L	4.37	NA	3.23	NA	0.536	NA	1.61	NA	NA	NA	6.91	NA	NA	NA	3.09	NA	4.53	NA	NA	NA	2.65	NA	2.27	0.797
Chloride	mg/L	39.2	39.8	67.4	77.7	34.4	30.8	57.4	78.7	95.5	364	157	259	NA	NA	79	NA	106	NA	NA	NA	31.9	NA	27.5	11.2
SPLP Chloride	mg/L	NA	NA	NA	28.0*	NA	NA	NA	NA	NA	NA	NA	59.3*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Br)	mg/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2.00	NA	<2.00	NA	NA	NA	3.61	NA	<2.00	<2.00
Bromide (Sat Paste)	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.050	NA	<0.050	NA	NA	NA	<0.050	NA	<0.050	<0.050
EC	mmhos/ cm	0.727	0.64	0.781	1.06	1.46	2.33	2.59	3.32	1.24	3.77	1.08	0.95	NA	NA	1.41	1.45	1.68	1.38	NA	NA	0.643	0.72	0.844	0.479
ESP	%	NA	NA	NA	NA	0.4	0.49	NA	1.34	1.5	NA	NA	NA	NA	NA	1.4	1.57	1.6	2.16	NA	NA	0.698	1.44	0.544	0.463
SAR	N/A	NA	NA	NA	NA	0.443	0.38	NA	0.87	1.28	NA	NA	NA	NA	NA	1.72	1.34	2.3	1.66	NA	NA	2.02	1.67	2.18	1.26
Calcium	meq/L	2.92	NA	2.94	NA	9.92	15.2	17.4	18.6	4.99	NA	3.8	NA	NA	NA	6.56	6.86	7.72	6.14	NA	NA	1.89	2.59	3.5	2.02
Magnesium	meq/L	1.54	NA	1.58	NA	4.72	6.52	11.1	12.1	2.7	NA	1.8	NA	NA	NA	4.01	4.05	4.29	3.18	NA	NA	1.17	1.45	1.85	1.14
Sodium	meq/L	1.73	NA	2.61	NA	1.2	1.27	3.54	3.43	2.5	NA	3.46	NA	NA	NA	3.95	3.14	5.63	3.59	NA	NA	2.5	2.38	3.57	1.59
SPLP Sodium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	NA	NA	NA	NA	63	70.8	NA	77.6	73	NA	NA	NA	NA	NA	66.5	79	63.9	70.4	NA	NA	62.2	65.2	67.8	61.7
Alkalinity (Sat. Paste)	meq/L	1.2	NA	3.3	NA	0.1	NA	1	NA	NA	NA	2.4	NA	NA	NA	0.8	NA	1.7	NA	NA	NA	0.4	NA	4.1	2.8
Sulfate	meq/L	0.737	NA	0.756	NA	16.7	NA	31.8	NA	NA	NA	0.368	NA	NA	NA	11.3	NA	12.1	NA	NA	NA	2.67	NA	1.21	1.11
Saturation %	%	35.3	NA	136	NA	140	NA	155	NA	NA	NA	129	NA	NA	NA	119	NA	123	NA	NA	NA	101	NA	138	110
pH (Saturated Paste)	s.u.	7.62	NA	8.06	NA	5.23	NA	7.19	NA	NA	NA	8.18	NA	NA	NA	6.69	NA	7.13	NA	NA	NA	6.66	NA	7.37	7.33
SPLP																									
SPLP Arsenic	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																									
Arsenic	mg/kg-dry	NA	NA	NA	NA	5.74	5.58	5.1	4.91	4.96	NA	NA	NA	2.36	<3.92	5.17	4.71	4.25	3.69	3.6	4.35	5.56	4.13	4.53	5.95
Barium	mg/kg-dry	NA	NA	NA	NA	205	213	170	181	161	NA	NA	NA	167	211	225	692	287	700	189	231	205	295	290	227
True Total Barium	mg/kg-dry	NA	NA	NA	NA	<500	356	<500	418	430	NA	NA	NA	394	336	772	3770	566	5430	432	321	631	1840	527	4750/415[b]/253[c]
Cadmium	mg/kg-dry	NA	NA	NA	NA	0.447	<0.499	0.402	<0.485	<0.499	NA	NA	NA	**1.7**	NA	<0.292	NA	<0.332	NA	**1.63**	NA	<0.33	NA	0.663	0.783
Chromium	mg/kg-dry	NA	NA	NA	NA	19.9	17.6	21.2	19.7	18.9	NA	NA	NA	27	NA	19.9	NA	27	NA	27.5	NA	22.8	NA	27	22.1
Lead	mg/kg-dry	NA	NA	NA	NA	17.2	16.6	17.5	16.5	15.4	NA	NA	NA	17.4	NA	16.2	NA	18.1	NA	15.05	NA	19.3	NA	20.4	21.3
Mercury	mg/kg-dry	NA	NA	NA	NA	0.0625	<0.103	0.064	<0.105	<0.106	NA	NA	NA	0.0702	NA	0.0527	NA	1.74	NA	0.0617	NA	0.0972	NA	0.0726	0.058
Selenium	mg/kg-dry	NA	NA	NA	NA	<1.48	<3.99	<1.49	<3.88	<3.99	NA	NA	NA	<0.712	NA	<1.46	NA	<1.66	NA	<0.754	NA	<1.65	NA	<1.9	<1.45
Silver	mg/kg-dry	NA	NA	NA	NA	<0.742	NA	<0.747	NA	NA	NA	NA	NA	<0.356	NA	<0.73	NA	<0.829	NA	<0.377	NA	<0.825	NA	<0.952	<0.724
Strontium	mg/kg-dry	NA	NA	NA	NA	NA	38.3	NA	43.8	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	mg/kg-dry	NA	NA	NA	NA	79.7	73.2	80.1	74.4	76.8	NA	NA	NA	79.9	NA	76.4	NA	72.8	NA	73	NA	83.3	NA	85	98.3
Hydrocarbons (Dry Weight)																									
Oil & Grease	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.10	NA	<0.10	NA	NA	NA	<0.10	NA	<0.10	<0.10
TPH-GRO (C6-C10)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C6-C8 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4.06	NA	<10.96	NA	NA	NA	<5.07	NA	<6.51	<4.02
C8-C10 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<8.13	NA	<21.9	NA	NA	NA	<10.12	NA	<13.01	<8.06
C10-C12 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2.92	NA	<3.32	NA	NA	NA	<3.3	NA	<3.81	<2.89
C12-C16 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2.92	NA	<3.32	NA	NA	NA	<3.3	NA	<3.81	<2.89
C16-C35 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<5.84	NA	<6.63	NA	NA	NA	<6.6	NA	<7.62	<5.79
C8-C10 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<5.42	NA	<14.61	NA	NA	NA	<6.75	NA	<8.69	<5.37
C10-C12 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.46	NA	<1.66	NA	NA	NA	<1.65	NA	<1.9	<1.45
C12-C16 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2.92	NA	<3.32	NA	NA	NA	<3.3	NA	<3.81	<2.89
C16-C21 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2.92	NA	<3.32	NA	NA	NA	<3.3	NA	<3.81	<2.89
C21-C35 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2.92	NA	<3.32	NA	NA	NA	<3.3	NA	<3.81	<2.89
PAH (Dry Weight)																									
2-Methylnaphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																									
Sum TPH Mixture	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum TPH Fraction	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA	ND	NA	NA	NA	ND	NA	ND	ND
Sum Total PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4A
Soil Analytical Data and Screening - Property Excluding Soil Remediation Areas
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

		On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site
		SB-8	SB-08	SB-8	SB-13	SB-13	SB-13	SB-13	SB-13	SB-13	SB-14	SB-14	SB-14	SB-14	SB-14	SB-14	SB-14	SB-15	SB-15	SB-15	SB-15	SB-15	SB-15	SB-15	SB-16
		0-2'	2-4'	2-4'	0-2'	0-2'	2-4'	2-4'	4-6'	6-8'	0-2'	0-2'	2-4'	2-4'	4-6'	6-8'	6-8'	0-2'	0-2'	2-4'	2-4'	4-6'	6-8'	6-8'	0-2'
		SB-8 (0-2')	SB-08 (2-4')	SB-8 (2-4')	SB-13 (0-2')	SB-13 (0-2')	SB-13 (2-4')	SB-13 (2-4')	SB-13 (4-6')	SB-13 (6-8')	SB-14 (0-2')	SB-14 (0-2')	SB-14 (2-4')	SB-14 (2-4')	SB-14 (4-6')	SB-14 (6-8')	SB-14 (6-8')	SB-15 (0-2')	SB-15 (0-2')	SB-15 (2-4')	SB-15 (2-4')	SB-15 (4-6')	SB-15 (6-8')	SB-15 (6-8')	SB-16 (0-2')
		06/21/22	06/21/22	06/21/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22
Salinity & Other	**Units**	ICON	HET	ICON	HET	ICON	HET	ICON	HET	HET	HET	ICON	HET	ICON	HET	HET	ICON	HET	ICON	HET	ICON	HET	HET	ICON	HET
% Moisture	%	33.2	34	33.9	39.5	42.5	39.7	38	41.3	44	40.1	39.2	38.8	36.7	42.4	44.2	53.3	41.4	34.3	39.2	34.1	41.2	43.4	41.6	43.6
% Moisture for Metals Conve	%	33.2	34	33.9	39.5	42.5	39.7	38	41.3	44	40.1	39.2	38.8	36.7	42.4	44.2	53.3	41.4	34.3	39.2	34.1	41.2	43.4	41.6	43.6
% Moisture for Organics Con	%	33.2	34	33.9	39.5	42.5	39.7	38	41.3	44	40.1	39.2	38.8	36.7	42.4	44.2	53.3	41.4	34.3	39.2	34.1	41.2	43.4	41.6	43.6
Chloride	meq/L	NA	1.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/L	NA	13.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chloride	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Br)	mg/Kg	NA	<2.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Sat Paste)	meq/L	NA	<0.050	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC	mmhos/ cm	0.63	0.455	0.31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ESP	%	0.73	<0.1	1.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SAR	N/A	1.06	1.51	1.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	meq/L	3.01	1.81	1.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	meq/L	1.57	0.947	0.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	meq/L	1.61	1.77	1.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	74.5	64.3	70.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (Sat. Paste)	meq/L	NA	2.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	meq/L	NA	0.926	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Saturation %	%	NA	118	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (Saturated Paste)	s.u.	NA	7.54	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP																									
SPLP Arsenic	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																									
Arsenic	mg/kg-dry	3.96	6.2	4.22	6.76	6.65	7.11	5.14	9.45	8.16	6.13	3.38	5.93	5.17	5.07	3.66	4.46	5.14	5.65	5.8	4.99	5.9	7.49	6.07	7.7
Barium	mg/kg-dry	1350	212	245	1101	408	522	197	267	416	292	247	278	929	250	249	530	287	258	235	297	294	231	217	234
True Total Barium	mg/kg-dry	42200	<500	1390	9640	3990	2840	1390	810	796	<500	4050	616	6640	518	<500	3360	539	762	<500	1470	537	3920	618	589
Cadmium	mg/kg-dry	NA	0.465	NA	0.774	NA	0.367	NA	0.589	0.809	0.62	NA	0.479	NA	0.46	<0.358	NA	0.742	NA	0.429	NA	0.432	0.449	NA	0.663
Chromium	mg/kg-dry	NA	22.1	NA	30.9	NA	19.2	NA	19.6	18.6	22.7	NA	20.9	NA	19	18	NA	21.2	NA	21	NA	20.2	17.39	NA	19.7
Lead	mg/kg-dry	NA	17.7	NA	42.8	NA	17.7	NA	17.2	18.6	22.5	NA	17.6	NA	18.2	17.65	NA	21.3	NA	17.8	NA	16.04	18.7	NA	20.7
Mercury	mg/kg-dry	NA	0.0312	NA	0.0737	NA	0.06	NA	0.0625	0.0609	**0.22**	NA	**1.474**	NA	0.063	0.057	NA	0.0609	NA	0.07	NA	0.0633	0.0758	NA	0.0787
Selenium	mg/kg-dry	NA	<1.52	NA	<1.65	NA	<1.66	NA	<1.7	<1.79	<1.67	NA	<1.63	NA	<1.74	<1.79	NA	<1.71	NA	<1.64	NA	<1.7	<1.77	NA	<1.77
Silver	mg/kg-dry	NA	<0.758	NA	<0.826	NA	<0.829	NA	<0.852	<0.893	<0.835	NA	<0.817	NA	<0.868	<0.896	NA	<0.853	NA	<0.822	NA	<0.85	<0.883	NA	<0.887
Strontium	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	mg/kg-dry	NA	82.3	NA	119.5	NA	80	NA	81.3	78.9	93.2	NA	82.4	NA	72.2	65.2	NA	102	NA	81.4	NA	77	65.2	NA	85.8
Hydrocarbons (Dry Weight)																									
Oil & Grease	%	NA	<0.10	NA	<0.10	NA	<0.10	NA	<0.10	<0.10	<0.10	NA	<0.10	NA	<0.10	<0.10	NA	<0.10	NA	<0.10	NA	<0.10	<0.10	NA	<0.10
TPH-GRO (C6-C10)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C6-C8 Aliphatics	mg/kg-dry	NA	<4.56	NA	<4.99	NA	<4.64	NA	<5.5	<7.21	<4.54	NA	<4.75	NA	<5.12	<7.22	NA	<4.69	NA	<4.74	NA	<5.03	<6.54	NA	<6.29
C8-C10 Aliphatics	mg/kg-dry	NA	<9.12	NA	<10	NA	<9.29	NA	<10.99	<14.45	<9.08	NA	<9.49	NA	<10.23	<14.44	NA	<9.39	NA	<9.49	NA	<10.09	<13.09	NA	<12.61
C10-C12 Aliphatics	mg/kg-dry	NA	<3.03	NA	<3.31	NA	<3.32	NA	<3.41	<3.57	<3.34	NA	<3.27	NA	<3.47	<3.58	NA	<3.41	NA	<3.29	NA	<3.4	<3.53	NA	<3.55
C12-C16 Aliphatics	mg/kg-dry	NA	<3.03	NA	<3.31	NA	<3.32	NA	<3.41	<3.57	<3.34	NA	<3.27	NA	<3.47	<3.58	NA	<3.41	NA	<3.29	NA	<3.4	<3.53	NA	<3.55
C16-C35 Aliphatics	mg/kg-dry	NA	<6.06	NA	<6.61	NA	<6.63	NA	<6.81	<7.14	<6.68	NA	<6.54	NA	<6.94	<7.17	NA	<6.83	NA	<6.58	NA	<6.8	<7.07	NA	<7.09
C8-C10 Aromatics	mg/kg-dry	NA	<6.09	NA	<6.66	NA	<6.19	NA	<7.33	<9.63	<6.06	NA	<6.34	NA	<6.82	<9.64	NA	<6.26	NA	<6.33	NA	<6.72	<8.73	NA	<8.4
C10-C12 Aromatics	mg/kg-dry	NA	<1.52	NA	<1.65	NA	<1.66	NA	<1.7	<1.79	<1.67	NA	<1.63	NA	<1.74	<1.79	NA	<1.71	NA	<1.64	NA	<1.7	<1.77	NA	<1.77
C12-C16 Aromatics	mg/kg-dry	NA	<3.03	NA	<3.31	NA	<3.32	NA	<3.41	3.96	<3.34	NA	<3.27	NA	<3.47	4.37	NA	<3.41	NA	<3.29	NA	<3.4	7.93	NA	<3.55
C16-C21 Aromatics	mg/kg-dry	NA	<3.03	NA	<3.31	NA	<3.32	NA	<3.41	<3.57	<3.34	NA	<3.27	NA	<3.47	<3.58	NA	<3.41	NA	<3.29	NA	<3.4	<3.53	NA	<3.55
C21-C35 Aromatics	mg/kg-dry	NA	<3.03	NA	<3.31	NA	<3.32	NA	<3.41	<3.57	<3.34	NA	<3.27	NA	<3.47	4.34	NA	<3.41	NA	<3.29	NA	<3.4	<3.53	NA	<3.55
PAH (Dry Weight)																									
2-Methylnaphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																									
Sum TPH Mixture	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum TPH Fraction	mg/kg-dry	NA	ND	NA	ND	NA	ND	NA	ND	4	ND	NA	ND	NA	ND	9	NA	ND	NA	ND	NA	ND	8	NA	ND
Sum Total PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4A
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Grand River Oil & Gas Field
Iberville Parish, Louisiana

		On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site
		SB-16	SB-16	SB-16	SB-16	SB-16	SB-16	SB-21	SB-21	SB-22	SB-22	SB-23	SB-23	SB-24	SB-24	SB-25	SB-25	SB-25	SB-25	SB-26	SB-26	SB-26	SB-26	SB-27
		0-2'	2-4'	2-4'	4-6'	6-8'	6-8'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	2-4'	2-4'	0-2'	0-2'	2-4'	2-4'	0-2'
		SB-16 (0-2')	SB-16 (2-4')	SB-16 (2-4')	SB-16 (4-6')	SB-16 (6-8')	SB-16 (6-8')	SB-21 (0-2')	SB-21 (0-2')	SB-22 (0-2')	SB-22 (0-2')	SB-23 (0-2')	SB-23 (0-2')	SB-24 (0-2')	SB-24 (0-2')	SB-25 (0-2')	SB-25 (0-2')	SB-25 (2-4')	SB-25 (2-4')	SB-26 (0-2')	SB-26 (0-2')	SB-26 (2-4')	SB-26 (2-4')	SB-27 (0-2')
		06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	09/27/22	09/27/22	09/27/22	09/27/22	09/27/22	09/27/22	09/27/22	09/27/22	09/27/22
Salinity & Other	**Units**	ICON	HET	ICON	HET	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET
% Moisture	%	39.8	41.9	37	42.4	44.1	46.5	41.1	31.7	39.7	35.6	36.2	34.2	38.9	34.9	27.5	24.6	33	32.8	30.1	28.9	37.1	36.1	35.8
% Moisture for Metals Conve	%	39.8	41.9	37	42.4	44.1	46.5	41.1	31.7	39.7	35.6	36.2	34.2	38.9	34.9	27.5	24.6	33	32.8	30.1	28.9	37.1	36.1	35.8
% Moisture for Organics Con	%	39.8	41.9	37	42.4	44.1	46.5	41.1	31.7	39.7	35.6	36.2	34.2	38.9	34.9	27.5	24.6	33	32.8	30.1	28.9	37.1	36.1	35.8
Chloride	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chloride	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Br)	mg/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Sat Paste)	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC	mmhos/ cm	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ESP	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SAR	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (Sat. Paste)	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Saturation %	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (Saturated Paste)	s.u.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP																								
SPLP Arsenic	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																								
Arsenic	mg/kg-dry	7.06	5.87	4.76	3.94	3.9	4.23	NA	5.58	NA	6.92	NA	4.3	NA	3.21	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	mg/kg-dry	1010	260	350	234	263	438	NA	1370	NA	546	NA	202	NA	179	139	239	161	271	187	232	170	236	171
True Total Barium	mg/kg-dry	4960	570	723	<500	<500	1170	NA	6910	NA	3150	NA	492	NA	537	404	370	408	398	410	481	426	395	448
Cadmium	mg/kg-dry	NA	0.45	NA	<0.347	0.487	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	mg/kg-dry	NA	21	NA	19	17.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	mg/kg-dry	NA	17	NA	16.96	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	mg/kg-dry	NA	0.059	NA	0.0606	0.0583	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	mg/kg-dry	NA	<1.72	NA	<1.74	<1.79	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	mg/kg-dry	NA	<0.861	NA	<0.868	<0.894	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	mg/kg-dry	NA	80.6	NA	73	52.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrocarbons (Dry Weight)																								
Oil & Grease	%	NA	<0.10	NA	<0.10	0.1	NA	<0.10	NA	<0.10	NA	<0.10	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO (C6-C10)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C6-C8 Aliphatics	mg/kg-dry	NA	<6.01	NA	<6.18	<6.35	NA	<5.96	NA	<5.94	NA	<4.69	NA	<5.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aliphatics	mg/kg-dry	NA	<12.01	NA	<12.38	<12.72	NA	<11.94	NA	<11.87	NA	<9.37	NA	<10.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aliphatics	mg/kg-dry	NA	<3.44	NA	<3.47	<3.58	NA	<3.4	NA	<3.32	NA	<3.13	NA	<3.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aliphatics	mg/kg-dry	NA	<3.44	NA	<3.47	<3.58	NA	6.25	NA	<3.32	NA	<3.13	NA	<3.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C35 Aliphatics	mg/kg-dry	NA	<6.88	NA	<6.94	<7.16	NA	103.1	NA	8.89	NA	21.2	NA	9.62	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aromatics	mg/kg-dry	NA	<8	NA	<8.25	<8.48	NA	<7.95	NA	<7.91	NA	<6.24	NA	<6.78	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aromatics	mg/kg-dry	NA	<1.72	NA	<1.74	<1.79	NA	<1.7	NA	<1.66	NA	<1.57	NA	<1.64	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aromatics	mg/kg-dry	NA	<3.44	NA	<3.47	8.4	NA	7.86	NA	<3.32	NA	<3.13	NA	<3.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C21 Aromatics	mg/kg-dry	NA	<3.44	NA	<3.47	5.21	NA	11.14	NA	<3.32	NA	<3.13	NA	<3.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C21-C35 Aromatics	mg/kg-dry	NA	<3.44	NA	<3.47	<3.58	NA	<3.4	NA	<3.32	NA	<3.13	NA	<3.27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAH (Dry Weight)																								
2-Methylnaphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																								
Sum TPH Mixture	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum TPH Fraction	mg/kg-dry	NA	ND	NA	ND	14	NA	128	NA	9	NA	21	NA	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Total PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4B
Soil Analytical Data - Property Soil Remediation Areas
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

	Area:	LAA2-SRA	LAA2-SRA	LAA2-SRA	LAA2-SRA	LAA2-SRA	LAA2-SRA	LAA2-SRA	LAA2-SRA	LAA2-SRA	LAA2-SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA
	Area:	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site
	Location ID:	HA-1	HA-1	HA-1	HA-1	HA-01R	SB-17	SB-17	SB-18	SB-19	SB-20	HA-2	HA-2	HA-2	HA-2	SB-09	SB-09	SB-9	SB-09	SB-09	SB-10	SB-10
	Sample Depth:	0-2'	0-2'	2-4'	2-4'	2-4'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	0-2'	2-4'	2-4'	0-2'	2-4'	2-4'	4-6'	6-8'	0-2'	0-2'
	Sample Date:	08/29/19	08/29/19	08/29/19	08/29/19	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	06/23/22	08/29/19	08/29/19	08/29/19	08/29/19	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22
Salinity & Other	**Units**	ICON	HET	ICON	HET	HET	HET	ICON	HET	HET	HET	ICON	HET	ICON	HET	HET	HET	ICON	HET	HET	HET	ICON
% Moisture	%	45.7	51.8	37.7	48.2	57.4	60.2	NA	63.3	57.6	59.9	42.6	57.4	48.4	50.9	63.6	44.1	39.6	63.4	51.7	65.7	59.8
Chloride	meq/L	NA	5.88	NA	15	NA	NA	NA	NA	NA	NA	NA	2.5	NA	3.01	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/L	NA	45.1	NA	121	NA	NA	NA	NA	NA	NA	NA	12	NA	33.1	NA	NA	NA	NA	NA	NA	NA
SPLP Chloride	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Br)	mg/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Sat Paste)	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC	mmhos/ cm	1.31	1.5	1.55	2.72	NA	NA	NA	NA	NA	NA	0.94	0.877	1.46	2.42	NA	NA	NA	NA	NA	NA	NA
ESP	%	3.66	2.39	8.85	6.09	NA	NA	NA	NA	NA	NA	1.62	0.897	8.11	3.27	NA	NA	NA	NA	NA	NA	NA
SAR	N/A	5.4	4.96	13.0	14.8	9.32	NA	NA	NA	NA	NA	3.01	2.95	10.8	10	NA	NA	NA	NA	NA	NA	NA
Calcium	meq/L	2.59	3.69	1.03	2.13	1.62	NA	NA	NA	NA	NA	3.15	2.04	1.44	4.38	NA	NA	NA	NA	NA	NA	NA
Magnesium	meq/L	1.32	1.69	0.52	0.991	0.672	NA	NA	NA	NA	NA	1.3	1.07	0.72	1.53	NA	NA	NA	NA	NA	NA	NA
Sodium	meq/L	7.54	8.13	11.4	18.5	9.98	NA	NA	NA	NA	NA	4.49	3.68	11.2	17.2	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	56.5	48.3	55.3	48.7	NA	NA	NA	NA	NA	NA	35.7	54.3	65.5	44.8	NA	NA	NA	NA	NA	NA	NA
Alkalinity (Sat. Paste)	meq/L	NA	1.2	NA	2	NA	NA	NA	NA	NA	NA	NA	1.4	NA	3.8	NA	NA	NA	NA	NA	NA	NA
Sulfate	meq/L	NA	7.15	NA	7.92	NA	NA	NA	NA	NA	NA	NA	4.51	NA	14.7	NA	NA	NA	NA	NA	NA	NA
Saturation %	%	NA	90.6	NA	116	129	NA	NA	NA	NA	NA	NA	107	NA	116	NA	NA	NA	NA	NA	NA	NA
pH (Saturated Paste)	s.u.	NA	6.74	NA	7.48	NA	NA	NA	NA	NA	NA	NA	6.69	NA	7.91	NA	NA	NA	NA	NA	NA	NA
SPLP																						
SPLP Arsenic	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.7	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																						
Arsenic	mg/kg-dry	5.9	11.62	8.61	<8.9	NA	NA	NA	NA	NA	NA	23.4	<11.74	7.57	<10.2	<5.49	9.79	12.7	<5.46	<4.14	<5.83	6.35
Barium	mg/kg-dry	228	216	345	357	NA	NA	NA	NA	NA	NA	3630	12019	1030	1141	560	581	3570	182.2	234	155.7	3370
True Total Barium	mg/kg-dry	539	785	573	1170	NA	NA	NA	NA	NA	NA	265000	25700	3900	1920	2130	84300	160000	1490	1600	5750	21600
Cadmium	mg/kg-dry	0.658	<5.2	0.633	<4.4	NA	NA	NA	NA	NA	NA	7.52	<5.9	0.741	<5.1	0.857	2.56	NA	<0.546	<0.414	0.76	NA
Chromium	mg/kg-dry	17.9	38.2	21	25.5	NA	NA	NA	NA	NA	NA	435	89.2	19.8	31.2	20.22	191	NA	18.88	13.83	31.5	NA
Lead	mg/kg-dry	21.5	28.4	17.2	21	NA	NA	NA	NA	NA	NA	707	115.3	20.5	28.3	21.32	220	NA	14.4	14.99	29.4	NA
Mercury	mg/kg-dry	<0.107	<0.166	<0.0996	<0.137	NA	NA	NA	NA	NA	NA	2.08	<0.162	<0.0984	<0.151	0.0371	0.0742	NA	0.1637	0.0631	0.0603	NA
Selenium	mg/kg-dry	<3.87	<10.4	<3.96	<8.9	NA	NA	NA	NA	NA	NA	<3.69	<11.7	<3.85	<10.2	<2.75	<1.79	NA	<2.73	<2.07	<2.92	NA
Silver	mg/kg-dry	NA	<10.4	NA	<8.9	NA	NA	NA	NA	NA	NA	NA	<11.7	NA	<10.2	<1.374	1.483	NA	<1.366	<1.035	<1.458	NA
Strontium	mg/kg-dry	251	498	262	230	NA	NA	NA	NA	NA	NA	336	401	263	348	NA	NA	NA	NA	NA	NA	NA
Zinc	mg/kg-dry	80.3	130.9	71	90.2	NA	NA	NA	NA	NA	NA	1350	232.9	67.5	105.7	108.5	440	NA	52.7	56.5	114	NA
Hydrocarbons (Dry Weight)																						
Oil & Grease	%	9.36	8.4	0.16	NA	NA	11.2	2.2	2.05	1.97	2.92	12.4	1.2	2.13	0.2	<0.10	0.43	NA	0.45	<0.10	<0.10	NA
TPH-GRO (C6-C10)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	25783	NA	165	NA	NA	NA	13668	NA	NA	NA	24216	NA	3488	NA	NA	NA	2003	NA	NA	NA	353
TPH-ORO (>C28)	mg/kg-dry	30203	NA	223	NA	NA	NA	13291	NA	NA	NA	28920	NA	4516	NA	NA	NA	1046	NA	NA	NA	391
C6-C8 Aliphatics	mg/kg-dry	NA	<51.9	NA	<48.3	NA	25.08	NA	28.9	9.06	13.2	NA	<58.7	NA	<50.9	<9.75	<5.97	NA	<8.96	<5.9	<10.87	NA
C8-C10 Aliphatics	mg/kg-dry	NA	<51.9	NA	<48.3	NA	74.9	NA	120.2	33	36.4	NA	<58.7	NA	<50.9	<19.53	<11.95	NA	<17.9	<11.8	<21.75	NA
C10-C12 Aliphatics	mg/kg-dry	NA	<51.9	NA	<48.3	NA	<50.3	NA	<54.5	<47.2	<49.9	NA	<58.7	NA	<50.9	<5.49	50.3	NA	<5.46	<4.14	<5.83	NA
C12-C16 Aliphatics	mg/kg-dry	NA	112.9	NA	<48.3	NA	123.4	NA	202.2	333	352	NA	<58.7	NA	<50.9	<5.49	302	NA	<5.46	4.95	11.98	NA
C16-C35 Aliphatics	mg/kg-dry	NA	932	NA	<48.3	NA	1714	NA	1692	3019	4539	NA	<58.7	NA	<50.9	14.86	1038	NA	<10.93	29.4	189.8	NA
C8-C10 Aromatics	mg/kg-dry	NA	<51.9	NA	<48.3	NA	25.9	NA	41.7	29.7	14.76	NA	<58.7	NA	<50.9	<13.02	8.53	NA	<11.94	<7.87	<14.52	NA
C10-C12 Aromatics	mg/kg-dry	NA	<51.9	NA	<48.3	NA	27.9	NA	19.9	9.17	45	NA	<58.7	NA	<50.9	<2.75	41.9	NA	<2.73	<2.07	<2.92	NA
C12-C16 Aromatics	mg/kg-dry	NA	124	NA	<48.3	NA	332	NA	191.3	51.4	516	NA	<58.7	NA	<50.9	<5.49	227	NA	14.13	5.45	15.31	NA
C16-C21 Aromatics	mg/kg-dry	NA	330	NA	<48.3	NA	204.8	NA	64.6	54.7	419	NA	77	NA	<50.9	6.68	153.5	NA	9.78	<4.14	35.6	NA
C21-C35 Aromatics	mg/kg-dry	NA	1815	NA	<48.3	NA	50.8	NA	29.2	6.23	53.9	NA	244	NA	<50.9	<5.49	46	NA	<5.46	<4.14	9.13	NA
PAH (Dry Weight)																						
2-Methylnaphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0282	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0282	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0444	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0282	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.052	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0282	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0282	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0441	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0282	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0511	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.132	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0282	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.0282	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0372	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0733	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																						
Sum TPH Mixture	mg/kg-dry	55986	NA	388	NA	NA	NA	26959	NA	NA	NA	53136	NA	8004	NA	NA	NA	3049	NA	NA	NA	744
Sum TPH Fraction	mg/kg-dry	NA	3314	NA	ND	NA	2579	NA	2390	3545	5989	NA	321	NA	ND	22	1867	NA	24	40	262	NA
Sum Total PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4B
Soil Analytical Data - Property Soil Remediation Areas
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

	Area:	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-WP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA
	Area:	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site
	Location ID:	SB-10	SB-10	SB-10	SB-10	SB-10	SB-11	SB-11	SB-11	SB-11	SB-11	SB-11	SB-12	SB-12	SB-12	SB-12	SB-01	SB-1	SB-01	SB-1	SB-02	SB-02
	Sample Depth:	2-4'	2-4'	4-6'	4-6'	6-8'	0-2'	0-2'	2-4'	2-4'	4-6'	6-8'	0-2'	0-2'	2-4'	2-4'	0-2'	0-2'	2-4'	2-4'	0-2'	2-4'
	Sample Date:	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	06/22/22	07/28/22	07/28/22	06/22/22	06/22/22	06/22/22	06/22/22	06/21/22	06/21/22	06/21/22	06/21/22	06/21/22	06/21/22
Salinity & Other	**Units**	HET	ICON	HET	ICON	HET	HET	ICON	HET	ICON	HET	HET	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	HET
% Moisture	%	50.5	44	65.5	51.5	67.1	57.7	61.9	50.6	44.1	44.8	46.1	57.8	65.8	40.7	22.8	38.8	41.2	52.2	44.2	47	40
Chloride	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.09	NA	2.46	NA	2	1.06
Chloride	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16.7	NA	46.9	NA	27.5	18.8
SPLP Chloride	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Br)	mg/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2.00	NA	<2.00	NA	<2.00	<2.00
Bromide (Sat Paste)	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.050	NA	<0.050	NA	<0.050	<0.050
EC	mmhos/ cm	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.467	0.52	0.75	1.14	0.656	0.462
ESP	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.58	0.77	1.03	1.62	0.632	0.67
SAR	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.14	1.13	2.2	1.99	1.42	1.37
Calcium	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.07	2.06	3.37	4.68	2.93	2.08
Magnesium	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.983	1.03	1.28	2.27	1.37	0.934
Sodium	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.41	1.4	3.36	3.71	2.08	1.68
SPLP Sodium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	68.7	74.3	67.4	77.4	57.8	64.3
Alkalinity (Sat. Paste)	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5	NA	2.9	NA	2.5	2.5
Sulfate	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.13	NA	1.51	NA	1.31	0.691
Saturation %	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	122	NA	138	NA	98.4	120
pH (Saturated Paste)	s.u.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.82	NA	7.42	NA	7.32	7.41
SPLP																						
SPLP Arsenic	mg/L	NA	NA	NA	NA	NA	NA	NA	<0.0277	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	NA	NA	NA	NA	NA	NA	NA	22	NA	NA	NA	NA	NA	5.12	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	NA	NA	NA	NA	NA	NA	NA	0.485	NA	NA	NA	NA	NA	0.148	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	NA	NA	NA	NA	NA	NA	NA	0.493	NA	NA	NA	NA	NA	0.16	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																						
Arsenic	mg/kg-dry	17	4.22	6.99	5.92	<6.08	5.86	8.47	33.8	28.1	4.93	5.36	4.88	5.34	39.3	61.3	5.95	3.85	6.5	6.57	7	5.48
Barium	mg/kg-dry	830	2320	464	485	178.4	284	3740	352	2040	226	223	1336	1350	567	1470	2255	3050	1554	2600	1489	2967
True Total Barium	mg/kg-dry	200000	64500	2900	2620	1030	14000	102000	239000	320000	463	491	7510	6510	307000	323000	25800	51900	9570	33700	64400	17900
Cadmium	mg/kg-dry	4.22	NA	0.583	NA	0.657	1.04	1.65	8.66	8.98	0.542	0.462	0.756	0.844	8.8	12.9	0.864	NA	0.473	NA	0.504	<0.333
Chromium	mg/kg-dry	313	NA	16.43	NA	15.65	109.9	196	579	327	28.8	27.5	25.6	22.3	676	172	288	NA	63.4	NA	90.9	39.7
Lead	mg/kg-dry	388	NA	19.54	NA	13.1	59	122	783	779	16.1	16.2	31	23.2	789	1060	92	NA	31	NA	57.2	30.5
Mercury	mg/kg-dry	1.372	NA	0.0867	NA	0.1167	0.248	0.523	2.69	2.1	0.052	0.063	2.7	<0.109	0.1218	2.06	0.0516	NA	<0.0278	NA	0.213	0.1575
Selenium	mg/kg-dry	<2.02	NA	<2.9	NA	<3.04	<2.36	NA	<2.02	NA	<0.906	<0.928	<2.37	NA	<1.69	NA	<1.63	NA	<2.09	NA	<1.89	<1.67
Silver	mg/kg-dry	2.57	NA	<1.449	NA	<1.52	<1.182	NA	7.17	NA	<0.453	<0.464	<1.185	NA	7	NA	<0.817	NA	<1.046	NA	<0.943	<0.833
Strontium	mg/kg-dry	NA	NA	NA	NA	NA	NA	223	NA	449	NA	NA	NA	99.6	NA	505	NA	NA	NA	NA	NA	NA
Zinc	mg/kg-dry	747	NA	63.5	NA	67.2	147.3	273	1484	1390	80.6	78.8	120.6	109	1578	2080	130.2	NA	86.4	NA	104.7	86.2
Hydrocarbons (Dry Weight)																						
Oil & Grease	%	3.64	NA	0.31	NA	0.57	0.2	<0.05	1.86	0.14	<0.10	<0.10	<0.10	<0.05	0.24	0.21	<0.10	NA	<0.10	NA	<0.10	<0.10
TPH-GRO (C6-C10)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	NA	8571	NA	307	NA	NA	370	NA	14079	NA	NA	NA	85.4	NA	6373	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28)	mg/kg-dry	NA	8571	NA	307	NA	NA	323	NA	8157	NA	NA	NA	249.4	NA	1865	NA	NA	NA	NA	NA	NA
C6-C8 Aliphatics	mg/kg-dry	7.8	NA	<10.7	NA	<11.98	<7.8	NA	48.2	NA	NA	NA	36	NA	12.43	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aliphatics	mg/kg-dry	50.9	NA	<21.36	NA	<23.92	<15.63	NA	109.5	NA	NA	NA	134.1	NA	60.2	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aliphatics	mg/kg-dry	<40.4	NA	<5.8	NA	<6.08	<4.73	NA	20.6	NA	<3.62	<3.71	<4.74	NA	60.4	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aliphatics	mg/kg-dry	83.6	NA	6.49	NA	<6.08	27.4	NA	243	NA	<3.62	<3.71	6	NA	396	NA	NA	NA	NA	NA	NA	NA
C16-C35 Aliphatics	mg/kg-dry	758	NA	20.99	NA	19.24	92.9	NA	816	NA	<7.25	<7.42	62.8	NA	728	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aromatics	mg/kg-dry	15.27	NA	<14.23	NA	<15.96	<10.43	NA	29.8	NA	NA	NA	51.9	NA	22.3	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aromatics	mg/kg-dry	<20.2	NA	<2.9	NA	<3.04	5.11	NA	32.2	NA	<1.81	<1.86	<2.37	NA	59.9	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aromatics	mg/kg-dry	110.5	NA	12.12	NA	15.11	19.1	NA	164	NA	<3.62	<3.71	6.02	NA	157.8	NA	NA	NA	NA	NA	NA	NA
C16-C21 Aromatics	mg/kg-dry	78.4	NA	<5.8	NA	12.4	8.06	NA	41.1	NA	<3.62	<3.71	<4.74	NA	33.4	NA	NA	NA	NA	NA	NA	NA
C21-C35 Aromatics	mg/kg-dry	<40.4	NA	<5.8	NA	7.81	<4.73	NA	21.1	NA	<3.62	<3.71	<4.74	NA	<3.37	NA	NA	NA	NA	NA	NA	NA
PAH (Dry Weight)																						
2-Methylnaphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																						
Sum TPH Mixture	mg/kg-dry	NA	17142	NA	614	NA	NA	693	NA	22236	NA	NA	NA	335	NA	8238	NA	NA	NA	NA	NA	NA
Sum TPH Fraction	mg/kg-dry	1104	NA	40	NA	55	153	NA	1526	NA	ND	ND	297	NA	1530	NA	NA	NA	NA	NA	NA	NA
Sum Total PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4B
Soil Analytical Data - Property Soil Remediation Areas
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

	Area:	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA	LAA3-EP SRA
	Area:	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site	On-Site
	Location ID:	SB-03	SB-3	SB-03	SB-3	SB-04	SB-4	SB-04	SB-4	SB-04	SB-05R	SB-05R	SB-05	SB-5	SB-05	SB-5	SB-05R
	Sample Depth:	0-2'	0-2'	2-4'	2-4'	0-2'	0-2'	2-4'	2-4'	4-6'	0-2'	0-2'	2-4'	2-4'	4-6'	4-6'	6-8'
	Sample Date:	06/21/22	06/21/22	06/21/22	06/21/22	06/21/22	06/21/22	06/21/22	06/21/22	06/21/22	09/27/22	09/27/22	06/21/22	06/21/22	06/21/22	06/21/22	09/27/22
Salinity & Other	**Units**	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	HET	ICON	HET	ICON	HET	ICON	HET
% Moisture	%	35.4	33.7	41.2	36.9	28.7	23.5	30.4	28.3	46.4	28.5	27.4	35	33.4	39.7	34.4	45.1
Chloride	meq/L	1.07	NA	2.19	NA	1.24	NA	2.71	NA	5.82	NA	NA	0.771	NA	1.43	NA	NA
Chloride	mg/L	20	NA	45	NA	11.3	NA	44	NA	67.9	NA	NA	13.6	NA	21.3	NA	NA
SPLP Chloride	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Br)	mg/Kg	3.01	NA	3.23	NA	3.86	NA	3.36	NA	<2.00	NA	NA	<2.00	NA	<2.00	NA	NA
Bromide (Sat Paste)	meq/L	<0.050	NA	<0.050	NA	<0.050	NA	<0.050	NA	<0.050	NA	NA	<0.050	NA	<0.050	NA	NA
EC	mmhos/ cm	0.74	0.78	0.747	0.59	0.768	0.64	0.72	0.73	1.12	NA	NA	0.431	0.34	0.63	0.32	NA
ESP	%	0.577	1.11	1.18	2.56	0.554	1.38	1.52	2.37	1.53	NA	NA	0.645	0.9	0.661	1.52	NA
SAR	N/A	1.17	1.22	2.61	2.45	1.16	1.07	3.3	2.71	3.5	NA	NA	1.22	1.02	1.96	1.14	NA
Calcium	meq/L	4.01	3.7	2.71	1.6	4.26	2.87	2.15	1.99	3.67	NA	NA	1.96	1.41	2.52	1.1	NA
Magnesium	meq/L	1.59	1.62	1.12	0.81	1.43	1.17	0.899	1.03	1.6	NA	NA	0.982	0.73	1.19	0.59	NA
Sodium	meq/L	1.96	1.99	3.61	2.69	1.95	1.52	4.07	3.33	5.68	NA	NA	1.48	1.05	2.67	1.05	NA
SPLP Sodium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	40.2	25.8	64.3	60.5	23.1	7.91	59.6	29	70.9	NA	NA	53.9	63.1	63.5	66.6	NA
Alkalinity (Sat. Paste)	meq/L	4.8	NA	3.8	NA	4	NA	2.9	NA	3.7	NA	NA	2.6	NA	3	NA	NA
Sulfate	meq/L	0.365	NA	1.19	NA	0.492	NA	0.764	NA	1.02	NA	NA	0.436	NA	1.31	NA	NA
Saturation %	%	98.4	NA	128	NA	67.7	NA	121	NA	119	NA	NA	98.8	NA	121	NA	NA
pH (Saturated Paste)	s.u.	7.62	NA	7.62	NA	7.81	NA	7.99	NA	7.7	NA	NA	7.28	NA	7.56	NA	NA
SPLP																	
SPLP Arsenic	mg/L	NA	NA	NA	NA	<0.0277	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	5.06	NA	NA	NA	3.63	NA	7.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	0.0522	NA	NA	NA	0.118	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	0.0202	NA	NA	NA	0.086	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																	
Arsenic	mg/kg-dry	11.56	12	3.44	3.22	16.5	13.3	8.12	9	<3.73	2.13	6.88	5.03	4.73	3.53	3.41	NA
Barium	mg/kg-dry	684	4510	2126	1110	387	4230	3549	3610	875	389	328	2815	4460	2206	2580	991
True Total Barium	mg/kg-dry	207000	412000	8300	12100	301000	439000	43900	434000	5370	219	467	90100	116000	6060	16900	NA
Cadmium	mg/kg-dry	0.794	0.654	<0.34	<0.495	0.641	0.611	0.507	0.496	0.381	1.78	<0.997	<0.308	NA	<0.332	NA	NA
Chromium	mg/kg-dry	800	481	29.1	17.7	579	220	30.7	67.4	19.4	29	26.1	186	NA	33.5	NA	NA
Lead	mg/kg-dry	288	302	20.6	14.8	293	266	30.6	146	18.8	18.5	20.6	92.8	NA	22.2	NA	NA
Mercury	mg/kg-dry	0.1127	1.12	0.993	<0.106	0.0718	1.24	1.62	0.548	0.1246	0.074	NA	0.0682	NA	0.0556	NA	NA
Selenium	mg/kg-dry	<1.55	NA	<1.7	NA	<1.4	NA	<7.18	NA	<1.87	<0.699	<7.98	<1.54	NA	<1.66	NA	NA
Silver	mg/kg-dry	1.077	NA	<0.85	NA	1.71	NA	<0.718	NA	<0.933	<0.35	NA	<0.769	NA	<0.829	NA	NA
Strontium	mg/kg-dry	NA	219	NA	53.8	NA	200	NA	112	NA	NA	42.9	NA	NA	NA	NA	NA
Zinc	mg/kg-dry	231	207	76.2	61.1	230	186	79.9	127	70.5	80.7	91.8	88.2	NA	78.3	NA	NA
Hydrocarbons (Dry Weight)																	
Oil & Grease	%	0.25	NA	<0.10	NA	<0.10	NA	0.1	NA	<0.10	NA	NA	<0.10	NA	<0.10	NA	NA
TPH-GRO (C6-C10)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	NA	2157	NA	16.5	NA	1008	NA	1883	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28)	mg/kg-dry	NA	345	NA	21.9	NA	158	NA	326	NA	NA	NA	NA	NA	NA	NA	NA
C6-C8 Aliphatics	mg/kg-dry	12.52	NA	<5.07	NA	9.5	NA	<3.97	NA	<6.7	NA	NA	<4.37	NA	<4.56	NA	NA
C8-C10 Aliphatics	mg/kg-dry	34.5	NA	10.39	NA	24	NA	<7.93	NA	<13.4	NA	NA	<8.74	NA	<9.12	NA	NA
C10-C12 Aliphatics	mg/kg-dry	<3.1	NA	<3.4	NA	80	NA	<2.87	NA	<3.73	NA	NA	<3.08	NA	<3.32	NA	NA
C12-C16 Aliphatics	mg/kg-dry	35.9	NA	<3.4	NA	506	NA	5.24	NA	<3.73	NA	NA	14.52	NA	<3.32	NA	NA
C16-C35 Aliphatics	mg/kg-dry	107.7	NA	<6.8	NA	620	NA	9.94	NA	<7.46	NA	NA	35.8	NA	<6.63	NA	NA
C8-C10 Aromatics	mg/kg-dry	9.6	NA	25.7	NA	6.8	NA	<5.29	NA	<8.92	NA	NA	<5.83	NA	<6.09	NA	NA
C10-C12 Aromatics	mg/kg-dry	6.25	NA	<1.7	NA	107	NA	<1.44	NA	<1.87	NA	NA	<1.54	NA	<1.66	NA	NA
C12-C16 Aromatics	mg/kg-dry	31.9	NA	<3.4	NA	292	NA	<2.87	NA	<3.73	NA	NA	9.58	NA	<3.32	NA	NA
C16-C21 Aromatics	mg/kg-dry	4.58	NA	<3.4	NA	39.6	NA	<2.87	NA	<3.73	NA	NA	<3.08	NA	<3.32	NA	NA
C21-C35 Aromatics	mg/kg-dry	<3.1	NA	<3.4	NA	<28.1	NA	<2.87	NA	<3.73	NA	NA	<3.08	NA	<3.32	NA	NA
PAH (Dry Weight)																	
2-Methylnaphthalene	mg/kg-dry	NA	NA	NA	NA	5.62	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NA	NA	NA	NA	0.65	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NA	NA	NA	NA	<0.0302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NA	NA	NA	NA	0.261	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NA	NA	NA	NA	<0.0302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NA	NA	NA	NA	<0.0302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NA	NA	NA	NA	<0.0302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NA	NA	NA	NA	<0.0302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NA	NA	NA	NA	<0.0302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NA	NA	NA	NA	<0.0302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NA	NA	NA	NA	0.0564	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NA	NA	NA	NA	0.532	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NA	NA	NA	NA	<0.0302	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NA	NA	NA	NA	0.853	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NA	NA	NA	NA	0.175	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																	
Sum TPH Mixture	mg/kg-dry	NA	2502	NA	38	NA	1166	NA	2209	NA	NA	NA	NA	NA	NA	NA	NA
Sum TPH Fraction	mg/kg-dry	243	NA	36	NA	1685	NA	15	NA	ND	NA	NA	60	NA	ND	NA	NA
Sum Total PAH	mg/kg-dry	NA	NA	NA	NA	9.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	NA	NA	NA	NA	8.92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	NA	NA	NA	NA	0.23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4C
Soil Analytical Data - Off-Site
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

	Area:	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site
	Location ID:	HA-3	HA-3	HA-3	HA-3	HA-3	HA-3	HA-3	HA-3	LT-7	LT-7	LT-7	LT-7	LT-7	LT-7	LT-7	LT-7	LT-7	LT-7	LT-7	LT-7	LT-7	LT-8	LT-8	LT-8
	Sample Depth:	0-2'	0-2'	2-4'	2-4'	4-6'	4-6'	6-8'	6-8'	0-2'	0-2'	4-6'	4-6'	8-10'	16-18'	16-18'	20-22'	20-22'	24-26'	24-26'	36-38'	36-38'	0-2'	4-6'	8-10'
	Sample Date:	08/29/19	08/29/19	08/29/19	08/29/19	08/29/19	08/29/19	08/29/19	08/29/19	06/27/22	06/27/22	06/27/22	06/27/22	06/27/22	06/27/22	06/27/22	06/27/22	06/27/22	06/27/22	06/27/22	06/27/22	06/27/22	06/28/22	06/28/22	06/28/22
Salinity & Other	**Units**	ICON	HET	ICON	HET	ICON	HET	ICON	HET	HET	ICON	HET	ICON	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	ICON	ICON	HET
% Moisture	%	37.2	40.2	38.3	44.5	37.3	45.1	37.9	40.9	18.9	17.4	23.5	24.2	25.6	43.4	40.7	54.1	41.5	38.8	35.4	38.7	39	25.7	24.9	24.3
Chloride	meq/L	NA	2.76	NA	14.7	NA	26.1	NA	38.3	0.548	NA	0.386	NA	NA	1.26	NA	2.38	NA	1.34	NA	3.41	NA	NA	NA	1.15
Chloride	mg/L	NA	25.1	NA	218	NA	398	NA	721	8.81	17.5	6.08	7.83	8.98	22.3	40.3	25	43.2	22.8	35.6	38.9	36.3	10.1	7	11
SPLP Chloride	mg/L	NA	NA	NA	NA	NA	NA	321*	40.2	NA	4.84*	NA	2.47*	NA	NA	NA	NA	NA	NA	13.9*	NA	16.1*	2.79*	1.84*	NA
Bromide (Br)	mg/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Sat Paste)	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC	mmhos/ cm	0.56	0.696	1.66	1.96	2.83	3.07	3.62	4.45	0.47	0.52	0.268	0.24	0.47	0.701	0.62	0.963	0.58	0.705	0.6	1.07	0.82	0.4	0.48	0.49
ESP	%	1.89	1.91	7.67	4.27	13.8	NA	11	NA	0.4	1.24	NA	1.28	1.3	NA	NA	NA	NA	NA	NA	NA	NA	1.46	1.55	NA
SAR	N/A	2.65	4.39	8.27	10.1	15.1	NA	12.9	NA	0.679	0.52	NA	0.44	0.5	NA	NA	NA	NA	NA	NA	NA	NA	0.47	0.6	NA
Calcium	meq/L	1.59	1.62	2.34	2.68	2.46	3.01	4.48	8.02	2.63	2.81	1.41	1.21	2.15	2.93	NA	4.01	NA	3.06	NA	3.97	NA	1.96	2.26	1.91
Magnesium	meq/L	0.75	<0.820	1.15	1.1	1.28	1.36	2.54	3.45	1.39	1.18	0.544	0.52	0.97	1.23	NA	1.63	NA	1.16	NA	1.99	NA	0.8	0.92	0.781
Sodium	meq/L	2.87	3.95	10.9	13.9	20.6	22.5	24.2	34.6	0.963	0.74	0.609	0.41	0.63	1.66	NA	2.26	NA	1.55	NA	2.12	NA	0.56	0.76	1.1
SPLP Sodium	mg/L	NA	NA	NA	NA	NA	NA	NA	197	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	64.2	55.2	56.7	54.3	50.3	NA	52.8	NA	23.1	29.4	NA	20.7	27.8	NA	NA	NA	NA	NA	NA	NA	NA	18.8	16.2	NA
Alkalinity (Sat. Paste)	meq/L	NA	1.4	NA	1.8	NA	1.6	NA	1.8	2.5	NA	1.8	NA	NA	3.4	NA	3	NA	4	NA	4.6	NA	NA	NA	2.2
Sulfate	meq/L	NA	1.59	NA	1.47	NA	0.844	NA	3.21	0.616	NA	0.27	NA	NA	1.42	NA	1.95	NA	1	NA	1.36	NA	NA	NA	0.867
Saturation %	%	NA	116	NA	126	NA	144	NA	120	62.7	NA	58	NA	NA	113	NA	93.2	NA	98.1	NA	95.7	NA	NA	NA	58.4
pH (Saturated Paste)	s.u.	NA	7.28	NA	7.05	NA	7.32	NA	7.08	7.58	NA	7.74	NA	NA	7.9	NA	7.81	NA	8.03	NA	8	NA	NA	NA	7.91
SPLP																									
SPLP Arsenic	mg/L	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	NA	<1.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NA	<0.10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																									
Arsenic	mg/kg-dry	13.8	13.04	4.62	10.27	4.4	<9.1	8.77	14	5.72	4.47	6.6	4.79	4.06	NA	NA	NA	NA	NA	NA	NA	NA	2.61	3.96	5.73
Barium	mg/kg-dry	4250	463	951	519	314	319	535	340	149	144	136	141	160	NA	NA	NA	NA	NA	NA	NA	NA	119	133	144
True Total Barium	mg/kg-dry	16700	7510	2260	771	490	566	821	341	2910	234	<500	220	270	NA	NA	NA	NA	NA	NA	NA	NA	208	203	<500
Cadmium	mg/kg-dry	0.817	<4.2	<0.456	<4.1	0.501	<4.6	0.546	<4.2	<0.247	<0.500	<0.261	<0.494	<0.486	NA	NA	NA	NA	NA	NA	NA	NA	<0.500	<0.496	0.267
Chromium	mg/kg-dry	33.1	35.1	17.1	31.5	18.5	25.1	17.6	23.4	14.1	12.2	11.19	9.62	12.5	NA	NA	NA	NA	NA	NA	NA	NA	9.35	9.68	11.85
Lead	mg/kg-dry	47.2	26.1	18.5	24.5	17.9	18.9	15.8	17.8	11.17	9.71	8.22	7.58	10.3	NA	NA	NA	NA	NA	NA	NA	NA	7.02	6.76	9.31
Mercury	mg/kg-dry	0.135	NA	<0.107	<0.139	<0.105	<0.135	<0.101	<0.12	0.0224	<0.104	0.0281	<0.0991	<0.106	NA	NA	NA	NA	NA	NA	NA	NA	<0.107	<0.0928	0.038
Selenium	mg/kg-dry	<3.89	<8.4	<3.65	<8.1	<3.64	<9.1	<3.70	<8.3	<1.23	<4.00	<1.31	<3.95	<3.89	NA	NA	NA	NA	NA	NA	NA	NA	<4.00	<3.97	<1.32
Silver	mg/kg-dry	NA	<8.4	NA	<8.1	NA	<9.1	NA	<8.3	<0.617	NA	<0.654	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.661
Strontium	mg/kg-dry	175	NA	79.5	108	61	62.1	56.5	62.4	NA	26.7	NA	28.7	36	NA	NA	NA	NA	NA	NA	NA	NA	25.7	26	NA
Zinc	mg/kg-dry	90.5	98.3	69.9	99.6	72.6	88.3	64.8	77.2	52.8	48	40.9	35.4	50.2	NA	NA	NA	NA	NA	NA	NA	NA	35.3	34.6	46.1
Hydrocarbons (Dry Weight)																									
Oil & Grease	%	0.11	NA	0.6	NA	0.09	NA	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO (C6-C10)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	161	NA	177	NA	<79.7	NA	233	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28)	mg/kg-dry	317	NA	246	NA	97.9	NA	177	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C6-C8 Aliphatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aliphatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aliphatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aliphatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C35 Aliphatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aromatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aromatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aromatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C21 Aromatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C21-C35 Aromatics	mg/kg-dry	NA	<41.8	NA	NA	NA	NA	NA	<42.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAH (Dry Weight)																									
2-Methylnaphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																									
Sum TPH Mixture	mg/kg-dry	478	NA	423	NA	98	NA	410	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum TPH Fraction	mg/kg-dry	NA	ND	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Total PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4C
Soil Analytical Data - Off-Site
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

	Area:	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site	Off-Site
	Location ID:	LT-8	LT-8	LT-8	LT-8	LT-8	LT-8	LT-8	LT-8	LT-8	LT-9	LT-9	LT-9	LT-9	LT-9	LT-9	LT-9	LT-9	LT-9
	Sample Depth:	8-10'	16-18'	16-18'	20-22'	20-22'	24-26'	24-26'	36-38'	36-38'	0-2'	4-6'	4-6'	8-10'	8-10'	12-14'	12-14'	20-22'	20-22'
	Sample Date:	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22	06/28/22
Salinity & Other	**Units**	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON
% Moisture	%	27.4	24.2	26.1	27.6	22.7	28.5	29.6	32.3	28.7	25.9	27.1	26.6	27.5	25.4	25.8	26.4	35.8	28.3
Chloride	meq/L	NA	1.32	NA	1.04	NA	0.944	NA	2.02	NA	NA	0.312	NA	1.78	NA	1.72	NA	1.15	NA
Chloride	mg/L	17.4	17.8	25.3	16.5	14.6	10.7	17.7	31.5	43.2	10.2	4.75	8.15	19.1	25.6	23.8	31.8	20.9	18.9
SPLP Chloride	mg/L	NA	NA	NA	NA	NA	NA	11.9*	NA	12.6*	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Br)	mg/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromide (Sat Paste)	meq/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC	mmhos/ cm	0.42	0.488	0.5	0.422	0.34	0.662	0.44	0.695	0.56	0.39	0.496	0.41	0.574	0.49	0.525	0.48	0.659	0.43
ESP	%	1.5	NA	NA	NA	NA	NA	NA	NA	NA	1.2	NA	1.41	NA	1.25	NA	NA	NA	NA
SAR	N/A	0.81	NA	NA	NA	NA	NA	NA	NA	NA	0.54	NA	0.62	NA	0.7	NA	NA	NA	NA
Calcium	meq/L	1.53	1.88	NA	1.49	NA	2.68	NA	2.81	NA	1.93	2.45	1.87	2.19	1.78	2.04	NA	2.56	NA
Magnesium	meq/L	0.66	0.815	NA	0.647	NA	1.29	NA	1.28	NA	0.84	1.06	0.79	0.972	0.77	0.839	NA	1.26	NA
Sodium	meq/L	0.85	0.923	NA	0.94	NA	1.31	NA	1.28	NA	0.63	0.94	0.72	1.1	0.79	0.923	NA	1.16	NA
SPLP Sodium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CEC	meq/100g	21.3	NA	NA	NA	NA	NA	NA	NA	NA	24.5	NA	25.5	NA	24.3	NA	NA	NA	NA
Alkalinity (Sat. Paste)	meq/L	NA	2	NA	2	NA	3.4	NA	2.9	NA	NA	2.5	NA	2.2	NA	2	NA	3.4	NA
Sulfate	meq/L	NA	0.81	NA	0.492	NA	1.42	NA	0.783	NA	NA	1.19	NA	0.691	NA	0.687	NA	0.97	NA
Saturation %	%	NA	49.7	NA	50.2	NA	78	NA	80.2	NA	NA	70.6	NA	47.1	NA	52.7	NA	90.9	NA
pH (Saturated Paste)	s.u.	NA	7.91	NA	7.88	NA	7.91	NA	7.94	NA	NA	7.84	NA	7.81	NA	7.67	NA	7.89	NA
SPLP																			
SPLP Arsenic	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chromium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Lead	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Strontium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																			
Arsenic	mg/kg-dry	4.16	NA	NA	NA	NA	NA	NA	NA	NA	5.08	5.43	3.89	5.37	5.61	NA	NA	NA	NA
Barium	mg/kg-dry	147	NA	NA	NA	NA	NA	NA	NA	NA	137	166	156	130.2	149	NA	NA	NA	NA
True Total Barium	mg/kg-dry	261	NA	NA	NA	NA	NA	NA	NA	NA	196	<500	245	<500	180	NA	NA	NA	NA
Cadmium	mg/kg-dry	<0.491	NA	NA	NA	NA	NA	NA	NA	NA	<0.494	0.337	<0.489	<0.276	<0.497	NA	NA	NA	NA
Chromium	mg/kg-dry	10.9	NA	NA	NA	NA	NA	NA	NA	NA	10.5	13.9	11.5	11.2	10.4	NA	NA	NA	NA
Lead	mg/kg-dry	8.18	NA	NA	NA	NA	NA	NA	NA	NA	8	11.06	9.44	8.62	9.01	NA	NA	NA	NA
Mercury	mg/kg-dry	<0.104	NA	NA	NA	NA	NA	NA	NA	NA	<0.0935	0.068	<0.105	0.0432	<0.0949	NA	NA	NA	NA
Selenium	mg/kg-dry	<3.93	NA	NA	NA	NA	NA	NA	NA	NA	<3.95	<1.37	<3.91	<1.38	<3.98	NA	NA	NA	NA
Silver	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.686	NA	<0.69	NA	NA	NA	NA	NA
Strontium	mg/kg-dry	31.4	NA	NA	NA	NA	NA	NA	NA	NA	26.5	NA	32.5	NA	35.1	NA	NA	NA	NA
Zinc	mg/kg-dry	41.9	NA	NA	NA	NA	NA	NA	NA	NA	41.6	55.3	46	43.9	44.1	NA	NA	NA	NA
Hydrocarbons (Dry Weight)																			
Oil & Grease	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-GRO (C6-C10)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (C10-C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28)	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C6-C8 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C35 Aliphatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C8-C10 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C10-C12 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C12-C16 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C16-C21 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C21-C35 Aromatics	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAH (Dry Weight)																			
2-Methylnaphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																			
Sum TPH Mixture	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum TPH Fraction	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Total PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum LMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum HMW PAH	mg/kg-dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES:

Moisture reported for the sample was used for dry weight conversions.

For HET sample where % moisture was not analyzed, moisture data from the split sample was used for dry weight conversions.

ICON metals were reported in dry weight. HET metals and ICON and HET hydrocarbons (TPH, PAH) were reported in wet weight and converted to dry weight.

< - Not detected at or above the reporting limit shown.

NA - Not analyzed, NS - No Standard

LAA - Limited Admission Area

SRA - Soil Remediation Area

EP - Eastern Pit

WP - Western Pit

[a] Screening value shown for wetland soil is the higher of Louisiana soil background and lowest of the USEPA Eco-SSLs for bird, mammal, invertebrate, and plant, and the NOAA SQuiRT freshwater threshold effect concentration (TEC) and probable effect concentration (PEC). The screening value for barium is the higher of Louisiana soil background and calculated soil screening value.

[b] HET performed confirmatory analyses utilizing SGS North America that prepared (i.e., dried and crushed) sample retains obtained from Waypoint Analytical.

[c] HET performed confirmatory analyses utilizing SGS North America as-received (i.e., wet weight) sample retains obtained from Waypoint Analytical.

Gray cell indicates that sample location and/or sample depth is not evaluated.

Sum Totals for TPH Mixture, TPH Fractions, PAH, LMW PAH, and HMW PAH are calculated based on individual results.

- Sum TPH Mixture is the sum of TPH-G, TPH-D, and TPH-O.
- Sum TPH Fraction is the sum total of aliphatic and aromatic TPH fractions.
- Sum Total PAH is the sum total of 16 PAH.
- Sum LMW PAH is the sum total of 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene.
- Sum HMW PAH is the sum total of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene.

Value highlighted yellow and bolded indicates exceedance of ecological screening value.

TABLE 5
Barium Speciation
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Barium speciation by X-Ray Diffraction and Energy Dispersive X-Ray Spectroscopy

Sample:	**SB-03 (0-2')**	**SB-04 (0-2')**	**SB-11 (2-4')**	**SB-12 (2-4')**
Date:	**6/21/2022**	**6/21/2022**	**6/22/2022**	**6/22/2022**
Sampler:	**HET**	**HET**	**HET**	**HET**
Mineral Phases Identified by XRD				
Quartz	19.5	13.3	17.8	18.3
K-Feldspars	0.5	0.3	1.4	0.3
Plagioclase	0.6	1.2	1.0	1.4
Calcite	3.0	3.6	2.6	3.0
Pyrite	ND	ND	ND	ND
Fe Dolomite	ND	ND	ND	ND
Barium Sulfide	ND	ND	ND	ND
Barite	64.1	73.4	44.9	66.0
Witherite	ND	ND	ND	ND
Barium Chloride	ND	ND	ND	ND
Baria	ND	ND	ND	ND
Barium Peroxide	ND	ND	ND	ND
Total Clay	12.3	8.2	32.3	11.1
Total	100	100	100	100
Weight Percent Elemental Composition by EDX Normalized to 100%				
Carbon	2.17	2.27	3.90	2.67
Oxygen	32.64	31.41	35.68	32.53
Sodium	0.26	0.16	0.27	0.20
Magnesium	0.35	0.21	0.72	0.31
Aluminum	2.47	1.66	5.19	2.56
Silicon	8.66	7.09	13.25	8.77
Phosphorous	ND	ND	ND	ND
Sulfur	9.07	10.03	6.46	9.14
Chlorine	0.04	0.02	0.03	0.01
Potassium	0.63	0.48	1.31	0.62
Calcium	1.87	1.67	1.68	1.46
Chromium	ND	ND	ND	ND
Manganese	ND	ND	ND	ND
Iron	3.01	2.05	3.41	2.20
Zinc	ND	ND	0.42	0.41
Strontium	ND	ND	ND	ND
Barium	38.84	42.96	27.68	39.14
Titanium	ND	ND	ND	ND
Total	100	100	100	100

Notes:
ND - Non-detect
SB-03 and SB-04 are located in Limited Admission Area 3 - Eastern Pit Soil Remediation Area.
SB-11, and SB-12 are located in Limited Admission Area 3 - Western Pit Soil Remediation Area.

TABLE 5
Barium Speciation
August J. Levert, Jr., Family, LLC, et al. v. BP American Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Barium speciation by X-Ray Diffraction

Sample:	**HA-2 (0-2')**
Date:	**8/29/2019**
Sampler:	**HET**
Bulk Mineralogy Whole Sample (Wt %)	
Quartz	24.2
K-Feldspars	1.5
Plagioclase	2.5
Calcite	ND
Pyrite	ND
Fe Dolomite	ND
Barite	6.9
Total Clay	64.9
Total	100
Clay Mineralogy (Wt %)	
Illite	18.2
Kaolinite	14.0
Chlorite	--
Smectite	32.8
Mix-Layered Illite & Mica	--
% Illite layers in mixed layer I/S clay	--
Relative % Clay	
Illite	28.0
Kaolinite	21.6
Chlorite	--
Smectite	50.5
Mix-Layered Illite & Mica	--
Total	100

Notes:
ND - Non-detect
HA-2 is located in Limited Admission Area 3 - Western Pit Soil Remediation Area.

TABLE 6
Toxicity Reference Values (TRVs) for BERA
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Constituent	**TRV**			
	Avian (Northern Cardinal, American Robin, Spotted Sandpiper, Mallard, Snowy Egret)		**Mammal (Swamp Rabbit, Marsh Rice Rat, American Mink)**	
	mg/kg/day	**Source**	**mg/kg/day**	**Source**
Cadmium	1.47	USEPA (2005a)	0.77	USEPA (2005a)
Cadmium (CdS)	79[a,b]	Cooksy (2012); Pfaff (2021)	79[b]	Cooksy (2012); Pfaff (2021)
Mercury	3.25[c]	USEPA (1999; Table E-8)	1.01[d]	USEPA (1999; Table E-7)
Zinc	66.1	USEPA (2007c)	75.4	USEPA (2007c)
Zinc (ZnS)	894[e,f]	USEPA (1988)	894[f]	USEPA (1988)

[a]Mammal TRV for cadmium sulfate used as surrogate for avian TRV for cadmium sulfate.

[b]Cadmium sulfide; Acute (1 day) LD50 for rat of 7080 mg/day; uncertainty factor of 10 for interspecies variability, 3 for acute to chronic endpoint, and 3 for LOAEL to NOAEL.

[c]Mercuric chloride; Acute (5 day) LOAEL (mortality) for quail of 325 mg/kg/d; uncertainty factor of 10 applied to estimate from an acute to chronic endpoint (produces a very conservative TRV estimate.)

[d]Mercuric chloride; Chronic (6 month) NOAEL (reproduction) for mink of 1.01 mg/kg/day.

[e]Mammal TRV for zinc sulfate used as surrogate for avian TRV for zinc sulfate.

[f]Zinc sulfide; Acute (1 day) LD50 for rat of >50,000 mg/kg; uncertainty factor of 10 for interspecies variability, 3 for acute to chronic endpoint, and 3 for LOAEL to NOAEL.

TABLE 7
Soil/Sediment Bioavailability Factors for BERA
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

COPEC	Soil/Sediment Bioavailability Factor	Citation
Cadmium	0.036	Prokop et al. (2003); Shaheen et al. (2016); Feijtel (1986)
Mercury	0.00031	Xu et al. (2019); Chibunda et al. (2009); Chalmers et al. (2013)
Zinc	0.01 - 0.1	USEPA (2005); Feijtel (1986)

TABLE 8
Bioconcentration Factors (BCFs) for Food Items for BERA
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

COPEC	Soil- Plant BCF	Citation	Soil-Earthworm BCF	Citation	Soil-Mammal BCF	Citation
Cadmium	0.5860	Bechtel-Jacobs (1998a; Table 6)	7.708	Sample et al. (1998a; Table 11)	0.3330	Sample et al. (1998b; Table 7)
Mercury	0.2700	Fernández-Martínez (2015); Rodriguez (2007); Hamilton (2008)	1.693	Sample et al. (1998a; Table 11)	0.0534	Sample et al. (1998b; Table 7)
Zinc	0.3660	Bechtel-Jacobs (1998a; Table 6)	3.201	Sample et al. (1998a; Table 11)	0.7717	Sample et al. (1998b; Table 7)

TABLE 8
Bioconcentration Factors (BCFs) for Food Items for BERA
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

COPEC	Soil/Sediment - Benthic Invertebrate BCF	Citation	Sediment - Fish BCF	Citation
Cadmium	0.614	Bechtel Jacobs (1998b; Table 2)	0.42	Chen and Chen (1999; Table 2)
Mercury	0.48	Razavi (2013); USFWS (1994); Ridal et al. (2010); ERM (2019)	1.1	LDEQ LEAU database (2019); ERM (2019)
Zinc	2.33	Bechtel Jacobs (1998b; Table 2)	0.138	Chen and Chen (1999; Table 2)

TABLE 9
Species Factors for HQ Calculations for BERA
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Parameter	Description	Units	Northern Cardinal	Source	American Robin	Source	Spotted Sandpiper	Source
BW	Body weight of receptor	Kg	0.045	The Cornell Lab (2022b)[a]	0.0773	USEPA (1993; Page 2-197); [source: Clench & Leberman (1978)]; Sample & Suter (1994; Page 21; Table 4.9); [source: Dunning 1984])	0.0425	USEPA (1993; Page 2-152) [Source: Maxson & Oring (1980)][b]
Food IR	Ingestion rate of food	Kg/Kg BW/d	0.19	Nagy (2001)	0.132	Nagy (2001)	0.196	Nagy (2001), Seaman (2005), Elner (2005)
Soil / Sediment Ingestion	Ingestion Proportion of soil or sediment	Fraction of Total Diet	0.093	Beyer et al. (1994)[b]	0.02	Sample and Suter (1994; Page 22; Table 4.9); [Source: Beyer et al. (1994)]	0.17	Beyer et al. (1994)[d]
Fd (plants)	Fraction of diet consisting of plants		0.71	The Cornell Lab (2022b)[a]	0.41	USEPA (1993; Page 2-198); [Source: Wheelwright (1986)]	0	
Fd (inverts)	Fraction of diet consisting of soil invertebrates		0.29	The Cornell Lab (2022b)[a]	0.59	USEPA (1993; Page 2-198); [Source: Wheelwright (1986)]	0	
Fd (mammals)	Fraction of diet consisting of mammals		0		0		0	
Fd (benthic inverts)	Fraction of diet consisting of benthic invertebrates		0		0		1	USEPA (1993; Page 2-152); [Source: Maxson & Oring (1980)]
Fd (fish)	Fraction of diet consisting of fish		0		0		0	

NOTES:

[a]Northern Cardinal body weight: average of body weight range for adults (42-48 g).
[b]Surrogate value based on wild turkey.
[c]Spotted Sandpiper body weight: mean body weight of adult male (37.9 g) and female (47.1 g).
[d]Stilt sandpiper is used as a surrogate for spotted sandpiper.

TABLE 9
Species Factors for HQ Calculations for BERA
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Parameter	Description	Units	Mallard	Source	Snowy Egret	Source
BW	Body weight of receptor	Kg	1.134	USEPA (1993; Page 2-43); [Source: Nelson & Martin (1953)][a]	0.371	Parsons et al. (2000)
Food IR	Ingestion rate of food	Kg/Kg BW/d	0.05	Nagy (2001)	0.116	Nagy (2001)
Soil / Sediment Ingestion	Ingestion Proportion of soil or sediment	Fraction of Total Diet	0.033	Beyer et al. (1994)	0.005	Sample and Suter (1994 ; Section 4.13; Page 27)[c]
Fd (plants)	Fraction of diet consisting of plants		0.5	USEPA (1993; Pages 2-44 and 2-45); [Source: Dillon (1959); Swanson et al. (1985)][b]	0	
Fd (inverts)	Fraction of diet consisting of soil invertebrates		0		0	
Fd (mammals)	Fraction of diet consisting of mammals		0		0	
Fd (benthic inverts)	Fraction of diet consisting of benthic invertebrates		0.5	USEPA (1993; Pages 2-44 and 2-45); [Source: Dillon (1959); Swanson et al. (1985)][d]	0.1	Smith (1997)[d]
Fd (fish)	Fraction of diet consisting of fish		0		0.9	Smith (1997)[d]

NOTES:

[a]Mallard body weight: Mean body weight of adult male (1,225 g) and adult female (1,043 g).
[b]Mallard diet: Dillon
[c]Surrogate value based on great blue heron.
[d]Snowy egret diet (based on % biomass stomach contents): fish (91.4%), crayfish (6-7%); frogs (1%); invertebrates (1%; [insects, grass shrimp]).

TABLE 9
Species Factors for HQ Calculations for BERA
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Parameter	Description	Units	Swamp Rabbit	Source	Marsh Rice Rat	Source	American Mink	Source
BW	Body weight of receptor	Kg	2.118	Bond et al. (2006)[a]	0.0625	Wolfe, J. (1982)[d]	1	Sample and Suter (1994; Page 18; Table 4.6); [Source: Newell et al. (1987)]
Food IR	Ingestion rate of food	Kg/Kg BW/d	0.13	Sample and Suter (1994; Section 4.5, Page 16)[b]	0.112	Nagy (2001)	0.137	Sample and Suter (1994; Page 18; Table 4.6); [Source: Bleavins and Aulerich (1981)]
Soil / Sediment Ingestion	Ingestion Proportion of soil or sediment	Fraction of Total Diet	0.063	Sample and Suter (1994; Section 4.5, Page 17)[b]	0.094	Beyer et al. (1994)[e]	0.005	Sample and Suter (1994; Page 18; Table 4.6)
Fd (plants)	Fraction of diet consisting of plants		1	USEPA (1993; Page 2-356); [Source: Spencer & Chapman (1986)][c]	0.5	Wolfe, J. (1982)	0	
Fd (inverts)	Fraction of diet consisting of soil invertebrates		0		0		0	
Fd (mammals)	Fraction of diet consisting of mammals		0		0		0.22	Dolan (1986)
Fd (benthic inverts)	Fraction of diet consisting of benthic invertebrates		0		0.5	Wolfe, J. (1982)	0.64	Dolan (1986)
Fd (fish)	Fraction of diet consisting of fish		0		0		0.14	Dolan (1986)

NOTES:

[a]Swamp rabbit body weight: arithmetic mean of adult males and females.
[b]Swamp rabbit diet (based on Eastern cottontail) is converted to dry weight assuming 45% moisture in food.
[c]Swamp rabbit soil ingestion rate is based on black-tailed jackrabbit.
[d]Marsh rice rat: average of body weight range for adults (45g-80g).
[e]Marsh rice rat: Raccoon is used as a surrogate for marsh rice rat.

TABLE 10
Exposure Modifying Factors (EMFs) for Receptors for BERA
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

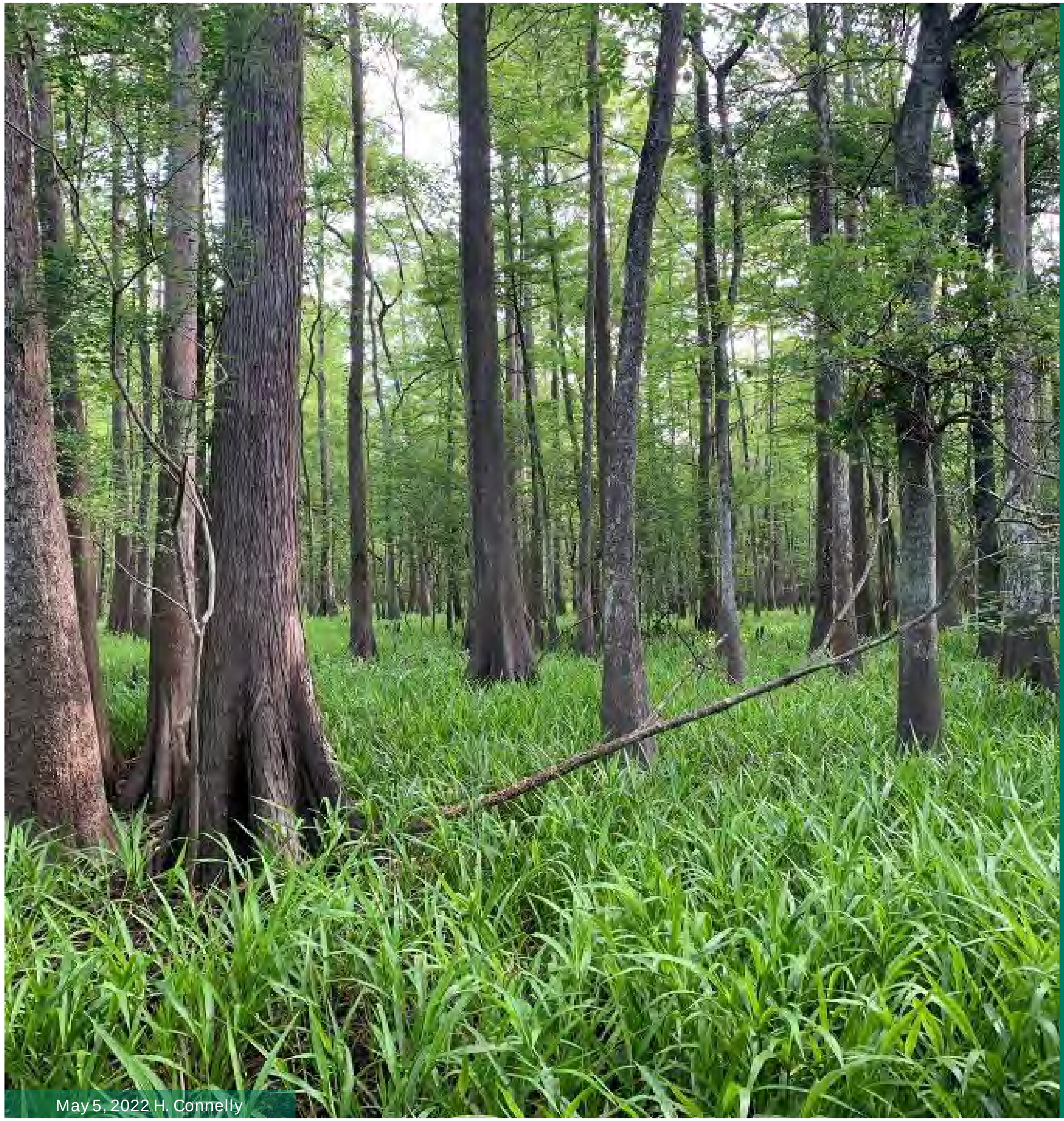
Parameter	Description	Northern Cardinal	American Robin	Spotted Sandpiper	Mallard Duck	Snowy Egret	Swamp Rabbit	Marsh Rice Rat	American Mink	Citations
Home Range	Home Range of receptor (acres)	34[a]	0.61[b]	8[c]	405[d]	490[e]	7.9[f]	0.66[g]	216[h]	The Cornell Lab (2022b); USEPA (1993) [Source: Pitts (1984); Howell (1942); Maxson and Oring, L. et al. (1980); Gilmer. et al. (1975); Custer & Osborn (1978)]; Gould, A. (1974); Wolfe, J. (1982); Halbrook (2018)
Spatial Factor	Fraction of home range that may be contaminated	0.0015	0.082	0.0063	0.00012	0.00010	0.0063	0.076	0.00023	Spatial Factor = potentially affected area ÷ receptor home range, with an upperbound value of 1 (100%) Calculated based on estimated size of potentially affected area (assumed 0.05 acre)
Time (Temporal) Factor	Fraction of time spent in presumed contaminated area	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	Based on the amount of time the animal spends in the affected area

NOTES:

[a]The Cornell Lab (2022b); Average of minimum breeding home ranges.
[b]USEPA (1993) [Source: Pitts (1984); Howell (1942)]; Average of mean territory sizes.
[c]USEPA (1993) [Source: Maxson and Oring, L. et al. (1980)]
[d]USEPA (1993) [Source: Gilmer. et al. (1975)]; Average of male and female home ranges.
[e]USEPA (1993) [Source: Custer & Osborn (1978)].
[f]Gould, A. (1974); Average of adult male (10.6 acres) and female (5.14 acres) home ranges.
[g]Wolfe, J. (1982); Average of adult male (0.81 acres) and female (0.51 acres) home ranges.
[h]Halbrook (2018); Based on maximum home range of males and females.

ATTACHMENT A PHOTOGRAPHS

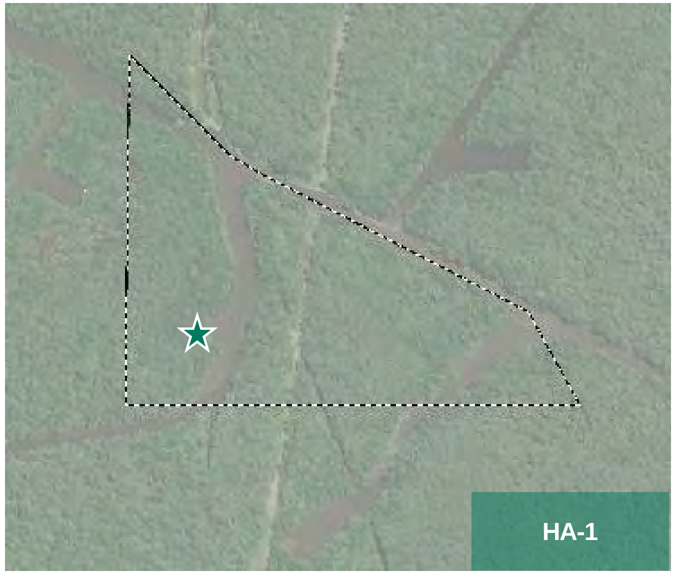
November 2022



Attachment A-1

Photographs of Natural Communities at the Property

August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana



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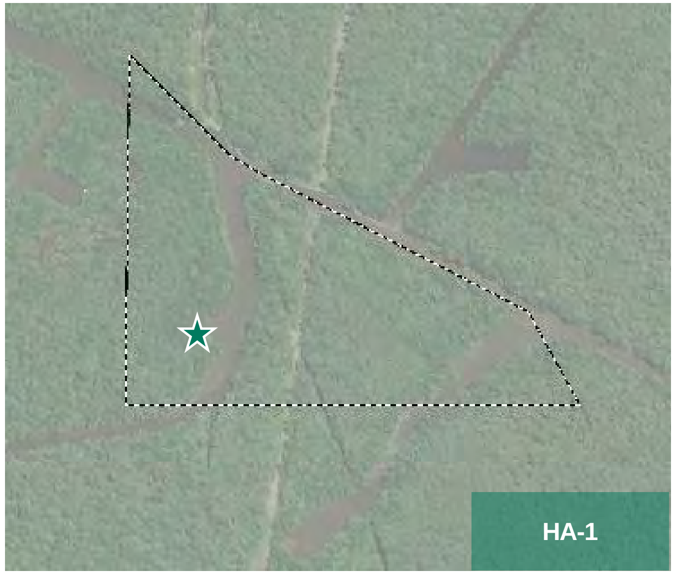

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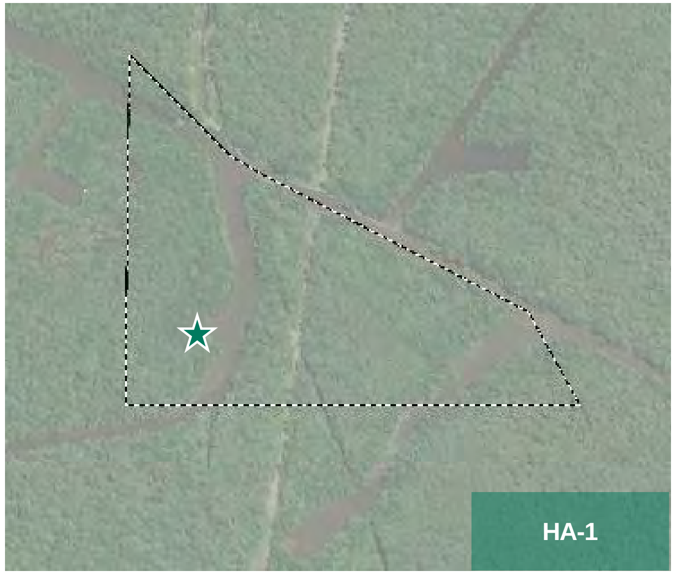

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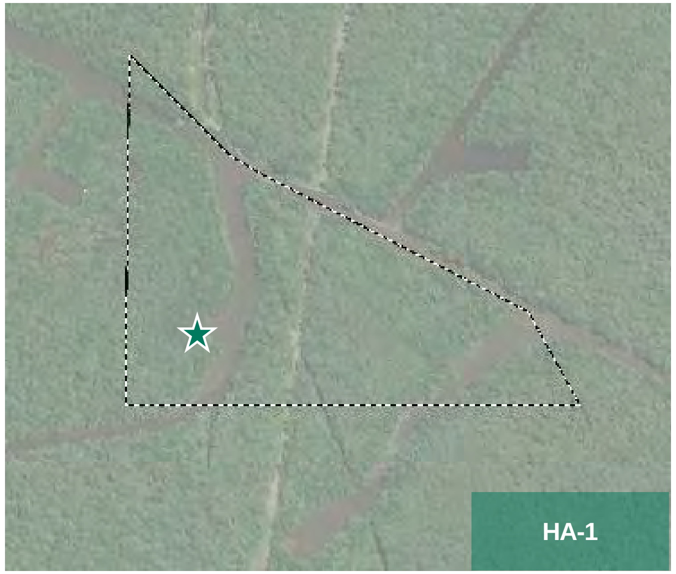

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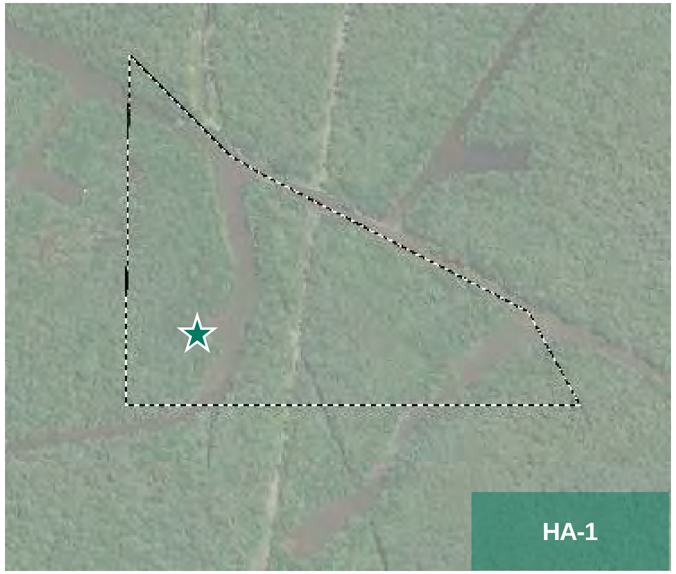

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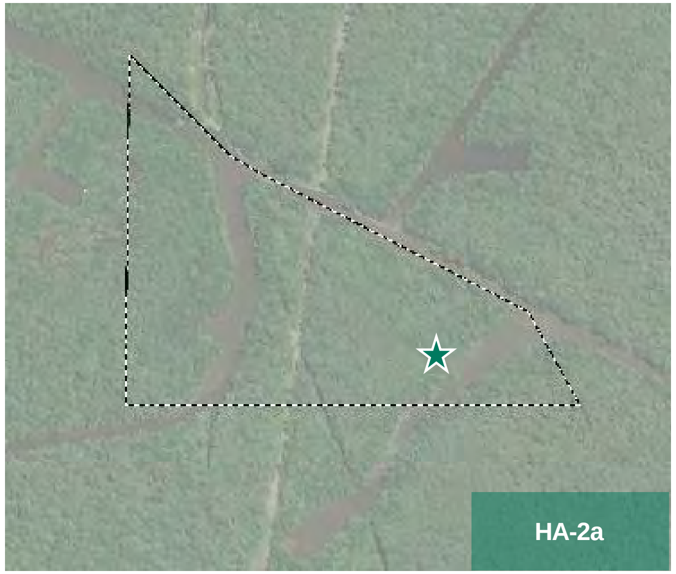
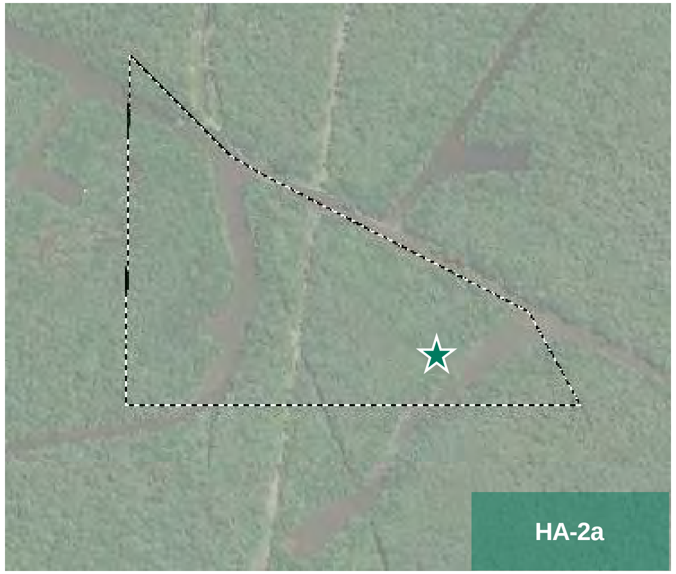


Cypress Swamp



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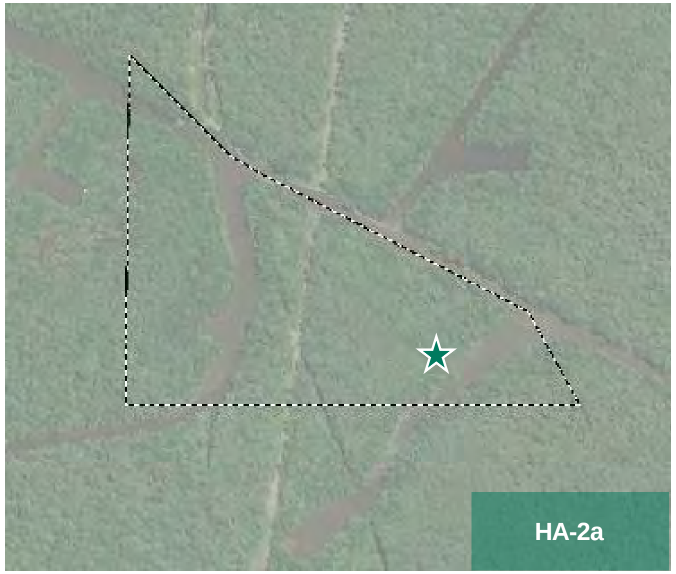

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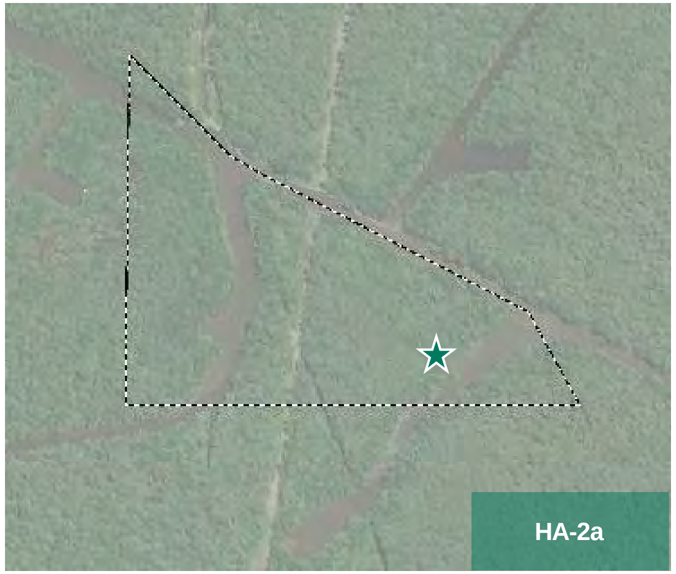

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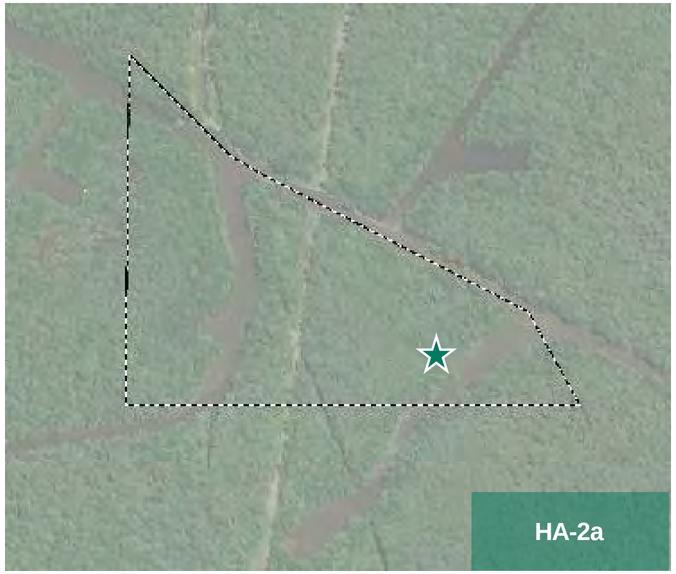

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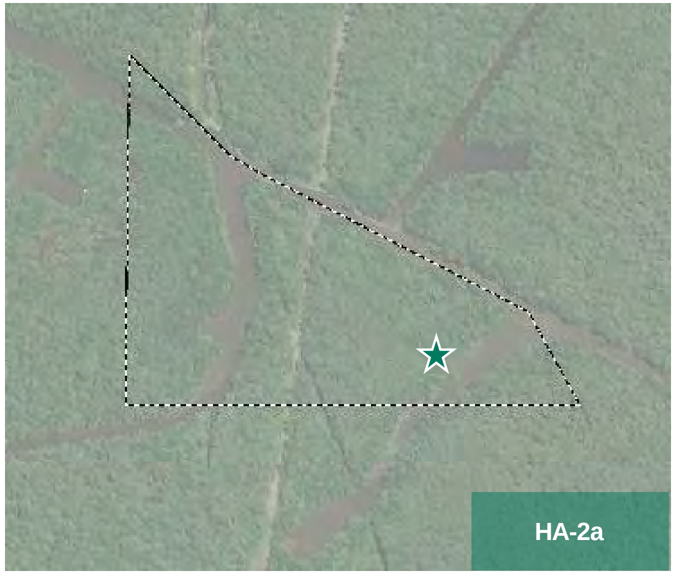

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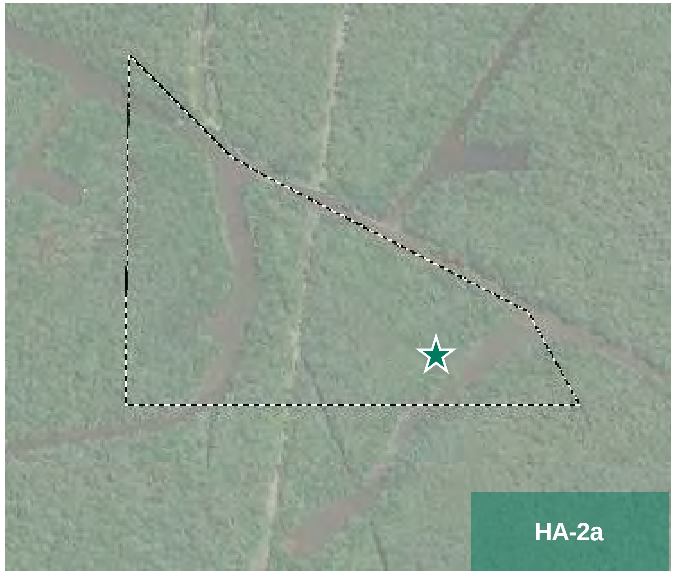
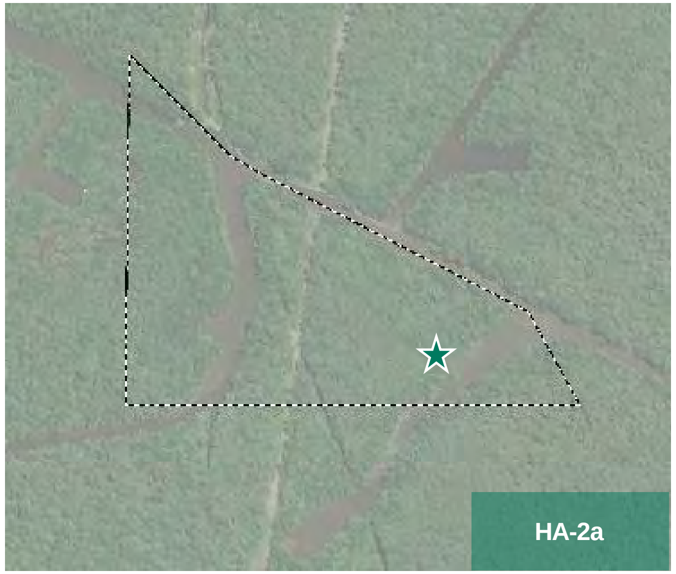


Open Water

August 17, 2022 H. Connelly



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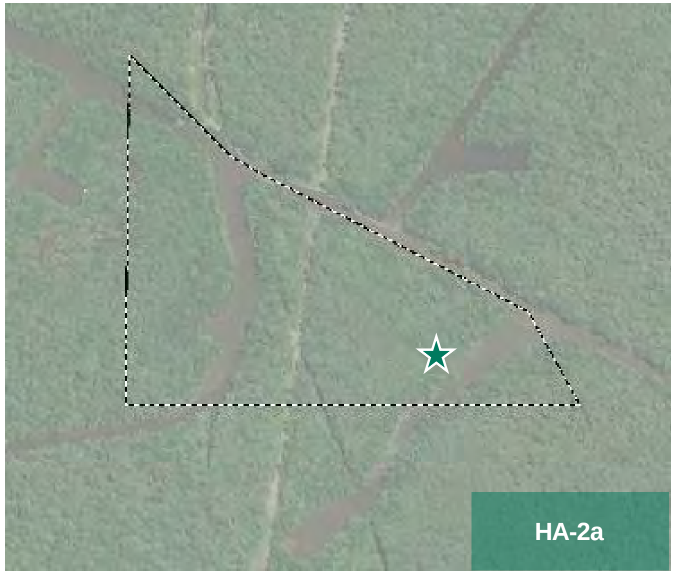

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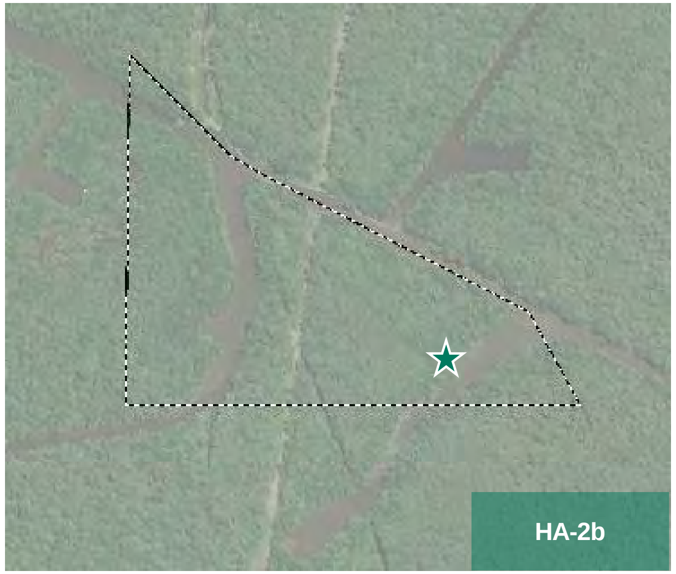

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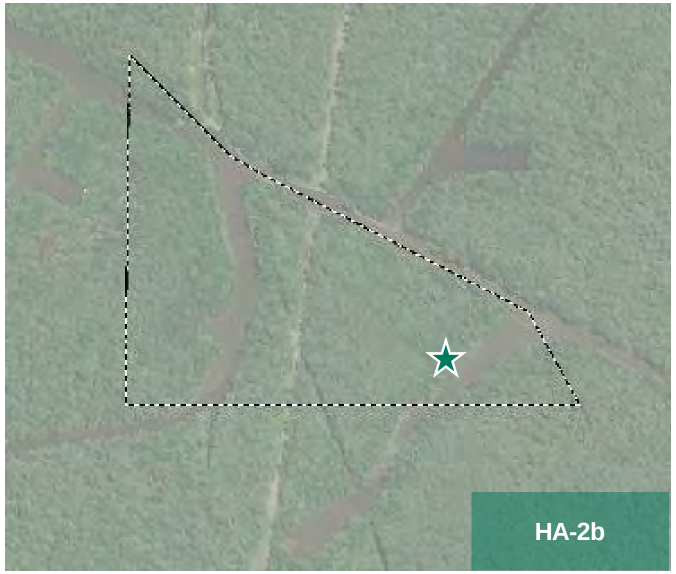

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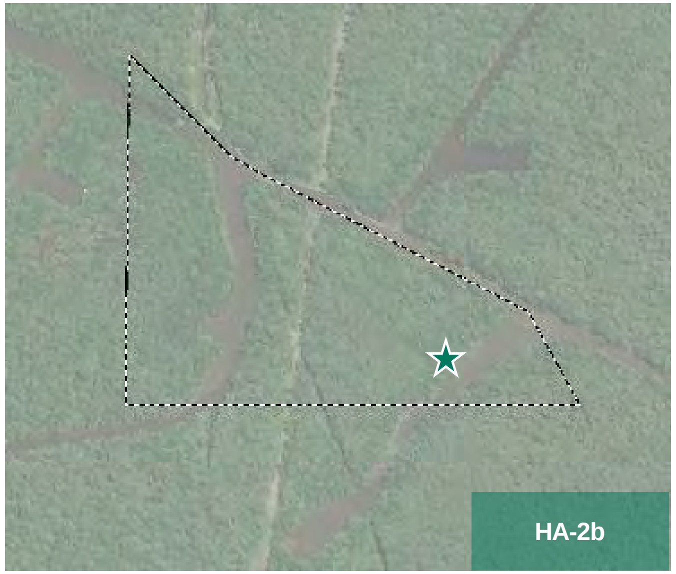

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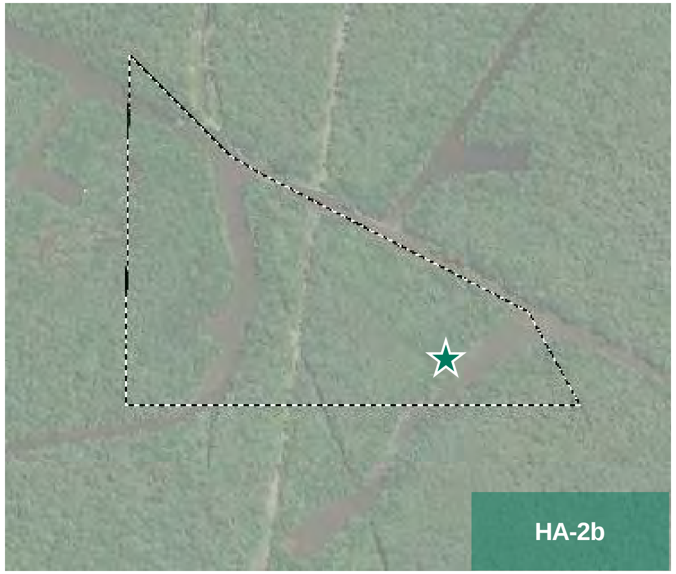

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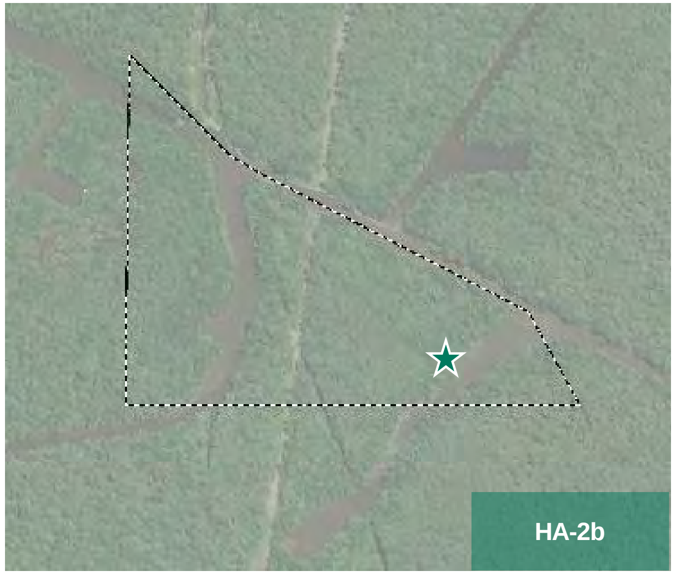

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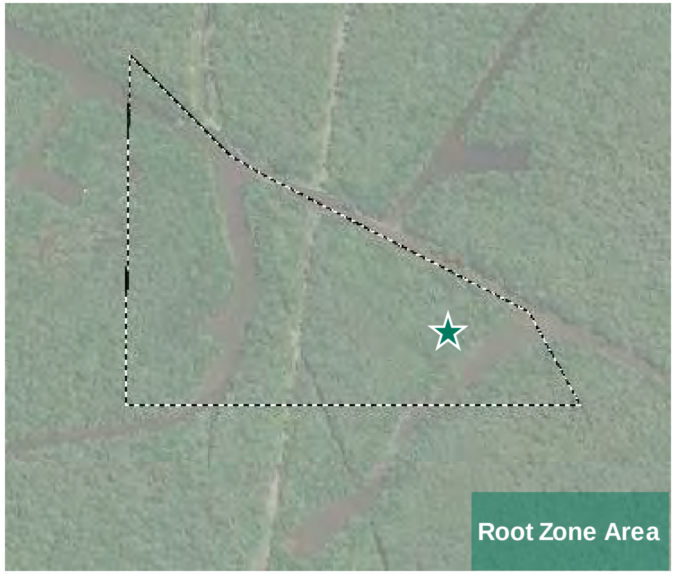

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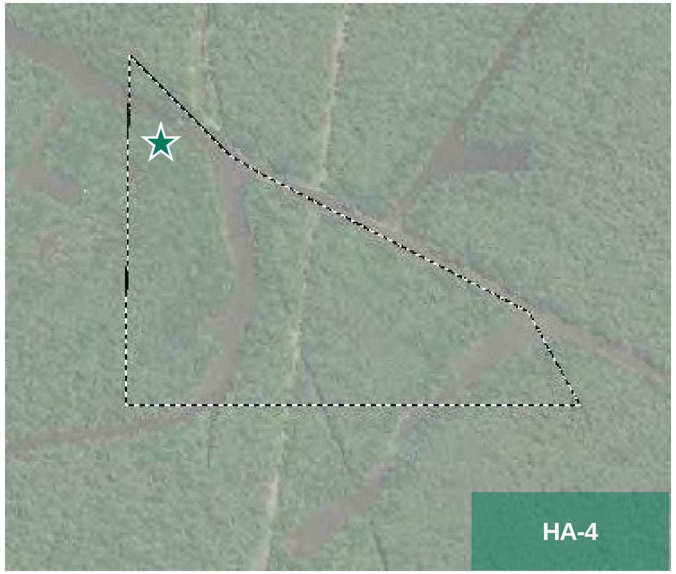

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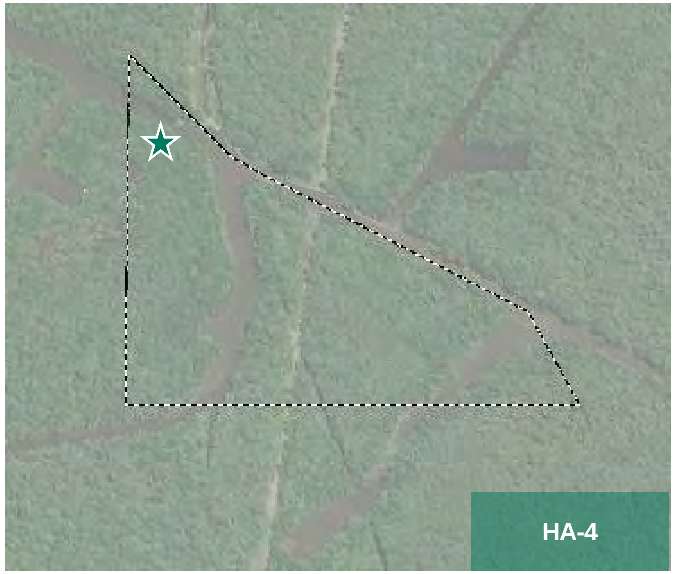

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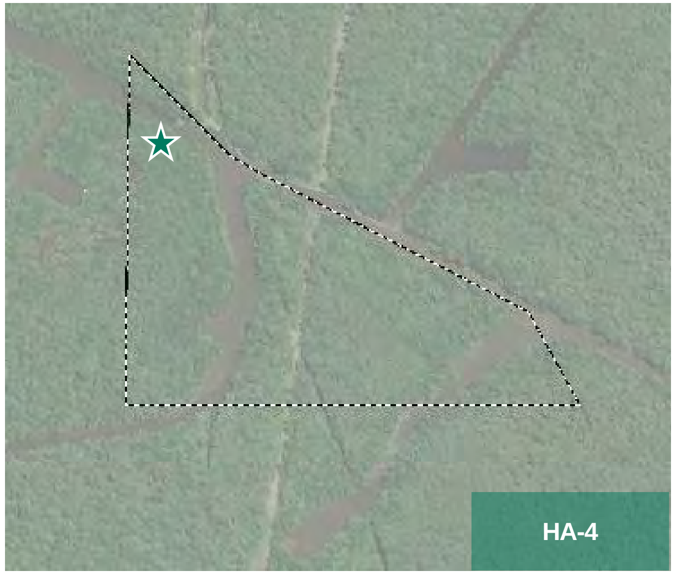

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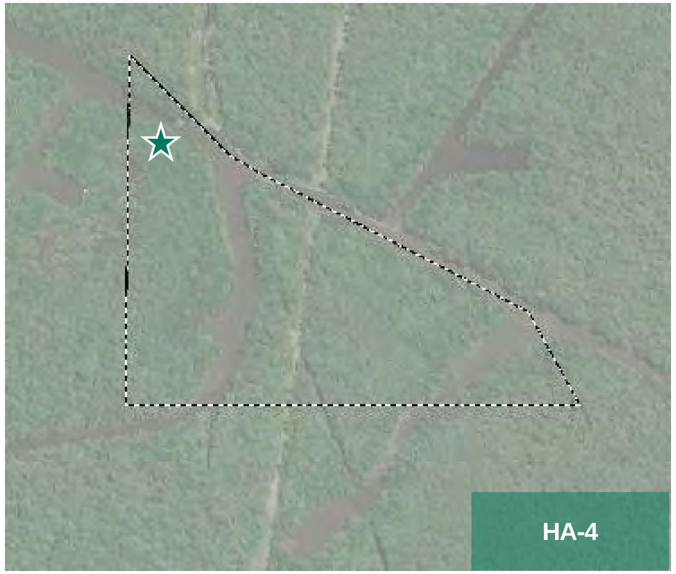

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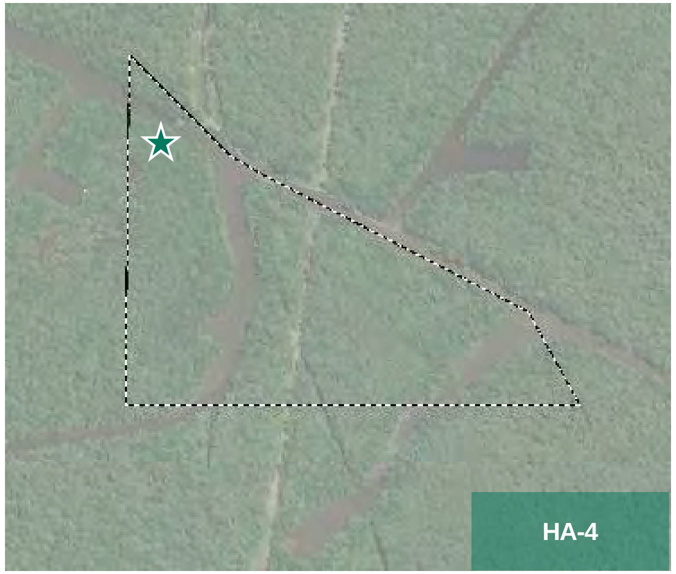

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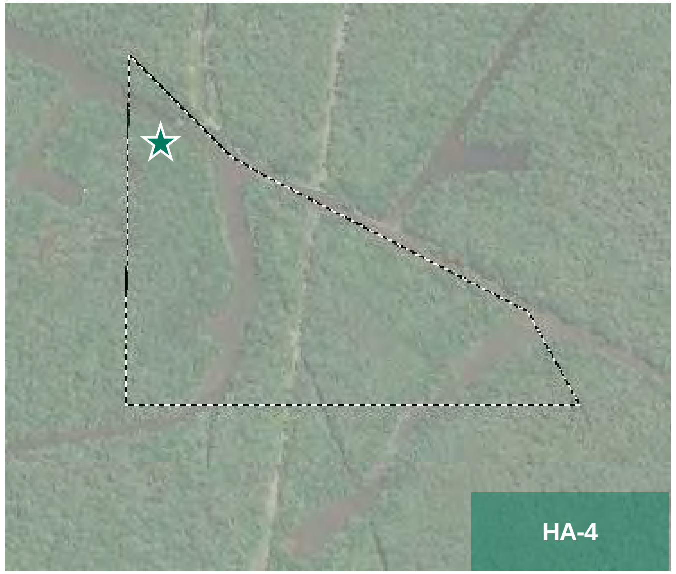

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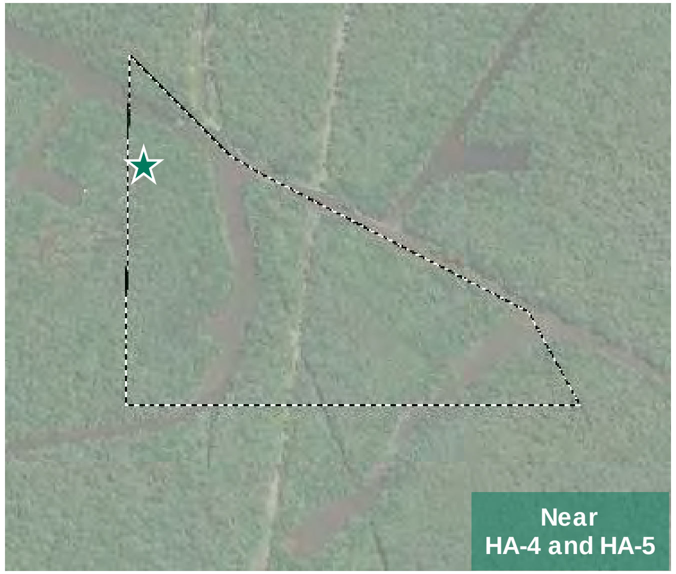
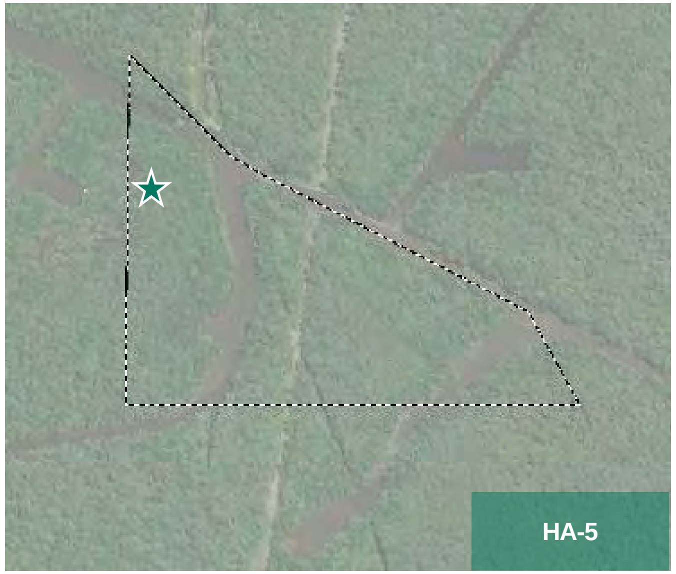


Emergent Marsh



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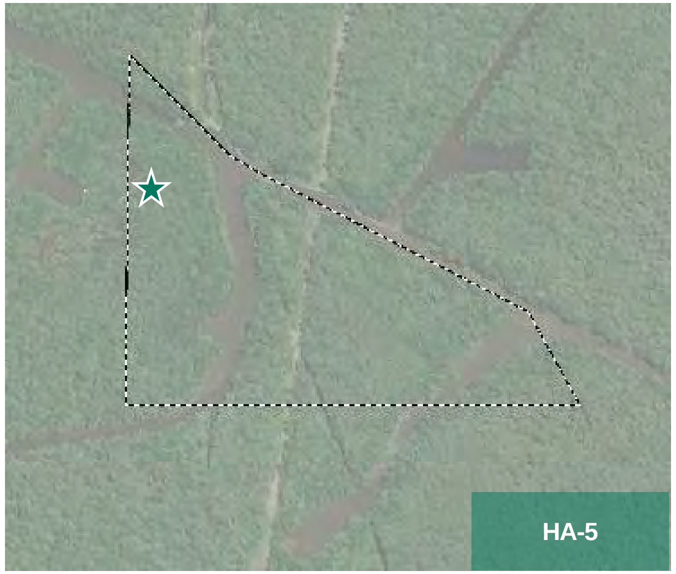

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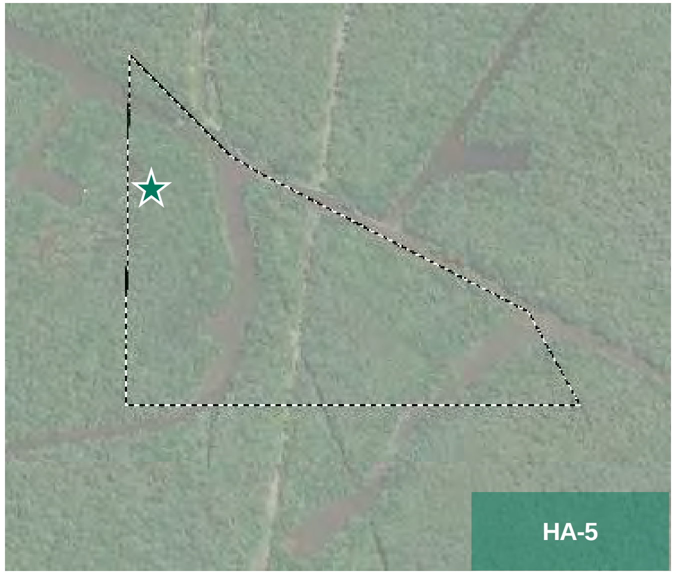
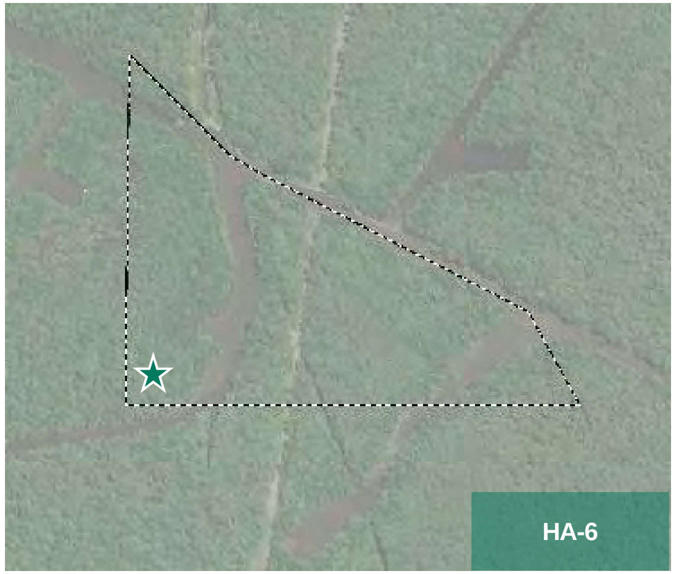


Cypress Swamp



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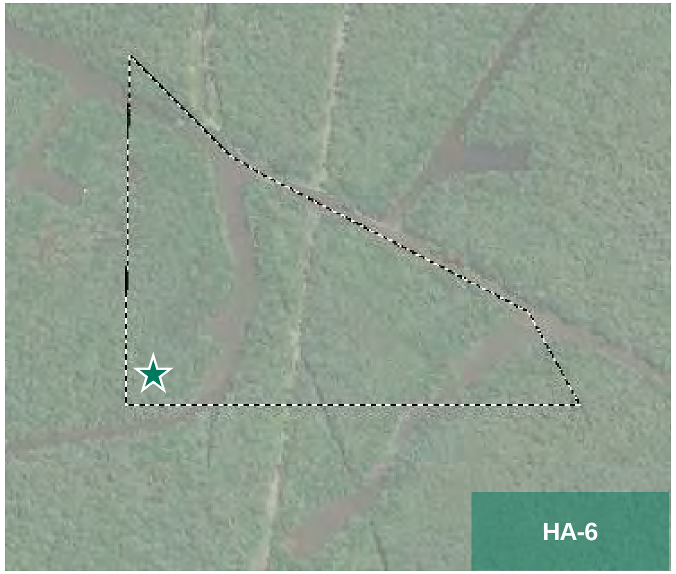

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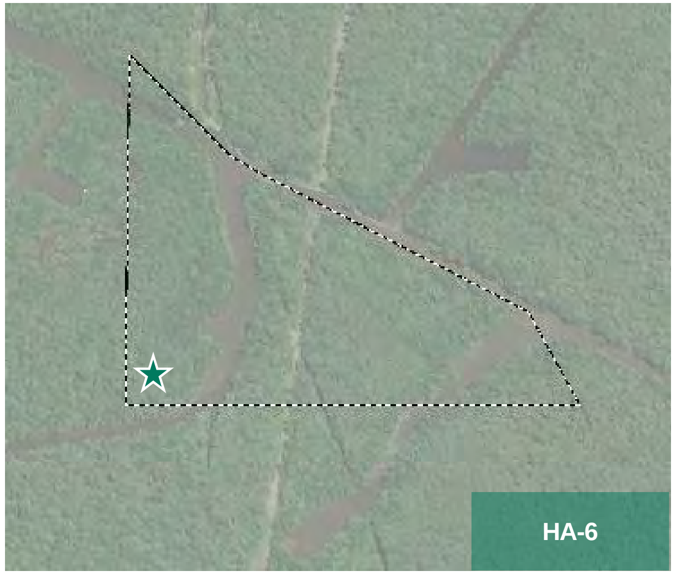
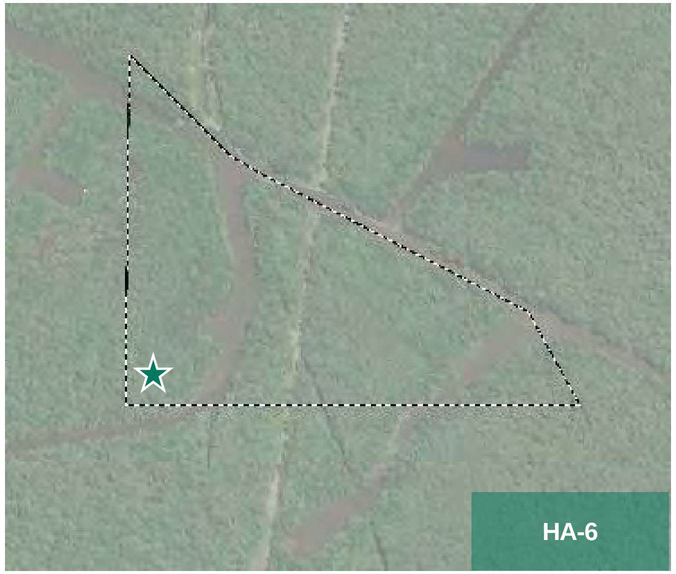
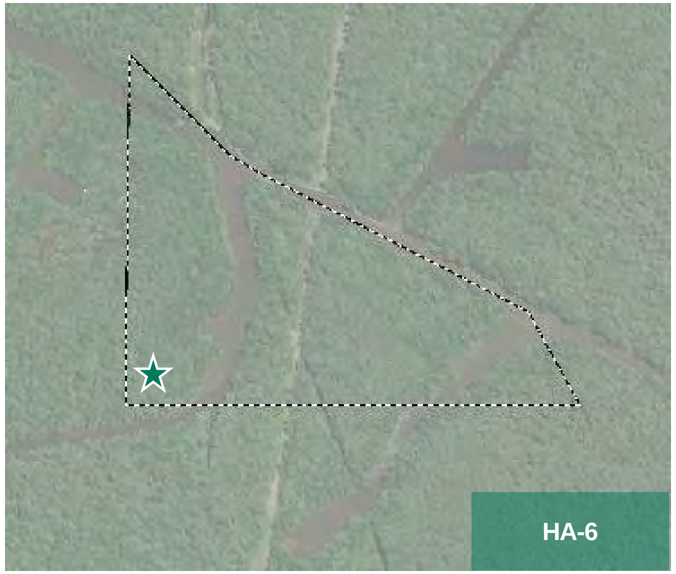


Cypress Swamp



Cypress Swamp

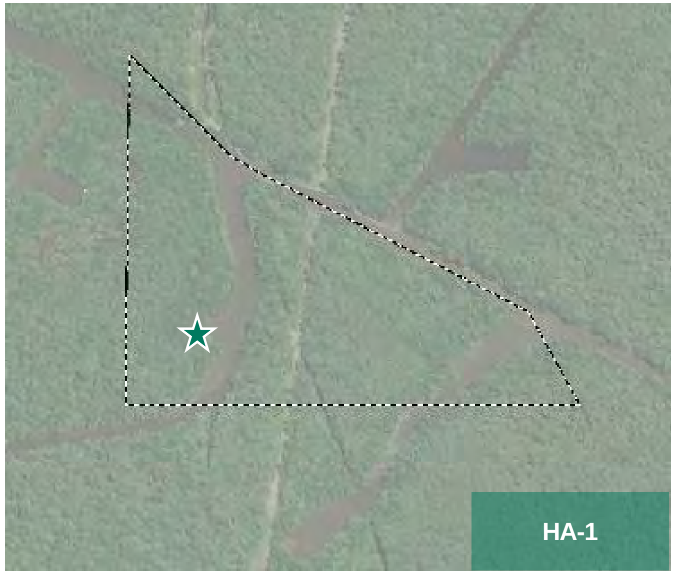


Cypress Swamp

Attachment A-2

Photographs of Vegetation at the Property

August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

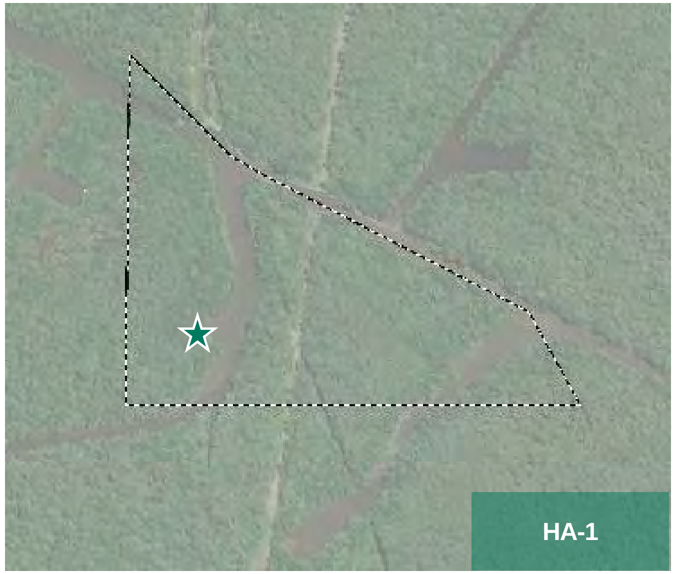


Sawtooth blackberry

Rubus argutus

Wetland Classification

FAC

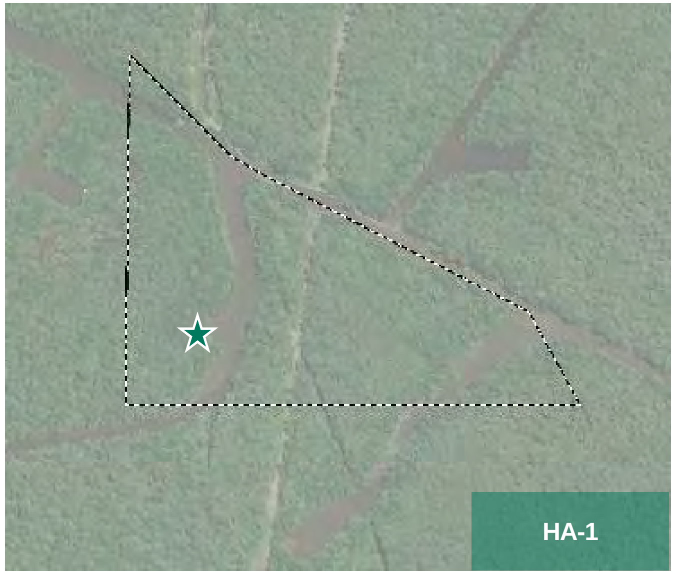


Sedge

Carex spp.

Wetland Classification

NA

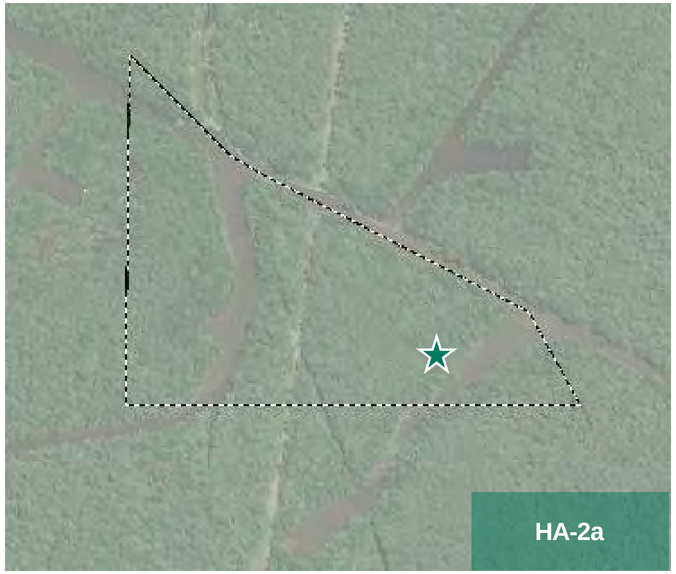


Bluejacket

Tradescantia ohiensis

Wetland Classification

FAC

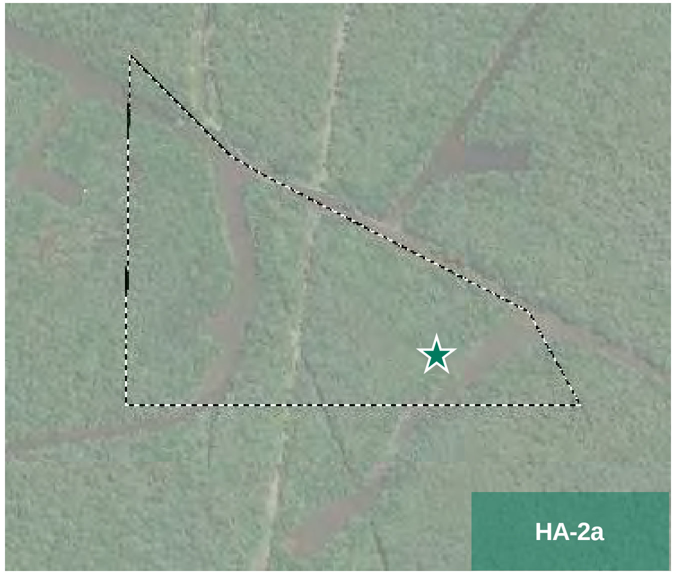


Bulbous bittercress

Cardamine bulbosa

Wetland Classification

OBL



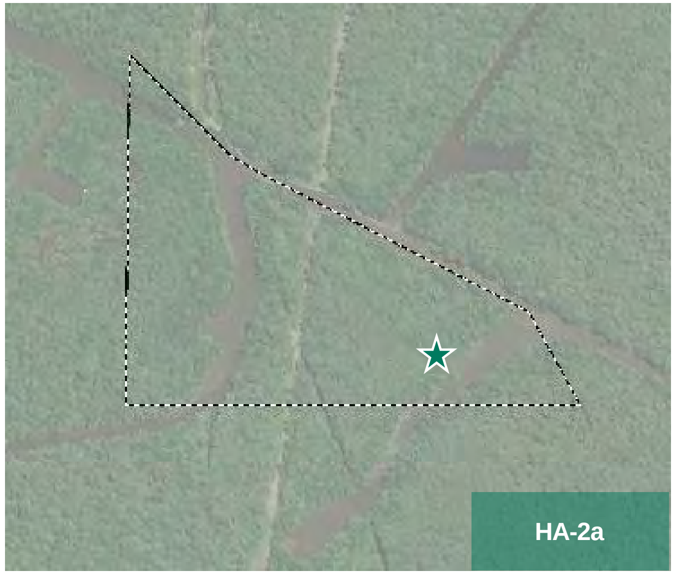
Planertree

Planera aquatica

Wetland Classification

OBL


May 5, 2022 J. Shugart

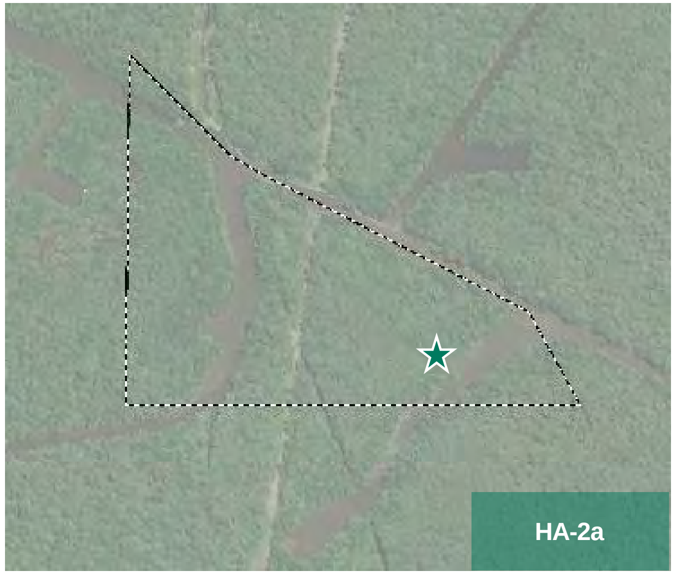


Ravenfoot sedge

Carex crus-corvi

Wetland Classification

OBL

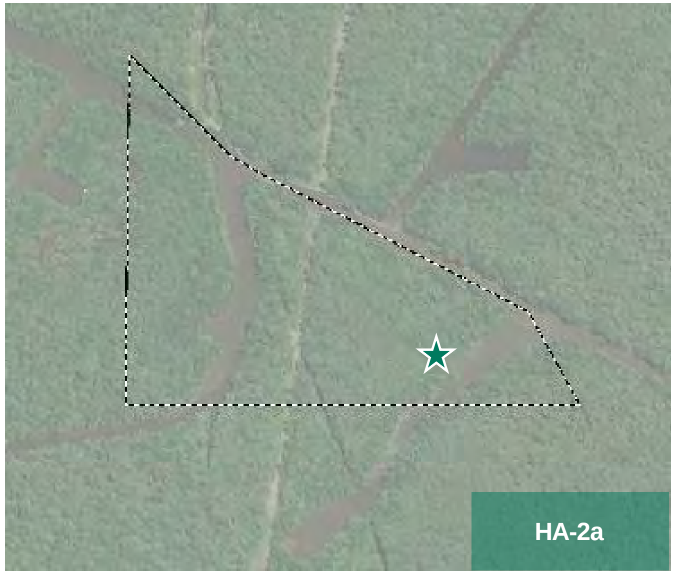


Whitenymph

Trepocarpus aethusae

Wetland Classification

FACW

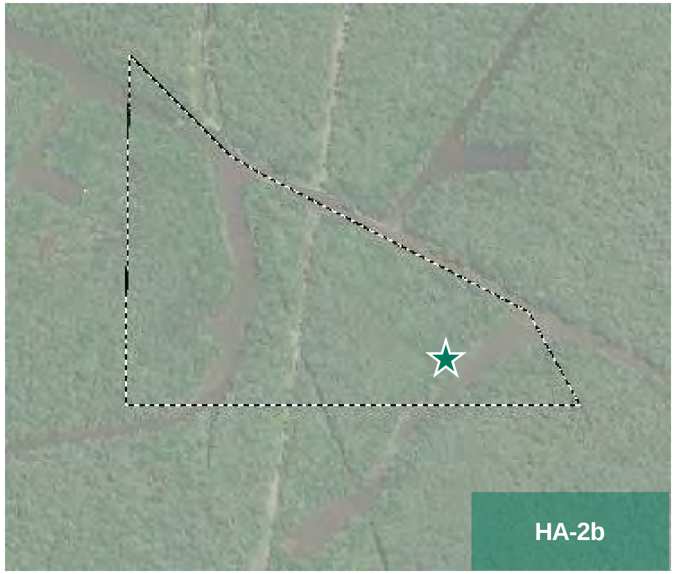


Whitenymph

Trepocarpus aethusae

Wetland Classification

FACW

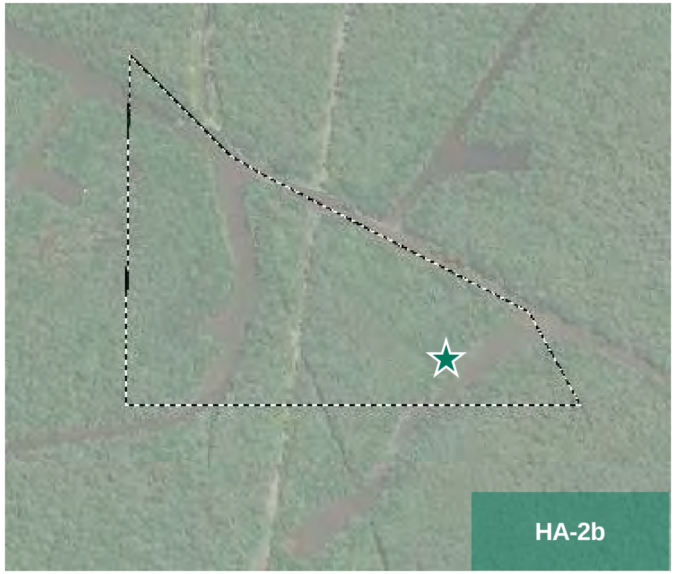


Common chickweed

Stellaria media

Wetland Classification

FACU

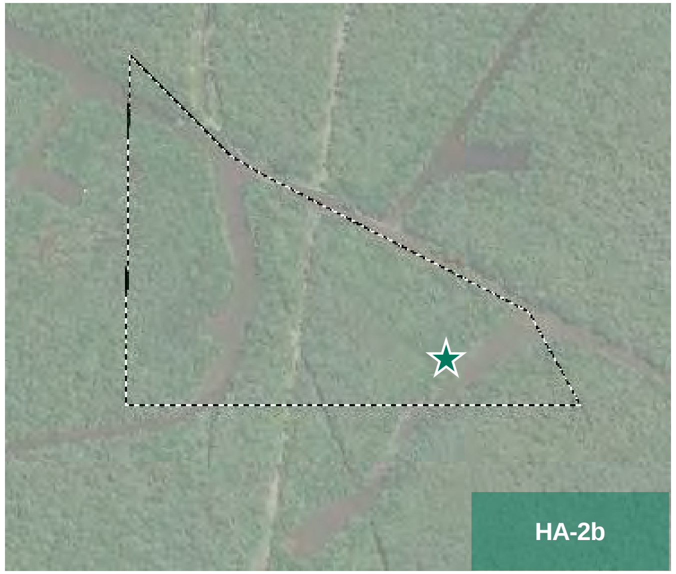


Common yellow oxalis

Oxalis stricta

Wetland Classification

UPL

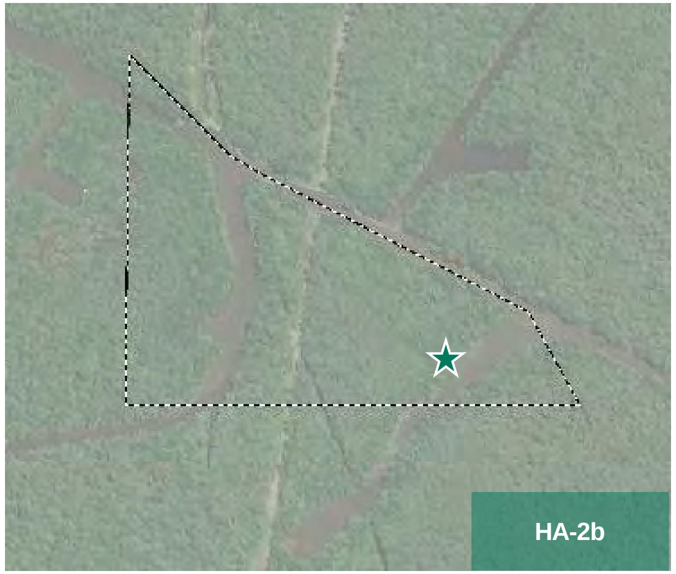


Fivelobe cucumber

Cayaponia quinqueloba

Wetland Classification

FAC

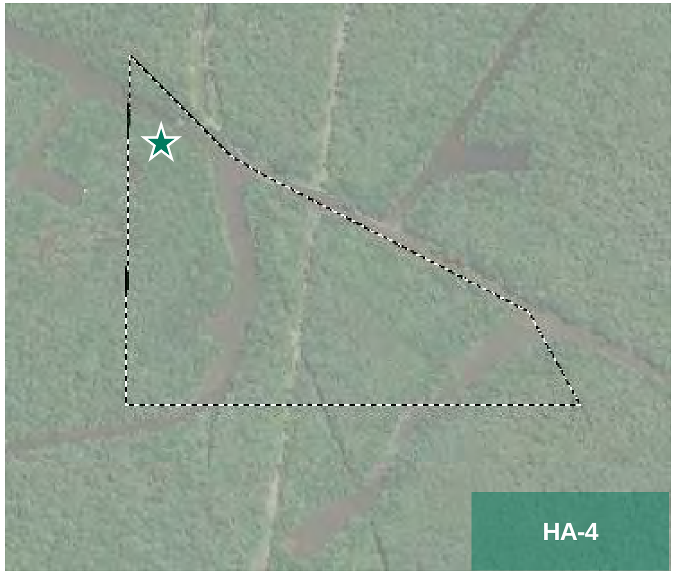


Looseflower water-willow

Justicia ovata

Wetland Classification

OBL

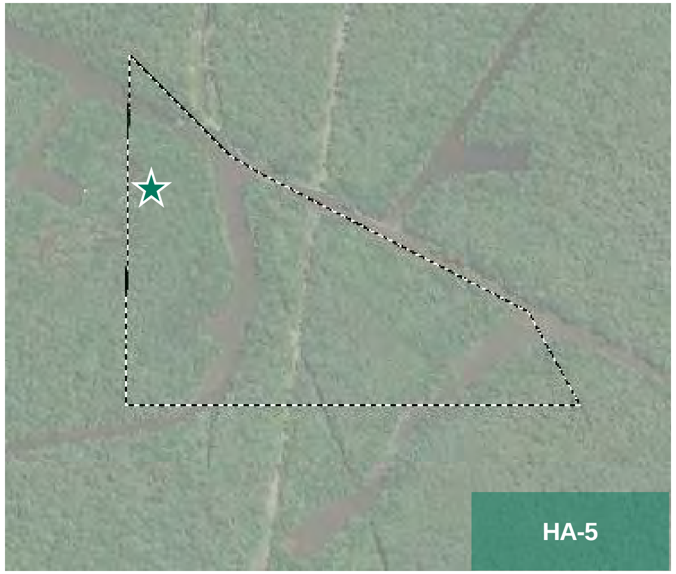


Clasping Venus' looking-glass

Triodanis perfoliata

Wetland Classification

FACU

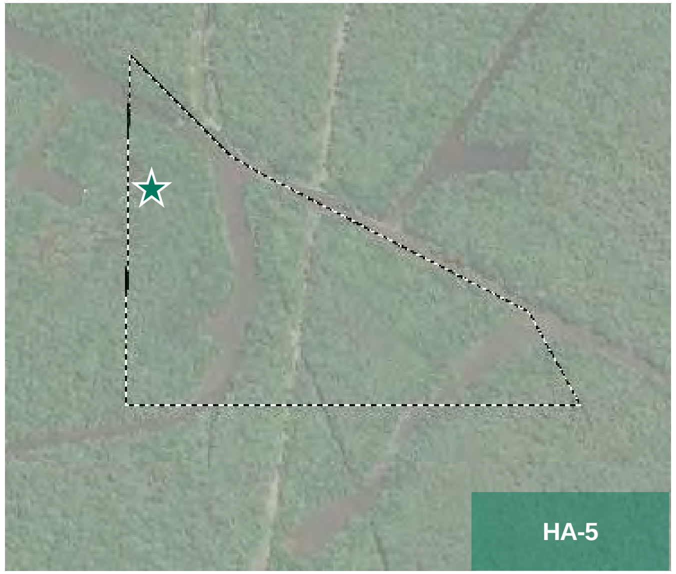


Marsh seedbox

Ludwigia palustris

Wetland Classification

OBL



Stiff marsh bedstraw

Galium tinctorium

Wetland Classification

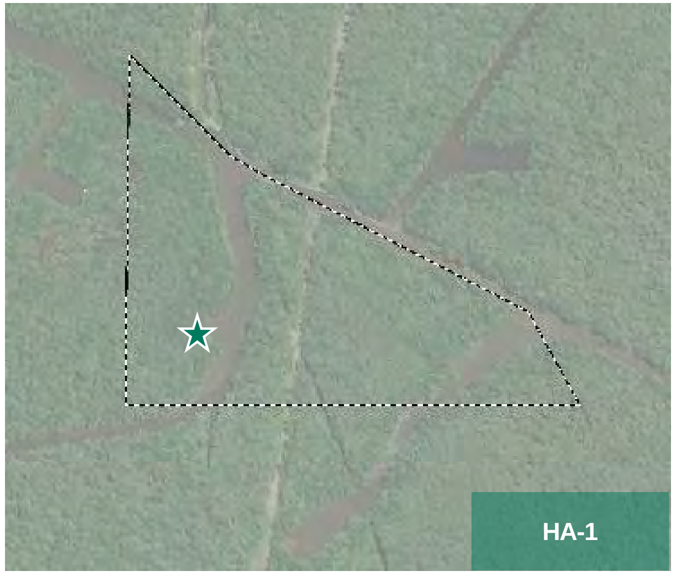
FACW

Western ratsnake
May 5, 2022 J. Shugart

Attachment A-3

Photographs of Wildlife at the Property

August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

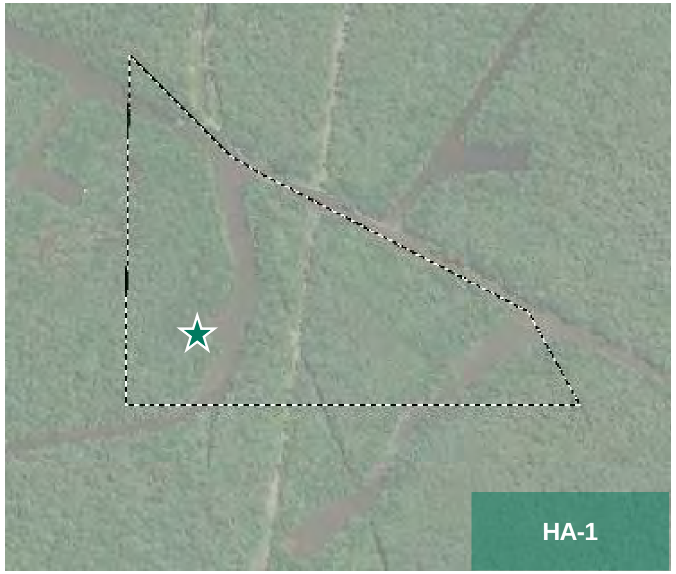


Prothonotary Warbler

Protonotaria citrea

Diet

Insects

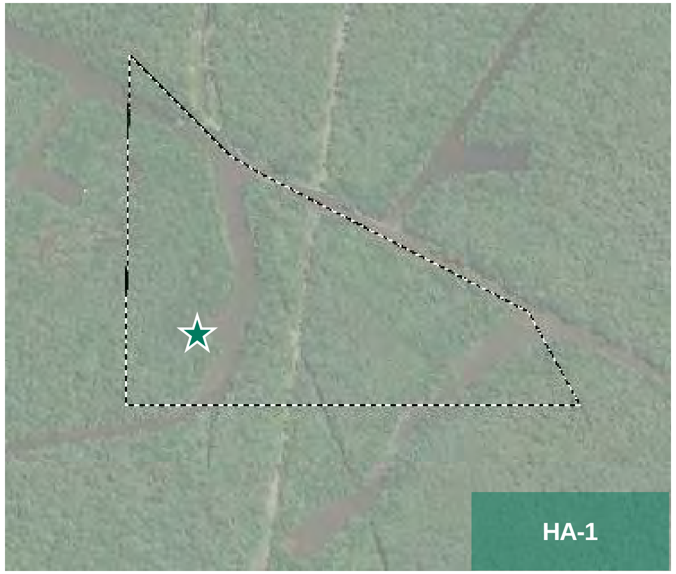


Eastern lubber grasshopper

Romalea microptera

Trophic Level

Primary

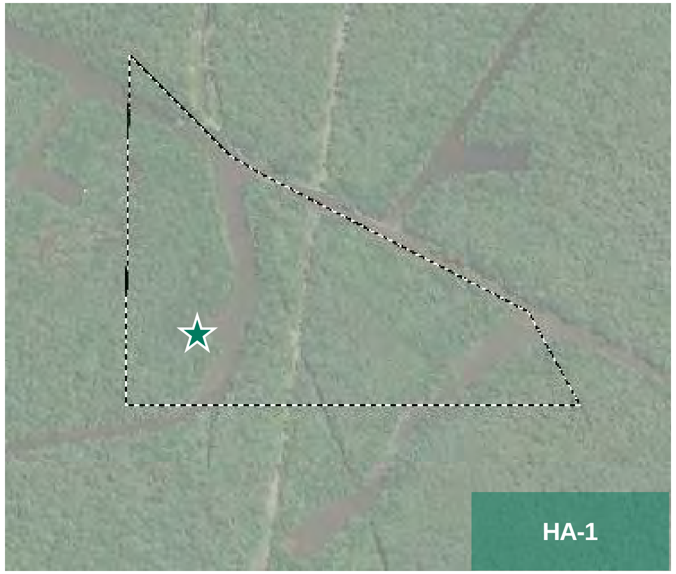


Gulf coast toad

Incilius nebulifer

Trophic Level

Secondary

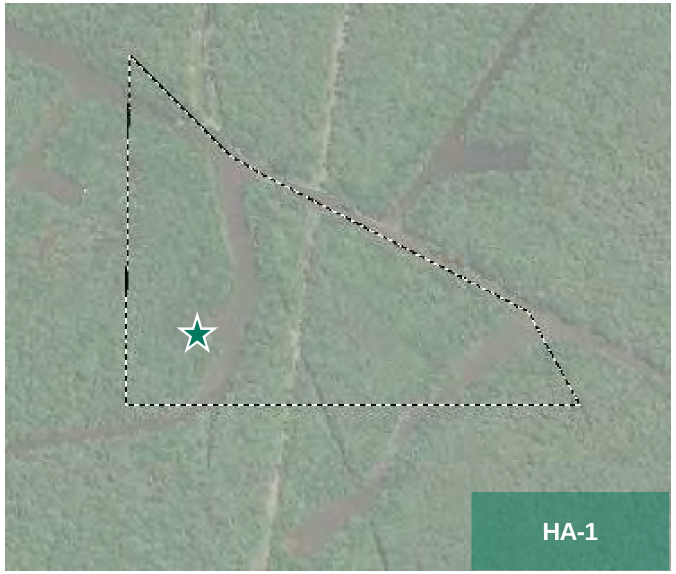


Oblong-winged katydid

Amblycorypha oblongifolia

Trophic Level

Primary

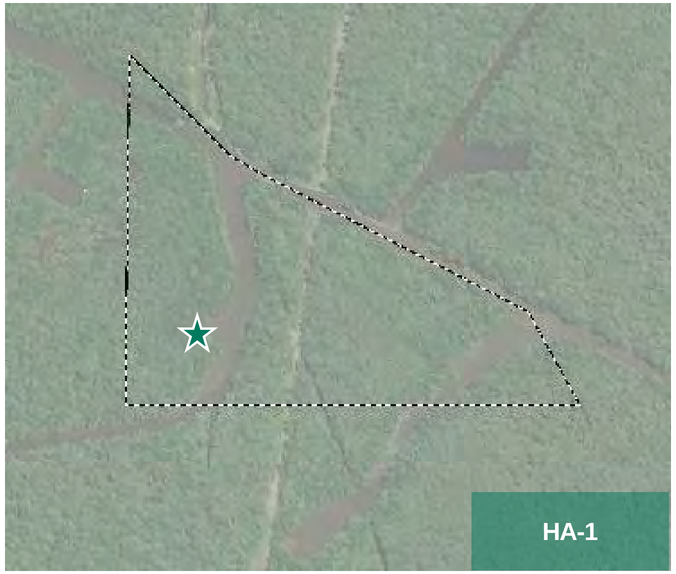


Six-spotted fishing spider

Dolomedes triton

Trophic Level

Secondary

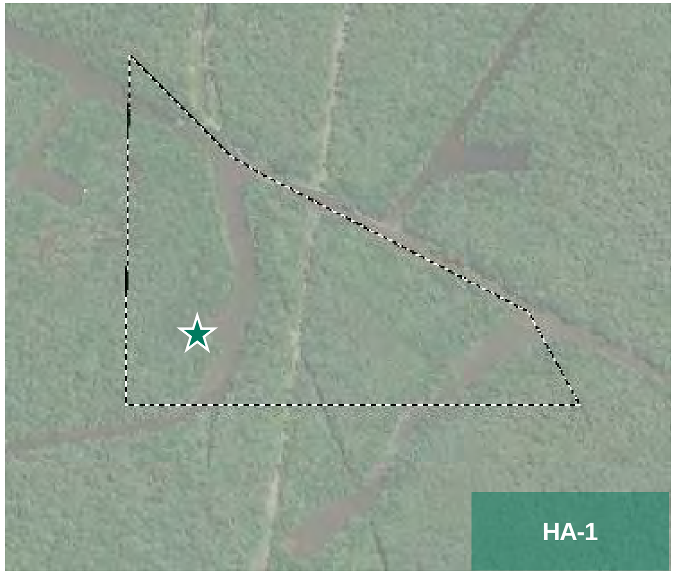


Western ratsnake

Pantherophis obsoletus

Trophic Level

Tertiary

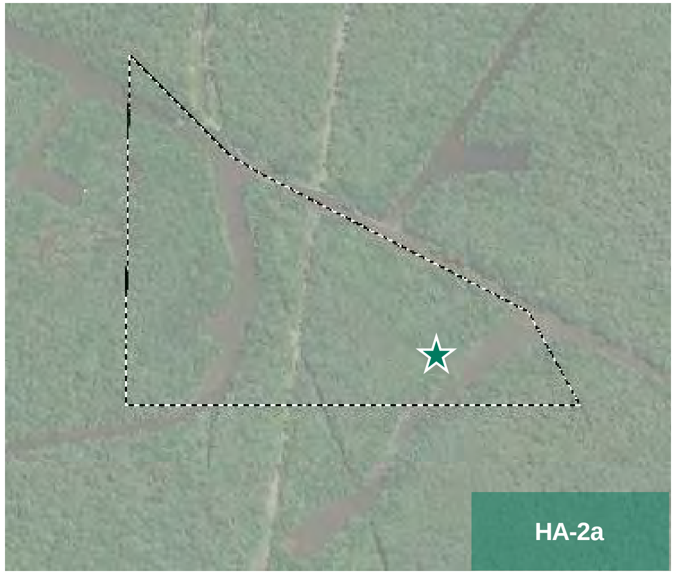


Toad

Family Bufonidae

Trophic Level

Secondary

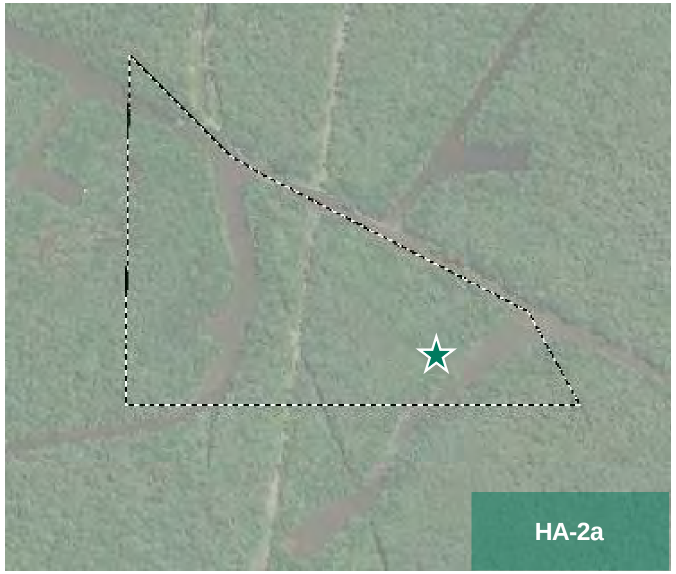


Red-Bellied Woodpecker

Melanerpes carolinus

Diet

Insects

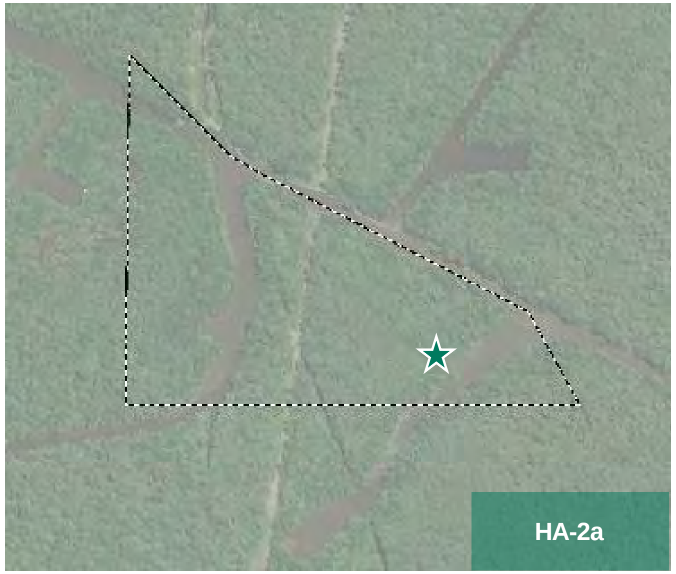


Spanish moth caterpillar

Xanthopastis timais

Trophic Level

Primary

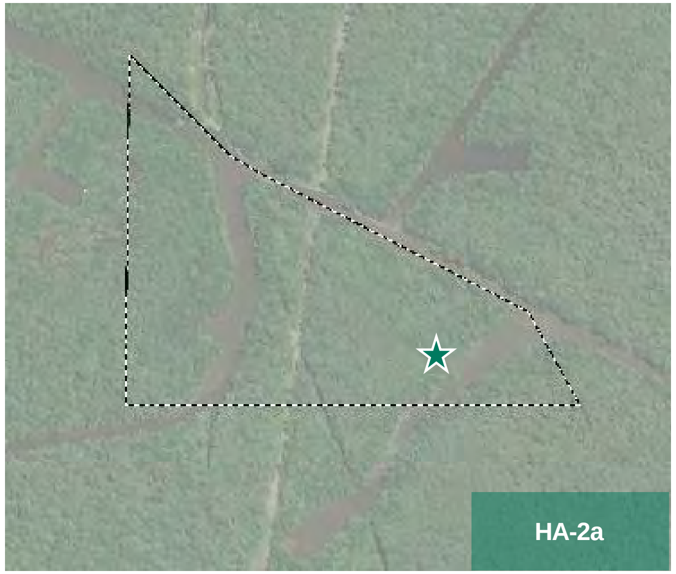


Snail

Class Gastropoda

Trophic Level

Primary

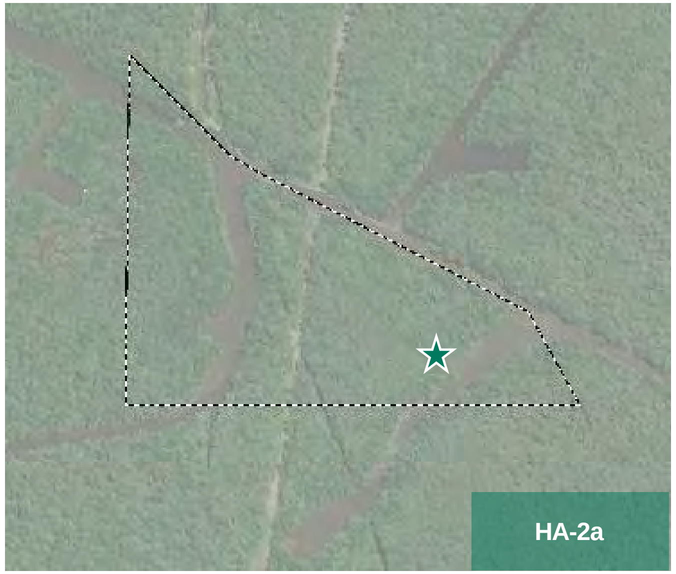


Spanish moth caterpillar

Xanthopastis timais

Trophic Level

Primary

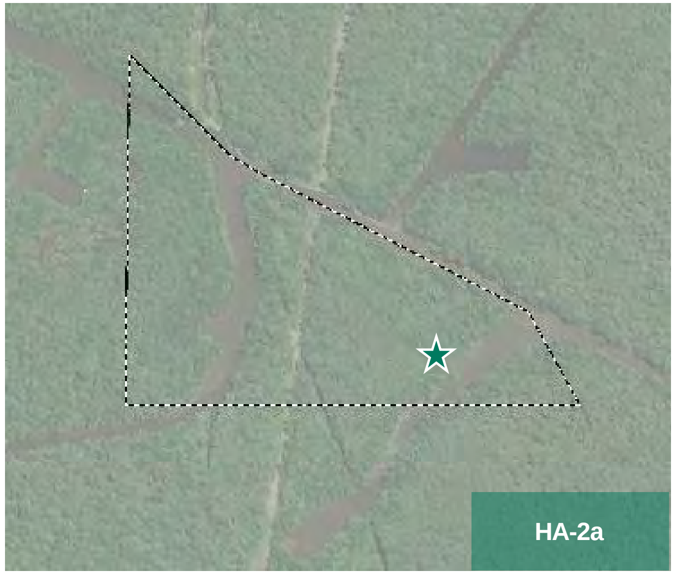


Spider nest

Order Araneae

Trophic Level

Secondary

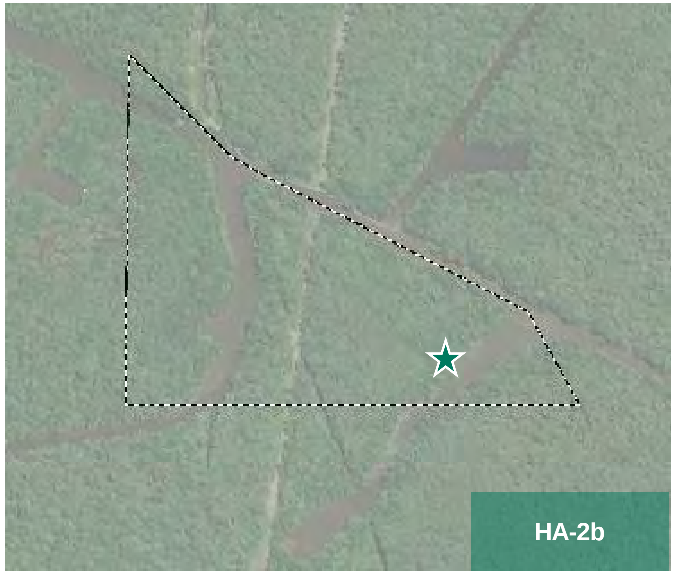


Grasshopper

Infraorder Acrididea

Trophic Level

Primary

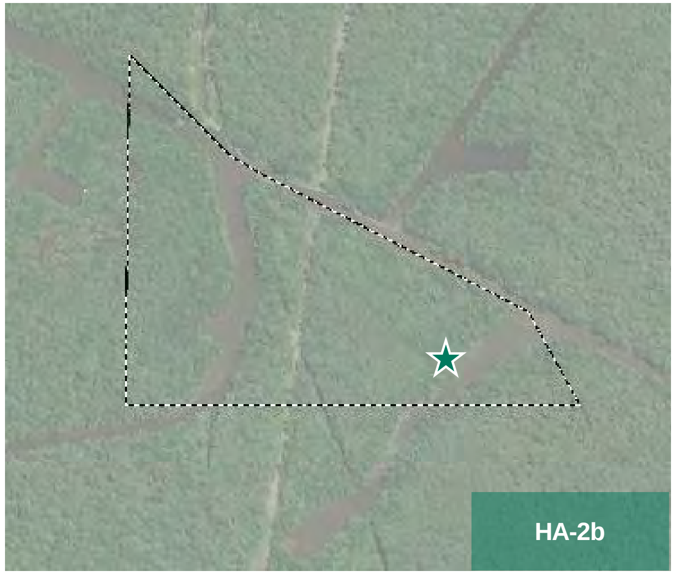


White-Eyed Vireo

Vireo griseus

Diet

Insects

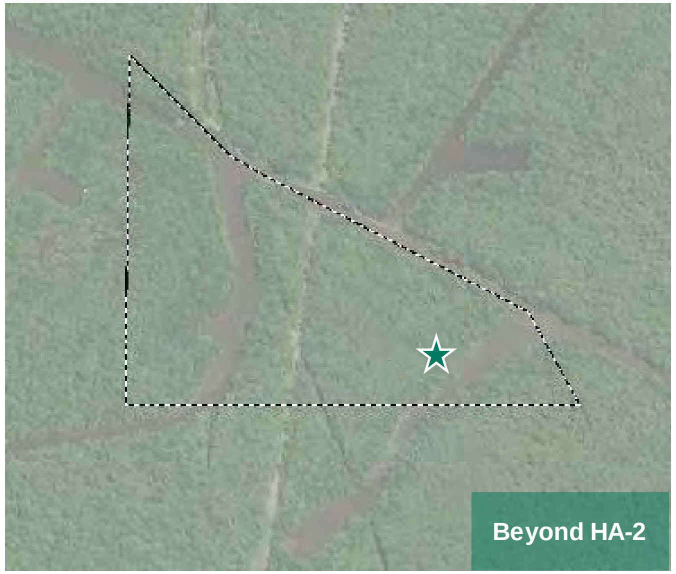


Great blue skimmer

Libellula vibrans

Trophic Level

Secondary

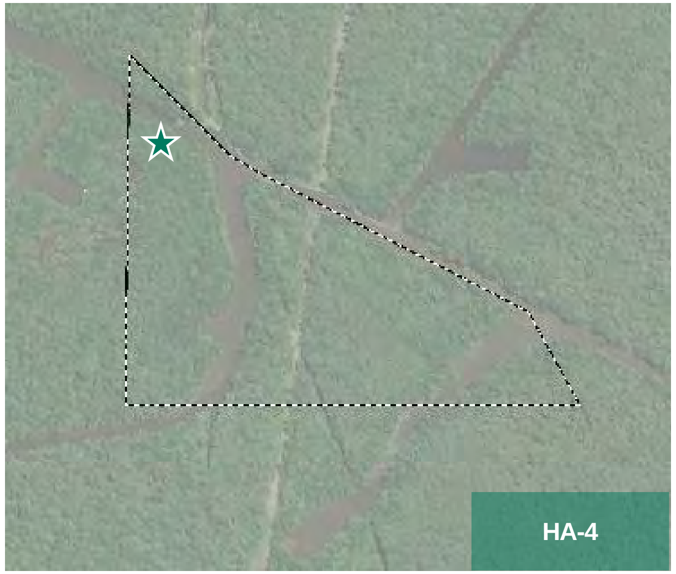


Grasshopper

Infraorder Acrididea

Trophic Level

Primary

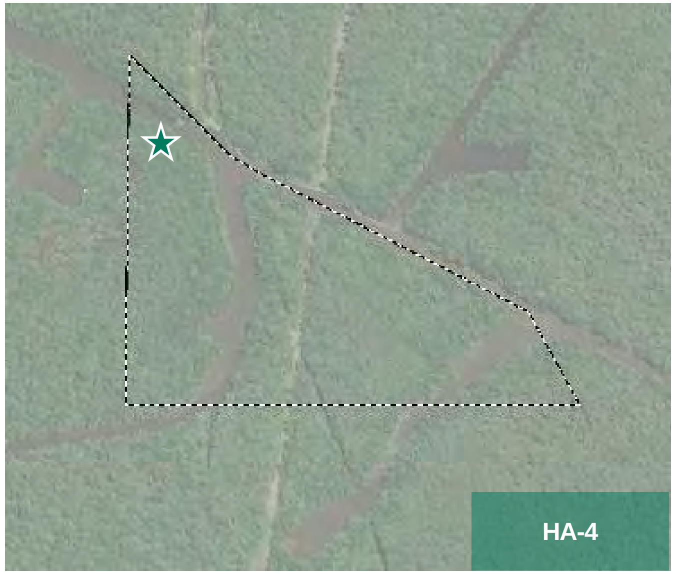


Cottonmouth

Agkistrodon piscivorus

Trophic Level

Tertiary

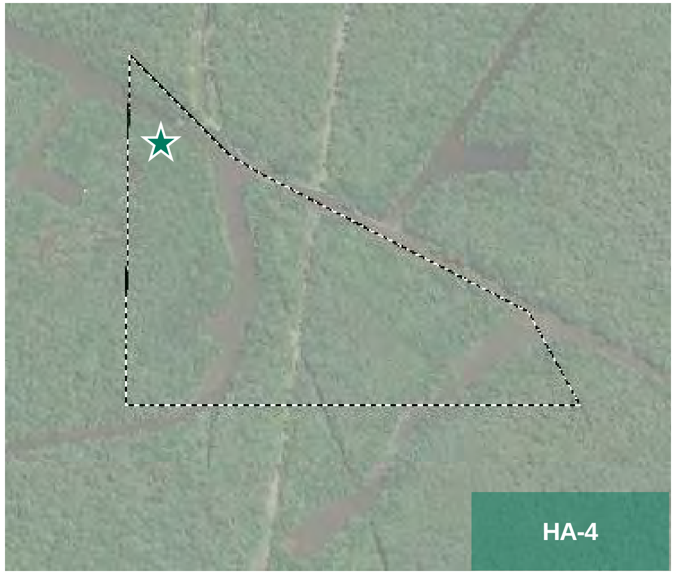


Fourteen spotted leaf beetle

Cryptocephalus guttulatus

Trophic Level

Primary



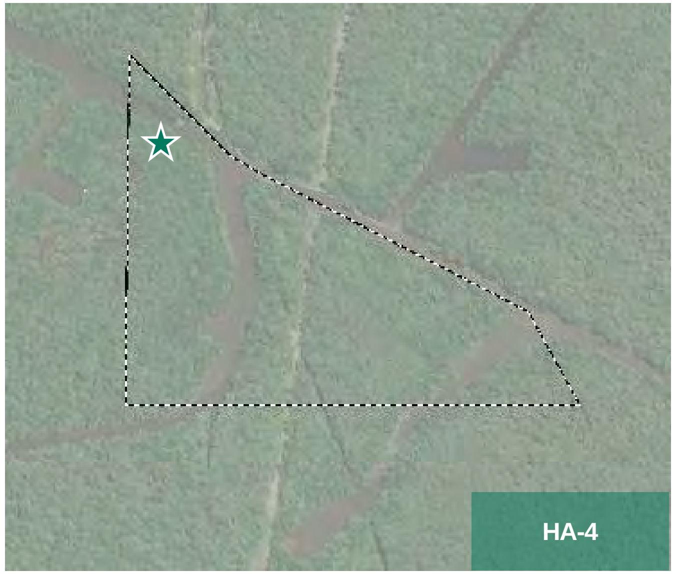
Pale-bordered field cockroach

Pseudomops septentrionalis

Trophic Level

Primary

August Levert_BP Plan_009672

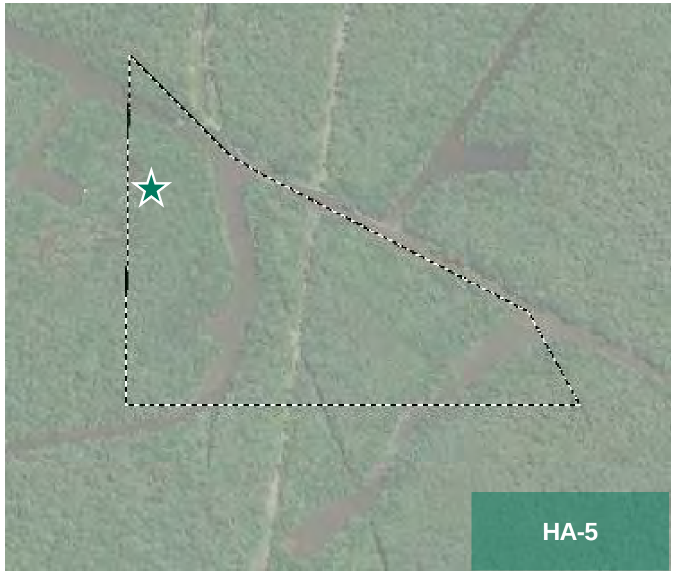


Harvestman spider

Order Opiliones

Trophic Level

Secondary

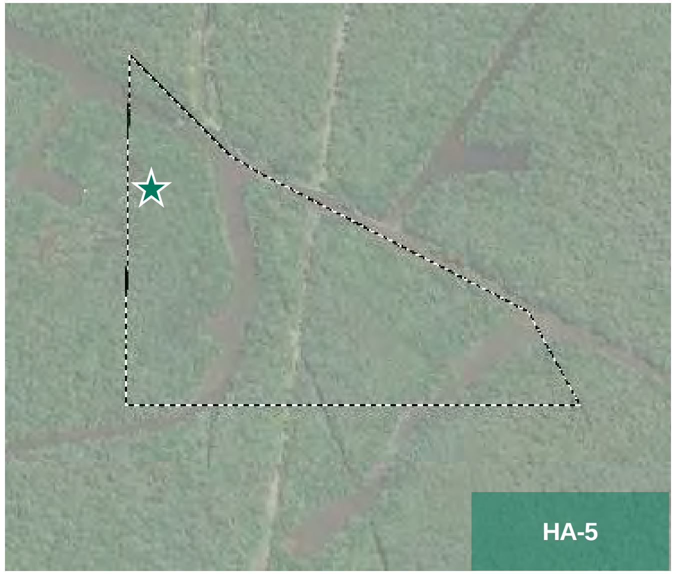


Alligatorweed flea beetle

Agasicles hygrophila

Trophic Level

Primary

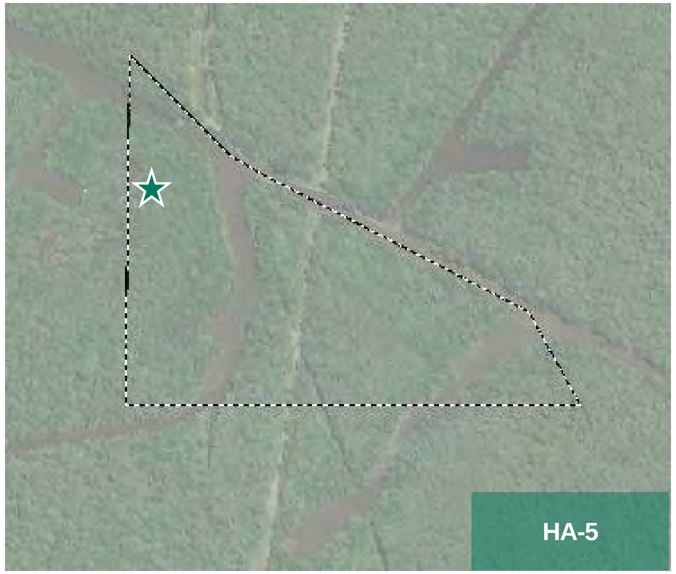


Snake

Suborder Serpentes

Trophic Level

Tertiary

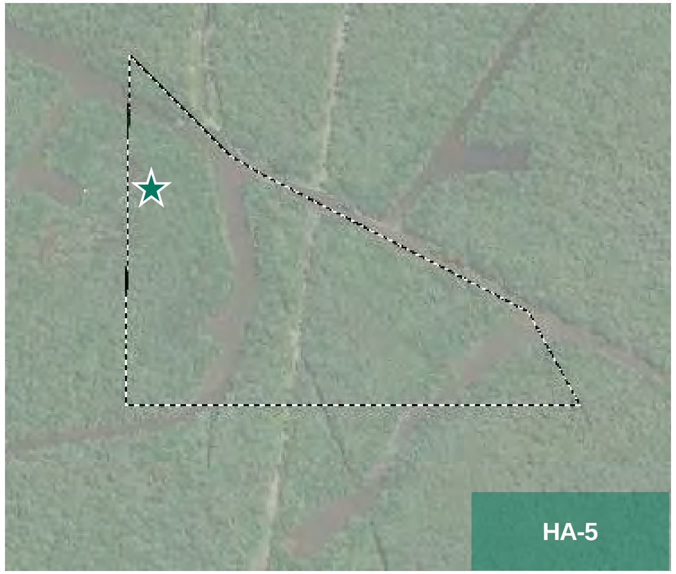


Katydid

Family Tettigoniidae

Trophic Level

Primary



Harvestman spider

Order Opiliones

Trophic Level

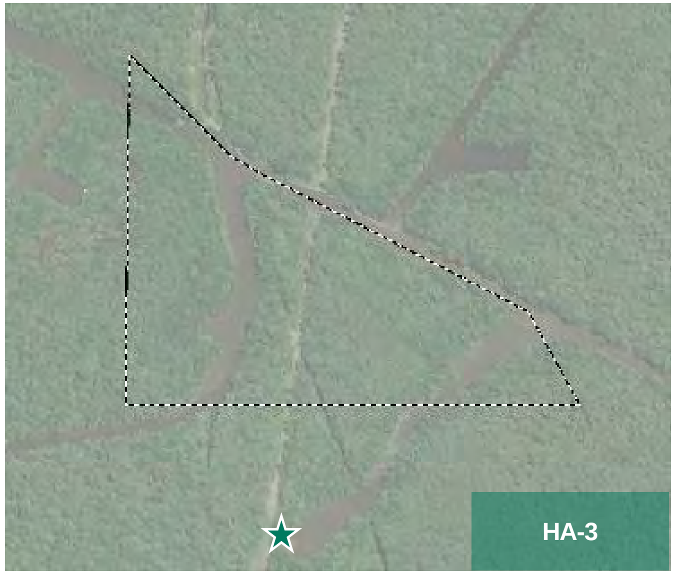
Secondary

May 5, 2022 J. Shugart

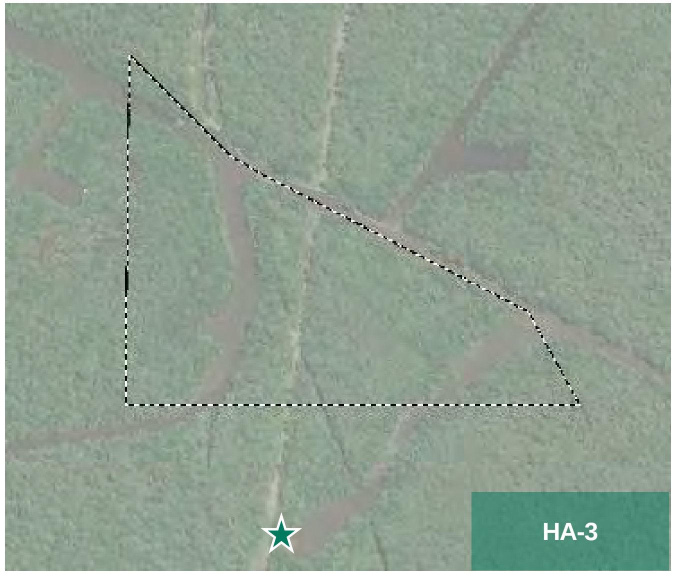
Attachment A-4

Photographs of HA-3 (Off-Site) Vegetation and Wildlife

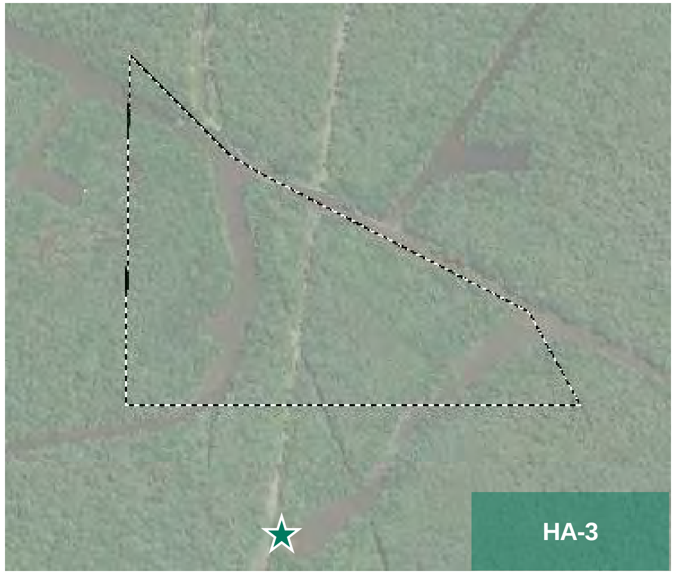
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana



Emergent Marsh



Emergent Marsh

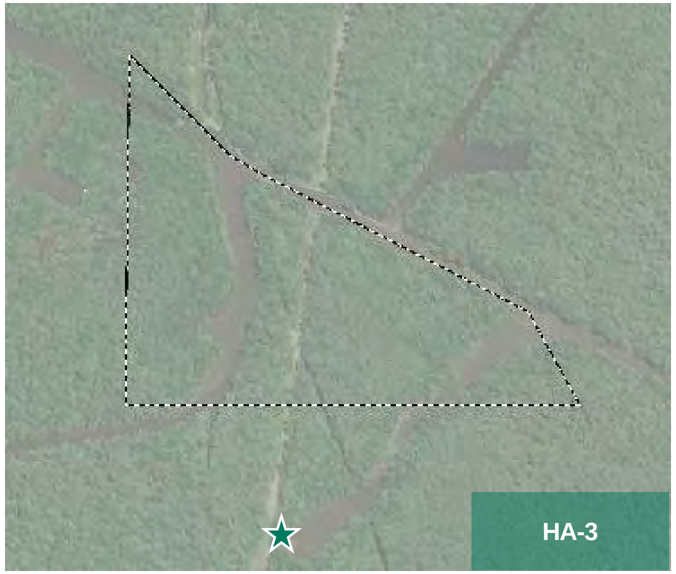


Shoreline sedge

Carex hyalinolepis

Wetland Classification

OBL

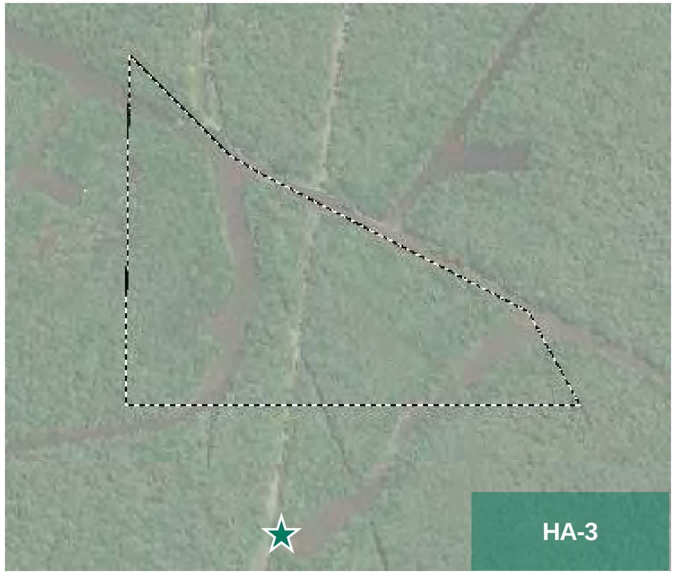


Great Egret

Ardea alba

Diet

Fish

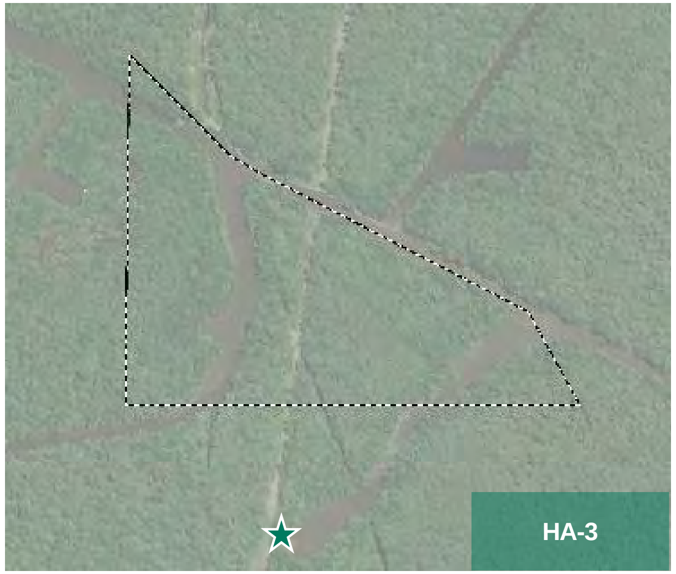


Neotropic Cormorant

Phalacrocorax brasilianus

Diet

Fish

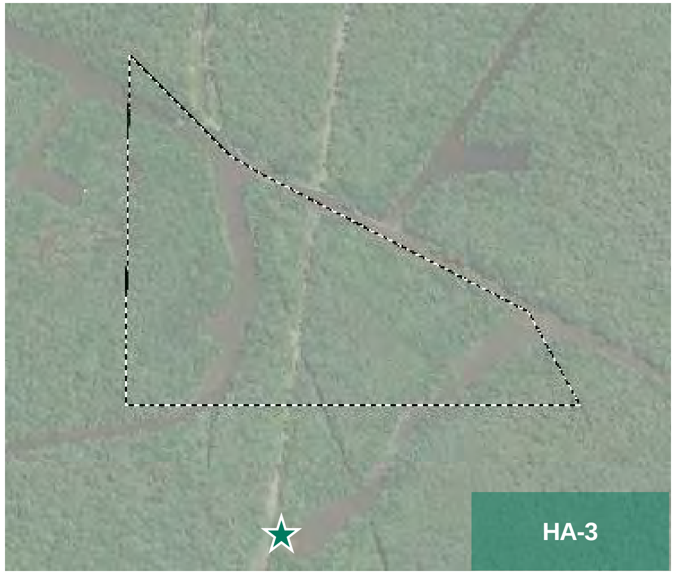


Common five-lined skink

Plestiodon fasciatus

Trophic Level

Secondary

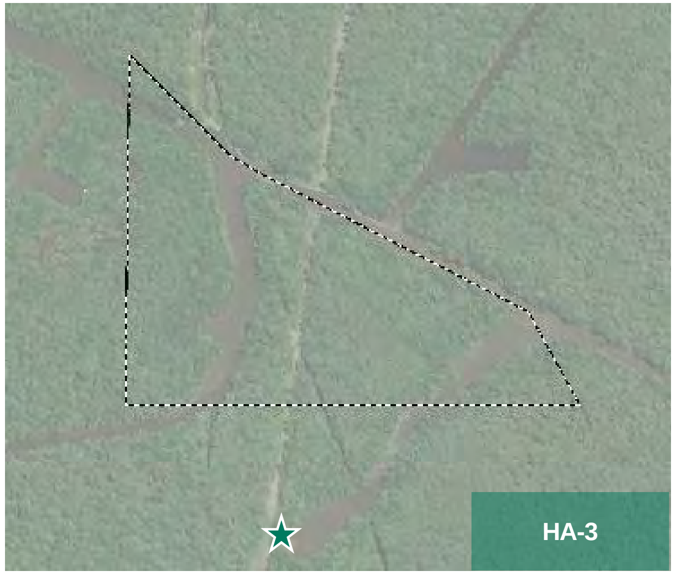


Tussock moth caterpillar

Orgyia spp.

Trophic Level

Primary

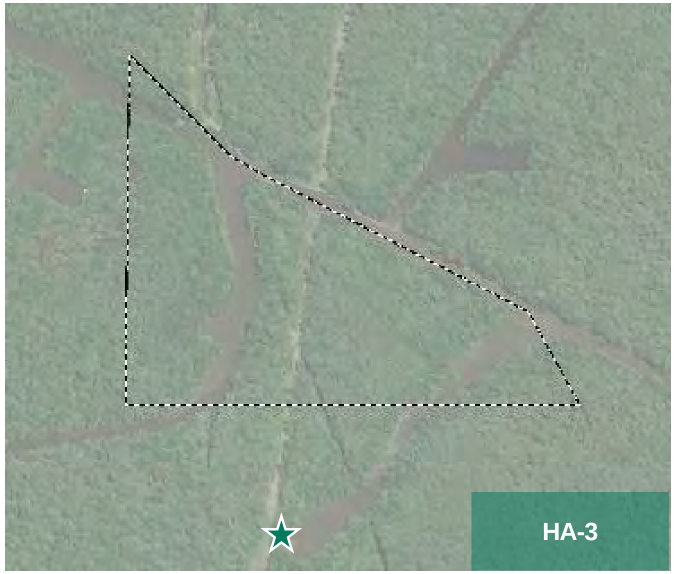


Crawfish trap

Order Decapoda

Trophic Level

Secondary

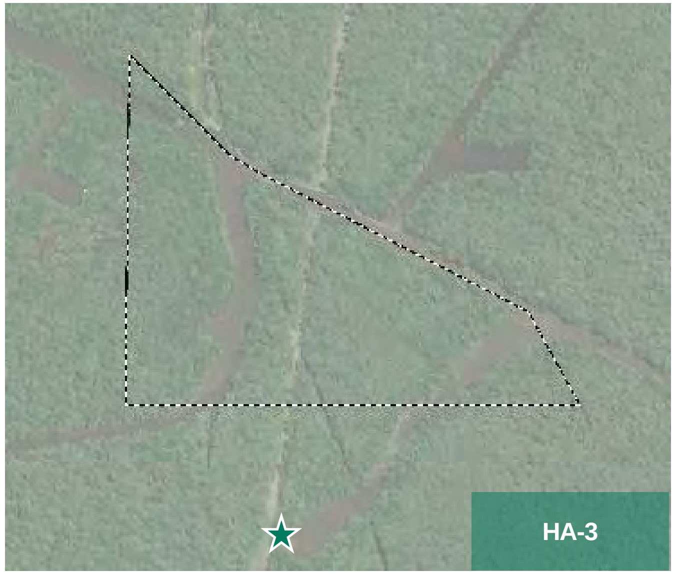


Giant floater mussel

Pyganodon grandis

Trophic Level

Primary



Lovebug

Plecia nearctica

Trophic Level

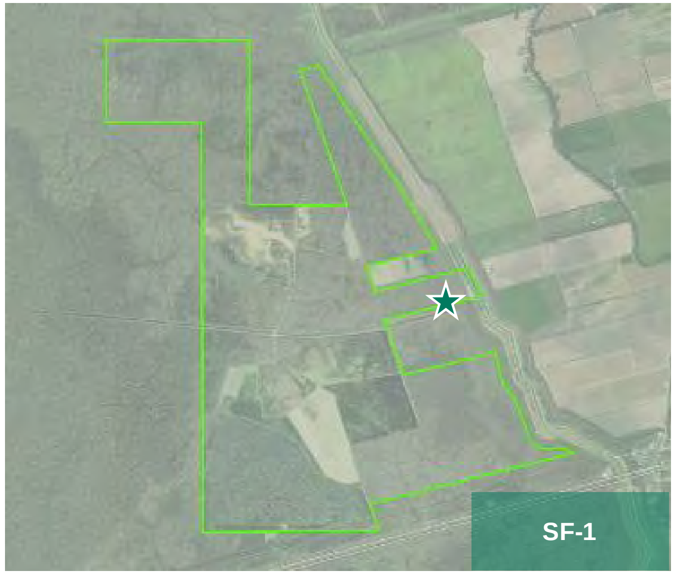
Primary

Southern leopard frog
May 5, 2022 J. Shugart

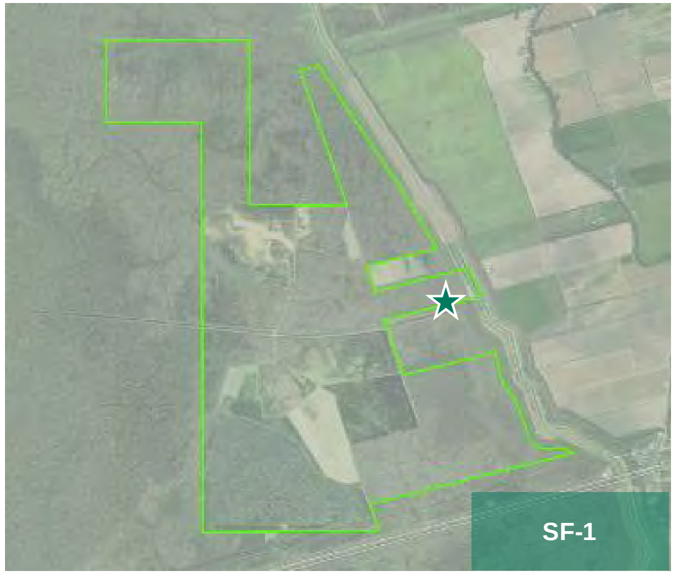
Attachment A-5

Photographs of Sherburne Wildlife Management Area

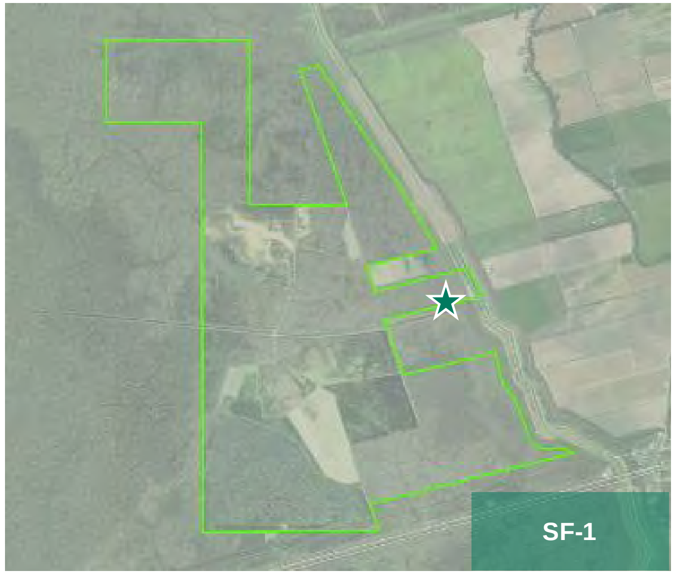
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana



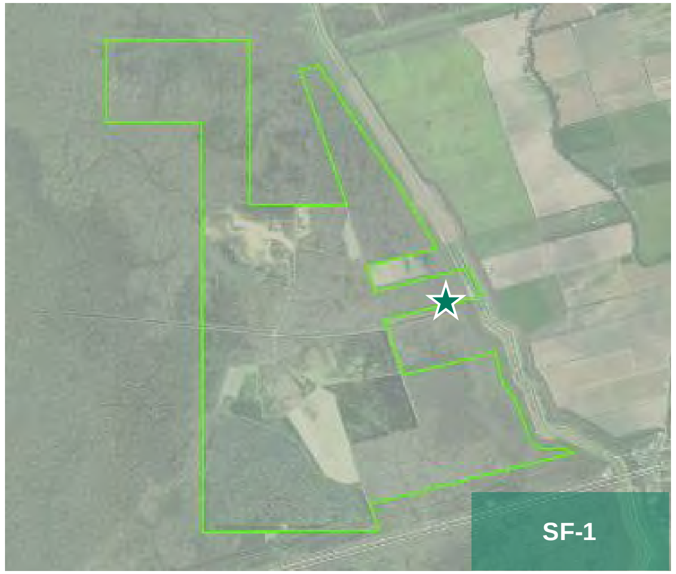
Bottomland Hardwood Forest



Bottomland Hardwood Forest



Cypress Swamp



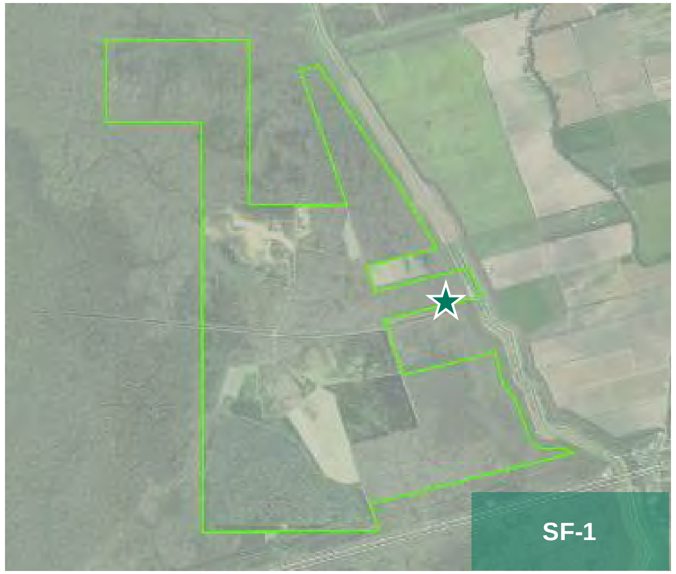
American alligator

Alligator mississippiensis

Trophic Level

Apex

May 5, 2022 J. Shugart

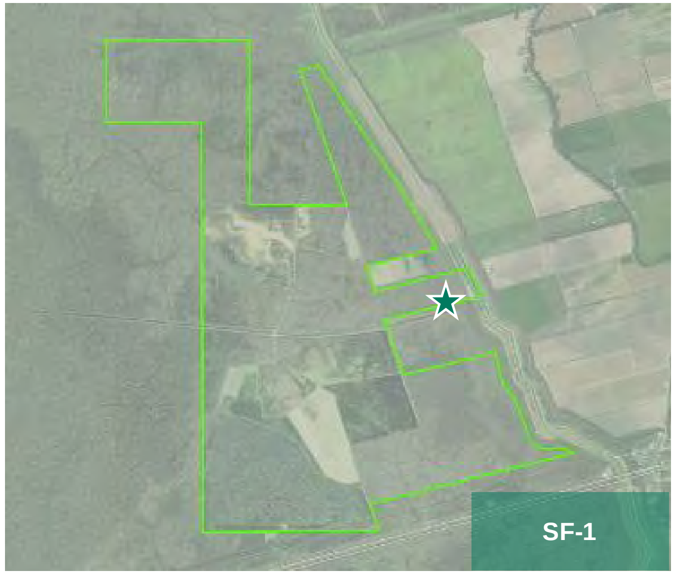


Yellow-Crowned Night Heron

Nyctanassa violacea

Diet

Aquatic Invertebrates



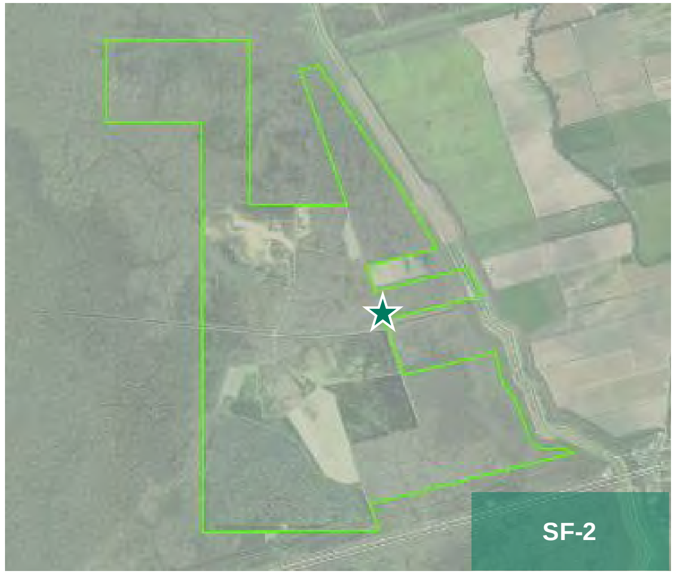
Common eastern firefly

Photinus pyralis

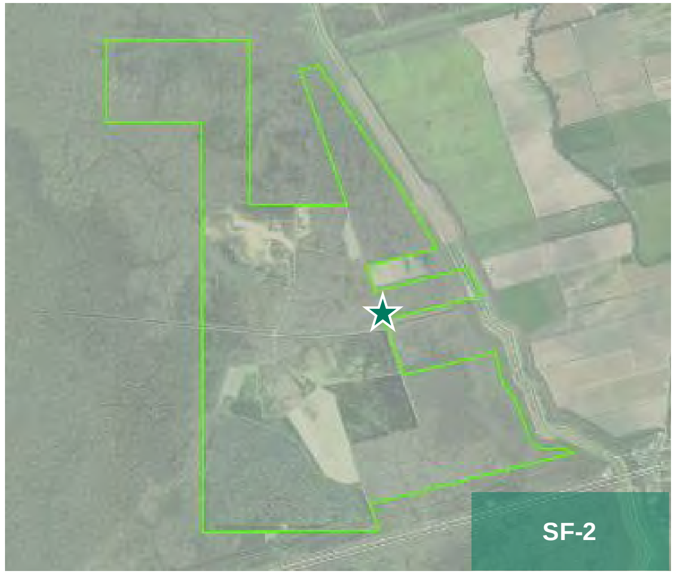
Trophic Level

Primary

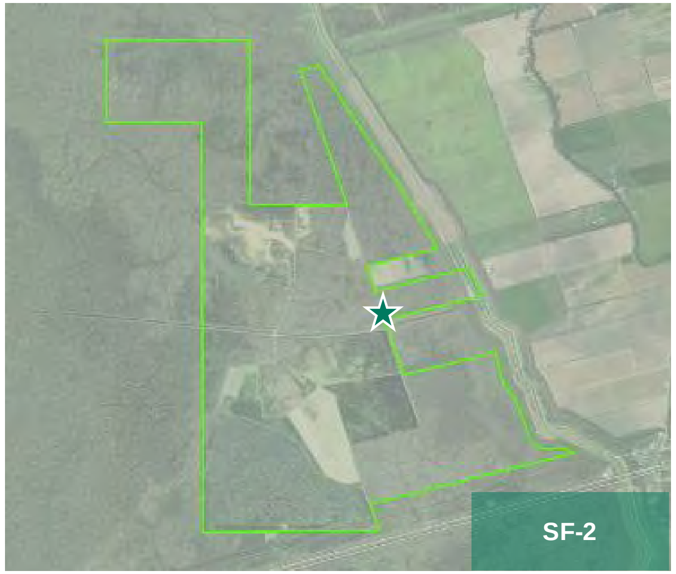
May 5, 2022 J. Shugart



Bottomland Hardwood Forest



Bottomland Hardwood Forest

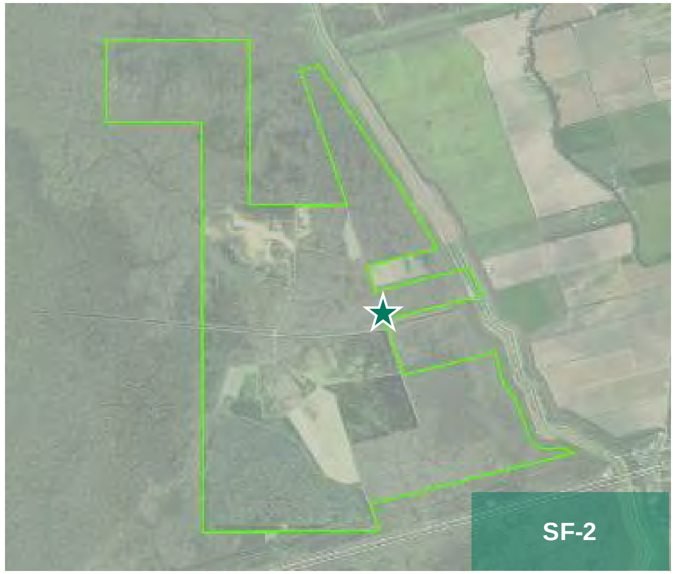


Eastern bluestar

Amsonia tabernaemontana

Wetland Classification

FACW

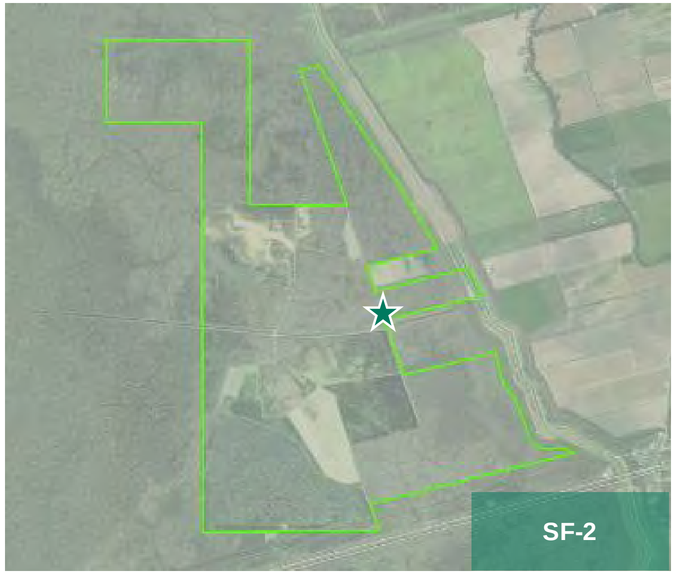


Hop sedge

Carex lupulina

Wetland Classification

OBL

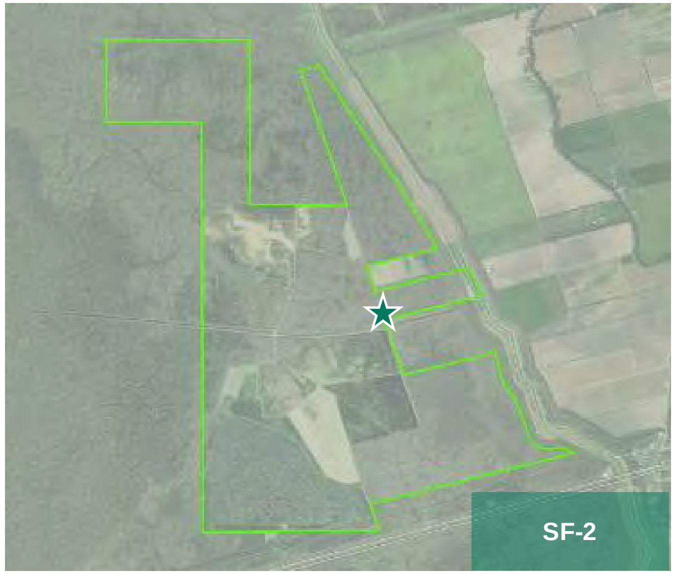


Crowngrass

Paspalum sp.

Wetland Classification

NA

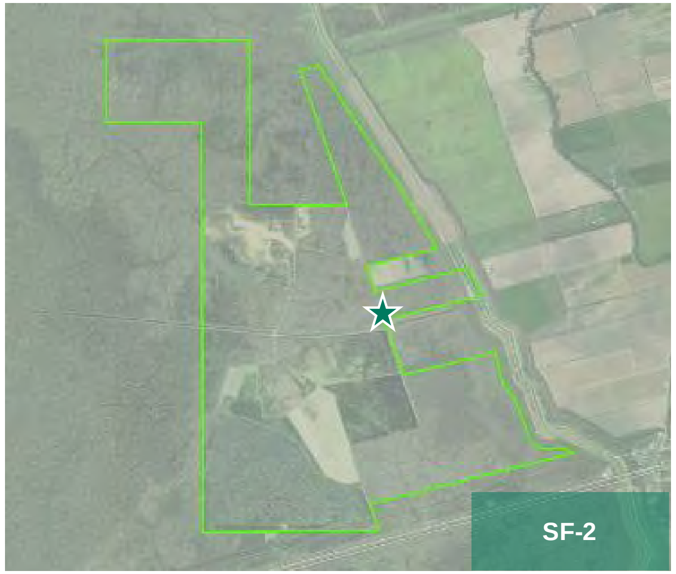


Ravenfoot sedge

Carex crus-corvi

Wetland Classification

OBL

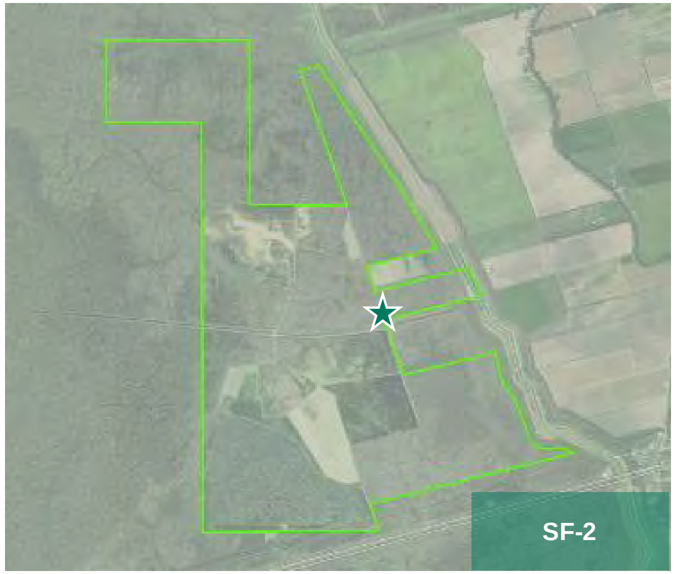


Unknown herb/forb

Unknown

Wetland Classification

Unknown

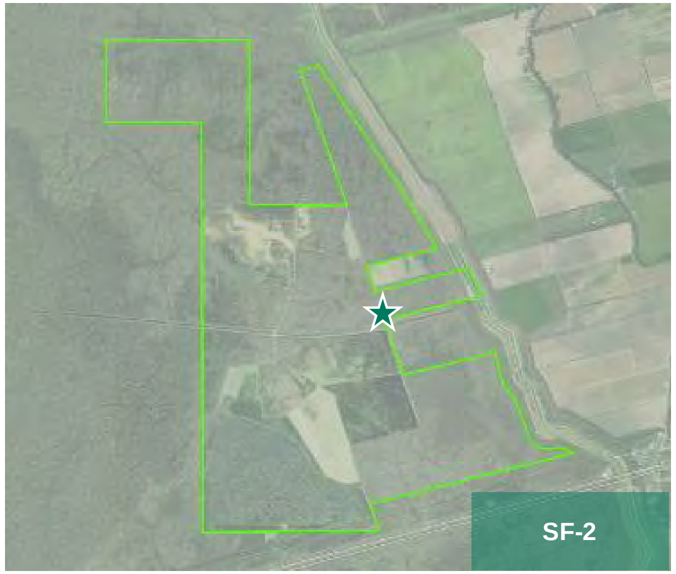


Caterpillar

Symmerista spp.

Trophic Level

Primary

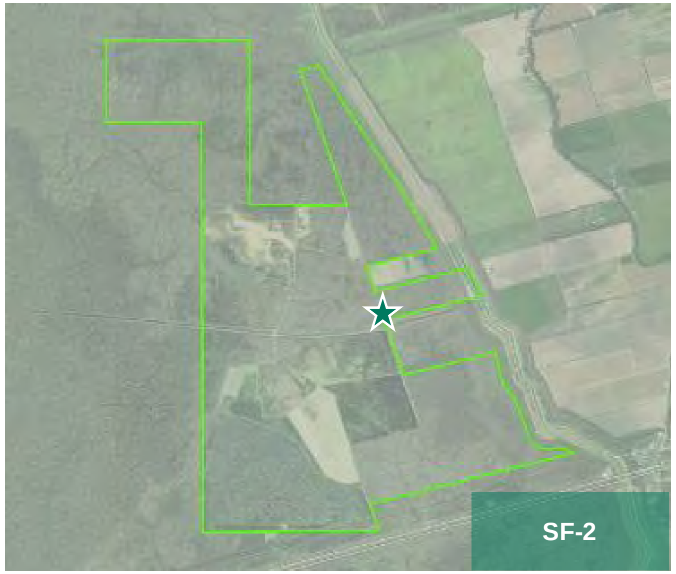


Crescent butterfly

Nymphalinae

Trophic Level

Primary

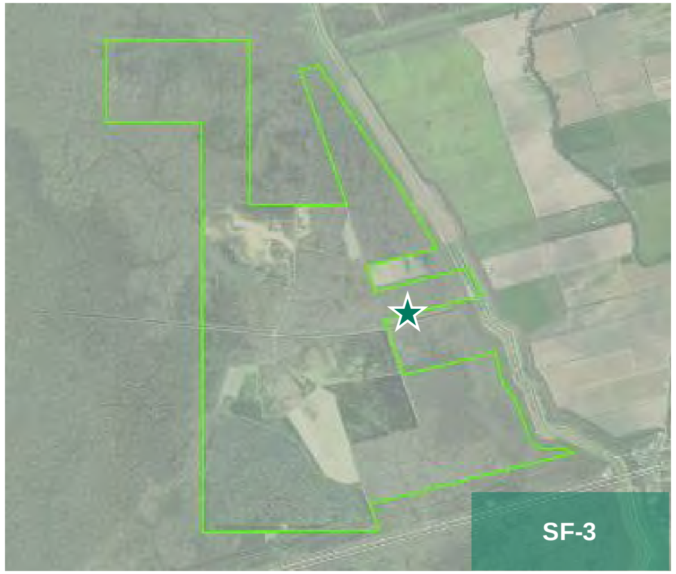


Southern leopard frog

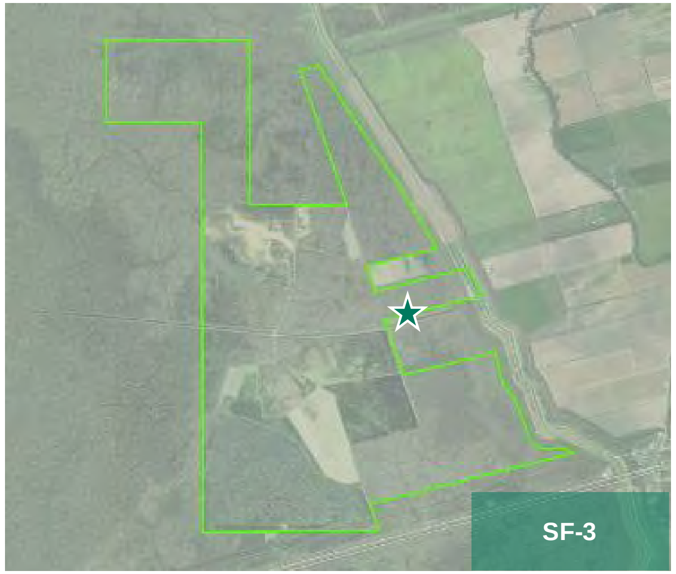
Lithobates sphenocephalus

Trophic Level

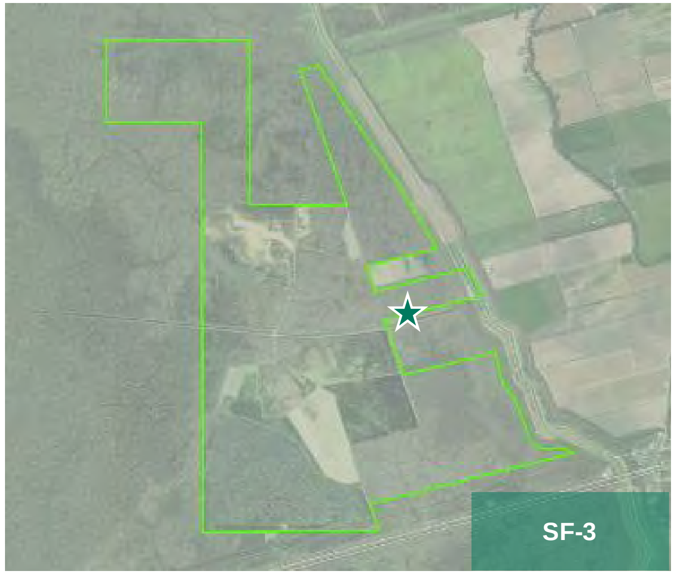
Secondary



Bottomland Hardwood Forest



Bottomland Hardwood Forest



Raccoon

Procyon lotor

Trophic Level

Secondary

ATTACHMENT B FIELD NOTES

November 2022

Location Grand River Date 5/5/22
Project / Client Levert

7:20 Safety meeting
Jack Miller's landing
Plaquemine
Denise Redd-Robinette
George Arceneaux
Donald Watts
Jake VanCoevering
TODD WEBB
Hayden Wallis
Jonathan Neon
Jody Gehrugart
Emily Martin

7:35 Head out to
site to HA-2
Alligator
p red-bellied woodpecker
cuckoo (yellow-billed)
prothonotary warbler
dragonfly

p = Jody photo
photo = Helen photo
JF

Location Grand River Date 5/5/22
Project / Client Levert

7:53 Vegetation survey
pit perimeter

4 photos HA-2
white eyed vireo
chickadee
Northern parula
cypress (bald)
elm (american)
cottonmouth grass
p grasshopper
tallow
mosquitoes
red eyed vireo
dewberry (southern)
sugarberry
poison ivy
lemna
p. apiaceae sp.
p. ~~slug~~ snail sp.
japanese climbing
fern
JF

46

Location Grand River Date 5/5/22

Project / Client Levert

frog sp.
box elder
brunichia obovata
butterweed
p. harvestman
downy woodpecker
water elm
pileated woodpecker
peppervine
american ~~permus~~ persimmon
(cardamine)
p ~~flowering spurge~~.
daddy longlegs
common salvina
cardinal
trumpet creeper
photo HA-2
p. swallow tail caterpillar
lizard tail.
spring spider lily
virginia dayflower
p. carex sp.

HL [signature]

Location Grand River Date 5/5/22 47

Project / Client Levert

red maple
bee sp.
eastern pondhawk
p. carrot sp.
grape sp.
spider sp.
carolina coralbead
fern sp.
cypress knees!
p. grasshopper sp. (#2)
alligator weed
(soft wet soil)
deciduos holly
photo HA-2

8:30 Pit #1 @ HA-2
Black willow
Box elder
Red maple
tallow
apac sp. (carrot)

HL [signature]

48 Location Grand River+ Date 5/5/22
Project / Client Levert

Caroline coralbean
virginia dayflower
Persimmon
Peppervine
juvenile cypress
horned beak sedge
poison ivy
panicum sp.
swamp smartweed
Lemna
prothonary warbler
white eyed vireo
red bellied woodpecker
Cottonmouth grass
Acadian flycatcher
cardinal
white-eyed vireo
apple snail
spider lily
poison ivy
ladies eardrop

HL

Location Grand River Date 5/5/22 49
Project / Client Levert

~~carolina~~ HL
Canadian black snake root
carex sp.
tall ironweed or
american germander
photo pit #1
late flowering boneset
basket grass
frog sp.
American crow
japenese climbing fern
Eastern black nightshade
dragon fly
oak sp.
water oak
butterweed
resurection fern
wasp
marsh fern
virgina creeper

HL

50 Location: Grand River Date 5/5/22
Project / Client Levert

Green flatsedge
blackberry
sugarberry
crawfish
photo HA-2 pit #1
grasshopper sp.
Southern shield fern
heart leafed nettle
cardinal
common chickweed
Southern dewberry
spring spider lily
photo pit #1 HA-2
P melon sp.
sonchus asper
clover
P. clover
eastern pondhawk
sugarberry

HL

Location Grand River Date 5/5/22 51
Project / Client Levert

alligator weed
p. loose flower water willow
water locust
3 photos George, Jody, Emily looking for vireo (white-eyed)
fish crow
chimney swift
skink (little brown)
9:15 Back to boat
GPS coordinates at Pit #1 HA-2
east side of pit
30.194945
91.337651
Pit #2 HA-2
east side of pit
30.195160
91.338058
9:20 Back to boat again

HL

52 Location Grand River Date 5/5/22
Project / Client Levert

9:29 traveling to HA-1
from HA-2
little blue heron
along pipeline right
of way.

9:33 Arrive HA-1
frogs
photo blackberries
HA-1
GPS on eastside of
pit
30.195519
91.341749

cottonmouth grass
blackberry
tallow
box elder
prothonotary warbler

Location Grand River Date 5/5/22 53
Project / Client Levert

yellow throated vireo
tufted titmouse
chickadee
beaver (chewed tree)
frog
clover
3 photos HA-1 at pit
sonchus asper
red-bellied woodpecker
cypress
butterweed
crawfish
spider wort (ohio)
ladies eardrops
virginia creeper
southern dewberry
common salvinia
lemna
red-bellied woodpecker

54 Location Grand River Date 5/5/22
Project / Client Levert

p. slender yellow oxalis
panicum sp. sp.
oak sp. (Schumards)
blue mist flower
carex sp.
Barred owl
p Eastern lubber
hickory (water)
sugarberry
red maple
bald cypress
yellow-throated vireo
loose flower waterwillow
elm
horned beaksedge
trumpet creeper
poison ivy
red-eyed vireo
persimmon
lower elevation, holds water
p. diamond back water 4-5' long snake

Location Grand River Date 5/5/22 55
Project / Client Levert

dragonfly
p. snake in log
boneset (late flowers)
carolina geranium
chickadee
~~cherokee~~ 14c
carrot sp.
carex sp. #2
peppervine
lizard's tongue
travel to HA-6 from HA-1
↳ Gulf Coast toad
3 photos HA-6
standing water
very wet soil
GPS: 30.194890
91.342246
p. prothonotary warbler
carolina wren
no evidence
of hydrocarbon

american crow
red-eyed vireo
cardinal
ants
p. grasshopper
eastern pondhawk
mosquito
water elm
chickadee
2 photos@HA-6 no hydro-carbon, ICON locati-
justicia
spider sp.
red bellied woodpecker
resurrection fern
tupelo
alligator weed
swamp smartweed
small
p. 6-spotted fishing spider

moth
ladybug
horned beak-sedge
frog
moss
crane fly
water elm
ant
bronze frog
turkey vulture (from boat near HA-1)

10:55 arrive at near HA-4 and HA-5 -
photo Iberville remediation
30.1987787 to HA-5
91.34233

11:07 arrive HA-5

58 Location Grand River Date 5/5/22
Project / Client Levert

HA-5 30.197757
91.34240
water elm
water hickory
ladies eardrops
bitter pecan
red maple
crawfish tower
cypress
tallow
eastern pond hawk
swamp smartweed
American elm
horned beak sedge
water ~~honey~~ locust
trumpet creeper
eastern pondhawk
red-eyed vireo
Swamp privet
white-eyed vireo
resurrection fern
Schumard fern
yellow-billed cuckoo

Location Grand River Date 5/5/22 59
Project / Client Levert

cypress (bald)
2 photos HA-5
wet soil, leaf litter
rough leaf dogwood
harvestman
eastern pondhawk
trumpet creeper
p. ludwigea rapens
dragonfly
p. gallium sp. (dainty, 4 leaf)
p. beetle sp.
p. grasshopper sp.
prothontary warbler
p. grasshopper #2
red-shouldered hawk
peppervine
crawfish
p cottomouth snake
photo cottonmouth snake
photo frog

60 Location Grand River Date 5/5/22
Project / Client Levert

red-bellied wood
pecker
checked for salt
parameters
no snags
no crystals
no yellowing
no stunting
no halophytes
no salt species

11:30 Head to HA-4
GPS: 30.197757
91.342409
white-eyed vireo
carolina wren
solidago
ladies eardrop
peppervine
trumpet vine
blackberry
HL [initials]

Location Grand River Date 5/5/22 61
Project / Client Levert

Southern dewberry
blue mist flower
spittle bug
persimmon tree
elderberry
box elder
tallow
p. cool beetles
poison ivy
snail
box elder
red maple
prothonotary warbler
Canada blk snake root
oak sp.
shells in soil
soil is drier
no salt indicators
lizard
p. bug
mosquito
anole
eastern pond hawk
HL [initials]

62 Location Grand River Date 5/5/22
Project / Client Levert

moth
wild strawberry
high bush blackberry
p. venus looking glass?
photo HA-4
white sweet clover
photo HA-4
Carolina coralbean
mulberry (red)
mammal burrow
boneset
Virginia creeper
roughleaf dogwood
water oak
Sonchus asper
Sugarberry
12:00 Head to boat
Japanese honeysuckle
mimosa on
path HA-4 to
boat

Location Grand River Date 5/5/22 63
Project / Client Levert

tricolored heron
heading from
HA-4 to HA-3 in
boat, white perch
alligator

12:30 at HA-3
30.1928474
91.340215
Great blue heron
white eyed vireo
blue grey gnat
catcher
tufted titmouse
prothonotary warbler
pit no water
eastern pondhawk
red maple
peppervine
water oak
buttonweed
tallow tree

64 Location Grand River Date 5/5/22
Project / Client Levert

rough leaf dogwood
Ladies eardrops
carolina coralbean
palmetto (dwarf)
box elder
sanchus asper
sugarberry
spanish moss
American Elm
southern dewberry
mosquitos
virginia creeper
carrot sp.
~~dandelion~~ HC
Canda blk Snakeroot
Youngia japonica
poison ivy
Shumards oak
S. Shield ferm
roughleaf dogwood
carex sp.

Location Grand River Date 5/5/22 65
Project / Client Levert

sow thistle
yellow thistle
N. Parula
Japenese climbing fern
Cottonmouth grass
water elm
butterweed
roughleaf dogwood
black willow
heart leaf nettle
spring spider lily
horned beak sedge
skink
common chickweed
p. carex sp #2
lovebug
resurection fern
persimmon
snails
high bush blackberry
p. caterpillar

66 Location Grand River Date 5/5/22
Project / Client Levert

basket grass
mammal burrow
copper iris
broad headed skink
p. crawfish trap
apple snail
great egret

Back at launch 1:30

3:20 Sherburne WMA
South Farm
Unit
Location SF-1
30.415310
91.526872
Ladies eardrops
red-bellied woodpeck
Acaid Flycatcher
N. Parula
Prothonary Warbler

Location Grand River Date 5/5/22 67
Project / Client Levert

Sugarberry
Bald cypress
mosquitoes
Schumard oak
Panicum sp.
Smilix bona-nox
Persimmon
harvestman
evidence of pigs
2 photos SF-1
eastern pondhawk
pepper vine
Swamp privet
gallium sp. (as site)
frog
water hickory
vitis sp (same as site)
rabbit pellets
trumpet creeper
spanish moss
sweet gum
Spider

68 Location Grand River Date 5/5/22
Project / Client Levert

E. bluestar
S. dewberry
iris sp. (likely copper)
carolina coralbean
rough leaf dogwood
oak leaf litter
wet soil, some
standing water
p. bug
horned beak sedge

traveling to SF-2
see alligator
chickadee
yellow crown night
heron

3:51 SF-2 30.414984
91.532199

black willow
E. bluestar

Location Grand River Date 5/5/22 69
Project / Client Levert

p. Carex sp 15:53
~~panicum sp~~ NC maidencane
peppervine
persimmon
p. carex sp 2 15:58
tallow tree
poison ivy
trumpet creeper
red maple
water hickory
moth
carolina geranium
~~lythrum~~ sp.
symphiotrychum sp.
schumard oak
vitis sp. (like site)
E. pondhawk
cricket
spotted ladies thumb

70 Location Grand River Date 5/5/22
Project / Client Levert

caterpillar
sugarberry
pepperwine
ladies eardrops
butterweed
Bald cypress
southern leopard
frog
2 photos @ SF-2
southern dewberry
chickadee
prothonotary warbler
red-winged black bird
p. butterfly
↑ Vanessa sp.
american crow
cardinal

Location Grand River Date 5/5/22 71
Project / Client Levert

4:14 SF-3
30.414318
91.530441

ladies eardrops
swamp smartweed
bald cypress
red maple
mosquito
water hickory
sugarberry
tupello
2 photos SF-3
loose flower water willow
trumpet creeper
vitis sp
carex sp.
butterweed
tallow
Shumards oak
persimmon
paper wasp
harvestmen
Prothon. warbler

Location Grand River Date 5/5/22

Project / Client Levert

ants
box elder
maidencane
Smilax bona-nox
peppervine
E. bluestar
chickweh
4:20 end site
p. raccon + baby on tree

Location Date

Project / Client

August Levert Date 8/17/22 117
0645446

Jude Baudoin - HET
Matt Green - HET
Hayden Wallis - HET
Jake Vancowering - HET
Denise Redd-Robinette
Chase Jaubert ICON
safety Meeting 8:41
Jack Miller Landing

Jake: armadillo & saw
family → water snake this
of 3 leopard frog
walking through water

8:49 Head to site
at well 123040
HA-2

9:10 photo near HA-2
frog
9:14 photo second
pit at HA-2
further from
canal

August Levert 8/17/22
0645446

9:31 photo grasshopper beyond HA-2

9:41 HET clearing grasses around tree cypress to do root study water depth 3-4"

9:43 photo water level on trees near cypress "root zone tree"

9:51 video Matt Green root zone study

10:20 Head to HA-4

10:35 2 photos standing water HA-4 area

Levert 8/17/22
0645446

moist soil, wet leaf litter, standing water is 4" deep

10:40 photo HA-4 standing water

10:45 photo HA-5 2" deep water standing

10:49 head to HA-1

10:56 at HA-1 pit 2 photos standing water at HA-1 pit 4" deep water in area

11:02 Head back to HA-2

Hayden says there is squirrel hunting here

Location Levert Date 8/17/22

Project / Client 0645446

11:15 Heading to Landing

11:19 Back to Jack Miller

AL

Location Date

Project / Client

ATTACHMENT C   RECAP FORM 18

November 2022

ATTACHMENT C

RECAP FORM 18
ECOLOGICAL CHECKLIST

Section 1 - Facility Information

1. Name of facility: Levert Property

2. Location of facility: Section 15 of Township 10 South, Range 11E, within the Grand River Oil and Gas Field

   Parish: Iberville Parish, Louisiana

3. Mailing address: NA

4. Type of facility and/or operations associated with AOC:
   Oil and gas exploration and production (E&P)

5. Name of AOC or AOI: Levert Property (BP former operational areas)

6. If available, attach a USGS topographic map of the facility and/or aerial or other photographs of the release site and surrounding areas.

Section 2 - Land Use Information

1. Describe land use at and in the vicinity of the AOC/AOI: The Property is approximately 55 acres of wetland cypress tupelo swamps and bottomland hardwood forests. Permanent residential structures were not observed on the Property. Current and potential future land uses include oil and gas E&P operations, recreational (hunting, fishing), undeveloped, and silviculture.

2. Describe land use adjacent to the facility:
   The surrounding areas are also wetlands with similar anticipated land uses.(oil and gas E&P operations, recreation (hunting, fishing), undeveloped, and silviculture.

3. Provide the following information regarding the nearest surface water body which has been impacted or has the potential to be impacted by COC migrating from the AOC/AOC:

a) Name of the surface water body: Willow Lake and unnamed canals are present within the Levert Property. Additionally, the Levert Property contains USFWS designated freshwater emergent wetlands and freshwater forested/shrub wetlands throughout.

b) Type of surface water body:

   [ ] freshwater river or stream
   [X] freshwater swamp/marsh/wetland
   [ ] saltwater or brackish swamp/marsh/wetland
   [X] lake or pond
   [ ] bayou or estuary
   [ ] drainage ditch
   [X] other: canal

c) Designated use of the segment/subsegment of the surface water body (LAC 33:IX): The Levert Property is located within the LDEQ Subsegment #120107 (Upper Grand River and Lower Flat River – From headwaters to Intracoastal Waterway) and has the following designated uses: primary and secondary contact recreation, and fish and wildlife propagation.

d) Distance from the AOC/AOI to nearest surface water body: 0 feet. The nearest named surface water body, Willow Lake, intersects the Levert Property from north to south. Two canals also traverse the Levert Property.

4. Do any potentially sensitive environmental areas exist adjacent to or in proximity to the site, e.g., federal and state parks, national and state monuments, wetlands, etc? [X] Yes [ ] No

If yes, explain:
Wetlands are present within and surrounding the Levert Property.

Section 3 - Release Information

1. Nature of the release: Investigation of potential releases associated with BP former E&P operations.

2. Location of the release (within the facility): Sampling was performed in various areas of the Levert Property, including the vicinity of BP former operational areas.

3. Location of the release with respect to the facility property boundaries: Potential releases are limited within the Levert Property boundaries.

4. Constituents known or suspected to have been released: Constituents are associated with petroleum exploration & production include salts, metals, and total petroleum hydrocarbons (TPH).

5. Indicate which media are known or suspected to be impacted and if sampling data are available:

[X]	soil 0 - 3 feet bgs	[X] yes	[ ] no	*suspected, sampling data available*
[X]	soil 0 - 15 feet bgs	[X] yes	[ ] no	*suspected, sampling data available*
[X]	soil >15 feet bgs	[X] yes	[ ] no	*suspected, sampling data available*
[X]	groundwater	[X] yes	[ ] no	*suspected, sampling data available*
[ ]	surface water/sediment	[ ] yes	[ ] no	

6. Has migration occurred outside the facility property boundaries? [ ] yes [X] no
If yes, describe the designated use of the offsite land impacted:

Section 4 - Criteria for Further Assessment

If the AOI meets **all** of the criteria presented below, then typically no further ecological evaluation shall be required. If the AOI **does not** meet **all** of the criteria, then a screening level ecological risk shall be conducted. The Submitter should make the initial decision regarding whether or not a screening level ecological risk assessment is warranted based on compliance of the AOI with criteria listed below. After review of the ecological checklist and other available site information, the Department will make a final determination on the need for a screening level ecological risk assessment. If site conditions at the AOI change such that one or more of the criteria are not met, then a screening level ecological risk assessment shall be conducted. Answers shall be based on current site conditions (i.e., shall not consider future remedial actions or institutional or engineering controls).

Indicate if the AOI meets the following criteria:

(1) The area of impacted soil is approximately 5 acres or less in size (based on the AOI identified for the human health assessment) and it is not expected that the COC will migrate such that the soil AOI becomes greater than 5 acres in size. [X] yes [ ] no

(2) There is no current release or demonstrable long-term threat of release (via runoff or groundwater discharge) of COC from the AOI to a surface water body. [X] yes [ ] no

(3) Recreational species, commercial species, threatened or endangered species, and/or their habitats are not currently being exposed, or expected to be exposed, to COC present at or migrating from the AOI.
[ ] yes [X] no *Recreational species are present and are included in the risk assessment.*

(4) There are no obvious impacts to ecological receptors or their habitats and none are expected in the future.

[X] yes [   ] no

Is further ecological evaluation required at this AOI? [X] yes [   ] no
An E&P-related ecological evaluation based on the data collected from the Levert Property is being conducted as a part of this investigation.

Section 5 - Site Summary

Section 6 - Submitter Information

Date: October 3, 2022

Name of person submitting this checklist: Helen R. Connelly, Ph.D.

Affiliation: Environmental Resources Management

Signature: ____________ Date: October 3, 2022

Additional Preparers: ____________

ATTACHMENT D FLORA AND FAUNA

November 2022

ATTACHMENT D-1
Comparison of Plants Documented on the Property and at the Sherburne Wildlife Management Area Reference Area
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

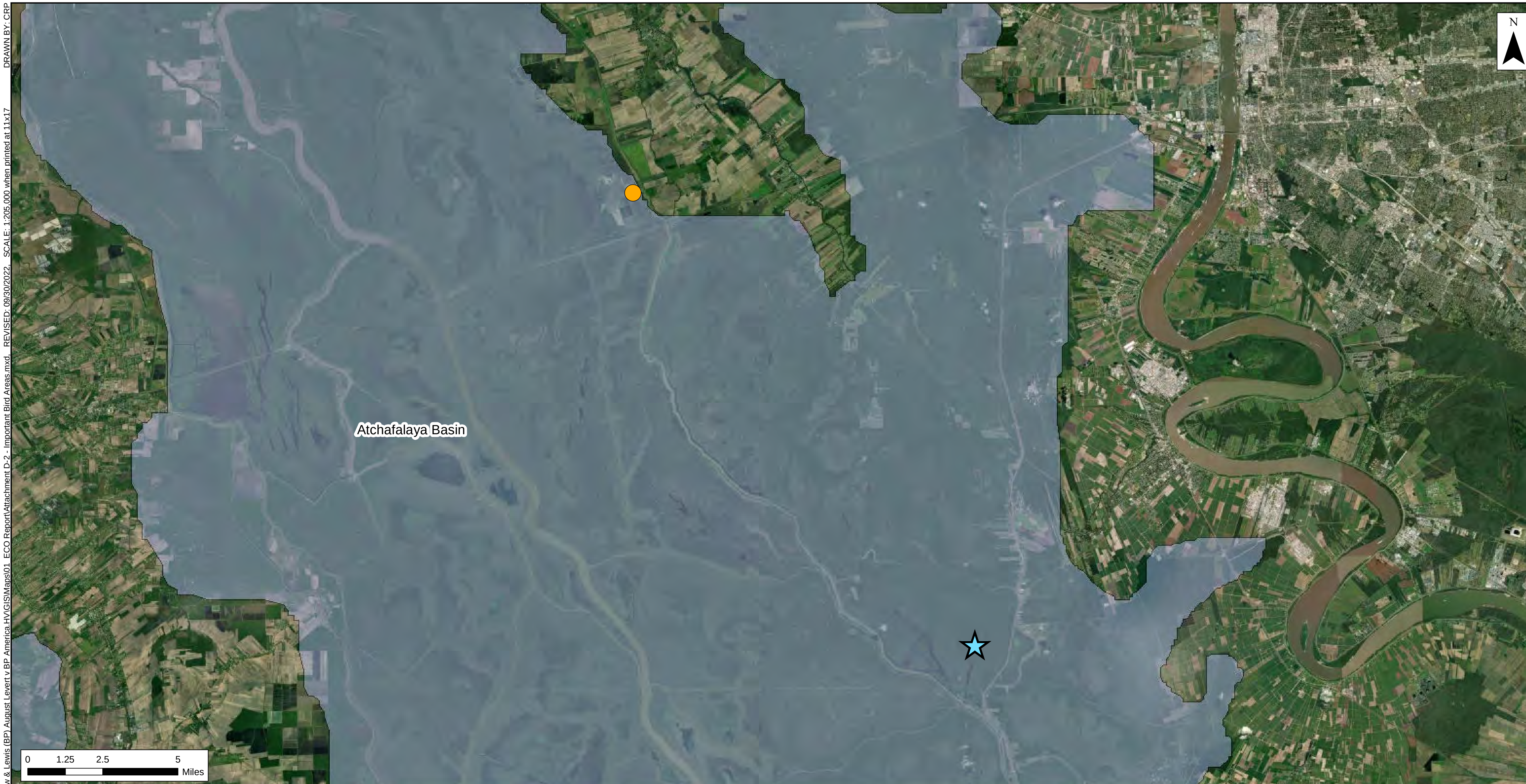
Common Name	*Scientific Name*	Property Checklist	Sherburne WMA Checklist
American buckwheat vine	*Brunnichia ovata*	✓	✓
Bald cypress	*Taxodium distichum*	✓	✓
Bedstraw	*Galium spp.*	✓	✓
Black willow	*Salix nigra*	✓	✓
Boxelder	*Acer negundo*	✓	✓
Butterweed	*Packera glabella*	✓	✓
Carolina coralbead	*Cocculus carolinus*	✓	✓
Carolina geranium	*Geranium carolinianum*	✓	✓
Chinese tallow	*Triadica sebifera*	✓	✓
Common persimmon	*Diospyros virginiana*	✓	✓
Eastern poison ivy	*Toxicodendron radicans*	✓	✓
Eastern swampprivet	*Forestiera acuminata*	✓	✓
Grape	*Vitis spp.*	✓	✓
Looseflower water-willow	*Justicia ovata*	✓	✓
Oak	*Quercus spp.*	✓	✓
Panicgrass	*Panicum spp.*	✓	✓
Peppervine	*Nekemias arborea*	✓	✓
Ravenfoot sedge	*Carex crus-corvi*	✓	✓
Red maple	*Acer rubrum*	✓	✓
Roughleaf dogwood	*Cornus drummondii*	✓	✓
Sedge	Carex spp.	✓	✓
Shortbristle horned beaksedge	*Rhynchospora corniculata*	✓	✓
Shumard's oak	*Quercus shumardii*	✓	✓
Southern dewberry	*Rubus trivialis*	✓	✓
Sugarberry	*Celtis laevigata*	✓	✓
Swamp smartweed	*Polygonum hydropiperoides*	✓	✓
Trumpet creeper	*Campsis radicans*	✓	✓
Water hickory	*Carya aquatica*	✓	✓
Water tupelo	*Nyssa aquatica*	✓	✓
Aster	*Symphyotrichum spp.*		✓
Copper iris	*Iris fulva*		✓
Dallisgrass	*Paspalum dilatatum*		✓
Eastern bluestar	*Amsonia tabernaemontana*		✓
Hop sedge	*Carex lupulina*		✓
Maidencane	*Panicum hemitomon*		✓
Saw greenbrier	*Smilax bona-nox*		✓
Spanish moss	*Tillandsia usneoides*		✓
Spotted ladysthumb	*Polygonum persicaria*		✓
Sweetgum	*Liquidambar styraciflua*		✓
Alligatorweed	*Alternanthera philoxeroides*	✓	
American elm	*Ulmus americana*	✓	
American water willow	*Justicia americana*	✓	
Basketgrass	*Oplismenus hirtellus*	✓	
Blue mistflower	*Conoclinium coelestinum*	✓	
Bluejacket	*Tradescantia ohiensis*	✓	
Bulbous bittercress	*Cardamine bulbosa*	✓	
Canada germander	*Teucrium canadense*	✓	
Canadian black snakeroot	*Sanicula canadensis*	✓	
Carrot	*Family Apiaceae*	✓	
Clasping Venus' looking-glass	*Triodanis perfoliata*	✓	
Clover	*Trifolium spp.*	✓	
Common boneset	*Eupatorium perfoliatum*	✓	
Common chickweed	*Stellaria media*	✓	
Common yellow oxalis	*Oxalis stricta*	✓	
Creeping primrose-willow	*Ludwigia repens*	✓	
Duckweed	Lemna spp.	✓	

ATTACHMENT D-1
Comparison of Plants Documented on the Property and at the Sherburne Wildlife Management Area Reference Area
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Common Name	*Scientific Name*	Property Checklist	Sherburne WMA Checklist
Eastern marsh fern	Thelypteris palustris	✓	
Elderberry	*Sambucus spp.*	✓	
Elm	*Ulmus spp.*	✓	
Fern	*Clade Tracheophyta*	✓	
Fivelobe Cucumber	*Cayaponia quinqueloba*	✓	
Goldenrod	*Solidago spp.*	✓	
Green ash	*Fraxinus pennsylvanica*	✓	
Green flatsedge	*Cyperus virens*	✓	
Heartleaf nettle	*Urtica chamaedryoides*	✓	
Honey locust	*Gleditsia triacanthos*	✓	
Indian strawberry	*Duchesnea indica*	✓	
Japanese climbing fern	*Lygodium japonicum*	✓	
Kunth's maiden fern	*Thelypteris kunthii*	✓	
Lateflowering thoroughwort	*Eupatorium serotinum*	✓	
Lizard's tail	*Saururus cernuus*	✓	
Long's sedge	*Carex longii*	✓	
Marsh seedbox	*Ludwigia palustris*	✓	
Melon	*Family Cucurbitaceae*	✓	
Moss	*Bryophyta*	✓	
Nuttall oak	*Quercus texana*	✓	
Pecan	*Carya illinoinensis*	✓	
Planertree	*Planera aquatica*	✓	
Possumhaw (Ilex genus)	*Ilex decidua*	✓	
Red mulberry	*Morus rubra*	✓	
Resurrection fern	*Pleopeltis polypodioides*	✓	
Savannah-panicgrass	*Phanopyrum gymnocarpon*	✓	
Sawtooth blackberry	*Rubus argutus*	✓	
Sieva bean	*Phaseolus lunatus*	✓	
Slender yellow woodsorrel	*Oxalis dillenii*	✓	
Spider lily	*Hymenocallis occidentalis*	✓	
Spiny sowthistle	*Sonchus asper*	✓	
Stiff marsh bedstraw	*Galium tinctorium*	✓	
Virginia creeper	*Parthenocissus quinquefolia*	✓	
Virginia dayflower	*Commelina virginica*	✓	
Water locust	*Gleditsia aquatica*	✓	
Water oak	*Quercus nigra*	✓	
Water spangles	*Salvinia minima*	✓	
West Indian nightshade	*Solanum ptychanthum*	✓	
White clover	*Trifolium repens*	✓	
Whitenymph	*Trepocarpus aethusae*	✓	
Yellow Thistle	*Cirsium horridulum*	✓	
Total Documented	97	87	39

Notes
Wetland classification and growth habit is provided by the USDA (2022) PLANTS database.
Sherburne Wildlife Management Area species recorded by Dr. Helen Connelly (ERM, May 5, 2022) and Mr. Jody Shugart (ERM, May 5, 2022).

References
U.S. Department of Agriculture (USDA) Natural Resources Conservation Service. 2022. PLANTS Database. Available: https://plants.sc.egov.usda.gov/java/. Accessed August 2022.



August Levert Property Location

Sherburne Wildlife Management Area

Important Bird Areas

Attachment D-2
Important Bird Areas
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Notes:
Aerial Imagery Basemap via ESRI
Important Bird Areas from US Audubon (2022).

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\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America HV\GIS\Maps\01_ECO Report\Attachment D-2 - Important Bird Areas.mxd   REVISED: 09/30/2022   SCALE: 1:205,000 when printed at 11x17   DRAWN BY: CRP

Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N

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ATTACHMENT D-3
Comparison of Birds Documented on the Property and at the Sherburne Wildlife Management Area Reference Area
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Common Name	*Scientific Name*	Property Checklist	Sherburne WMA Checklist
Acadian Flycatcher	*Empidonax virescens*	✓	✓
American Crow	*Corvus brachyrhynchos*	✓	✓
Barred Owl	*Strix varia*	✓	✓
Carolina Chickadee	*Poecile carolinensis*	✓	✓
Carolina Wren	*Thryothorus ludovicianus*	✓	✓
Downy Woodpecker	*Dryobates pubescens*	✓	✓
Fish Crow	*Corvus ossifragus*	✓	✓
Little Blue Heron	*Egretta caerulea*	✓	✓
Northern Cardinal	*Cardinalis cardinalis*	✓	✓
Northern Parula	*Setophaga americana*	✓	✓
Pileated Woodpecker	*Dryocopus pileatus*	✓	✓
Prothonotary Warbler	*Protonotaria citrea*	✓	✓
Red-bellied Woodpecker	*Melanerpes carolinus*	✓	✓
Red-eyed Vireo	*Vireo olivaceus*	✓	✓
Tricolored Heron	*Egretta tricolor*	✓	✓
Tufted Titmouse	*Baeolophus bicolor*	✓	✓
Turkey Vulture	*Cathartes aura*	✓	✓
White-eyed Vireo	*Vireo griseus*	✓	✓
Yellow-billed Cuckoo	*Coccyzus americanus*	✓	✓
Anhinga	*Anhinga anhinga*		✓
Barn Swallow	*Hirundo rustica*		✓
Black-bellied Whistling Duck	*Dendrocygna autumnalis*		✓
Blue Jay	*Cyanocitta cristata*		✓
Blue-gray Gnatcatcher	*Polioptila caerulea*		✓
Brown-headed Cowbird	*Molothrus ater*		✓
Cliff Swallow	*Petrochelidon pyrrhonota*		✓
Common Gallinule	*Gallinula galeata*		✓
Common Grackle	*Quiscalus quiscula*		✓
Common Yellowthroat	*Geothlypis trichas*		✓
Great Blue Heron	*Ardea herodias*		✓
Great Crested Flycatcher	*Myiarchus crinitus*		✓
Great Egret	*Ardea alba*		✓
Green Heron	*Butorides virescens*		✓
Indigo Bunting	*Passerina cyanea*		✓
Kentucky Warbler	*Geothlypis formosa*		✓
Least Bittern	*Ixobrychus exilis*		✓
Mississippi Kite	*Ictinia mississippiensis*		✓
Neotropic Cormorant	*Phalacrocorax brasilianus*		✓
Orchard Oriole	*Icterus spurius*		✓
Painted Bunting	*Passerina ciris*		✓
Pied-billed Grebe	*Podilymbus podiceps*		✓
Purple Gallinule	*Porphyrio porphyrio*		✓
Red-winged Blackbird	*Agelaius phoeniceus*		✓
Ruby-throated Hummingbird	*Archilochus colubris*		✓
Snowy Egret	*Egretta thula*		✓
Spotted Sandpiper	*Actitis macularius*		✓
Wood Duck	*Aix sponsa*		✓
Yellow-crowned Night-Heron	*Nyctanassa violacea*		✓
Chimney Swift	*Chaetura pelagica*	✓	
Red-shouldered Hawk	*Buteo lineatus*	✓	
Yellow-throated Vireo	*Vireo flavifrons*	✓	
Total Species	51	22	48

Notes

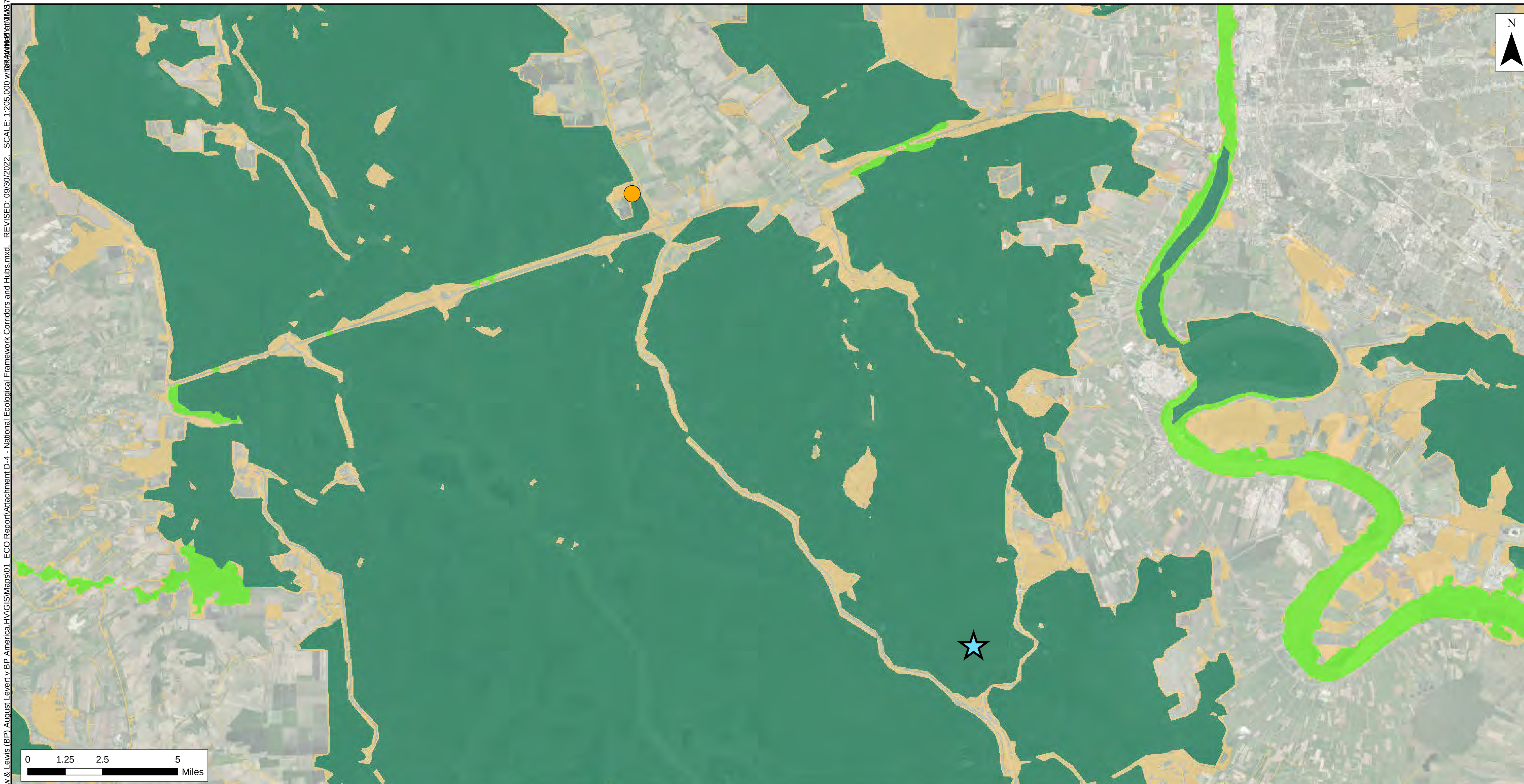
Diet data provided by the The Cornell Lab (2022).

Sherburne WMA South Farm Unit checklist combines field data from Dr. Helen Connelly (ERM) and Jody Shugart's (ERM) field data from the May 5, 2022, site investigation and all species documented on eBird in the South Farm Unit in May 2022 (eBird, 2022).

References

The Cornell Lab. 2022a. All About Birds. Available: https://www.allaboutbirds.org/news/. Accessed August 2022.

eBird. 2022. "Sherburne WMA Complex--South Farm." Available: https://ebird.org/hotspot/L727380. Downloaded May 27, 2022.



August Levert Property Location

Sherburne Wildlife Management Area

NEF Hubs

NEF Corridors

Auxiliary connections

Notes:
Sherburne WMA is predominately ecological hub.
Aerial Imagery Basemap via ESRI.
NEF: National Ecological Framework from US EPA.

Attachment D-4
National Ecological Framework Corridors, Hubs, and Connectivity
August J. Levert, Jr., Family, LLC, et al. v.
BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

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\\USBDCFS02\Data\Houston\Projects\0645446 Liskow & Lewis (BP) August Levert v BP America.HV\GIS\Maps\01_ECO Report\Attachment D-4 - National Ecological Framework Corridors and Hubs.mxd, REVISED: 09/30/2022, SCALE: 1:205,000 when printed at 11x17

Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N

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ATTACHMENT E BARIUM SOIL SCREENING VALUE

November 2022

ATTACHMENT E-1

Calculated Barium Soil Screening Value

August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

1. INTRODUCTION

The form (compound) of barium in Property soils is barium sulfate. X-ray diffraction analyses (XRD) demonstrate that barium sulfate is the only form of barium in Property soils (HET/ICON, 2022, see Table 5). Barium sulfate is of very low toxicity in aquatic and terrestrial soils and sediments.

I have calculated a barium sulfate soil screening value for delineating AOIs at this Property because screening values for barium sulfate are not available from USEPA, LDEQ, and LDNR. The screening value calculated for the Property is based on toxicity to invertebrates and plants, which are the ecological receptors that are primarily in direct contact with soils. There is sufficient information in the scientific literature to calculate an invertebrate and plant screening value based on barium sulfate and direct contact with soil, whereas the information in the scientific literature for mammals and birds and this pathway of exposure is limited. Barium sulfate risk to mammals and birds is calculated based on ingestion (including soil ingestion) as the primary route of exposure (USEPA, 1997).

2. LITERATURE REVIEW

To calculate the screening value, I performed a literature review and identified seven scientific studies that report invertebrate and/or plant effects associated with barium sulfate in soil. These scientific studies are specific to barium sulfate, rather than other more soluble forms of barium that have different toxicities. The studies identified are shown in Attachments E-2 through E-7 (Lamb et al., 2103; ESG, 2003; Simini et al., 2002; Kuperman et al., 2006; Kuperman et al., 2002; Honarvar, 1975; and Miller et al., 1980).

In the seven barium sulfate studies (literature review), there are 19 no observed effects concentrations (NOEC) and 7 lowest observed effects concentrations (LOEC) reported that I used to develop the soil screening value. A NOEC is defined as the highest tested concentration in a laboratory or field toxicity test at which no statistically or biologically significant adverse effects are observed. A LOEC is the lowest value at which an adverse effect is observed. NOECs and LOECs for the health effects of reproduction, growth, and survival in plants and invertebrates were included in developing the screening value (USEPA, 1997). The seven studies also report effects concentrations (NOECs and LOECs) that were not used in developing the screening value, however the 19 NOECs and 7 LOECs are the highest or the lowest, respectively, for each health effect studied, making these NOECs and LOECs the most conservative choices for developing the screening value. Both NOECs and LOECs are reported in ecological risk assessment (USEPA, 1997). The use of a NOEC as a screening value, at the screening level of ecological risk assessment (AOI delineation) is appropriate.

3. BARIUM ANALYTICAL METHODS

The studies we evaluated to develop the barium Property soil screening value include three types of barium concentrations: 1) “nominal” barium sulfate concentrations, which are the result of intentionally mixing known amounts of barium sulfate and soil in the lab, in order to achieve a specific soil concentration for toxicity testing, 2) "total barium" concentrations, which result from analyzing the amount of barium that can be extracted from a sample using concentrated and heated acid, or from analyzing a sample using a mineralogic analysis, such as XRF, and 3) "barium" concentrations that are the result of acid extraction and analysis similar to the USEPA method 3050/6010 used in LDEQ investigations. Generally, "nominal" or "total barium" are larger concentrations than "barium" concentrations, however, the differences in reported concentrations from these methods are related to the analytical method, rather than the amount of barium in the sample. For the calculation of this soil screening value, "barium" concentrations are used. "Barium" concentration data (as defined here) are the type of data previously used by ERM to develop a sediment barium screening value (ERM, 2019) and are the type of data used by LDEQ (RECAP, 2003). There are sufficient "barium" NOECs and LOECs to calculate a soil barium screening value. All NOEC and LOEC data in the literature review, including all data from "total barium" and "nominal" studies, support that barium sulfate in soil is of very low toxicity to soil invertebrates and to plants.

3.1 "Nominal" Data: Barium Sulfate Toxicity

To understand the very low toxicity of barium sulfate to soil invertebrates and plants, all NOECs and LOECs ("nominal", "total barium", and "barium") from the literature search were evaluated. In the three studies that report "nominal" barium sulfate concentrations (ESG, 2003; Honavar, 1975; Miller et al., 1980), barium sulfate is shown to be of extremely low toxicity to soil invertebrates, such as insects and earthworms, and the reported no effect to survival (NOEC) value is 1,000,000 mg/kg dw barium sulfate (no effect due to exposure to 100% barium sulfate). For plants, such as clovers, grasses, green beans, and corn, the no effects to growth and survival (NOEC) value is an average of 297,777 mg/kg dw barium sulfate. This represents no effect to plants at higher concentrations than are encountered at the Property, or at legacy sites, generally. In summary, invertebrates and plants exposed to large amounts of nominally measured barium sulfate in soil, in a laboratory setting, are not predicted to have adverse effects to growth and survival. "Nominally" measured barium sulfate toxicity data are shown in Attachment E-3 and E-4.

3.2 "Total Barium" Data: Barium Sulfate Toxicity

NOECs and LOECs based on "total barium" concentrations from the literature review demonstrate no effects to growth, reproduction, and survival (invertebrates) in "total barium" concentrations up to 29,200 mg/kg dw barium in soil. The "total barium" no effects average is 10,900 mg/kg dw barium in soil for worms and insects, however this is likely a low estimate for no effects. That is, higher concentrations likely would also cause no effects. For most of these studies, the highest concentrations tested in each experiment (e.g., 10,000 – 29,200 mg/kg dw) did not cause adverse effects. The actual no effects value may be higher, if higher concentrations had been tested.

In some instances, there are "total barium" LOEC values that are lower than NOEC values (Simini et al., 2002; Kuperman et al., 2007). This is due to there being multiple types of tests performed and species used, which results in some variation, but this is not a source of concern. The authors of these specific studies (Simini et al., 2002; Kuperman et al., 2007) reported in their paper that they found barium sulfate to be so non-toxic, including in the LOECs mentioned here, that they elected to shift their study to soluble forms of barium, rather than barium sulfate, and calculated a USEPA toxicity value for soluble barium (which is not the form of barium at the Property). In summary, barium sulfate, measured as "total barium" is of very low toxicity, and is supportive of the ultimate barium soil screening value calculated using "barium" NOECs and LOECs. "Total barium" toxicity data are shown in Attachments E-5 and E-6.

3.3 “Barium” Data: Barium Sulfate Toxicity

The barium soil screening value developed for the Property was calculated using “barium” NOEC data for invertebrates (earthworms) and plants (ryegrass). These “barium” data used are the result of the same type of analytical methods that we have used previously to develop a barium sediment screening value (2197 mg/kg dw barium in sediment, ICON/HET? XXX). That is, the sediment barium screening value of 2,197 mg/kg dw and the calculated soil screening value (2,424 mg/kg dw) developed for this Property are both based on barium data that are the result of similar barium extraction and analysis laboratory methodology.

As explained, barium analytical results vary widely, depending on the extraction method and analytical equipment used, therefore, it is important that the analytical methods used to develop a screening value are similar to the analytical methods used to analyze barium in Property soils. For this reason, the “barium” NOECs are used to calculate the Property soil screening value, because the “barium” NOEC studies use similar acid digestion and inductively coupled plasma (ICP) analysis (Lamb et al., 2013; ESG, 2003), as used by ERM (3050/6010) to analyze Property data, in accordance with RECAP requirements. Therefore, the “barium” NOECs are the most appropriate data for calculating a barium soil screening value.

4. BARIUM SOIL SCREENING VALUE: CALCULATION

There are 3 “barium” invertebrate NOECs and one “barium” plant NOEC identified in the literature review of barium sulfate toxicity in soil. The four NOEC values are similar, which lends confidence to the results: 2033, 3377, 2080, 1910 (all mg/kg dw barium in soil). The three invertebrate NOECs of 2033, 3377, 2080 (mg/kg dw) are for no adverse effects to earthworm growth and survival (Lamb et al., 2013; ESG, 2003), and the plant NOEC of 1,910 mg/kg dw is for no adverse effect to ryegrass growth (ESG, 2003). There is a plant LOEC from Lamb et al. (2013) that is a lower value than the plant NOEC, but it is not included, as this plant study uniformly produced effects at all concentrations, other than the control, indicating interference from other factors. The authors (Lamb et al., 2013) identified that their results are not in agreement with other barium plant studies.

To calculate the barium soil screening value for the Property, the three invertebrate NOECs (2033 mg/kg dw, 3377 mg/kg dw, 2080 mg/kg dw) were used to calculate an average (2,493 mg/kg dw), a geometric mean (2,424 mg/kg dw) and a median (2,080 mg/kg dw). These three values were compared to the plant NOEC of 1,910 mg/kg dw, and the invertebrate values were selected for use, based on being similar to the plant value, and based on having more data to support them.

The geometric mean value of 2,424 mg/kg dw was selected as the soil screening value, as this represents the most commonly used measure of central tendency for toxicity values (USEPA, 2005a). See Inset Table E-1 below for calculations.

Values above 2,424 mg/kg dw do not represent toxicity, but are further evaluated in the ERA.

Data for the barium screening value of 2,424 mg/kg dw are shown on Attachments E-1 and E-2.

Table E-1: Development of Barium Soil Screening Value

Barium Sulfate Invertebrate NOEC	Reference	Barium Sulfate Plant NOEC	Reference
2,033	Lamb et al., 2013	1,910	ESG International, 2003
3,377	Lamb et al., 2013		
2,080	ESG International, 2003		
2,424	**Geometric Mean Invertebrate NOEC**		
2,493	Average Invertebrate NOEC		
2,080	Median Invertebrate NOEC		

ATTACHMENT E-2
Barium Invertebrate NOEC for Barite
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Chemical Name	Species Scientific Name	Species Common Name	Species Group	Organism Age/Weight	Organism Lifestage	Chemical Concentration	Total Barium/ Barium Sulfate	Media Type	Test Location	Observed Duration (Days)	Observed Duration Units (Days)	Endpoint	Effect	Effect Measure-ment	NOEC/LOEC	Concentration	Concentration Units (dw)	pH	Authors	Title	Source	Publication Year
Barium sulfate	*Eisenia fetida*	Earthworm	Invertebrate	Adult	NR	Acid Digestion, ICP/MS	Barium	Soil	Lab	NR	NR	Growth	Weight loss	No effect	NOEC	2,033	mg/kg	6.1 - 8.3	Lamb, D., Matanitobua, V., Palanisami, T., Megharaj, M. and Naidu, R.	Bioavailability of Barium to Plants and Invertebrates in Soils Contaminated by Barite	Environmental Science and Technology, No. 47, pp. 4670-4676	2013
Barium sulfate	*Eisenia fetida*	Earthworm	Invertebrate	Adult	NR	Acid Digestion, ICP/MS	Barium	Soil	Lab	NR	NR	Survival	Mortality	No effect	NOEC	3,367	mg/kg	6.1 - 8.3	Lamb, D., Matanitobua, V., Palanisami, T., Megharaj, M. and Naidu, R.	Bioavailability of Barium to Plants and Invertebrates in Soils Contaminated by Barite	Environmental Science and Technology, No. 47, pp. 4670-4676	2013
Barium sulfate	*Eisenia andrei*	Earthworm	Invertebrate	Adult	NR	E3073A aqua regia digest	Barium	Soil	Lab	14	Days	Survival	Mortality	No Effect	NOEC	2,080	mg/kg	8.01-8.48	ESG International, Guelph, Ontario	Ecotoxicity Evaluation of Reference Site Soils Amended with Barium Sulphate	Technical Appendices for Barite Soil Remediation Guidelines, Alberta, Canada	2003

ATTACHMENT E-3
Barium Plant NOEC for Barite
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Chemical Name	Species Scientific Name	Species Common Name	Species Group	Organism Age/Weight	Organism Lifestage	Chemical Concentration	Total Barium/ Barium Sulfate	Media Type	Test Location	Observed Duration (Days)	Observed Duration Units (Days)	Endpoint	Effect	Effect Measure-ment	NOEC/LOEC	Concentration	Concentration Units (dw)	pH	Authors	Title	Source	Publication Year
Barium sulfate	*Lactuca sativa L.*	Great Lakes lettuce	Plant	Seed	Juvenile	Acid Digestion, ICP/MS	Barium	Soil	Lab	56	Days	Growth	Shoot Biomass	Lowest Effect	**LOEC**	**483**	mg/kg	6.5	Lamb, D., Matanitobua, V., Palanisami, T., Megharaj, M. and Naidu, R.	Bioavailability of Barium to Plants and Invertebrates in Soils Contaminated by Barite	Environmental Science and Technology, No. 47, pp. 4670-4676	2013
Barium sulfate	*Lolium perenne*	Ryegrass	Plant	Seed	Juvenile	E3073A aqua regia digest	Barium	Soil	Lab	14	Days	Growth	Root length	No Effect	**NOEC**	**1,910**	mg/kg	7.98-8.65	ESG International, Guelph, Ontario	Ecotoxicity Evaluation of Reference Site Soils Amended with Barium Sulphate	Technical Appendices for Barite Soil Remediation Guidelines, Alberta, Canada	2003

ATTACHMENT E-4
Nominally Measured Barium Sulfate Invertebrate Effects Due to Barite
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Chemical Name	Species Scientific Name	Species Common Name	Species Group	Organism Age/Weight	Organism Lifestage	Chemical Concentration	Total Barium/ Barium Sulfate	Media Type	Test Location	Observed Duration (Days)	Observed Duration Units (Days)	Endpoint	Effect	Effect Measurement	NOEC/LOEC	Concentration	Concentration Units (dw)	pH	Authors	Title	Source	Publication Year
Barium sulfate	*Onychiurus folsomi*	Springtail insect	Invertebrate	Adult	NR	Nominal	Barium sulfate	Soil	Lab	7	Days	Survival	Mortality	No Effect	NOEC	1,000,000	mg/kg	7.8-8.01	ESG International, Guelph, Ontario	Ecotoxicity Evaluation of Reference Site Soils Amended with Barium Sulphate	Technical Appendices for Barite Soil Remediation Guidelines, Alberta, Canada	2003
Barium sulfate	*Eisenia andrei*	Earthworm	Invertebrate	Adult	NR	Nominal	Barium sulfate	Soil	Lab	14	Days	Survival	Mortality	No Effect	NOEC	1,000,000	mg/kg	8.01-8.48	ESG International, Guelph, Ontario	Ecotoxicity Evaluation of Reference Site Soils Amended with Barium Sulphate	Technical Appendices for Barite Soil Remediation Guidelines, Alberta, Canada	2003

ATTACHMENT E-5
Nominally Measured Barium Sulfate Plant Effects Due to Barite
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Chemical Name	Species Scientific Name	Species Common Name	Species Group	Organism Age/Weight	Organism Lifestage	Chemical Concentration	Total Barium/ Barium Sulfate	Media Type	Test Location	Observed Duration (Days)	Observed Duration Units (Days)	Endpoint	Effect	Effect Measurement	NOEC/LOEC	Concentration	Concentration Units (dw)	pH	Authors	Title	Source	Publication Year
Barium sulfate	*Phaseolus vulgaris*	Green beans	Plant	Seed	Juvenile	Nominal	Barium sulfate	Soil	Lab	56	Days	Growth	Biomass	No effect	NOEC	795,833	mg/kg	6.0 - 6.2	Honarvar, S. Miller, R., Honarvar, S., and Hunsaker, B.	Effect of Drilling Fluid Components and Mixtures on Plants and Soils Effects of Drilling Fluids on Soils and Plants: I. Individual Fluid Components	Utah State University DigitalCommons, Masters Degree J. Environ. Quai., Vol. 9, no. 4	1975 1980
Barium sulfate	*Phaseolus vulgaris*	Green beans	Plant	Seed	Juvenile	Nominal	Barium sulfate	Soil	Lab	56	Days	Growth	Biomass	No effect	NOEC	227,500	mg/kg	6.0 - 6.2	Honarvar, S. Miller, R., Honarvar, S., and Hunsaker, B.	Effect of Drilling Fluid Components and Mixtures on Plants and Soils Effects of Drilling Fluids on Soils and Plants: I. Individual Fluid Components	Utah State University DigitalCommons, Masters Degree J. Environ. Quai., Vol. 9, no. 5	1975 1980
Barium sulfate	*Zea mays succharate*	Sweet corn	Plant	Seed	Juvenile	Nominal	Barium sulfate	Soil	Lab	56	Days	Growth	Biomass	No effect	NOEC	227,500	mg/kg	6.0 - 6.2	Honarvar, S. Miller, R., Honarvar, S., and Hunsaker, B.	Effect of Drilling Fluid Components and Mixtures on Plants and Soils Effects of Drilling Fluids on Soils and Plants: I. Individual Fluid Components	Utah State University DigitalCommons, Masters Degree J. Environ. Quai., Vol. 9, no. 5	1975 1980
Barium sulfate	*Trifolium hybridum*	Alsike Clover	Plant	Seed	Juvenile	Nominal	Barium Sulfate	Soil	Lab	21	Days	Growth	Root Biomass	No Effect	NOEC	30,000	mg/kg	7.98-9.06	ESG International, Guelph, Ontario	Ecotoxicity Evaluation of Reference Site Soils Amended with Barium Sulphate	Technical Appendices for Barite Soil Remediation Guidelines, Alberta, Canada	2003
Barium sulfate	*Dactylis glomerata*	Orchardgrass	Plant	Seed	Juvenile	Nominal	Barium sulfate	Soil	Lab	14	Days	Growth	Shoot Biomass	No Effect	NOEC	1,000	mg/kg	7.86-8.58	ESG International, Guelph, Ontario	Ecotoxicity Evaluation of Reference Site Soils Amended with Barium Sulphate	Technical Appendices for Barite Soil Remediation Guidelines, Alberta, Canada	2003
Barium sulfate	*Dactylis glomerata*	Orchardgrass	Plant	Seed	Juvenile	Nominal	Barium sulfate	Soil	Lab	14	Days	Survival	Emergence	No Effect	NOEC	1,000,000	mg/kg	7.86-8.58	ESG International, Guelph, Ontario	Ecotoxicity Evaluation of Reference Site Soils Amended with Barium Sulphate	Technical Appendices for Barite Soil Remediation Guidelines, Alberta, Canada	2003
Barium sulfate	*Lolium perenne*	Ryegrass	Plant	Seed	Juvenile	Nominal	Barium sulfate	Soil	Lab	14	Days	Growth	Root length	No Effect	NOEC	300,000	mg/kg	7.98-8.65	ESG International, Guelph, Ontario	Ecotoxicity Evaluation of Reference Site Soils Amended with Barium Sulphate	Technical Appendices for Barite Soil Remediation Guidelines, Alberta, Canada	2003
Barium sulfate	*Zea mays succharate*	Sweet corn	Plant	Seed	Juvenile	Nominal	Barium sulfate	Soil	Lab	56	Days	Growth	Biomass	20% Reduction in weight	**LOEC**	**795,833**	mg/kg	6.0 - 6.2	Honarvar, S. Miller, R., Honarvar, S., and Hunsaker, B.	Effect of Drilling Fluid Components and Mixtures on Plants and Soils Effects of Drilling Fluids on Soils and Plants: I. Individual Fluid Components	Utah State University DigitalCommons, Masters Degree J. Environ. Quai., Vol. 9, no. 4	1975 1980

ATTACHMENT E-6
Total Barium Invertebrate Effects Due to Barite
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Chemical Name	Species Scientific Name	Species Common Name	Species Group	Organism Age/Weight	Organism Lifestage	Chemical Concentration	Total Barium/ Barium Sulfate	Media Type	Test Location	Observed Duration (Days)	Observed Duration Units (Days)	Endpoint	Effect	Effect Measurement	NOEC/LOEC	Concentration	Concentration Units (dw)	pH	Authors	Title	Source	Publication Year
Barium sulfate	*Eisenia fetida*	Earthworm	Invertebrate	0.3 - 0.6 gms	Adult	USEPA Method 200.8, ICP-MS	Total barium	Soil	Lab	21	Days	Reproduction	Cocoons	70% Reduction in number	LOEC	100 - 1,000	mg/kg	5.0	Simini, M. Checkai, R., Kuperman, R., and Phillips, C. Kuperman, R., Simini, M., Checkai, R., Phillips, C., Speicher, J., and Barclift, D.	Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Soil Screening Levels (ECO-SSL) Using Earthworm (*Eisenia fetida*) Benchmark Values Toxicity Benchmarks for Antimony, Barium, and Beryllium Determined Using Reproduction Endpoints for *Folsomia candida*, *Eisenia fetida*, and *Enchytraeus crypticus*	U.S. Army Soldier and Biological Chemical Command Environmental Toxicology and Chemistry, Vol. 25, No. 3, pp. 754-762	2002 2006
Barium sulfate	*Enchytraeus crypticus*	Potworm	Invertebrate	Adult	Adult 1 cm long, with eggs	USEPA Method 200.8, ICP-MS	Total barium	Soil	Lab	28	Days	Reproduction	No. of offspring	EC20	LOEC	5,000	mg/kg	5.0	Kuperman, R., Simini, M., Checkai, R., and Phillips, C. Kuperman, R., Simini, M., Checkai, R., Phillips, C., Speicher, J., and Barclift, D.	Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Screening Levels (ECO-SSL) Using Enchytraeid Reproduction Benchmark Values Toxicity Benchmarks for Antimony, Barium, and Beryllium Determined Using Reproduction Endpoints for *Folsomia candida*, *Eisenia fetida*, and *Enchytraeus crypticus*	U.S. Army Soldier and Biological Chemical Command Environmental Toxicology and Chemistry, Vol. 25, No. 3, pp. 754-762	2002 2006
Barium sulfate	*Enchytraeus crypticus*	Potworm	Invertebrate	Adult	Adult 1 cm long, with eggs	USEPA Method 200.8, ICP-MS	Total barium	Soil	Lab	28	Days	Reproduction	No. of offspring	Lowest Effect	LOEC	500 - 1,000	mg/kg	5.0	Kuperman, R., Simini, M., Checkai, R., and Phillips, C. Kuperman, R., Simini, M., Checkai, R., Phillips, C., Speicher, J., and Barclift, D.	Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Screening Levels (ECO-SSL) Using Enchytraeid Reproduction Benchmark Values Toxicity Benchmarks for Antimony, Barium, and Beryllium Determined Using Reproduction Endpoints for *Folsomia candida*, *Eisenia fetida*, and *Enchytraeus crypticus*	U.S. Army Soldier and Biological Chemical Command Environmental Toxicology and Chemistry, Vol. 25, No. 3, pp. 754-762	2002 2006
Barium sulfate	*Eisenia fetida*	Earthworm	Invertebrate	0.3 - 0.6 gms	Adult	USEPA Method 200.8, ICP-MS	Total barium	Soil	Lab	21	Days	Reproduction	Cocoons	10% Reduction in number	NOEC	500 - 5000	mg/kg	5.0	Simini, M., Checkai, R., Kuperman, R., and Phillips, C. Kuperman, R., Simini, M., Checkai, R., Phillips, C., Speicher, J., and Barclift, D.	Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Soil Screening Levels (ECO-SSL) Using Earthworm (*Eisenia fetida*) Benchmark Values Toxicity Benchmarks for Antimony, Barium, and Beryllium Determined Using Reproduction Endpoints for *Folsomia candida*, *Eisenia fetida*, and *Enchytraeus crypticus*	U.S. Army Soldier and Biological Chemical Command Environmental Toxicology and Chemistry, Vol. 25, No. 3, pp. 754-762	2002 2006
Barium sulfate	*Enchytraeus crypticus*	Potworm	Invertebrate	Adult	Adult 1 cm long, with eggs	USEPA Method 200.8, ICP-MS	Total barium	Soil	Lab	14	Days	Survival	Mortality	No effect	NOEC	10,000	mg/kg	5.0	Kuperman, R., Simini, M., Checkai, R., and Phillips, C. Kuperman, R., Simini, M., Checkai, R., Phillips, C., Speicher, J., and Barclift, D.	Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Screening Levels (ECO-SSL) Using Enchytraeid Reproduction Benchmark Values Toxicity Benchmarks for Antimony, Barium, and Beryllium Determined Using Reproduction Endpoints for *Folsomia candida*, *Eisenia fetida*, and *Enchytraeus crypticus*	U.S. Army Soldier and Biological Chemical Command Environmental Toxicology and Chemistry, Vol. 25, No. 3, pp. 754-762	2002 2006
Barium sulfate	*Folsomia candida*	Springtail insect	Invertebrate	Adult	NR	USEPA Method 200.8, ICP-MS	Total barium	Soil	Lab	14	Days	Survival	Mortality	No effect	NOEC	10,000	mg/kg	5.29	Kuperman, R., Simini, M., Checkai, R., Phillips, C., Speicher, J., and Barclift, D.	Toxicity Benchmarks for Antimony, Barium, and Beryllium Determined Using Reproduction Endpoints for *Folsomia candida*, *Eisenia fetida*, and *Enchytraeus crypticus*	Environmental Toxicology and Chemistry, Vol. 25, No. 3, pp. 754-762	2006
Barium sulfate	*Folsomia candida*	Springtail insect	Invertebrate	Adult	NR	USEPA Method 200.8, ICP-MS	Total barium	Soil	Lab	28	Days	Reproduction	No. of offspring	No effect	NOEC	10,000	mg/kg	5.29	Kuperman, R., Simini, M., Checkai, R., Phillips, C., Speicher, J., and Barclift, D.	Toxicity Benchmarks for Antimony, Barium, and Beryllium Determined Using Reproduction Endpoints for *Folsomia candida*, *Eisenia fetida*, and *Enchytraeus crypticus*	Environmental Toxicology and Chemistry, Vol. 25, No. 3, pp. 754-762	2006
Barium sulfate	*Eisenia fetida*	Earthworm	Invertebrate	Adult	NR	XRF	Total Barium	Soil	Lab	NR	NR	Survival	Mortality	No effect	NOEC	29,200	mg/kg	6.1 - 8.3	Lamb, D., Matanitobua, V., Palanisami, T., Megharaj, M. and Naidu, R.	Bioavailability of Barium to Plants and Invertebrates in Soils Contaminated by Barite	Environmental Science and Technology, No. 47, pp. 4670-4676	2013
Barium sulfate	*Eisenia fetida*	Earthworm	Invertebrate	Adult	NR	XRF	Total Barium	Soil	Lab	NR	NR	Growth	Weight loss	No effect	NOEC	5,700	mg/kg	6.1 - 8.3	Lamb, D., Matanitobua, V., Palanisami, T., Megharaj, M. and Naidu, R.	Bioavailability of Barium to Plants and Invertebrates in Soils Contaminated by Barite	Environmental Science and Technology, No. 47, pp. 4670-4676	2013

ATTACHMENT E-7
Total Barium Plant Effects Due to Barite
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Chemical Name	Species Scientific Name	Species Common Name	Species Group	Organism Age/Weight	Organism Lifestage	Chemical Concentration	Total Barium/ Barium Sulfate	Media Type	Test Location	Observed Duration (Days)	Observed Duration Units (Days)	Endpoint	Effect	Effect Measurement	NOEC/LOEC	Concentration	Concentration Units (dw)	pH	Authors	Title	Source	Publication Year
Barium sulfate	*Lactuca sativa L.*	Great Lakes lettuce	Plant	Seed	Juvenile	XRF	Total Barium	Soil	Lab	56	Days	Growth	Shoot Biomass	Lowest Effect	**LOEC**	**1300**	mg/kg	6.5	Lamb, D., Matanitobua, V., Palanisami, T., Megharaj, M. and Naidu, R.	Bioavailability of Barium to Plants and Invertebrates in Soils Contaminated by Barite	Environmental Science and Technology, No. 47, pp. 4670-4676	2013

ATTACHMENT F BACKGROUND CALCULATIONS

November 2022

ATTACHMENT F-1
Background Data Collected by USGS
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

SiteID	StateID	CollDate	Depth (cm)	Ag (mg/kg)	D_Ag (mg/kg)	As (mg/kg)	D_As (mg/kg)	Ba (mg/kg)	D_Ba (mg/kg)
120	LA	7/30/2008	0-5	1	0	4.9	1	514	1
140	LA	8/6/2008	0-5	1	0	2	1	111	1
204	LA	7/26/2008	0-5	1	0	5.7	1	296	1
332	LA	8/2/2008	0-5	1	0	2.5	1	187	1
460	LA	7/26/2008	0-5	1	0	3	1	210	1
588	LA	8/6/2008	0-5	1	0	4.8	1	138	1
824	LA	7/30/2008	0-5	1	0	4.2	1	448	1
1072	LA	7/28/2008	0-5	1	0	10	1	652	1
1144	LA	7/30/2008	0-5	1	0	11.4	1	654	1
1356	LA	8/2/2008	0-5	1	0	2.1	1	232	1
1612	LA	8/5/2008	0-5	1	0	5.1	1	520	1
1740	LA	8/3/2008	0-5	1	0	5.4	1	641	1
1848	LA	7/28/2008	0-5	1	0	5.5	1	542	1
2168	LA	7/29/2008	0-5	1	0	10.7	1	765	1
2380	LA	8/4/2008	0-5	1	0	1.9	1	236	1
2636	LA	8/6/2008	0-5	1	0	1.7	1	304	1
2872	LA	7/28/2008	0-5	1	0	7.4	1	712	1
2892	LA	8/6/2008	0-5	1	0	3.2	1	231	1
3404	LA	8/4/2008	0-5	1	0	2.9	1	425	1
3640	LA	7/31/2008	0-5	1	0	6.9	1	576	1
3896	LA	7/27/2008	0-5	1	0	1.3	1	104	1
3980	LA	8/1/2008	0-5	1	0	9.4	1	514	1
4216	LA	7/30/2008	0-5	1	0	5.4	1	648	1
4236	LA	8/6/2008	0-5	1	0	3.6	1	180	1
4300	LA	8/1/2008	0-5	1	0	4.3	1	624	1
4428	LA	8/2/2008	0-5	1	0	3.3	1	102	1
4492	LA	8/6/2008	0-5	1	0	5.6	1	342	1
4664	LA	7/31/2008	0-5	1	0	3.9	1	471	1
4684	LA	8/6/2008	0-5	1	0	2.6	1	75	1
4920	LA	7/31/2008	0-5	1	0	1	1	283	1
5240	LA	8/1/2008	0-5	1	0	10.1	1	2690	1
5452	LA	8/2/2008	0-5	1	0	4	1	363	1
5688	LA	7/31/2008	0-5	1	0	1.5	1	228	1
5708	LA	8/6/2008	0-5	1	0	6.8	1	378	1
5836	LA	8/4/2008	0-5	1	0	10.8	1	603	1
5944	LA	7/26/2008	0-5	1	0	3.8	1	264	1
6264	LA	7/29/2008	0-5	1	0	7	1	842	1
6476	LA	8/2/2008	0-5	1	0	2.8	1	103	1
6712	LA	7/31/2008	0-5	1	0	5.9	1	376	1
6968	LA	7/28/2008	0-5	1	0	5.8	1	728	1
7500	LA	8/4/2008	0-5	1	0	2.9	1	196	1
7736	LA	7/31/2008	0-5	1	0	5.6	1	269	1
7992	LA	7/28/2008	0-5	1	0	11.5	1	632	1
8012	LA	8/6/2008	0-5	1	0	3.8	1	368	1
8076	LA	8/1/2008	0-5	1	0	6.9	1	688	1
8312	LA	7/30/2008	0-5	1	0	7.6	1	692	1
8332	LA	8/6/2008	0-5	1	0	10.1	1	471	1
8396	LA	8/3/2008	0-5	1	0	9.3	1	606	1
8524	LA	8/4/2008	0-5	1	0	4.4	1	348	1
8780	LA	8/6/2008	0-5	1	0	3.2	1	273	1
8908	LA	8/4/2008	0-5	1	0	8.7	1	484	1
9016	LA	7/30/2008	0-5	1	0	3.3	1	687	1
9336	LA	7/30/2008	0-5	1	0	5.4	1	599	1
9548	LA	8/3/2008	0-5	1	0	1.6	1	408	1
9804	LA	8/6/2008	0-5	1	0	1.9	1	88	1

ATTACHMENT F-1
Background Data Collected by USGS
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

SiteID	StateID	CollDate	Depth (cm)	Ag (mg/kg)	D_Ag (mg/kg)	As (mg/kg)	D_As (mg/kg)	Ba (mg/kg)	D_Ba (mg/kg)
9932	LA	8/4/2008	0-5	1	0	12.7	1	649	1
10040	LA	7/29/2008	0-5	1	0	8.2	1	638	1
10060	LA	8/6/2008	0-5	1	0	1.2	1	64	1
10572	LA	7/31/2008	0-5	1	0	6.3	1	185	1
10808	LA	7/31/2008	0-5	1	0	4.4	1	203	1
11064	LA	7/28/2008	0-5	1	0	14.5	1	606	1
11148	LA	8/1/2008	0-5	1	0	4.3	1	634	1
11340	LA	8/4/2008	0-5	1	0	5.6	1	452	1
11468	LA	7/26/2008	0-5	1	0	3.4	1	206	1
11596	LA	8/4/2008	0-5	1	0	1.1	1	156	1
11724	LA	8/4/2008	0-5	1	0	17.4	1	710	1
11832	LA	7/30/2008	0-5	1	0	5.1	1	217	1
11852	LA	8/2/2008	0-5	1	0	32.6	1	198	1
12088	LA	7/29/2008	0-5	1	0	8.4	1	703	1
12408	LA	7/30/2008	0-5	1	0	8.7	1	710	1
12620	LA	8/2/2008	0-5	1	0	2	1	149	1
12856	LA	7/31/2008	0-5	1	0	2	1	144	1
12876	LA	8/6/2008	0-5	1	0	4.1	1	211	1
13004	LA	8/3/2008	0-5	1	0	6.5	1	731	1
13112	LA	7/31/2008	0-5	1	0	3.7	1	163	1
120	LA	7/30/2008	0-15	1	0	4.8	1	448	1
140	LA	8/6/2008	0-30	1	0	1.8	1	132	1
204	LA	7/26/2008	0-5	1	0	6.1	1	271	1
332	LA	8/2/2008	0-15	1	0	1	1	147	1
460	LA	7/26/2008	0-10	1	0	3.1	1	199	1
588	LA	8/6/2008	0-20	1	0	5.3	1	168	1
824	LA	7/30/2008	0-20	1	0	4	1	353	1
1072	LA	7/28/2008	0-20	1	0	6.8	1	474	1
1144	LA	7/30/2008	0-20	1	0	11	1	667	1
1356	LA	8/2/2008	0-20	1	0	1.4	1	226	1
1612	LA	8/5/2008	0-30	1	0	6.8	1	503	1
1740	LA	8/3/2008	0-20	1	0	7.9	1	624	1
1848	LA	7/28/2008	0-10	1	0	5	1	607	1
2168	LA	7/29/2008	0-8	1	0	9.6	1	775	1
2380	LA	8/4/2008	0-20	1	0	2.5	1	254	1
2636	LA	8/6/2008	0-15	1	0	1.4	1	267	1
2872	LA	7/28/2008	0-10	1	0	5.7	1	565	1
2892	LA	8/6/2008	0-20	1	0	3	1	234	1
3404	LA	8/4/2008	0-30	1	0	3.2	1	447	1
3640	LA	7/31/2008	0-30	1	0	6.9	1	468	1
3896	LA	7/27/2008	0-20	1	0	2.3	1	111	1
3980	LA	8/1/2008	0-10	1	0	8.7	1	535	1
4216	LA	7/30/2008	0-20	1	0	5.7	1	629	1
4236	LA	8/6/2008	0-20	1	0	3.8	1	154	1
4300	LA	8/1/2008	0-5	1	0	5.6	1	592	1
4428	LA	8/2/2008	0-20	1	0	1.8	1	86	1
4492	LA	8/6/2008	0-10	1	0	5.3	1	291	1
4664	LA	7/31/2008	0-15	1	0	3.9	1	432	1
4684	LA	8/6/2008	0-30	1	0	5.7	1	68	1
4920	LA	7/31/2008	0-5	1	0	1.4	1	364	1
5240	LA	8/1/2008	0-15	1	0	14	1	2530	1
5452	LA	8/2/2008	0-20	1	0	4	1	339	1
5688	LA	7/31/2008	0-30	1	0	2.7	1	242	1
5708	LA	8/6/2008	0-20	1	0	6.6	1	318	1
5836	LA	8/4/2008	0-20	1	0	13.7	1	686	1

ATTACHMENT F-1
Background Data Collected by USGS
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

SiteID	StateID	CollDate	Depth (cm)	Ag (mg/kg)	D_Ag (mg/kg)	As (mg/kg)	D_As (mg/kg)	Ba (mg/kg)	D_Ba (mg/kg)
5944	LA	7/26/2008	0-20	1	0	4.5	1	304	1
6264	LA	7/29/2008	0-20	1	0	7.5	1	847	1
6476	LA	8/2/2008	0-20	1	0	2.9	1	97	1
6712	LA	7/31/2008	0-25	1	0	6.7	1	354	1
6968	LA	7/28/2008	0-25	1	0	8.4	1	667	1
7500	LA	8/4/2008	0-15	1	0	3	1	205	1
7736	LA	7/31/2008	0-15	1	0	5.6	1	287	1
7992	LA	7/28/2008	0-8	1	0	11.4	1	647	1
8012	LA	8/6/2008	0-20	1	0	3.9	1	370	1
8076	LA	8/1/2008	0-20	1	0	7.3	1	694	1
8312	LA	7/30/2008	0-30	1	0	4.9	1	657	1
8332	LA	8/6/2008	0-70	1	0	10.4	1	536	1
8396	LA	8/3/2008	0-30	1	0	8.9	1	597	1
8524	LA	8/4/2008	0-20	1	0	3.9	1	387	1
8780	LA	8/6/2008	0-10	1	0	3.8	1	232	1
8908	LA	8/4/2008	0-20	1	0	8.8	1	479	1
9016	LA	7/30/2008	0-30	1	0	3.3	1	238	1
9336	LA	7/30/2008	0-20	1	0	6.9	1	646	1
9548	LA	8/3/2008	0-20	1	0	5.8	1	403	1
9804	LA	8/6/2008	0-15	1	0	2	1	74	1
9932	LA	8/4/2008	0-30	1	0	11.1	1	648	1
10040	LA	7/29/2008	0-30	1	0	9.6	1	708	1
10060	LA	8/6/2008	0-25	1	0	1.2	1	74	1
10572	LA	7/31/2008	0-10	1	0	6.3	1	187	1
10808	LA	7/31/2008	0-10	1	0	3.4	1	162	1
11064	LA	7/28/2008	0-8	1	0	13.9	1	654	1
11148	LA	8/1/2008	0-20	1	0	4.8	1	575	1
11340	LA	8/4/2008	0-30	1	0	6.4	1	402	1
11468	LA	7/26/2008	0-30	1	0	3.4	1	223	1
11596	LA	8/4/2008	0-30	1	0	1.9	1	170	1
11724	LA	8/4/2008	0-50	1	0	18	1	617	1
11832	LA	7/30/2008	0-20	1	0	4.9	1	243	1
11852	LA	8/2/2008	0-20	1	0	38.2	1	180	1
12088	LA	7/29/2008	0-30	1	0	8	1	638	1
12408	LA	7/30/2008	0-30	1	0	8.6	1	749	1
12620	LA	8/2/2008	0-25	1	0	1.8	1	159	1
12856	LA	7/31/2008	0-20	1	0	1.9	1	141	1
12876	LA	8/6/2008	0-10	1	0	3.3	1	218	1
13004	LA	8/3/2008	0-20	1	0	6.7	1	701	1
13112	LA	7/31/2008	0-20	1	0	3.8	1	169	1

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Grand River Oil & Gas Field
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SiteID	StateID	CollDate	Depth (cm)	Cd (mg/kg)	D_Cd (mg/kg)	Cr (mg/kg)	D_Cr (mg/kg)	Hg (mg/kg)	D_Hg (mg/kg)
120	LA	7/30/2008	0-5	0.3	1	66	1	0.09	1
140	LA	8/6/2008	0-5	0.1	0	19	1	0.01	1
204	LA	7/26/2008	0-5	0.3	1	35	1	0.08	1
332	LA	8/2/2008	0-5	0.1	0	20	1	0.02	1
460	LA	7/26/2008	0-5	0.1	0	27	1	0.05	1
588	LA	8/6/2008	0-5	0.1	0	31	1	0.02	1
824	LA	7/30/2008	0-5	0.1	0	39	1	0.03	1
1072	LA	7/28/2008	0-5	0.6	1	70	1	0.06	1
1144	LA	7/30/2008	0-5	0.4	1	71	1	0.05	1
1356	LA	8/2/2008	0-5	0.1	0	18	1	0.01	1
1612	LA	8/5/2008	0-5	0.3	1	62	1	0.07	1
1740	LA	8/3/2008	0-5	1.1	1	65	1	0.09	1
1848	LA	7/28/2008	0-5	0.4	1	38	1	0.05	1
2168	LA	7/29/2008	0-5	0.3	1	40	1	0.03	1
2380	LA	8/4/2008	0-5	0.1	0	30	1	0.03	1
2636	LA	8/6/2008	0-5	0.1	0	23	1	0.01	1
2872	LA	7/28/2008	0-5	0.3	1	52	1	0.05	1
2892	LA	8/6/2008	0-5	0.1	0	34	1	0.01	1
3404	LA	8/4/2008	0-5	0.1	0	24	1	0.07	1
3640	LA	7/31/2008	0-5	0.2	1	48	1	0.06	1
3896	LA	7/27/2008	0-5	0.1	1	12	1	0.05	1
3980	LA	8/1/2008	0-5	0.4	1	80	1	0.06	1
4216	LA	7/30/2008	0-5	0.2	1	39	1	0.04	1
4236	LA	8/6/2008	0-5	0.2	1	28	1	0.13	1
4300	LA	8/1/2008	0-5	0.2	1	58	1	0.04	1
4428	LA	8/2/2008	0-5	0.1	0	21	1	0.02	1
4492	LA	8/6/2008	0-5	0.1	0	32	1	0.06	1
4664	LA	7/31/2008	0-5	0.1	0	20	1	0.01	0
4684	LA	8/6/2008	0-5	0.1	0	22	1	0.02	1
4920	LA	7/31/2008	0-5	0.1	0	5	1	0.01	1
5240	LA	8/1/2008	0-5	0.3	1	23	1	4.43	1
5452	LA	8/2/2008	0-5	0.1	1	34	1	0.01	1
5688	LA	7/31/2008	0-5	0.1	0	25	1	0.02	1
5708	LA	8/6/2008	0-5	0.1	1	66	1	0.06	1
5836	LA	8/4/2008	0-5	1	1	67	1	0.07	1
5944	LA	7/26/2008	0-5	0.2	1	15	1	0.05	1
6264	LA	7/29/2008	0-5	0.2	1	38	1	0.03	1
6476	LA	8/2/2008	0-5	0.1	0	18	1	0.03	1
6712	LA	7/31/2008	0-5	0.2	1	19	1	0.03	1
6968	LA	7/28/2008	0-5	0.4	1	60	1	0.05	1
7500	LA	8/4/2008	0-5	0.1	0	15	1	0.02	1
7736	LA	7/31/2008	0-5	0.1	0	30	1	0.03	1
7992	LA	7/28/2008	0-5	0.5	1	47	1	0.11	1
8012	LA	8/6/2008	0-5	0.1	0	28	1	0.04	1
8076	LA	8/1/2008	0-5	0.5	1	57	1	0.06	1
8312	LA	7/30/2008	0-5	0.3	1	54	1	0.04	1
8332	LA	8/6/2008	0-5	0.1	1	72	1	0.02	1
8396	LA	8/3/2008	0-5	0.4	1	75	1	0.05	1
8524	LA	8/4/2008	0-5	0.1	0	31	1	0.03	1
8780	LA	8/6/2008	0-5	0.1	1	19	1	0.02	1
8908	LA	8/4/2008	0-5	0.1	1	39	1	0.06	1
9016	LA	7/30/2008	0-5	0.1	0	27	1	0.02	1
9336	LA	7/30/2008	0-5	0.1	1	37	1	0.03	1
9548	LA	8/3/2008	0-5	0.1	0	22	1	0.03	1
9804	LA	8/6/2008	0-5	0.1	0	25	1	0.01	1

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SiteID	StateID	CollDate	Depth (cm)	Cd (mg/kg)	D_Cd (mg/kg)	Cr (mg/kg)	D_Cr (mg/kg)	Hg (mg/kg)	D_Hg (mg/kg)
9932	LA	8/4/2008	0-5	0.2	1	46	1	0.02	1
10040	LA	7/29/2008	0-5	1.1	1	55	1	0.07	1
10060	LA	8/6/2008	0-5	0.1	0	10	1	0.01	0
10572	LA	7/31/2008	0-5	0.1	0	38	1	0.02	1
10808	LA	7/31/2008	0-5	0.1	0	31	1	0.04	1
11064	LA	7/28/2008	0-5	0.8	1	61	1	0.08	1
11148	LA	8/1/2008	0-5	0.2	1	55	1	0.08	1
11340	LA	8/4/2008	0-5	0.1	0	22	1	0.01	1
11468	LA	7/26/2008	0-5	0.1	0	35	1	0.06	1
11596	LA	8/4/2008	0-5	0.1	0	19	1	0.02	1
11724	LA	8/4/2008	0-5	0.1	1	32	1	0.01	1
11832	LA	7/30/2008	0-5	0.1	0	33	1	0.02	1
11852	LA	8/2/2008	0-5	0.1	0	77	1	0.04	1
12088	LA	7/29/2008	0-5	0.3	1	60	1	0.04	1
12408	LA	7/30/2008	0-5	0.5	1	59	1	0.04	1
12620	LA	8/2/2008	0-5	0.1	0	18	1	0.02	1
12856	LA	7/31/2008	0-5	0.1	0	24	1	0.02	1
12876	LA	8/6/2008	0-5	0.1	0	27	1	0.03	1
13004	LA	8/3/2008	0-5	0.1	0	44	1	0.02	1
13112	LA	7/31/2008	0-5	0.1	0	23	1	0.03	1
120	LA	7/30/2008	0-15	0.2	1	67	1	0.07	1
140	LA	8/6/2008	0-30	0.1	0	11	1	0.01	1
204	LA	7/26/2008	0-5	0.3	1	37	1	0.08	1
332	LA	8/2/2008	0-15	0.1	0	16	1	0.04	1
460	LA	7/26/2008	0-10	0.1	0	33	1	0.04	1
588	LA	8/6/2008	0-20	0.1	0	25	1	0.02	1
824	LA	7/30/2008	0-20	0.1	0	32	1	0.03	1
1072	LA	7/28/2008	0-20	0.6	1	57	1	0.04	1
1144	LA	7/30/2008	0-20	0.4	1	61	1	0.05	1
1356	LA	8/2/2008	0-20	0.1	0	21	1	0.01	1
1612	LA	8/5/2008	0-30	0.2	1	84	1	0.07	1
1740	LA	8/3/2008	0-20	0.8	1	62	1	0.07	1
1848	LA	7/28/2008	0-10	0.3	1	45	1	0.03	1
2168	LA	7/29/2008	0-8	0.3	1	53	1	0.03	1
2380	LA	8/4/2008	0-20	0.1	0	23	1	0.02	1
2636	LA	8/6/2008	0-15	0.1	0	19	1	0.01	0
2872	LA	7/28/2008	0-10	0.3	1	37	1	0.05	1
2892	LA	8/6/2008	0-20	0.1	0	19	1	0.01	1
3404	LA	8/4/2008	0-30	0.1	0	29	1	0.06	1
3640	LA	7/31/2008	0-30	0.2	1	37	1	0.05	1
3896	LA	7/27/2008	0-20	0.1	1	19	1	0.04	1
3980	LA	8/1/2008	0-10	0.4	1	79	1	0.05	1
4216	LA	7/30/2008	0-20	0.2	1	51	1	0.04	1
4236	LA	8/6/2008	0-20	0.2	1	30	1	0.11	1
4300	LA	8/1/2008	0-5	0.2	1	60	1	0.04	1
4428	LA	8/2/2008	0-20	0.1	0	18	1	0.02	1
4492	LA	8/6/2008	0-10	0.1	0	31	1	0.06	1
4664	LA	7/31/2008	0-15	0.1	0	6	1	0.01	1
4684	LA	8/6/2008	0-30	0.1	0	13	1	0.01	1
4920	LA	7/31/2008	0-5	0.1	0	7	1	0.02	1
5240	LA	8/1/2008	0-15	0.3	1	35	1	6.24	1
5452	LA	8/2/2008	0-20	0.1	1	31	1	0.01	0
5688	LA	7/31/2008	0-30	0.1	0	22	1	0.02	1
5708	LA	8/6/2008	0-20	0.1	0	69	1	0.04	1
5836	LA	8/4/2008	0-20	0.8	1	78	1	0.06	1

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SiteID	StateID	CollDate	Depth (cm)	Cd (mg/kg)	D_Cd (mg/kg)	Cr (mg/kg)	D_Cr (mg/kg)	Hg (mg/kg)	D_Hg (mg/kg)
5944	LA	7/26/2008	0-20	0.2	1	28	1	0.05	1
6264	LA	7/29/2008	0-20	0.3	1	37	1	0.04	1
6476	LA	8/2/2008	0-20	0.1	0	24	1	0.02	1
6712	LA	7/31/2008	0-25	0.2	1	35	1	0.05	1
6968	LA	7/28/2008	0-25	0.3	1	47	1	0.06	1
7500	LA	8/4/2008	0-15	0.1	0	17	1	0.02	1
7736	LA	7/31/2008	0-15	0.1	0	26	1	0.03	1
7992	LA	7/28/2008	0-8	0.4	1	53	1	0.09	1
8012	LA	8/6/2008	0-20	0.1	0	39	1	0.06	1
8076	LA	8/1/2008	0-20	0.4	1	47	1	0.06	1
8312	LA	7/30/2008	0-30	0.3	1	52	1	0.03	1
8332	LA	8/6/2008	0-70	0.1	1	84	1	0.01	1
8396	LA	8/3/2008	0-30	0.3	1	60	1	0.05	1
8524	LA	8/4/2008	0-20	0.1	0	22	1	0.02	1
8780	LA	8/6/2008	0-10	0.1	1	24	1	0.02	1
8908	LA	8/4/2008	0-20	0.1	0	35	1	0.04	1
9016	LA	7/30/2008	0-30	0.1	0	25	1	0.01	1
9336	LA	7/30/2008	0-20	0.1	0	51	1	0.03	1
9548	LA	8/3/2008	0-20	0.1	0	21	1	0.03	1
9804	LA	8/6/2008	0-15	0.1	0	19	1	0.01	0
9932	LA	8/4/2008	0-30	0.2	1	39	1	0.02	1
10040	LA	7/29/2008	0-30	1	1	78	1	0.07	1
10060	LA	8/6/2008	0-25	0.1	0	16	1	0.01	0
10572	LA	7/31/2008	0-10	0.1	0	38	1	0.02	1
10808	LA	7/31/2008	0-10	0.1	0	26	1	0.04	1
11064	LA	7/28/2008	0-8	0.8	1	56	1	0.09	1
11148	LA	8/1/2008	0-20	0.2	1	65	1	0.1	1
11340	LA	8/4/2008	0-30	0.1	0	23	1	0.02	1
11468	LA	7/26/2008	0-30	0.1	0	24	1	0.05	1
11596	LA	8/4/2008	0-30	0.1	0	13	1	0.02	1
11724	LA	8/4/2008	0-50	0.2	1	22	1	0.02	1
11832	LA	7/30/2008	0-20	0.1	0	32	1	0.03	1
11852	LA	8/2/2008	0-20	0.1	0	75	1	0.03	1
12088	LA	7/29/2008	0-30	0.3	1	41	1	0.04	1
12408	LA	7/30/2008	0-30	0.5	1	63	1	0.04	1
12620	LA	8/2/2008	0-25	0.1	0	17	1	0.02	1
12856	LA	7/31/2008	0-20	0.1	0	17	1	0.02	1
12876	LA	8/6/2008	0-10	0.1	0	22	1	0.05	1
13004	LA	8/3/2008	0-20	0.1	0	47	1	0.01	0
13112	LA	7/31/2008	0-20	0.1	0	33	1	0.02	1

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SiteID	StateID	CollDate	Depth (cm)	Pb (mg/kg)	D_Pb (mg/kg)	Se (mg/kg)	D_Se (mg/kg)	Sr (mg/kg)	D_Sr (mg/kg)
120	LA	7/30/2008	0-5	90.8	1	1	1	87.3	1
140	LA	8/6/2008	0-5	6.7	1	0.2	0	11	1
204	LA	7/26/2008	0-5	18.7	1	0.7	1	45	1
332	LA	8/2/2008	0-5	10.7	1	0.2	0	15.6	1
460	LA	7/26/2008	0-5	15.3	1	0.3	1	22.8	1
588	LA	8/6/2008	0-5	10.1	1	0.2	0	14.2	1
824	LA	7/30/2008	0-5	18.3	1	0.4	1	82.8	1
1072	LA	7/28/2008	0-5	47.2	1	0.7	1	122	1
1144	LA	7/30/2008	0-5	20.9	1	0.5	1	121	1
1356	LA	8/2/2008	0-5	10.9	1	0.2	0	21.2	1
1612	LA	8/5/2008	0-5	35	1	0.7	1	95.5	1
1740	LA	8/3/2008	0-5	25.4	1	1	1	96.4	1
1848	LA	7/28/2008	0-5	26	1	0.4	1	149	1
2168	LA	7/29/2008	0-5	19.6	1	0.2	1	167	1
2380	LA	8/4/2008	0-5	14.1	1	0.2	0	25.7	1
2636	LA	8/6/2008	0-5	11.3	1	0.2	0	32.4	1
2872	LA	7/28/2008	0-5	24.1	1	0.3	1	177	1
2892	LA	8/6/2008	0-5	9.8	1	0.2	0	30.8	1
3404	LA	8/4/2008	0-5	17.5	1	0.3	1	52	1
3640	LA	7/31/2008	0-5	24.8	1	0.5	1	142	1
3896	LA	7/27/2008	0-5	25.7	1	0.5	1	112	1
3980	LA	8/1/2008	0-5	41.7	1	0.7	1	96.3	1
4216	LA	7/30/2008	0-5	18.9	1	0.5	1	150	1
4236	LA	8/6/2008	0-5	26.3	1	0.2	0	24.6	1
4300	LA	8/1/2008	0-5	19.2	1	0.4	1	114	1
4428	LA	8/2/2008	0-5	11.1	1	0.2	0	12.9	1
4492	LA	8/6/2008	0-5	21.3	1	0.4	1	48	1
4664	LA	7/31/2008	0-5	13.9	1	0.2	0	203	1
4684	LA	8/6/2008	0-5	7.6	1	0.2	0	9.1	1
4920	LA	7/31/2008	0-5	9.3	1	0.2	0	31.2	1
5240	LA	8/1/2008	0-5	31.8	1	0.2	0	160	1
5452	LA	8/2/2008	0-5	19.2	1	0.2	0	75.5	1
5688	LA	7/31/2008	0-5	13.6	1	0.4	1	34.7	1
5708	LA	8/6/2008	0-5	27.6	1	0.9	1	78.3	1
5836	LA	8/4/2008	0-5	30.5	1	1.2	1	92.3	1
5944	LA	7/26/2008	0-5	26.2	1	0.3	1	104	1
6264	LA	7/29/2008	0-5	13.6	1	0.2	0	182	1
6476	LA	8/2/2008	0-5	11.3	1	0.2	0	11.3	1
6712	LA	7/31/2008	0-5	12.7	1	0.2	1	275	1
6968	LA	7/28/2008	0-5	27.9	1	0.6	1	124	1
7500	LA	8/4/2008	0-5	10.8	1	0.2	0	21.6	1
7736	LA	7/31/2008	0-5	16.4	1	0.3	1	37.2	1
7992	LA	7/28/2008	0-5	46.7	1	0.7	1	127	1
8012	LA	8/6/2008	0-5	17.8	1	0.4	1	44.7	1
8076	LA	8/1/2008	0-5	22.2	1	0.8	1	135	1
8312	LA	7/30/2008	0-5	17.5	1	0.4	1	160	1
8332	LA	8/6/2008	0-5	19.6	1	0.3	1	98	1
8396	LA	8/3/2008	0-5	25.9	1	0.9	1	104	1
8524	LA	8/4/2008	0-5	18.9	1	0.2	0	69.9	1
8780	LA	8/6/2008	0-5	14.6	1	0.2	0	30.6	1
8908	LA	8/4/2008	0-5	19.7	1	0.3	1	70.7	1
9016	LA	7/30/2008	0-5	17.2	1	0.3	1	27.9	1
9336	LA	7/30/2008	0-5	31.3	1	0.4	1	143	1
9548	LA	8/3/2008	0-5	22.2	1	0.2	0	74.9	1
9804	LA	8/6/2008	0-5	10	1	0.2	0	11.9	1

SiteID	StateID	CollDate	Depth (cm)	Pb (mg/kg)	D_Pb (mg/kg)	Se (mg/kg)	D_Se (mg/kg)	Sr (mg/kg)	D_Sr (mg/kg)
9932	LA	8/4/2008	0-5	17.5	1	0.4	1	136	1
10040	LA	7/29/2008	0-5	80.6	1	1.1	1	124	1
10060	LA	8/6/2008	0-5	8.1	1	0.2	0	7	1
10572	LA	7/31/2008	0-5	16	1	0.3	1	20.1	1
10808	LA	7/31/2008	0-5	22.4	1	0.4	1	32.7	1
11064	LA	7/28/2008	0-5	34.1	1	0.7	1	152	1
11148	LA	8/1/2008	0-5	32.1	1	0.5	1	131	1
11340	LA	8/4/2008	0-5	11.8	1	0.2	0	83.5	1
11468	LA	7/26/2008	0-5	19.8	1	0.6	1	20.5	1
11596	LA	8/4/2008	0-5	9.3	1	0.2	0	15.4	1
11724	LA	8/4/2008	0-5	11.8	1	0.2	0	213	1
11832	LA	7/30/2008	0-5	13.3	1	0.3	1	27.4	1
11852	LA	8/2/2008	0-5	36.2	1	1	1	28.1	1
12088	LA	7/29/2008	0-5	19.8	1	0.4	1	145	1
12408	LA	7/30/2008	0-5	23.2	1	0.7	1	143	1
12620	LA	8/2/2008	0-5	9.3	1	0.2	0	12.6	1
12856	LA	7/31/2008	0-5	8.8	1	0.2	0	16	1
12876	LA	8/6/2008	0-5	11.4	1	0.2	0	30.5	1
13004	LA	8/3/2008	0-5	13.3	1	0.2	0	136	1
13112	LA	7/31/2008	0-5	16.2	1	0.4	1	19.3	1
120	LA	7/30/2008	0-15	35.2	1	0.8	1	98.8	1
140	LA	8/6/2008	0-30	8.1	1	0.2	0	13	1
204	LA	7/26/2008	0-5	22.5	1	0.7	1	49.6	1
332	LA	8/2/2008	0-15	9.3	1	0.2	0	18	1
460	LA	7/26/2008	0-10	13.4	1	0.3	1	23.4	1
588	LA	8/6/2008	0-20	11.5	1	0.2	0	16.8	1
824	LA	7/30/2008	0-20	16.8	1	0.4	1	65.5	1
1072	LA	7/28/2008	0-20	35.7	1	0.4	1	82.5	1
1144	LA	7/30/2008	0-20	22.5	1	0.4	1	114	1
1356	LA	8/2/2008	0-20	11.1	1	0.2	1	26.1	1
1612	LA	8/5/2008	0-30	31	1	0.7	1	96.4	1
1740	LA	8/3/2008	0-20	28	1	1	1	104	1
1848	LA	7/28/2008	0-10	26.8	1	0.3	1	181	1
2168	LA	7/29/2008	0-8	15.5	1	0.2	0	173	1
2380	LA	8/4/2008	0-20	13.6	1	0.2	0	26.3	1
2636	LA	8/6/2008	0-15	9.4	1	0.2	0	28.1	1
2872	LA	7/28/2008	0-10	23.4	1	0.4	1	172	1
2892	LA	8/6/2008	0-20	11.2	1	0.2	0	31.5	1
3404	LA	8/4/2008	0-30	16	1	0.3	1	53.1	1
3640	LA	7/31/2008	0-30	20.8	1	0.3	1	139	1
3896	LA	7/27/2008	0-20	23.6	1	0.5	1	128	1
3980	LA	8/1/2008	0-10	33.3	1	0.6	1	101	1
4216	LA	7/30/2008	0-20	18.4	1	0.4	1	144	1
4236	LA	8/6/2008	0-20	25.5	1	0.3	1	21.2	1
4300	LA	8/1/2008	0-5	20	1	0.4	1	124	1
4428	LA	8/2/2008	0-20	9.7	1	0.2	0	16.3	1
4492	LA	8/6/2008	0-10	20.3	1	0.6	1	52	1
4664	LA	7/31/2008	0-15	16.4	1	0.2	0	225	1
4684	LA	8/6/2008	0-30	8.2	1	0.2	0	8.9	1
4920	LA	7/31/2008	0-5	10.9	1	0.2	1	32.4	1
5240	LA	8/1/2008	0-15	18.4	1	0.2	0	156	1
5452	LA	8/2/2008	0-20	17.5	1	0.2	1	82.9	1
5688	LA	7/31/2008	0-30	16.3	1	0.4	1	40.3	1
5708	LA	8/6/2008	0-20	24.6	1	0.6	1	78.7	1
5836	LA	8/4/2008	0-20	31.4	1	1.1	1	115	1

ATTACHMENT F-1
Background Data Collected by USGS
August J. Levert, Jr., Family, LLC, et al.
Grand River Oil & Gas Field
Iberville Parish, Louisiana

SiteID	StateID	CollDate	Depth (cm)	Pb (mg/kg)	D_Pb (mg/kg)	Se (mg/kg)	D_Se (mg/kg)	Sr (mg/kg)	D_Sr (mg/kg)
5944	LA	7/26/2008	0-20	31.9	1	0.3	1	100	1
6264	LA	7/29/2008	0-20	18.5	1	0.3	1	159	1
6476	LA	8/2/2008	0-20	10.4	1	0.2	0	10	1
6712	LA	7/31/2008	0-25	12.1	1	0.3	1	290	1
6968	LA	7/28/2008	0-25	27	1	0.7	1	133	1
7500	LA	8/4/2008	0-15	11.6	1	0.2	0	21.4	1
7736	LA	7/31/2008	0-15	18	1	0.3	1	38	1
7992	LA	7/28/2008	0-8	44.2	1	0.7	1	117	1
8012	LA	8/6/2008	0-20	19.6	1	0.4	1	47	1
8076	LA	8/1/2008	0-20	22.2	1	0.9	1	133	1
8312	LA	7/30/2008	0-30	16	1	0.4	1	174	1
8332	LA	8/6/2008	0-70	20.5	1	0.2	1	113	1
8396	LA	8/3/2008	0-30	24.5	1	1	1	93.9	1
8524	LA	8/4/2008	0-20	16.2	1	0.2	0	75.2	1
8780	LA	8/6/2008	0-10	12.8	1	0.2	0	29.1	1
8908	LA	8/4/2008	0-20	16.1	1	0.3	1	68.2	1
9016	LA	7/30/2008	0-30	10.9	1	0.2	0	26	1
9336	LA	7/30/2008	0-20	19	1	0.5	1	139	1
9548	LA	8/3/2008	0-20	14	1	0.2	0	85.7	1
9804	LA	8/6/2008	0-15	7.2	1	0.2	0	10.3	1
9932	LA	8/4/2008	0-30	20.1	1	0.3	1	134	1
10040	LA	7/29/2008	0-30	41.6	1	1	1	132	1
10060	LA	8/6/2008	0-25	4.4	1	0.2	0	8.1	1
10572	LA	7/31/2008	0-10	17.4	1	0.3	1	20.4	1
10808	LA	7/31/2008	0-10	20.3	1	0.4	1	31.7	1
11064	LA	7/28/2008	0-8	38	1	0.6	1	143	1
11148	LA	8/1/2008	0-20	20.9	1	0.5	1	115	1
11340	LA	8/4/2008	0-30	14.1	1	0.2	0	87.1	1
11468	LA	7/26/2008	0-30	19.7	1	0.5	1	21.5	1
11596	LA	8/4/2008	0-30	10.5	1	0.2	0	18.9	1
11724	LA	8/4/2008	0-50	13.2	1	0.2	0	196	1
11832	LA	7/30/2008	0-20	15.2	1	0.4	1	28.9	1
11852	LA	8/2/2008	0-20	37.4	1	1.2	1	31.6	1
12088	LA	7/29/2008	0-30	19	1	0.4	1	152	1
12408	LA	7/30/2008	0-30	23.9	1	0.6	1	151	1
12620	LA	8/2/2008	0-25	8.8	1	0.2	0	12.2	1
12856	LA	7/31/2008	0-20	9.6	1	0.2	1	14.3	1
12876	LA	8/6/2008	0-10	13.2	1	0.3	1	27	1
13004	LA	8/3/2008	0-20	13.8	1	0.2	0	132	1
13112	LA	7/31/2008	0-20	15.2	1	0.4	1	19.9	1

ATTACHMENT F-1
Background Data Collected by USGS
August J. Levert, Jr., Family, LLC, et al.
Grand River Oil & Gas Field
Iberville Parish, Louisiana

SiteID	StateID	CollDate	Depth (cm)	Zn (mg/kg)	D_Zn (mg/kg)
120	LA	7/30/2008	0-5	87	1
140	LA	8/6/2008	0-5	8	1
204	LA	7/26/2008	0-5	38	1
332	LA	8/2/2008	0-5	10	1
460	LA	7/26/2008	0-5	21	1
588	LA	8/6/2008	0-5	24	1
824	LA	7/30/2008	0-5	28	1
1072	LA	7/28/2008	0-5	135	1
1144	LA	7/30/2008	0-5	98	1
1356	LA	8/2/2008	0-5	15	1
1612	LA	8/5/2008	0-5	119	1
1740	LA	8/3/2008	0-5	111	1
1848	LA	7/28/2008	0-5	90	1
2168	LA	7/29/2008	0-5	70	1
2380	LA	8/4/2008	0-5	9	1
2636	LA	8/6/2008	0-5	9	1
2872	LA	7/28/2008	0-5	77	1
2892	LA	8/6/2008	0-5	11	1
3404	LA	8/4/2008	0-5	38	1
3640	LA	7/31/2008	0-5	140	1
3896	LA	7/27/2008	0-5	19	1
3980	LA	8/1/2008	0-5	112	1
4216	LA	7/30/2008	0-5	71	1
4236	LA	8/6/2008	0-5	98	1
4300	LA	8/1/2008	0-5	73	1
4428	LA	8/2/2008	0-5	25	1
4492	LA	8/6/2008	0-5	18	1
4664	LA	7/31/2008	0-5	55	1
4684	LA	8/6/2008	0-5	16	1
4920	LA	7/31/2008	0-5	8	1
5240	LA	8/1/2008	0-5	54	1
5452	LA	8/2/2008	0-5	33	1
5688	LA	7/31/2008	0-5	15	1
5708	LA	8/6/2008	0-5	75	1
5836	LA	8/4/2008	0-5	121	1
5944	LA	7/26/2008	0-5	37	1
6264	LA	7/29/2008	0-5	45	1
6476	LA	8/2/2008	0-5	10	1
6712	LA	7/31/2008	0-5	53	1
6968	LA	7/28/2008	0-5	95	1
7500	LA	8/4/2008	0-5	17	1
7736	LA	7/31/2008	0-5	21	1
7992	LA	7/28/2008	0-5	119	1
8012	LA	8/6/2008	0-5	32	1
8076	LA	8/1/2008	0-5	87	1
8312	LA	7/30/2008	0-5	75	1
8332	LA	8/6/2008	0-5	76	1
8396	LA	8/3/2008	0-5	118	1
8524	LA	8/4/2008	0-5	34	1
8780	LA	8/6/2008	0-5	76	1
8908	LA	8/4/2008	0-5	51	1
9016	LA	7/30/2008	0-5	14	1
9336	LA	7/30/2008	0-5	55	1
9548	LA	8/3/2008	0-5	17	1
9804	LA	8/6/2008	0-5	7	1

ATTACHMENT F-1
Background Data Collected by USGS
August J. Levert, Jr., Family, LLC, et al.
Grand River Oil & Gas Field
Iberville Parish, Louisiana

SiteID	StateID	CollDate	Depth (cm)	Zn (mg/kg)	D_Zn (mg/kg)
9932	LA	8/4/2008	0-5	56	1
10040	LA	7/29/2008	0-5	148	1
10060	LA	8/6/2008	0-5	4	1
10572	LA	7/31/2008	0-5	13	1
10808	LA	7/31/2008	0-5	65	1
11064	LA	7/28/2008	0-5	385	1
11148	LA	8/1/2008	0-5	88	1
11340	LA	8/4/2008	0-5	19	1
11468	LA	7/26/2008	0-5	24	1
11596	LA	8/4/2008	0-5	8	1
11724	LA	8/4/2008	0-5	30	1
11832	LA	7/30/2008	0-5	20	1
11852	LA	8/2/2008	0-5	55	1
12088	LA	7/29/2008	0-5	79	1
12408	LA	7/30/2008	0-5	86	1
12620	LA	8/2/2008	0-5	5	1
12856	LA	7/31/2008	0-5	11	1
12876	LA	8/6/2008	0-5	73	1
13004	LA	8/3/2008	0-5	40	1
13112	LA	7/31/2008	0-5	15	1
120	LA	7/30/2008	0-15	92	1
140	LA	8/6/2008	0-30	10	1
204	LA	7/26/2008	0-5	38	1
332	LA	8/2/2008	0-15	10	1
460	LA	7/26/2008	0-10	15	1
588	LA	8/6/2008	0-20	27	1
824	LA	7/30/2008	0-20	23	1
1072	LA	7/28/2008	0-20	228	1
1144	LA	7/30/2008	0-20	105	1
1356	LA	8/2/2008	0-20	10	1
1612	LA	8/5/2008	0-30	121	1
1740	LA	8/3/2008	0-20	123	1
1848	LA	7/28/2008	0-10	70	1
2168	LA	7/29/2008	0-8	71	1
2380	LA	8/4/2008	0-20	9	1
2636	LA	8/6/2008	0-15	7	1
2872	LA	7/28/2008	0-10	72	1
2892	LA	8/6/2008	0-20	11	1
3404	LA	8/4/2008	0-30	36	1
3640	LA	7/31/2008	0-30	127	1
3896	LA	7/27/2008	0-20	18	1
3980	LA	8/1/2008	0-10	114	1
4216	LA	7/30/2008	0-20	65	1
4236	LA	8/6/2008	0-20	88	1
4300	LA	8/1/2008	0-5	72	1
4428	LA	8/2/2008	0-20	13	1
4492	LA	8/6/2008	0-10	19	1
4664	LA	7/31/2008	0-15	60	1
4684	LA	8/6/2008	0-30	18	1
4920	LA	7/31/2008	0-5	9	1
5240	LA	8/1/2008	0-15	52	1
5452	LA	8/2/2008	0-20	37	1
5688	LA	7/31/2008	0-30	15	1
5708	LA	8/6/2008	0-20	67	1
5836	LA	8/4/2008	0-20	134	1

ATTACHMENT F-1
Background Data Collected by USGS
August J. Levert, Jr., Family, LLC, et al.
Grand River Oil & Gas Field
Iberville Parish, Louisiana

SiteID	StateID	CollDate	Depth (cm)	Zn (mg/kg)	D_Zn (mg/kg)
5944	LA	7/26/2008	0-20	31	1
6264	LA	7/29/2008	0-20	63	1
6476	LA	8/2/2008	0-20	6	1
6712	LA	7/31/2008	0-25	46	1
6968	LA	7/28/2008	0-25	93	1
7500	LA	8/4/2008	0-15	14	1
7736	LA	7/31/2008	0-15	21	1
7992	LA	7/28/2008	0-8	123	1
8012	LA	8/6/2008	0-20	31	1
8076	LA	8/1/2008	0-20	90	1
8312	LA	7/30/2008	0-30	74	1
8332	LA	8/6/2008	0-70	86	1
8396	LA	8/3/2008	0-30	117	1
8524	LA	8/4/2008	0-20	34	1
8780	LA	8/6/2008	0-10	80	1
8908	LA	8/4/2008	0-20	32	1
9016	LA	7/30/2008	0-30	12	1
9336	LA	7/30/2008	0-20	71	1
9548	LA	8/3/2008	0-20	23	1
9804	LA	8/6/2008	0-15	6	1
9932	LA	8/4/2008	0-30	68	1
10040	LA	7/29/2008	0-30	140	1
10060	LA	8/6/2008	0-25	4	1
10572	LA	7/31/2008	0-10	14	1
10808	LA	7/31/2008	0-10	57	1
11064	LA	7/28/2008	0-8	220	1
11148	LA	8/1/2008	0-20	80	1
11340	LA	8/4/2008	0-30	22	1
11468	LA	7/26/2008	0-30	23	1
11596	LA	8/4/2008	0-30	8	1
11724	LA	8/4/2008	0-50	36	1
11832	LA	7/30/2008	0-20	14	1
11852	LA	8/2/2008	0-20	61	1
12088	LA	7/29/2008	0-30	78	1
12408	LA	7/30/2008	0-30	93	1
12620	LA	8/2/2008	0-25	5	1
12856	LA	7/31/2008	0-20	9	1
12876	LA	8/6/2008	0-10	50	1
13004	LA	8/3/2008	0-20	49	1
13112	LA	7/31/2008	0-20	17	1

Outlier Tests

Outlier Tests for Selected Variables excluding nondetects

User Selected Options

Date/Time of Computation	ProUCL 5.17/14/2020 1:20:12 PM
From File	ProUCL data_USGS Bkg_Top 5 cm and A horizon_LA.xls
Full Precision	OFF

Rosner's Outlier Test for 5 Outliers in As (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**5.988**
SD of Detects	**4.832**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	5.988	4.816	38.2	143	6.689	3.52	3.89
2	5.772	4.056	32.6	68	6.615	3.51	3.89
3	5.591	3.41	18	141	3.639	3.51	3.89
4	5.506	3.263	17.4	66	3.645	3.51	3.88
5	5.425	3.121	14.5	61	2.908	3.51	3.88

For 5% significance level, there are 4 Potential Outliers
38.2, 32.6, 18, 17.4

For 1% Significance Level, there are 2 Potential Outliers
38.2, 32.6

Outlier Tests

Rosner's Outlier Test for 5 Outliers in Ba (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**429.3**
SD of Detects	**333.7**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	429.3	332.6	2690	31	6.798	3.52	3.89
2	414.1	278.1	2530	106	7.609	3.51	3.89
3	399.8	217.2	847	112	2.059	3.51	3.89
4	396.8	214.8	842	37	2.073	3.51	3.88
5	393.7	212.3	775	89	1.796	3.51	3.88

For 5% significance level, there are 2 Potential Outliers
2690, 2530

For 1% Significance Level, there are 2 Potential Outliers
2690, 2530

Rosner's Outlier Test for 5 Outliers in Cd (mg/kg)

Total N	**150**
Number NDs	**77**
Number Detects	**73**
Mean of Detects	**0.34**
SD of Detects	**0.243**
Number of data	**73**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.34	0.241	1.1	6	3.149	3.275	3.635
2	0.329	0.227	1.1	33	3.391	3.265	3.635
3	0.318	0.209	1	19	3.257	3.265	3.625
4	0.309	0.194	1	68	3.565	3.255	3.618
5	0.299	0.176	0.8	34	2.847	3.255	3.615

For 5% significance level, there are 4 Potential Outliers
1.1, 1.1, 1, 1

For 1% Significance Level, there is no Potential Outlier

Outlier Tests

Rosner's Outlier Test for 5 Outliers in Cr (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**37.67**
SD of Detects	**19.3**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	37.67	19.24	84	86	2.408	3.52	3.89
2	37.36	18.99	84	122	2.456	3.51	3.89
3	37.05	18.66	80	22	2.302	3.51	3.89
4	36.76	18.38	79	97	2.298	3.51	3.88
5	36.47	18.1	78	110	2.294	3.51	3.88

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for 5 Outliers in Pb (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**20.12**
SD of Detects	**11.61**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	20.12	11.57	90.8	1	6.107	3.52	3.89
2	19.64	10.09	80.6	57	6.042	3.51	3.89
3	19.23	8.776	47.2	8	3.187	3.51	3.89
4	19.04	8.495	46.7	43	3.256	3.51	3.88
5	18.85	8.206	44.2	118	3.089	3.51	3.88

For 5% significance level, there are 2 Potential Outliers
90.8, 80.6

For 1% Significance Level, there are 2 Potential Outliers
90.8, 80.6

Outlier Tests

Rosner's Outlier Test for 5 Outliers in Hg (mg/kg)

Total N	**150**
Number NDs	**7**
Number Detects	**143**
Mean of Detects	**0.114**
SD of Detects	**0.634**
Number of data	**143**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.114	0.631	6.24	103	9.702	3.5	3.87
2	0.0708	0.369	4.43	30	11.81	3.492	3.87
3	0.0399	0.0242	0.13	24	3.719	3.492	3.87
4	0.0393	0.0231	0.11	42	3.066	3.49	3.86
5	0.0388	0.0223	0.11	96	3.188	3.49	3.86

For 5% significance level, there are 3 Potential Outliers
6.24, 4.43, 0.13

For 1% Significance Level, there are 2 Potential Outliers
6.24, 4.43

Rosner's Outlier Test for 5 Outliers in Se (mg/kg)

Total N	**150**
Number NDs	**53**
Number Detects	**97**
Mean of Detects	**0.511**
SD of Detects	**0.253**
Number of data	**97**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.511	0.252	1.2	21	2.733	3.371	3.741
2	0.504	0.244	1.2	92	2.846	3.368	3.738
3	0.497	0.235	1.1	36	2.567	3.368	3.738
4	0.49	0.228	1.1	70	2.677	3.361	3.728
5	0.484	0.22	1	1	2.348	3.358	3.728

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Outlier Tests

Rosner's Outlier Test for 5 Outliers in Sr (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**81.84**
SD of Detects	**61.29**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	81.84	61.08	290	114	3.408	3.52	3.89
2	80.44	59.05	275	39	3.295	3.51	3.89
3	79.13	57.02	225	103	2.558	3.51	3.89
4	78.13	55.92	213	66	2.412	3.51	3.88
5	77.21	54.97	203	28	2.288	3.51	3.88

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for 5 Outliers in Zn (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**55.21**
SD of Detects	**51.06**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	55.21	50.89	385	61	6.481	3.52	3.89
2	52.99	43.42	228	83	4.031	3.51	3.89
3	51.81	41.08	220	136	4.094	3.51	3.89
4	50.67	38.79	148	57	2.509	3.51	3.88
5	50	38.07	140	20	2.364	3.51	3.88

For 5% significance level, there are 3 Potential Outliers
385, 228, 220

For 1% Significance Level, there are 3 Potential Outliers
385, 228, 220

Background Threshold Values

Background Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.17/14/2020 1:22:06 PM
From File	ProUCL data_USGS Bkg_Top 5 cm and A horizon_LA.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
ent or Future K Observations	1
ıber of Bootstrap Operations	2000

As (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	86
Minimum	1	First Quartile	3.2
Second Largest	32.6	Median	5.05
Maximum	38.2	Third Quartile	7.375
Mean	5.988	SD	4.832
Coefficient of Variation	0.807	Skewness	3.415
Mean of logged Data	1.557	SD of logged Data	0.683

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.738	**Normal GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	15.01	90% Percentile (z)	12.18
95% UPL (t)	14.01	95% Percentile (z)	13.94
95% USL	22.14	99% Percentile (z)	17.23

Gamma GOF Test

A-D Test Statistic	0.659	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.764	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0636	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0774	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.302	k star (bias corrected MLE)	2.261
Theta hat (MLE)	2.601	Theta star (bias corrected MLE)	2.649
nu hat (MLE)	690.7	nu star (bias corrected)	678.2
MLE Mean (bias corrected)	5.988	MLE Sd (bias corrected)	3.983

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	13.56	90% Percentile	11.32
95% Hawkins Wixley (HW) Approx. Gamma UPL	13.73	95% Percentile	13.67
95% WH Approx. Gamma UTL with 95% Coverage	15.02	99% Percentile	18.85
95% HW Approx. Gamma UTL with 95% Coverage	15.31		
95% WH USL	28.48	95% HW USL	30.91

Background Threshold Values

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.979	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	0.334	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0534	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.0727	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	17	90% Percentile (z)	11.39
95% UPL (t)	14.76	95% Percentile (z)	14.6
95% USL	46.59	99% Percentile (z)	23.26

Nonparametric Distribution Free Background Statistics
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	14.5
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	14.5	95% BCA Bootstrap UTL with 95% Coverage	14.5
95% UPL	13.79	90% Percentile	10.71
90% Chebyshev UPL	20.53	95% Percentile	13.25
95% Chebyshev UPL	27.12	99% Percentile	25.45
95% USL	38.2		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Ba (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	134
Minimum	64	First Quartile	207
Second Largest	2530	Median	373
Maximum	2690	Third Quartile	624
Mean	429.3	SD	333.7
Coefficient of Variation	0.777	Skewness	3.749
Mean of logged Data	5.832	SD of logged Data	0.697

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.704	**Normal GOF Test**	
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.138	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	1053	90% Percentile (z)	856.9
95% UPL (t)	983.4	95% Percentile (z)	978.1
95% USL	1545	99% Percentile (z)	1206

Background Threshold Values

Gamma GOF Test

A-D Test Statistic	1.966	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.764	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.0888	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.0774	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.328	k star (bias corrected MLE)	2.285
Theta hat (MLE)	184.4	Theta star (bias corrected MLE)	187.8
nu hat (MLE)	698.3	nu star (bias corrected)	685.6
MLE Mean (bias corrected)	429.3	MLE Sd (bias corrected)	284

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	971	90% Percentile	809.4
95% Hawkins Wixley (HW) Approx. Gamma UPL	988.3	95% Percentile	976.8
95% WH Approx. Gamma UTL with 95% Coverage	1075	99% Percentile	1345
95% HW Approx. Gamma UTL with 95% Coverage	1102		
95% WH USL	2032	95% HW USL	2225

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	6.1525E-6	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0997	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.0727	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	1254	90% Percentile (z)	833.5
95% UPL (t)	1086	95% Percentile (z)	1074
95% USL	3508	99% Percentile (z)	1727

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	775
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	775	95% BCA Bootstrap UTL with 95% Coverage	775
95% UPL	739.1	90% Percentile	694.7
90% Chebyshev UPL	1434	95% Percentile	729.7
95% Chebyshev UPL	1889	99% Percentile	1705
95% USL	2690		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Background Threshold Values

Cd (mg/kg)

General Statistics

Total Number of Observations	150	Number of Missing Observations	0
Number of Distinct Observations	9		
Number of Detects	73	Number of Non-Detects	77
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	0.1	Minimum Non-Detect	0.1
Maximum Detect	1.1	Maximum Non-Detect	0.1
Variance Detected	0.0591	Percent Non-Detects	51.33%
Mean Detected	0.34	SD Detected	0.243
Mean of Detected Logged Data	-1.291	SD of Detected Logged Data	0.646

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.786	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	1.266E-14	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.25	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.217	KM SD	0.207
95% UTL95% Coverage	0.603	95% KM UPL (t)	0.56
90% KM Percentile (z)	0.482	95% KM Percentile (z)	0.557
99% KM Percentile (z)	0.698	95% KM USL	0.908

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.191	SD	0.223
95% UTL95% Coverage	0.607	95% UPL (t)	0.561
90% Percentile (z)	0.477	95% Percentile (z)	0.558
99% Percentile (z)	0.709	95% USL	0.936

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.18	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.76	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.177	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.105	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.521	k star (bias corrected MLE)	2.426
Theta hat (MLE)	0.135	Theta star (bias corrected MLE)	0.14
nu hat (MLE)	368.1	nu star (bias corrected)	354.3
MLE Mean (bias corrected)	0.34		
MLE Sd (bias corrected)	0.218	95% Percentile of Chisquare (2kstar)	10.84

Background Threshold Values

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.173
Maximum	1.1	Median	0.0531
SD	0.235	CV	1.363
k hat (MLE)	0.548	k star (bias corrected MLE)	0.542
Theta hat (MLE)	0.315	Theta star (bias corrected MLE)	0.318
nu hat (MLE)	164.5	nu star (bias corrected)	162.6
MLE Mean (bias corrected)	0.173	MLE Sd (bias corrected)	0.234
95% Percentile of Chisquare (2kstar)	4.045	90% Percentile	0.459
95% Percentile	0.644	99% Percentile	1.096

The following statistics are computed using Gamma ROS Statistics on Imputed Data

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.718	0.777	95% Approx. Gamma UPL	0.604	0.637
95% Gamma USL	1.968	2.548			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.217	SD (KM)	0.207
Variance (KM)	0.0427	SE of Mean (KM)	0.017
k hat (KM)	1.099	k star (KM)	1.081
nu hat (KM)	329.6	nu star (KM)	324.4
theta hat (KM)	0.197	theta star (KM)	0.2
80% gamma percentile (KM)	0.346	90% gamma percentile (KM)	0.489
95% gamma percentile (KM)	0.631	99% gamma percentile (KM)	0.96

The following statistics are computed using gamma distribution and KM estimates

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.572	0.571	95% Approx. Gamma UPL	0.512	0.509
95% KM Gamma Percentile	0.508	0.504	95% Gamma USL	1.129	1.197

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.915	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	4.3261E-5	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.195	Mean in Log Scale	-2.171
SD in Original Scale	0.221	SD in Log Scale	1.071
95% UTL95% Coverage	0.843	95% BCA UTL95% Coverage	0.8
95% Bootstrap (%) UTL95% Coverage	0.8	95% UPL (t)	0.675
90% Percentile (z)	0.45	95% Percentile (z)	0.664
99% Percentile (z)	1.377	95% USL	4.089

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-1.81	95% KM UTL (Lognormal)95% Coverage	0.578
KM SD of Logged Data	0.676	95% KM UPL (Lognormal)	0.502
95% KM Percentile Lognormal (z)	0.497	95% KM USL (Lognormal)	1.565

Background Threshold Values

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.191	Mean in Log Scale	-2.166
SD in Original Scale	0.223	SD in Log Scale	0.966
95% UTL95% Coverage	0.696	95% UPL (t)	0.57
90% Percentile (z)	0.395	95% Percentile (z)	0.561
99% Percentile (z)	1.084	95% USL	2.895

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	146	95% UTL with95% Coverage	0.8
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
Approximate Sample Size needed to achieve specified CC	181	95% UPL	0.8
95% USL	1.1	95% KM Chebyshev UPL	1.121

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Cr (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	64
Minimum	5	First Quartile	22
Second Largest	84	Median	33
Maximum	84	Third Quartile	52.75
Mean	37.67	SD	19.3
Coefficient of Variation	0.512	Skewness	0.637
Mean of logged Data	3.488	SD of logged Data	0.557

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.918	**Normal GOF Test**
5% Shapiro Wilk P Value	5.049E-11	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.126	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	73.73	90% Percentile (z)	62.41
95% UPL (t)	69.73	95% Percentile (z)	69.43
95% USL	102.2	99% Percentile (z)	82.58

Gamma GOF Test

A-D Test Statistic	1.034	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0655	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0769	Detected data appear Gamma Distributed at 5% Significance Level

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

Background Threshold Values

Gamma Statistics

k hat (MLE)	3.707	k star (bias corrected MLE)	3.637
Theta hat (MLE)	10.16	Theta star (bias corrected MLE)	10.36
nu hat (MLE)	1112	nu star (bias corrected)	1091
MLE Mean (bias corrected)	37.67	MLE Sd (bias corrected)	19.75

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	75.05	90% Percentile	64.16
95% Hawkins Wixley (HW) Approx. Gamma UPL	76.4	95% Percentile	74.92
95% WH Approx. Gamma UTL with 95% Coverage	81.67	99% Percentile	98
95% HW Approx. Gamma UTL with 95% Coverage	83.64		
95% WH USL	140.4	95% HW USL	151

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	9.2132E-4	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0673	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0727	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	92.55	90% Percentile (z)	66.78
95% UPL (t)	82.47	95% Percentile (z)	81.75
95% USL	210.4	99% Percentile (z)	119.5

Nonparametric Distribution Free Background Statistics
Data appear Approximate Gamma Distribution at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	78
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	78	95% BCA Bootstrap UTL with 95% Coverage	78
95% UPL	75.9	90% Percentile	66.1
90% Chebyshev UPL	95.78	95% Percentile	75
95% Chebyshev UPL	122.1	99% Percentile	82.04
95% USL	84		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Pb (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	114
Minimum	4.4	First Quartile	12.73
Second Largest	80.6	Median	18.15
Maximum	90.8	Third Quartile	24.05
Mean	20.12	SD	11.61
Coefficient of Variation	0.577	Skewness	2.792
Mean of logged Data	2.878	SD of logged Data	0.484

Background Threshold Values

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.794	**Normal GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	41.81	90% Percentile (z)	35
95% UPL (t)	39.4	95% Percentile (z)	39.22
95% USL	58.94	99% Percentile (z)	47.13

Gamma GOF Test

A-D Test Statistic	1.111	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0779	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0768	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.217	k star (bias corrected MLE)	4.137
Theta hat (MLE)	4.771	Theta star (bias corrected MLE)	4.863
nu hat (MLE)	1265	nu star (bias corrected)	1241
MLE Mean (bias corrected)	20.12	MLE Sd (bias corrected)	9.891

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	38.55	90% Percentile	33.37
95% Hawkins Wixley (HW) Approx. Gamma UPL	38.71	95% Percentile	38.65
95% WH Approx. Gamma UTL with 95% Coverage	41.77	99% Percentile	49.91
95% HW Approx. Gamma UTL with 95% Coverage	42.12		
95% WH USL	69.98	95% HW USL	73.25

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.988	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.873	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0427	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0727	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	43.92	90% Percentile (z)	33.07
95% UPL (t)	39.73	95% Percentile (z)	39.43
95% USL	89.68	99% Percentile (z)	54.83

Nonparametric Distribution Free Background Statistics

Data appear Lognormal at 5% Significance Level

Background Threshold Values

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	44.2
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	44.2	95% BCA Bootstrap UTL with 95% Coverage	44.2
95% UPL	39.62	90% Percentile	32.22
90% Chebyshev UPL	55.07	95% Percentile	37.73
95% Chebyshev UPL	70.9	99% Percentile	64.23
95% USL	90.8		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Hg (mg/kg)

General Statistics

Total Number of Observations	150	Number of Missing Observations	0
Number of Distinct Observations	14		
Number of Detects	143	Number of Non-Detects	7
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	0.01	Minimum Non-Detect	0.01
Maximum Detect	6.24	Maximum Non-Detect	0.01
Variance Detected	0.401	Percent Non-Detects	4.667%
Mean Detected	0.114	SD Detected	0.634
Mean of Detected Logged Data	-3.34	SD of Detected Logged Data	0.874

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.143	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.482	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0745	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.109	KM SD	0.617
95% UTL95% Coverage	1.261	95% KM UPL (t)	1.134
90% KM Percentile (z)	0.9	95% KM Percentile (z)	1.124
99% KM Percentile (z)	1.544	95% KM USL	2.171

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.109	SD	0.619
95% UTL95% Coverage	1.265	95% UPL (t)	1.137
90% Percentile (z)	0.902	95% Percentile (z)	1.127
99% Percentile (z)	1.549	95% USL	2.178

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Background Threshold Values

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	26.29	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.816	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.347	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0827	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.538	k star (bias corrected MLE)	0.531
Theta hat (MLE)	0.212	Theta star (bias corrected MLE)	0.215
nu hat (MLE)	153.8	nu star (bias corrected)	151.9
MLE Mean (bias corrected)	0.114		
MLE Sd (bias corrected)	0.156	95% Percentile of Chisquare (2kstar)	3.994

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.109
Maximum	6.24	Median	0.03
SD	0.619	CV	5.672
k hat (MLE)	0.532	k star (bias corrected MLE)	0.525
Theta hat (MLE)	0.205	Theta star (bias corrected MLE)	0.208
nu hat (MLE)	159.5	nu star (bias corrected)	157.6
MLE Mean (bias corrected)	0.109	MLE Sd (bias corrected)	0.151
95% Percentile of Chisquare (2kstar)	3.966	90% Percentile	0.292
95% Percentile	0.412	99% Percentile	0.705

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.307	0.253	95% Approx. Gamma UPL	0.259	0.213
95% Gamma USL	0.824	0.722			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.109	SD (KM)	0.617
Variance (KM)	0.381	SE of Mean (KM)	0.0505
k hat (KM)	0.0313	k star (KM)	0.0351
nu hat (KM)	9.389	nu star (KM)	10.53
theta hat (KM)	3.487	theta star (KM)	3.108
80% gamma percentile (KM)	0.00312	90% gamma percentile (KM)	0.0919
95% gamma percentile (KM)	0.481	99% gamma percentile (KM)	2.692

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.305	0.252	95% Approx. Gamma UPL	0.258	0.212
95% KM Gamma Percentile	0.255	0.21	95% Gamma USL	0.819	0.717

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.803	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.144	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0745	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Threshold Values

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.109	Mean in Log Scale	-3.427
SD in Original Scale	0.619	SD in Log Scale	0.942
95% UTL95% Coverage	0.189	95% BCA UTL95% Coverage	0.0955
95% Bootstrap (%) UTL95% Coverage	0.11	95% UPL (t)	0.155
90% Percentile (z)	0.109	95% Percentile (z)	0.153
99% Percentile (z)	0.291	95% USL	0.757

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-3.399	95% KM UTL (Lognormal)95% Coverage	0.177
KM SD of Logged Data	0.891	95% KM UPL (Lognormal)	0.147
95% KM Percentile Lognormal (z)	0.145	95% KM USL (Lognormal)	0.657

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.109	Mean in Log Scale	-3.431
SD in Original Scale	0.619	SD in Log Scale	0.948
95% UTL95% Coverage	0.19	95% UPL (t)	0.156
90% Percentile (z)	0.109	95% Percentile (z)	0.154
99% Percentile (z)	0.294	95% USL	0.77

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	146	95% UTL with95% Coverage	0.11
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
Approximate Sample Size needed to achieve specified CC	181	95% UPL	0.09
95% USL	6.24	95% KM Chebyshev UPL	2.807

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Se (mg/kg)

General Statistics

Total Number of Observations	150	Number of Missing Observations	0
Number of Distinct Observations	11		
Number of Detects	97	Number of Non-Detects	53
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	0.2	Minimum Non-Detect	0.2
Maximum Detect	1.2	Maximum Non-Detect	0.2
Variance Detected	0.0641	Percent Non-Detects	35.33%
Mean Detected	0.511	SD Detected	0.253
Mean of Detected Logged Data	-0.782	SD of Detected Logged Data	0.467

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.857	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	1.499E-13	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0902	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Threshold Values

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.401	KM SD	0.251
95% UTL95% Coverage	0.871	95% KM UPL (t)	0.819
90% KM Percentile (z)	0.724	95% KM Percentile (z)	0.815
99% KM Percentile (z)	0.986	95% KM USL	1.242

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.366	SD	0.283
95% UTL95% Coverage	0.895	95% UPL (t)	0.836
90% Percentile (z)	0.729	95% Percentile (z)	0.832
99% Percentile (z)	1.025	95% USL	1.313

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.705	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.755	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0911	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.672	k star (bias corrected MLE)	4.534
Theta hat (MLE)	0.109	Theta star (bias corrected MLE)	0.113
nu hat (MLE)	906.4	nu star (bias corrected)	879.7
MLE Mean (bias corrected)	0.511		
MLE Sd (bias corrected)	0.24	95% Percentile of Chisquare (2kstar)	17.02

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.358
Maximum	1.2	Median	0.3
SD	0.293	CV	0.82
k hat (MLE)	1.007	k star (bias corrected MLE)	0.991
Theta hat (MLE)	0.356	Theta star (bias corrected MLE)	0.361
nu hat (MLE)	302	nu star (bias corrected)	297.3
MLE Mean (bias corrected)	0.358	MLE Sd (bias corrected)	0.36
95% Percentile of Chisquare (2kstar)	5.956	90% Percentile	0.826
95% Percentile	1.076	99% Percentile	1.656

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	1.223	1.361	95% Approx. Gamma UPL	1.066	1.163
95% Gamma USL	2.796	3.588			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.401	SD (KM)	0.251
Variance (KM)	0.0632	SE of Mean (KM)	0.0206
k hat (KM)	2.549	k star (KM)	2.502
nu hat (KM)	764.6	nu star (KM)	750.6
theta hat (KM)	0.157	theta star (KM)	0.16
80% gamma percentile (KM)	0.585	90% gamma percentile (KM)	0.741
95% gamma percentile (KM)	0.888	99% gamma percentile (KM)	1.211

Background Threshold Values

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.9	0.909	95% Approx. Gamma UPL	0.824	0.827
95% KM Gamma Percentile	0.818	0.821	95% Gamma USL	1.587	1.676

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.924	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	7.3138E-6	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0902	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.386	Mean in Log Scale	-1.177
SD in Original Scale	0.266	SD in Log Scale	0.688
95% UTL95% Coverage	1.113	95% BCA UTL95% Coverage	1
95% Bootstrap (%) UTL95% Coverage	1	95% UPL (t)	0.965
90% Percentile (z)	0.744	95% Percentile (z)	0.955
99% Percentile (z)	1.526	95% USL	3.071

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-1.074	95% KM UTL (Lognormal)95% Coverage	0.945
KM SD of Logged Data	0.545	95% KM UPL (Lognormal)	0.844
95% KM Percentile Lognormal (z)	0.837	95% KM USL (Lognormal)	2.109

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.366	Mean in Log Scale	-1.319
SD in Original Scale	0.283	SD in Log Scale	0.82
95% UTL95% Coverage	1.238	95% UPL (t)	1.044
90% Percentile (z)	0.765	95% Percentile (z)	1.031
99% Percentile (z)	1.803	95% USL	4.151

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	146	95% UTL with95% Coverage	1
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
Approximate Sample Size needed to achieve specified CC	181	95% UPL	1
95% USL	1.2	95% KM Chebyshev UPL	1.501

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Background Threshold Values

Sr (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	131
Minimum	7	First Quartile	26.15
Second Largest	275	Median	76.9
Maximum	290	Third Quartile	131.8
Mean	81.84	SD	61.29
Coefficient of Variation	0.749	Skewness	0.706
Mean of logged Data	4.039	SD of logged Data	0.939

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.898	**Normal GOF Test**
5% Shapiro Wilk P Value	1.332E-15	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	196.3	90% Percentile (z)	160.4
95% UPL (t)	183.6	95% Percentile (z)	182.6
95% USL	286.7	99% Percentile (z)	224.4

Gamma GOF Test

A-D Test Statistic	3.313	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.77	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.128	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.078	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.514	k star (bias corrected MLE)	1.488
Theta hat (MLE)	54.05	Theta star (bias corrected MLE)	54.99
nu hat (MLE)	454.2	nu star (bias corrected)	446.4
MLE Mean (bias corrected)	81.84	MLE Sd (bias corrected)	67.09

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	214	90% Percentile	170.9
95% Hawkins Wixley (HW) Approx. Gamma UPL	223	95% Percentile	213.7
95% WH Approx. Gamma UTL with 95% Coverage	241.3	99% Percentile	310.6
95% HW Approx. Gamma UTL with 95% Coverage	254.7		
95% WH USL	504.7	95% HW USL	587.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	2.240E-12	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.141	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	328.1	90% Percentile (z)	189.2
95% UPL (t)	270.1	95% Percentile (z)	266.1
95% USL	1311	99% Percentile (z)	504.6

Background Threshold Values

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	203
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	203	95% BCA Bootstrap UTL with 95% Coverage	203
95% UPL	181.5	90% Percentile	159.1
90% Chebyshev UPL	266.3	95% Percentile	179.2
95% Chebyshev UPL	349.9	99% Percentile	250.5
95% USL	290		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Zn (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	86
Minimum	4	First Quartile	16.25
Second Largest	228	Median	39
Maximum	385	Third Quartile	78.75
Mean	55.21	SD	51.06
Coefficient of Variation	0.925	Skewness	2.454
Mean of logged Data	3.589	SD of logged Data	0.985

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.811	**Normal GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	150.6	90% Percentile (z)	120.6
95% UPL (t)	140	95% Percentile (z)	139.2
95% USL	225.9	99% Percentile (z)	174

Gamma GOF Test

A-D Test Statistic	1.524	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.775	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0841	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0783	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Background Threshold Values

Gamma Statistics

k hat (MLE)	1.328	k star (bias corrected MLE)	1.306
Theta hat (MLE)	41.58	Theta star (bias corrected MLE)	42.28
nu hat (MLE)	398.3	nu star (bias corrected)	391.7
MLE Mean (bias corrected)	55.21	MLE Sd (bias corrected)	48.31

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	149.4	90% Percentile	119
95% Hawkins Wixley (HW) Approx. Gamma UPL	154.8	95% Percentile	150.7
95% WH Approx. Gamma UTL with 95% Coverage	169.4	99% Percentile	223
95% HW Approx. Gamma UTL with 95% Coverage	177.9		
95% WH USL	365.8	95% HW USL	425.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	5.4134E-5	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.11	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	228.1	90% Percentile (z)	128
95% UPL (t)	186	95% Percentile (z)	183.1
95% USL	976	99% Percentile (z)	358.4

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	140
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	140	95% BCA Bootstrap UTL with 95% Coverage	140
95% UPL	134.5	90% Percentile	118.1
90% Chebyshev UPL	208.9	95% Percentile	130.9
95% Chebyshev UPL	278.5	99% Percentile	224.1
95% USL	385		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

ATTACHMENT G LAA DISCUSSION

November 2022

ATTACHMENT G-1

Assessment of Ecological Risk in Soil Remediation Areas

August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

1. INTRODUCTION

The assessment presented here focuses on the soils that are planned for remediation in the Limited Admission Areas (LAAs). Soil remediation areas (SRAs) are planned for LAA2 and LAA3 and no soil remediation is planned for LAA1 (Figure 19). The SRAs in the LAAs are former operational areas that were not included in the Baseline Ecological Risk Assessment (BERA), due to being designated for corrective action. The finding of this assessment is that the SRAs are not predicted to be a source of ecological risk, even though they include soils planned for remediation to meet regulatory requirements.

Soils (0-4') in areas of the Property not planned for remediation are assessed in the BERA and are not included in the assessment presented here.

This assessment of the soil remediation areas includes soil concentrations (0-24"). This soil depth of 0-24" includes the effective root zone depth at the Property (0-24", HET, 2022) and the 0-12" recommended depth for the biologically active zone for soils (USEPA, 2015). The depth of 0-24" represents the depth of the majority of potential soil exposure for plants and animals in the SRAs (USEPA, 2015).

The SRAs in LAA2 and LAA3 are not included in the BERA. Therefore, this discussion of soil concentrations (0-2') in the SRAs is presented for reference and is supportive of the observed lack of ecological impact in these areas and throughout the Property. The BERA (for soils outside of the SRAs) is calculated using soil concentrations from 0-4', which includes both the USEPA (2015) recommended depth of 0-12" and the LDEQ RECAP (2003) depth of 0-3'.

The following sections are a discussion of ecological risk and the SRAs on the Property. Ecological risk is not predicted in the SRAs.

2. LAA1

Soils in LAA1 are not planned for remediation and are assessed in the BERA, rather than in the assessment presented in this section. Per the BERA, ecological risk is not predicted in LAA1, and no further action is recommended for LAA1 for any ecological reason.

3. LAA2: METALS ECOLOGICAL RISK

There is one small (approximately 0.04 acre) former operational area in LAA2, and this area is planned for remediation (see Figure 19). This SRA is referred to as Limited Admission Area 2 – Soil Remediation Area (LAA2-SRA). Average metal concentrations in the LAA2-SRA are generally below ecological screening values and ecological risk is not predicted due to exposure to metals in LAA2-SRA.

Ten of the eleven metals assessed in the LAA2-SRA are below ecological screening values (ESVs) and are not predicted to be associated with ecological risk. Specifically, three of the metals (mercury, selenium, and silver) are not detected, and seven metals (arsenic, barium, lead, chromium, lead, and zinc) have average soil concentrations (0-2’) that are below ESVs. Strontium in within the range of unimpacted Louisiana soils (background).

One metal, cadmium, has an average concentration in LAA2-SRA that slightly exceeds the ESV. This is an artifact of including an elevated reporting limit in calculating the cadmium average. Specifically, cadmium was detected at HA-1 (0-2’) at 0.658 mg/kg-dry (which is below the ESV), and the associated split sample was non-detect at an elevated reporting limit of <5.2 mg/kg-dry. Location LT-2 (0-4’), which is within LAA2 but outside the SRA, was non-detect (<0.489 mg/kg-dry) at a much lower reporting limit. Relying on the more representative data, rather than a skewed average value, ecological risk is not predicted due to cadmium in soils in LAA2-SRA (see inset Table G-1, below).

Table G-1. 95%UCL, Maximum, and Average COC Concentrations (0-2’) in LAA2-SRA (Pit) Compared to Screening Values

Constituents of Concern	95% UCL # of Obs.	95% UCL Performed (≥8Obs.) Y/N	95% UCL Conc.	MAX Conc.	AVG Conc.	Ecological Screening Value (ESV)
Arsenic	2	N	NA	11.62	8.8	12
Barium*	2	N	NA	228	222	2424
Cadmium	2	N	NA	0.658	1.6	0.8
Chromium*	2	N	NA	38.2	28.1	84
Lead*	2	N	NA	28.4	25.0	44
Mercury	2	N	NA	ND	ND	0.18
Selenium	2	N	NA	ND	ND	1
Silver	1	N	NA	ND	ND	4.2
Strontium	1	N	NA	251	NA	203
Zinc	2	N	NA	130.9	106	140

Notes

1) The ESV for wetland soil is the highest of: Louisiana USGS soil background, USEPA Eco-SSL (lowest value amongst bird, mammal, invertebrate, and plant Eco-SSLs), and NOAA SQuiRT freshwater threshold effect concentration (TEC) and probable effect concentration (PEC). The ESV for barium is the higher of Louisiana USGS soil background and calculated barium soil screening value.
2) Averages were calculated using ½ the detection limit for concentrations that are non-detect.
3) Louisiana background range from USGS data (Smith et al., 2013).
4) * Barium, chromium, and lead are not predicted to be present in SRA soils in bioavailable or toxic forms, based on soil pH and known biogeochemistry of these metals. Ecological Screening Values (ESVs) for chromium and lead are for bioavailable forms of these metals that are not predicted to be present at the Property.

In summary, ecological risk due to metal concentrations in LAA2-SRA is not predicted.

4. LAA3: METALS BIOAVAILABILITY AND ECOLOGICAL RISK

There are two small (approximately 0.03 and 0.05 acres) former operational areas within LAA3 that are planned for remediation for regulatory reasons. The two operational areas are described in this section as Western Pit and Eastern Pit (See Figure 19). The SRAs associated with these pits are referred to as Limited Admission Area 3 – Western Pit Soil Remediation Area (LAA3-WP SRA) and Limited Admission Area 3 – Eastern Pit Soil Remediation Area (LAA3-EP SRA). Metals bioavailability and the potential for ecological risk in the two soil remediation areas (Western Pit and Eastern Pit) are discussed in this section.

Metals in LAA3-WP SRA and LAA3-EP SRA are demonstrated to be of low bioavailability. Constituents of low bioavailability are not easily absorbed, taken up, or accumulated by living organisms. Compounds or constituents that are of low bioavailability are also of low toxicity, because a poorly bioavailable constituent will only be absorbed or accumulated by the organism in very small amounts, and therefore toxicity is limited.

In wetland soils, such as in the soils in LAA3-WP SRA and LAA3-EP SRA, a metal may be present in elevated concentrations, and still be of limited bioavailability and low toxicity due to the specific metal compound (or species) that is present. In the wetland soil conditions found in LAA3-WP SRA and LAA3-EP SRA, where the soil pH is approximately neutral, most metals are of very low bioavailability (Reddy and DeLaune, 2008) and of very low toxicity.

4.1 Barium Bioavailability and Ecological Risk

Barium is not predicted to be a source of ecological toxicity in LAA3-WP SRA and LAA3-EP SRA.

Average barium in LAA3-EP SRA (1,924 mg/kg-dw) is below the ESV of 2,424 mg/kg-dw (see Attachment E), and no ecological risk due to barium in LAA3 is predicted.

Average barium in LAA3-WP SRA (2,938 mg/kg-dw) slightly exceeds the barium ESV of 2,424 mg/kg-dw. This ESV (2,424 mg/kg-dw) was calculated using the range (2,033 – 3,377 mg/kg-dw) of barium sulfate concentrations in soil that produce no ecological effects to invertebrates and plants (see Attachment E). Barium in LAA3-WP SRA (2,938 mg/kg-dw average) is within this range (2,033 – 3,377 mg/kg-dw) of no effects concentrations and is not predicted to be a source of ecological risk. Experience with barium in soil throughout south Louisiana also informs the opinion that average barium of 2,938 mg/kg-dw is not associated with risk to wildlife, including mammals and birds. The low average concentration of barium in soil in the LAA3-WP SRA is not predicted to be a source of ecological risk.

Barium in LAA3-WP SRA is in the form of barium sulfate, which is of very low bioavailability and very low toxicity. Barium speciation performed on soils using XRD analysis (see Table 5) demonstrates that the form of barium present is barite (barium sulfate). Barium in LAA3-EP SRA at SB-03 and SB-04 (0-2') was analyzed and found to be in the form of barite, per XRD analysis and no other forms of barium were present. Barium was also analyzed in LAA3-WP SRA at SB-11 and SB-12 (2-4') and found to be in the form of barite, per XRD analysis, and no other forms of barium were present.

Barite is of very low ecological toxicity and is not of ecological concern (USEPA, 1994; ERM, 2019). There is no ecological risk predicted in LAA3-WP SRA, LAA3-EP SRA, or throughout the Property due to barium in soils.

4.2 Chromium and Lead Bioavailability and Ecological Risk

Chromium and lead are not predicted to be sources of ecological toxicity in LAA3-WP SRA and LAA3-EP SRA.

Chromium and lead form compounds in neutral pH wetland soils that are of very low solubility, very low bioavailability, and very low toxicity (DeLaune and Reddy, 2008).

In both LAA3-WP SRA and LAA3-EP SRA, the very limited bioavailability of chromium and lead is demonstrated by SPLP analyses. SPLP analysis involves dissolving 100 grams of soil into two liters of water over an 18-hour period, to determine if the metals present in the soil sample can dissolve in water.

SPLP analyses of soils in LAA3-EP SRA (0-2’, SB-03 and SB-04) demonstrate very low water solubility of lead and chromium. Chromium and lead were only detected in SPLP solution water in very low concentrations ranging from 0.02 – 0.12 mg/L (see Table 4). This is very low solubility, which indicates very low bioavailability (low levels of absorption/uptake), and very low toxicity to living organisms.

In LAA3-WP SRA, chromium and lead are also estimated to be of very low bioavailability and very low toxicity in in the 0-2’ interval, based on SPLP analyses. Location HA-2 (0-2’) in LAA3-WP SRA had non-detect SPLP results for both chromium and lead (<0.1 mg/L), indicating very low solubility and very low bioavailability of both chromium and lead.

Based on SPLP analyses demonstrating very low solubility in soil, ecological toxicity is not predicted due to lead and chromium in LAA3-WP SRA and LAA3-EP SRA.

4.3 Ecological Risk: Arsenic, Cadmium, Mercury, Selenium, Silver, Strontium, and Zinc

Arsenic, cadmium, mercury, selenium, silver, strontium, and zinc are not predicted to be sources of ecological toxicity in the soil remediation areas within LAA3-WP SRA and LAA3-EP SRA.

Average metals concentrations of arsenic, cadmium, mercury, selenium, silver, strontium, and zinc in the soil remediation areas within LAA3-WP SRA and LAA3-EP SRA are concentrations that are not associated with ecological risk (see Table G-2).

- **Arsenic: Below Ecological Risk Levels**

  Average arsenic (0-2’) concentrations in LAA3-WP SRA and LAA3-EP SRA are 7.3 mg/kg-dw and 8.8 mg/kg-dw, respectively, which are both below the arsenic Louisiana background value of 12 mg/kg-dw. Arsenic in LAA3-WP SRA and LAA3-EP SRA is not predicted to be a source of ecological risk.

- **Cadmium: Below Ecological Risk Levels**

  There is one elevated cadmium value (0-2’) in LAA3-WP SRA (HA-2, 0-2’, 7.52 mg/kg-dw) that is not confirmed by the resample (SB-09, 0-2’, 0.86 mg/kg-dw) collected in the immediate area. Otherwise, the average cadmium concentrations of 1.27 mg/kg-dw (LAA3-WP SRA) and 0.86 mg/kg-dw (LAA3-EP SRA) are similar to cadmium values evaluated in the BERA that are below levels of ecological risk. For example, the maximum cadmium concentration assessed in the BERA (1.7 mg/kg-dw, SB-06R, 0-2’) for soils outside of the remediation areas, does not result in HQ values greater than the benchmark of 1.0 (HQ < or = 0.01). Therefore, average cadmium concentrations in LAA3-WP SRA and LAA3-EP SRA (0.86 - 1.1 mg/kg-dw), which are less than the maximum cadmium value assessed in the BERA (1.7 mg/kg-dw), are also not predicted to be associated with ecological risk. Based on this assessment, cadmium is not predicted to be a source of ecological risk in LAA3-WP SRA and LAA3-EP SRA.

- **Mercury: Below Ecological Risk Levels**

  Average mercury concentrations (0-2’) in LAA3-WP SRA (0.72 mg/kg-dw) and LAA3-EP SRA (0.41 mg/kg-dw) are not predicted to be associated with ecological risk to wildlife, based on comparison to the mercury risk calculations performed for mercury in soils outside of the remediation areas, as part of the BERA. In the BERA, the average mercury concentration in preliminary AOI SB-14 (0.85 mg/kg-dw) is slightly higher than in LAA3-WP SRA (0.72 mg/kg-dw) and LAA3-EP SRA (0.41 mg/kg-dw) and was not found to be a source of ecological risk.

Therefore, in LAA3-WP SRA and LAA3-EP SRA, where average mercury concentrations are lower, mercury is also predicted not to be a risk to wildlife. Mercury in LAA3-WP SRA and LAA3-EP SRA is not predicted to be a source of ecological risk.

- **Zinc: Below Ecological Risk Levels**

  There is one elevated zinc value (0-2') in LAA3-WP SRA (HA-2, 0-2' 1350 mg/kg-dw) that was not confirmed by the split sample (232.9 mg/kg-dw), collected on the same day (08/29/19, Table 4), or by the resample (SB-09, 0-2', 108.5 mg/kg-dw) collected in the immediate area. The split sample (232.9 mg/kg-dw) is typical of zinc concentrations (0-2') throughout the Property (35.3 - 273 mg/kg-dw, 0-2') and the sample (1350 mg/kg-dw) is not. Otherwise, average zinc concentrations in LAA3-WP SRA (158 mg/kg-dw) and LAA3-EP SRA (158 mg/kg-dw) are slightly elevated above the ecological screening value of 140 mg/kg-dw, but are less than the maximum zinc value in soils outside of the remediation areas (199 mg/kg-dw), which was not calculated in the BERA to be a source of ecological risk (see Inset Table 5-2). Therefore, lower values (both SRAs: average 158 mg/kg-dw) in LAA3-WP SRA and the LAA3-EP SRA are also not predicted to be a source of ecological risk. Zinc in soils is not predicted to be a source of ecological risk in LAA3-WP SRA and LAA3-EP SRA.

- **Selenium, Silver, and Strontium: Below Ecological Risk Levels**

  Selenium, silver, and strontium are not predicted to be a source of ecological risk in LAA3-WP SRA and LAA3-EP SRA. Selenium is not detected, and therefore, no ecological risk due to selenium is predicted for the soil remediation areas within LAA3. Average silver is below the ESV (4.2 mg/kg-dw) in LAA3-EP SRA and not detected in LAA-WP SRA, and therefore, no ecological risk due to silver is predicted. Strontium in within the range of unimpacted Louisiana soils (background). In summary, no ecological risk is predicted in LAA3-WP SRA and LAA3-EP SRA due to selenium, silver, or strontium.

Table G-2. 95%UCL, Maximum, and Average COC Concentrations (0-2') in LAA3-WP SRA and LAA3-EP SRA Compared to Screening Values

Constituents of Concern	95% UCL # of Obs.	95% UCL Performed (≥8Obs.) Y/N	95% UCL Conc.	MAX Conc.	AVG Conc.	Ecological Screening Value (ESV)
LAA3-WP SRA						
Arsenic	9	Y	13.6	23.4	7.3	12
Barium*	9	Y	4749	12019	2938	2424
Cadmium	7	N	NA	1.65	1.27	0.8
Chromium*	8	Y	192	435	116	84
Lead*	8	Y	NA	707	139	44
Mercury	8	Y	1.29	2.7	0.72	0.18
Selenium	6	N	NA	ND	ND	1
Silver	5	N	NA	ND	ND	4.2
Strontium	3	N	NA	336	220	203
Zinc	7	N	NA	273	158	140
LAA3-EP SRA						
Arsenic	9	Y	11.8	16.5	8.8	12
Barium*	9	Y	2961	4510	1924	2424
Cadmium	8	Y	1.09	1.78	0.86	0.8
Chromium*	8	Y	503	800	314	84

Constituents of Concern	95% UCL # of Obs.	95% UCL Performed (≥8Obs.) Y/N	95% UCL Conc.	MAX Conc.	AVG Conc.	Ecological Screening Value (ESV)
Lead*	8	Y	255	302	167	44
Mercury	7	N	NA	1.24	0.41	0.18
Selenium	6	N	NA	ND	ND	1
Silver	5	N	NA	1.71	0.77	4.2
Strontium	3	N	NA	219	154	203
Zinc	8	Y	200	231	158	140

Notes

1) Screening value for wetland soil is the highest of soil background and lowest of the USEPA Eco-SSLs for bird, mammal, invertebrate, and plant, and the NOAA SQuiRT freshwater TEC and PEC. The ESV for barium is the higher of Louisiana soil background and calculated barium soil screening value.
2) 95% Upper Confidence Limits (UCLs) were calculated using ProUCL 5.2 software (USEPA, 2022c).
3) Averages were calculated using ½ the detection limit for concentrations that are non-detect.
4) Sample Location ICON HA-2 (0-2') cadmium (7.52 mg/kg-dw) and zinc (1350 mg/kg-dw) concentrations were elevated and not confirmed by HET split samples or by resamples (location SB-09), and are not included in the maximum, average, or 95% UCL calculations for LAA3-WP SRA.
5) Louisiana background from USGS data (Smith et al., 2013).
6) * Barium, chromium, and lead are not predicted to be present in LAA soils in bioavailable or toxic forms, based on soil pH and known biogeochemistry of these metals. ESVs for chromium and lead are for bioavailable forms of these metals that are not predicted to be present at the Property.

5. TPH IN SRAS

TPH are not predicted to be a source of ecological risk in the SRAs in LAA2 or LAA3.

TPH in soils in the SRAs (0-2'), as assessed by PAH concentrations, are not predicted to be a source of ecological risk. PAH concentrations are used to evaluate ecological risk due to TPH. There are not ecological screening values for TPH.

In the LAA3-EP SRA, total TPH fractions range from 243 – 1685 mg/kg-dw. PAH, used to assess TPH, are below USEPA Eco SSL screening values for soil in the LAA3-EP SRA. PAH were measured in the LAA3-EP SRA at the location of maximum TPH (SB-04, 0-2'), and sum totals are 9.15 mg/kg-dw total PAH (NOAA TEC and PEC, 1.61 – 22.8 mg/kg-dw), 8.92 mg/kg-dw low molecular weight (LMW) PAH (USEPA Eco SSL screening value 29 mg/kg-dw) and 0.23 mg/kg-dw high molecular weight (HMW) PAH (USEPA Eco SSL screening value 1.1 mg/kg-dw). These measured PAH are below USEPA soil screening values and within the range of NOAA TEC and PEC in the LAA3-EP SRA, and no ecological risk is predicted to be associated with PAH or TPH in the LAA3-EP SRA .

In the LAA3-WP SRA, total TPH fractions in soil (0-2') are low, 22.0 – 321 mg/kg-dw. PAH data were not collected, but these low TPH concentrations in soils are not predicted to be associated with ecological effects, based on the weathered nature of the TPH. The majority of the TPH detected in the LAA3-WP SRA (0-2') are in the C_{16}-C_{35} aliphatic range of hydrocarbons, which is typical of weathered and degraded TPH of low toxicity and low bioavailability. The C_{16}-C_{35} aliphatic range of hydrocarbons makes up the largest percentage of hydrocarbons detected throughout the area, which is consistent with aged and weathered TPH of low ecological toxicity. No ecological effects due to TPH are predicted in the LAA3-WP SRA.

In the LAA2-SRA, total TPH fraction concentrations (0-2') are 2390 – 5989 mg/kg-dw. PAH were measured at the location of maximum TPH (SB-20, 0-2') as 0.47 mg/kg-dw total PAH, 0.25 mg/kg-dw LMW PAH and 0.22 mg/kg-dw HMW PAH, which is below all USEPA Eco-SSL PAH screening values (1.1 – 100 mg/kg-dw) and NOAA TEC and PEC (1.61 – 22.8 mg/kg-dw). PAH and TPH are not predicted to be a source of ecological risk in the soil remediation area within LAA2.

In summary, TPH, evaluated as aged and weathered hydrocarbons, and as analyzed by PAH below screening values in soil (0-2') are not predicted to be a source of ecological risk in SRAs in the LAAs.

6. SUMMARY OF ECOLOGICAL RISK IN SOIL REMEDIATION AREAS

The soil concentrations in the SRAs within LAA2 and LAA3 are not predicted to be a source of risk to ecological species.

Average metal concentrations detected in soils planned for remediation (0-2') are of low bioavailability and low toxicity or are below conservative ecological screening values. Barium, chromium, and lead are predicted to be present only in forms of limited bioavailability and therefore, limited toxicity, and not associated with ecological risk. Cadmium, mercury, and zinc average concentrations are not predicted to be a source of ecological risk, by comparison to BERA calculations performed for soils of similar concentrations (outside the remediation areas). Arsenic average concentrations in the remediation areas are below ESVs and not predicted to be a source of risk. Selenium and silver average values are below ESVs and not predicted to be a source of ecological risk, and strontium does not have available ecological screening values.

TPH (0-2') in the soil remediation areas in the LAAs are assessed as weathered and degraded and of low toxicity. There are not ecological screening values for TPH, and TPH are assessed for ecological risk by evaluating PAH. PAH concentrations (0-2') are below ecological screening values, and not predicted to be a source of ecological risk.

Soil metal, TPH, and PAH concentrations in the SRAs in the LAAs are not predicted to be a source of ecological risk. This prediction of lack of ecological impact from soil (0-2') in SRAs in LAAs is strongly supported by the evidence of thriving vegetative and wildlife communities at each SRA. The SRAs will be remediated to meet regulatory standards, but there is not evidence that these areas require remediation for ecological reasons.

ATTACHMENT G-2
ProUCL Data for LAA3-WP SRA and LAA3-EP SRA (0-2')
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Area:	Location ID:	Sample Depth:	Sample ID:	Sample Date:	Sampler	Arsenic (mg/kg-dry)	D_Arsenic (mg/kg-dry)	Barium (mg/kg-dry)	D_Barium (mg/kg-dry)	True Total Barium (mg/kg-dry)	D_True Total Barium (mg/kg-dry)	Cadmium (mg/kg-dry)	D_Cadmium (mg/kg-dry)
LAA3-WP SRA	HA-2	0-2'	HA-2 (0-2')	08/29/19	ICON	23.4	1	3630	1	265000	1	7.52	1
LAA3-WP SRA	HA-2	0-2'	HA-2 (0-2')	08/29/19	HET	11.74	0	12019	1	25700	1	5.9	0
LAA3-WP SRA	LT-3	0-4'	LT-3 (0-4')	09/26/19	ICON	7.15	1	245	1	361	1	0.465	0
LAA3-WP SRA	SB-09	0-2'	SB-09 (0-2')	06/22/22	HET	5.49	0	560	1	2130	1	0.857	1
LAA3-WP SRA	SB-10	0-2'	SB-10 (0-2')	06/22/22	HET	5.83	0	155.7	1	5750	1	0.76	1
LAA3-WP SRA	SB-10	0-2'	SB-10 (0-2')	06/22/22	ICON	6.35	1	3370	1	21600	1	NA	NA
LAA3-WP SRA	SB-11	0-2'	SB-11 (0-2')	06/22/22	HET	5.86	1	284	1	14000	1	1.04	1
LAA3-WP SRA	SB-11	0-2'	SB-11 (0-2')	06/22/22	ICON	8.47	1	3740	1	102000	1	1.65	1
LAA3-WP SRA	SB-12	0-2'	SB-12 (0-2')	06/22/22	HET	4.88	1	1336	1	7510	1	0.756	1
LAA3-WP SRA	SB-12	0-2'	SB-12 (0-2')	06/22/22	ICON	5.34	1	1350	1	6510	1	0.844	1
LAA3-EP SRA	SB-01	0-2'	SB-01 (0-2')	06/21/22	HET	5.95	1	2255	1	25800	1	0.864	1
LAA3-EP SRA	SB-1	0-2'	SB-1 (0-2')	06/21/22	ICON	3.85	1	3050	1	51900	1	NA	NA
LAA3-EP SRA	SB-02	0-2'	SB-02 (0-2')	06/21/22	HET	7	1	1489	1	64400	1	0.504	1
LAA3-EP SRA	SB-03	0-2'	SB-03 (0-2')	06/21/22	HET	11.56	1	684	1	207000	1	0.794	1
LAA3-EP SRA	SB-3	0-2'	SB-3 (0-2')	06/21/22	ICON	12	1	4510	1	412000	1	0.654	1
LAA3-EP SRA	SB-04	0-2'	SB-04 (0-2')	06/21/22	HET	16.5	1	387	1	301000	1	0.641	1
LAA3-EP SRA	SB-4	0-2'	SB-4 (0-2')	06/21/22	ICON	13.3	1	4230	1	439000	1	0.611	1
LAA3-EP SRA	SB-5R	0-2'	SB-5R (0-2')	9/27/2022	HET	2.13	1	389	1	219	1	1.78	1
LAA3-EP SRA	SB-5R	0-2'	SB-5R (0-2')	9/27/2022	ICON	6.88	1	328	1	467	1	0.997	0

Notes:
Results in yellow were not included for maximum, average, and 95% UCLs.
Reporting limits are shown for non-detects. 1/2 reporting limit was used to calculated averages.

ATTACHMENT G-2
ProUCL Data for LAA3-WP SRA and LAA3-EP SRA (0-2')
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Area:	Location ID:	Sample Depth:	Sample ID:	Sample Date:	Sampler	Chromium (mg/kg-dry)	D_Chromium (mg/kg-dry)	Lead (mg/kg-dry)	D_Lead (mg/kg-dry)	Mercury (mg/kg-dry)	D_Mercury (mg/kg-dry)	Selenium (mg/kg-dry)	D_Selenium (mg/kg-dry)	Silver (mg/kg-dry)
LAA3-WP SRA	HA-2	0-2'	HA-2 (0-2')	08/29/19	ICON	435	1	707	1	2.08	1	3.69	0	NA
LAA3-WP SRA	HA-2	0-2'	HA-2 (0-2')	08/29/19	HET	89.2	1	115.3	1	0.162	0	11.7	0	11.7
LAA3-WP SRA	LT-3	0-4'	LT-3 (0-4')	09/26/19	ICON	35.5	1	18.8	1	0.101	0	3.72	0	NA
LAA3-WP SRA	SB-09	0-2'	SB-09 (0-2')	06/22/22	HET	20.22	1	21.32	1	0.0371	1	2.75	0	1.374
LAA3-WP SRA	SB-10	0-2'	SB-10 (0-2')	06/22/22	HET	31.5	1	29.4	1	0.0603	1	2.92	0	1.458
LAA3-WP SRA	SB-10	0-2'	SB-10 (0-2')	06/22/22	ICON	NA	NA	NA	NA	NA	NA	NA	NA	NA
LAA3-WP SRA	SB-11	0-2'	SB-11 (0-2')	06/22/22	HET	109.9	1	59	1	0.248	1	2.36	0	1.182
LAA3-WP SRA	SB-11	0-2'	SB-11 (0-2')	06/22/22	ICON	196	1	122	1	0.523	1	NA	NA	NA
LAA3-WP SRA	SB-12	0-2'	SB-12 (0-2')	06/22/22	HET	25.6	1	31	1	2.7	1	2.37	0	1.185
LAA3-WP SRA	SB-12	0-2'	SB-12 (0-2')	06/22/22	ICON	22.3	1	23.2	1	0.109	0	NA	NA	NA
LAA3-EP SRA	SB-01	0-2'	SB-01 (0-2')	06/21/22	HET	288	1	92	1	0.0516	1	1.63	0	0.817
LAA3-EP SRA	SB-1	0-2'	SB-1 (0-2')	06/21/22	ICON	NA	NA	NA	NA	NA	NA	NA	NA	NA
LAA3-EP SRA	SB-02	0-2'	SB-02 (0-2')	06/21/22	HET	90.9	1	57.2	1	0.213	1	1.89	0	0.943
LAA3-EP SRA	SB-03	0-2'	SB-03 (0-2')	06/21/22	HET	800	1	288	1	0.1127	1	1.55	0	1.077
LAA3-EP SRA	SB-3	0-2'	SB-3 (0-2')	06/21/22	ICON	481	1	302	1	1.12	1	NA	NA	NA
LAA3-EP SRA	SB-04	0-2'	SB-04 (0-2')	06/21/22	HET	579	1	293	1	0.0718	1	1.4	0	1.71
LAA3-EP SRA	SB-4	0-2'	SB-4 (0-2')	06/21/22	ICON	220	1	266	1	1.24	1	NA	NA	NA
LAA3-EP SRA	SB-5R	0-2'	SB-5R (0-2')	9/27/2022	HET	29	1	18.5	1	0.074	1	0.3495	0	0.175
LAA3-EP SRA	SB-5R	0-2'	SB-5R (0-2')	9/27/2022	ICON	26.1	1	20.6	1	NA	NA	3.99	0	NA

Notes:
Results in yellow were not included for maximum, average, and 95% UCLs.
Reporting limits are shown for non-detects. 1/2 reporting limit was used to calculated averages.

ATTACHMENT G-2
ProUCL Data for LAA3-WP SRA and LAA3-EP SRA (0-2')
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Area:	Location ID:	Sample Depth:	Sample ID:	Sample Date:	Sampler	D_Silver (mg/kg-dry)	Strontium (mg/kg-dry)	D_Strontium (mg/kg-dry)	Zinc (mg/kg-dry)	D_Zinc (mg/kg-dry)
LAA3-WP SRA	HA-2	0-2'	HA-2 (0-2')	08/29/19	ICON	NA	336	1	1350	1
LAA3-WP SRA	HA-2	0-2'	HA-2 (0-2')	08/29/19	HET	0	NA	NA	232.9	1
LAA3-WP SRA	LT-3	0-4'	LT-3 (0-4')	09/26/19	ICON	NA	76.9	1	85	1
LAA3-WP SRA	SB-09	0-2'	SB-09 (0-2')	06/22/22	HET	0	NA	NA	108.5	1
LAA3-WP SRA	SB-10	0-2'	SB-10 (0-2')	06/22/22	HET	0	NA	NA	114	1
LAA3-WP SRA	SB-10	0-2'	SB-10 (0-2')	06/22/22	ICON	NA	NA	NA	NA	NA
LAA3-WP SRA	SB-11	0-2'	SB-11 (0-2')	06/22/22	HET	0	NA	NA	147.3	1
LAA3-WP SRA	SB-11	0-2'	SB-11 (0-2')	06/22/22	ICON	NA	223	1	273	1
LAA3-WP SRA	SB-12	0-2'	SB-12 (0-2')	06/22/22	HET	0	NA	NA	120.6	1
LAA3-WP SRA	SB-12	0-2'	SB-12 (0-2')	06/22/22	ICON	NA	99.6	1	109	1
LAA3-EP SRA	SB-01	0-2'	SB-01 (0-2')	06/21/22	HET	0	NA	NA	130.2	1
LAA3-EP SRA	SB-1	0-2'	SB-1 (0-2')	06/21/22	ICON	NA	NA	NA	NA	NA
LAA3-EP SRA	SB-02	0-2'	SB-02 (0-2')	06/21/22	HET	0	NA	NA	104.7	1
LAA3-EP SRA	SB-03	0-2'	SB-03 (0-2')	06/21/22	HET	1	NA	NA	231	1
LAA3-EP SRA	SB-3	0-2'	SB-3 (0-2')	06/21/22	ICON	NA	219	1	207	1
LAA3-EP SRA	SB-04	0-2'	SB-04 (0-2')	06/21/22	HET	1	NA	NA	230	1
LAA3-EP SRA	SB-4	0-2'	SB-4 (0-2')	06/21/22	ICON	NA	200	1	186	1
LAA3-EP SRA	SB-5R	0-2'	SB-5R (0-2')	9/27/2022	HET	0	NA	NA	80.7	1
LAA3-EP SRA	SB-5R	0-2'	SB-5R (0-2')	9/27/2022	ICON	NA	42.9	1	91.8	1

Notes:
Results in yellow were not included for maximum, average, and 95% UCLs.
Reporting limits are shown for non-detects. 1/2 reporting limit was used to calculated averages.

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/27/2022 7:02:43 PM
From File	LAA3-WP and EP SRA_0-2-10.26.2022_Data_DO NOT PRINT.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (mg/kg-dry) (laa3-ep sra)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	2.13	Mean	8.797
Maximum	16.5	Median	7
SD	4.762	Std. Error of Mean	1.587
Coefficient of Variation	0.541	Skewness	0.222

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.764	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.316	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	11.75	95% Adjusted-CLT UCL (Chen-1995)	11.53
		95% Modified-t UCL (Johnson-1978)	11.77

Gamma GOF Test

A-D Test Statistic	0.269	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.201	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.281	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	3.19	k star (bias corrected MLE)	2.201
Theta hat (MLE)	2.758	Theta star (bias corrected MLE)	3.997
nu hat (MLE)	57.42	nu star (bias corrected)	39.61
MLE Mean (bias corrected)	8.797	MLE Sd (bias corrected)	5.93
		Approximate Chi Square Value (0.05)	26.19
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	23.92

Assuming Gamma Distribution

95% Approximate Gamma UCL	13.3	95% Adjusted Gamma UCL	14.57

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.192	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.252	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	0.756	Mean of logged Data	2.01
Maximum of Logged Data	2.803	SD of logged Data	0.657

Assuming Lognormal Distribution

95% H-UCL	16.72	90% Chebyshev (MVUE) UCL	15.05
95% Chebyshev (MVUE) UCL	17.79	97.5% Chebyshev (MVUE) UCL	21.59
99% Chebyshev (MVUE) UCL	29.06		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	11.41	95% BCA Bootstrap UCL	11.36
95% Standard Bootstrap UCL	11.3	95% Bootstrap-t UCL	12.11
95% Hall's Bootstrap UCL	11.54	95% Percentile Bootstrap UCL	11.32
90% Chebyshev(Mean, Sd) UCL	13.56	95% Chebyshev(Mean, Sd) UCL	15.72
97.5% Chebyshev(Mean, Sd) UCL	18.71	99% Chebyshev(Mean, Sd) UCL	24.59

Suggested UCL to Use

95% Student's-t UCL	11.75

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic (mg/kg-dry) (laa3-wp sra)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Number of Detects	7	Number of Non-Detects	3
Number of Distinct Detects	7	Number of Distinct Non-Detects	3
Minimum Detect	4.88	Minimum Non-Detect	5.49
Maximum Detect	23.4	Maximum Non-Detect	11.74
Variance Detects	43	Percent Non-Detects	30%
Mean Detects	8.779	SD Detects	6.557
Median Detects	6.35	CV Detects	0.747
Skewness Detects	2.468	Kurtosis Detects	6.26
Mean of Logged Detects	2.019	SD of Logged Detects	0.532

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.623	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.73	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.376	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.35	Detected Data Not Normal at 1% Significance Level	

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.77	KM Standard Error of Mean	1.825
90KM SD	5.327	95% KM (BCA) UCL	11.31
95% KM (t) UCL	11.12	95% KM (Percentile Bootstrap) UCL	11.04
95% KM (z) UCL	10.77	95% KM Bootstrap t UCL	22.04
90% KM Chebyshev UCL	13.25	95% KM Chebyshev UCL	15.73
97.5% KM Chebyshev UCL	19.17	99% KM Chebyshev UCL	25.93

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.965	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.711	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.311	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

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

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	3.42	k star (bias corrected MLE)	2.05
Theta hat (MLE)	2.567	Theta star (bias corrected MLE)	4.283
nu hat (MLE)	47.88	nu star (bias corrected)	28.69
Mean (detects)	8.779		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	2.639	Mean	7.237
Maximum	23.4	Median	5.75
SD	5.958	CV	0.823
k hat (MLE)	2.671	k star (bias corrected MLE)	1.936
Theta hat (MLE)	2.71	Theta star (bias corrected MLE)	3.738
nu hat (MLE)	53.41	nu star (bias corrected)	38.72
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (38.72, α)	25.47	Adjusted Chi Square Value (38.72, β)	23.62
95% Gamma Approximate UCL	11	95% Gamma Adjusted UCL	11.87

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.77	SD (KM)	5.327
Variance (KM)	28.37	SE of Mean (KM)	1.825
k hat (KM)	2.128	k star (KM)	1.556
nu hat (KM)	42.56	nu star (KM)	31.13
theta hat (KM)	3.651	theta star (KM)	4.993
80% gamma percentile (KM)	11.97	90% gamma percentile (KM)	16.05
95% gamma percentile (KM)	19.99	99% gamma percentile (KM)	28.88

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (31.13, α)	19.38	Adjusted Chi Square Value (31.13, β)	17.79
95% KM Approximate Gamma UCL	12.48	95% KM Adjusted Gamma UCL	13.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.771	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.838	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.28	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	7.625	Mean in Log Scale	1.888
SD in Original Scale	5.686	SD in Log Scale	0.491
95% t UCL (assumes normality of ROS data)	10.92	95% Percentile Bootstrap UCL	11
95% BCA Bootstrap UCL	12.7	95% Bootstrap t UCL	21.01
95% H-UCL (Log ROS)	10.7		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.917	KM Geo Mean	6.803
KM SD (logged)	0.446	95% Critical H Value (KM-Log)	2.148
KM Standard Error of Mean (logged)	0.154	95% H-UCL (KM -Log)	10.35
KM SD (logged)	0.446	95% Critical H Value (KM-Log)	2.148
KM Standard Error of Mean (logged)	0.154		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7.298	Mean in Log Scale	1.798
SD in Original Scale	5.919	SD in Log Scale	0.596
95% t UCL (Assumes normality)	10.73	95% H-Stat UCL	11.53

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	13.6	95% GROS Adjusted Gamma UCL	11.87

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Barium (mg/kg-dry) (laa3-ep sra)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	328	Mean	1925
Maximum	4510	Median	1489
SD	1672	Std. Error of Mean	557.5
Coefficient of Variation	0.869	Skewness	0.607

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.859	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.764	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.215	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.316	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2961	95% Adjusted-CLT UCL (Chen-1995)	2962
		95% Modified-t UCL (Johnson-1978)	2980

Gamma GOF Test

A-D Test Statistic	0.48	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.198	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.285	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	1.264	k star (bias corrected MLE)	0.917
Theta hat (MLE)	1523	Theta star (bias corrected MLE)	2099
nu hat (MLE)	22.75	nu star (bias corrected)	16.5
MLE Mean (bias corrected)	1925	MLE Sd (bias corrected)	2010
		Approximate Chi Square Value (0.05)	8.317
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	7.126

Assuming Gamma Distribution

95% Approximate Gamma UCL	3819	95% Adjusted Gamma UCL	4457

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.252	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	5.793	Mean of logged Data	7.117
Maximum of Logged Data	8.414	SD of logged Data	1.072

Assuming Lognormal Distribution

95% H-UCL	7955	90% Chebyshev (MVUE) UCL	4241
95% Chebyshev (MVUE) UCL	5253	97.5% Chebyshev (MVUE) UCL	6657
99% Chebyshev (MVUE) UCL	9415		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	2842	95% BCA Bootstrap UCL	2817
95% Standard Bootstrap UCL	2773	95% Bootstrap-t UCL	3175
95% Hall's Bootstrap UCL	2873	95% Percentile Bootstrap UCL	2764
90% Chebyshev(Mean, Sd) UCL	3597	95% Chebyshev(Mean, Sd) UCL	4355
97.5% Chebyshev(Mean, Sd) UCL	5406	99% Chebyshev(Mean, Sd) UCL	7471

Suggested UCL to Use

95% Student's-t UCL	2961

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Barium (mg/kg-dry) (laa3-wp sra)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	155.7	Mean	2669
Maximum	12019	Median	1343
SD	3587	Std. Error of Mean	1134
Coefficient of Variation	1.344	Skewness	2.293

Normal GOF Test

Shapiro Wilk Test Statistic	0.702	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.781	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.283	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4749	95% Adjusted-CLT UCL (Chen-1995)	5414
		95% Modified-t UCL (Johnson-1978)	4886

Gamma GOF Test

A-D Test Statistic	0.366	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.149	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.276	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.747	k star (bias corrected MLE)	0.589
Theta hat (MLE)	3575	Theta star (bias corrected MLE)	4529
nu hat (MLE)	14.93	nu star (bias corrected)	11.79
MLE Mean (bias corrected)	2669	MLE Sd (bias corrected)	3477
		Approximate Chi Square Value (0.05)	5.087
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	4.347

Assuming Gamma Distribution

95% Approximate Gamma UCL	6184	95% Adjusted Gamma UCL	7237

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.048	Mean of logged Data	7.087
Maximum of Logged Data	9.394	SD of logged Data	1.425

Assuming Lognormal Distribution

95% H-UCL	22417	90% Chebyshev (MVUE) UCL	6795
95% Chebyshev (MVUE) UCL	8605	97.5% Chebyshev (MVUE) UCL	11118
99% Chebyshev (MVUE) UCL	16055		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	4535	95% BCA Bootstrap UCL	5517
95% Standard Bootstrap UCL	4400	95% Bootstrap-t UCL	6731
95% Hall's Bootstrap UCL	11207	95% Percentile Bootstrap UCL	4606
90% Chebyshev(Mean, Sd) UCL	6072	95% Chebyshev(Mean, Sd) UCL	7614
97.5% Chebyshev(Mean, Sd) UCL	9754	99% Chebyshev(Mean, Sd) UCL	13957

Suggested UCL to Use

95% Student's-t UCL 4749

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cadmium (mg/kg-dry) (laa3-ep sra)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.504	Minimum Non-Detect	0.997
Maximum Detect	1.78	Maximum Non-Detect	0.997
Variance Detects	0.188	Percent Non-Detects	12.5%
Mean Detects	0.835	SD Detects	0.433
Median Detects	0.654	CV Detects	0.518
Skewness Detects	2.244	Kurtosis Detects	5.381
Mean of Logged Detects	-0.264	SD of Logged Detects	0.41

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.709	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.73	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.331	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.35	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.816	KM Standard Error of Mean	0.147
90KM SD	0.381	95% KM (BCA) UCL	1.081
95% KM (t) UCL	1.093	95% KM (Percentile Bootstrap) UCL	1.074
95% KM (z) UCL	1.057	95% KM Bootstrap t UCL	1.505
90% KM Chebyshev UCL	1.255	95% KM Chebyshev UCL	1.454
97.5% KM Chebyshev UCL	1.731	99% KM Chebyshev UCL	2.274

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.717	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.71	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.271	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

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

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	6.106	k star (bias corrected MLE)	3.585
Theta hat (MLE)	0.137	Theta star (bias corrected MLE)	0.233
nu hat (MLE)	85.49	nu star (bias corrected)	50.18
Mean (detects)	0.835		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.504	Mean	0.819
Maximum	1.78	Median	0.68
SD	0.404	CV	0.493
k hat (MLE)	6.823	k star (bias corrected MLE)	4.348
Theta hat (MLE)	0.12	Theta star (bias corrected MLE)	0.188
nu hat (MLE)	109.2	nu star (bias corrected)	69.56
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (69.56, α)	51.36	Adjusted Chi Square Value (69.56, β)	47.43
95% Gamma Approximate UCL	1.11	95% Gamma Adjusted UCL	1.202

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.816	SD (KM)	0.381
Variance (KM)	0.145	SE of Mean (KM)	0.147
k hat (KM)	4.583	k star (KM)	2.948
nu hat (KM)	73.33	nu star (KM)	47.17
theta hat (KM)	0.178	theta star (KM)	0.277
80% gamma percentile (KM)	1.166	90% gamma percentile (KM)	1.453
95% gamma percentile (KM)	1.721	99% gamma percentile (KM)	2.302

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (47.17, α)	32.41	Adjusted Chi Square Value (47.17, β)	29.34
95% KM Approximate Gamma UCL	1.187	95% KM Adjusted Gamma UCL	1.311

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.838	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.28	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.819	Mean in Log Scale	-0.275
SD in Original Scale	0.404	SD in Log Scale	0.381
95% t UCL (assumes normality of ROS data)	1.089	95% Percentile Bootstrap UCL	1.082
95% BCA Bootstrap UCL	1.167	95% Bootstrap t UCL	1.663
95% H-UCL (Log ROS)	1.116		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.281	KM Geo Mean	0.755
KM SD (logged)	0.364	95% Critical H Value (KM-Log)	2.143
KM Standard Error of Mean (logged)	0.141	95% H-UCL (KM -Log)	1.082
KM SD (logged)	0.364	95% Critical H Value (KM-Log)	2.143
KM Standard Error of Mean (logged)	0.141		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.793	Mean in Log Scale	-0.318
SD in Original Scale	0.418	SD in Log Scale	0.409
95% t UCL (Assumes normality)	1.074	95% H-Stat UCL	1.114

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.093

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chromium (mg/kg-dry) (laa3-ep sra)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	26.1	Mean	314.3
Maximum	800	Median	254
SD	282.3	Std. Error of Mean	99.8
Coefficient of Variation	0.898	Skewness	0.666

**Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.**

Normal GOF Test

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.749	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.333	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	503.3	95% Adjusted-CLT UCL (Chen-1995)	503.5
		95% Modified-t UCL (Johnson-1978)	507.2

Gamma GOF Test

A-D Test Statistic	0.295	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.163	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.301	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	1.007	k star (bias corrected MLE)	0.712
Theta hat (MLE)	312.2	Theta star (bias corrected MLE)	441.1
nu hat (MLE)	16.1	nu star (bias corrected)	11.4
MLE Mean (bias corrected)	314.3	MLE Sd (bias corrected)	372.3
		Approximate Chi Square Value (0.05)	4.834
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	3.811

Assuming Gamma Distribution

95% Approximate Gamma UCL	741.1	95% Adjusted Gamma UCL	940

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.851	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.19	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.265	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.262	Mean of logged Data	5.177
Maximum of Logged Data	6.685	SD of logged Data	1.328

Assuming Lognormal Distribution

95% H-UCL	3657	90% Chebyshev (MVUE) UCL	880.5
95% Chebyshev (MVUE) UCL	1115	97.5% Chebyshev (MVUE) UCL	1441
99% Chebyshev (MVUE) UCL	2081		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	478.4	95% BCA Bootstrap UCL	504.3
95% Standard Bootstrap UCL	469.7	95% Bootstrap-t UCL	552.4
95% Hall's Bootstrap UCL	514.1	95% Percentile Bootstrap UCL	479.9
90% Chebyshev(Mean, Sd) UCL	613.6	95% Chebyshev(Mean, Sd) UCL	749.2
97.5% Chebyshev(Mean, Sd) UCL	937.5	99% Chebyshev(Mean, Sd) UCL	1307

Suggested UCL to Use

95% Student's-t UCL 503.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chromium (mg/kg-dry) (laa3-wp sra)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	1
Minimum	20.22	Mean	107.2
Maximum	435	Median	35.5
SD	136	Std. Error of Mean	45.33
Coefficient of Variation	1.268	Skewness	2.126

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.764	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.316	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level
Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	191.5	95% Adjusted-CLT UCL (Chen-1995)	216.1
		95% Modified-t UCL (Johnson-1978)	196.9

Gamma GOF Test

A-D Test Statistic	0.629	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.275	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.287	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	1.006	k star (bias corrected MLE)	0.745
Theta hat (MLE)	106.6	Theta star (bias corrected MLE)	144
nu hat (MLE)	18.11	nu star (bias corrected)	13.41
MLE Mean (bias corrected)	107.2	MLE Sd (bias corrected)	124.3
		Approximate Chi Square Value (0.05)	6.168
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	5.17

Assuming Gamma Distribution

95% Approximate Gamma UCL	233.1	95% Adjusted Gamma UCL	278.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.252	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	3.007	Mean of logged Data	4.102
Maximum of Logged Data	6.075	SD of logged Data	1.086

Assuming Lognormal Distribution

95% H-UCL	406.8	90% Chebyshev (MVUE) UCL	211.8
95% Chebyshev (MVUE) UCL	262.6	97.5% Chebyshev (MVUE) UCL	333.1
99% Chebyshev (MVUE) UCL	471.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	181.8	95% BCA Bootstrap UCL	214.6
95% Standard Bootstrap UCL	178.2	95% Bootstrap-t UCL	363.8
95% Hall's Bootstrap UCL	500.8	95% Percentile Bootstrap UCL	184.1
90% Chebyshev(Mean, Sd) UCL	243.2	95% Chebyshev(Mean, Sd) UCL	304.9
97.5% Chebyshev(Mean, Sd) UCL	390.4	99% Chebyshev(Mean, Sd) UCL	558.3

Suggested UCL to Use

95% Student's-t UCL 191.5

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead (mg/kg-dry) (laa3-ep sra)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	18.5	Mean	167.2
Maximum	302	Median	179
SD	130.8	Std. Error of Mean	46.23
Coefficient of Variation	0.782	Skewness	-0.0864

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.791	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.749	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.275	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.333	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	254.8	95% Adjusted-CLT UCL (Chen-1995)	241.7
		95% Modified-t UCL (Johnson-1978)	254.5

Gamma GOF Test

A-D Test Statistic	0.72	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.301	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.3	Data Not Gamma Distributed at 5% Significance Level

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

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	1.191	k star (bias corrected MLE)	0.828
Theta hat (MLE)	140.4	Theta star (bias corrected MLE)	202
nu hat (MLE)	19.05	nu star (bias corrected)	13.24
MLE Mean (bias corrected)	167.2	MLE Sd (bias corrected)	183.8
		Approximate Chi Square Value (0.05)	6.055
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	4.882

Assuming Gamma Distribution

95% Approximate Gamma UCL	365.5	95% Adjusted Gamma UCL	453.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.816	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.851	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.283	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.265	Data Not Lognormal at 10% Significance Level

Data Not Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.918	Mean of logged Data	4.644
Maximum of Logged Data	5.71	SD of logged Data	1.201

Assuming Lognormal Distribution

95% H-UCL	1279	90% Chebyshev (MVUE) UCL	432.2
95% Chebyshev (MVUE) UCL	542.7	97.5% Chebyshev (MVUE) UCL	696.2
99% Chebyshev (MVUE) UCL	997.8		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	243.2	95% BCA Bootstrap UCL	235.5
95% Standard Bootstrap UCL	238.9	95% Bootstrap-t UCL	247.2
95% Hall's Bootstrap UCL	219.5	95% Percentile Bootstrap UCL	234.6
90% Chebyshev(Mean, Sd) UCL	305.9	95% Chebyshev(Mean, Sd) UCL	368.7
97.5% Chebyshev(Mean, Sd) UCL	455.9	99% Chebyshev(Mean, Sd) UCL	627.2

Suggested UCL to Use

95% Student's-t UCL	254.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Lead (mg/kg-dry) (laa3-wp sra)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	1
Minimum	18.8	Mean	125.2
Maximum	707	Median	31
SD	221.8	Std. Error of Mean	73.93
Coefficient of Variation	1.771	Skewness	2.821

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.535	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.764	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.316	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	262.7	95% Adjusted-CLT UCL (Chen-1995)	321.1
		95% Modified-t UCL (Johnson-1978)	274.3

Gamma GOF Test

A-D Test Statistic	1.008	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.752	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.267	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.29	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level
Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	0.737	k star (bias corrected MLE)	0.565
Theta hat (MLE)	169.9	Theta star (bias corrected MLE)	221.5
nu hat (MLE)	13.27	nu star (bias corrected)	10.18
MLE Mean (bias corrected)	125.2	MLE Sd (bias corrected)	166.5
		Approximate Chi Square Value (0.05)	4.053
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	3.278

Assuming Gamma Distribution

95% Approximate Gamma UCL	314.5	95% Adjusted Gamma UCL	388.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.848	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.252	Data appear Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level
Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	2.934	Mean of logged Data	4.016
Maximum of Logged Data	6.561	SD of logged Data	1.185

Assuming Lognormal Distribution

95% H-UCL	518.7	90% Chebyshev (MVUE) UCL	223
95% Chebyshev (MVUE) UCL	278.8	97.5% Chebyshev (MVUE) UCL	356.1
99% Chebyshev (MVUE) UCL	508		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	246.8	95% BCA Bootstrap UCL	348
95% Standard Bootstrap UCL	240.8	95% Bootstrap-t UCL	736.4
95% Hall's Bootstrap UCL	684.2	95% Percentile Bootstrap UCL	265.3
90% Chebyshev(Mean, Sd) UCL	347	95% Chebyshev(Mean, Sd) UCL	447.5
97.5% Chebyshev(Mean, Sd) UCL	586.9	99% Chebyshev(Mean, Sd) UCL	860.8

Suggested UCL to Use

Recommendation cannot be provided

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

When a data set follows an approximate distribution passing only one of the GOF tests,
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury (mg/kg-dry) (laa3-wp sra)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	1
Number of Detects	6	Number of Non-Detects	3
Number of Distinct Detects	6	Number of Distinct Non-Detects	3
Minimum Detect	0.0371	Minimum Non-Detect	0.101
Maximum Detect	2.7	Maximum Non-Detect	0.162
Variance Detects	1.328	Percent Non-Detects	33.33%
Mean Detects	0.941	SD Detects	1.152
Median Detects	0.386	CV Detects	1.224
Skewness Detects	0.997	Kurtosis Detects	-1.176
Mean of Logged Detects	-1.07	SD of Logged Detects	1.775

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.799	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.713	Detected Data appear Normal at 1% Significance Level	
Lilliefors Test Statistic	0.308	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.373	Detected Data appear Normal at 1% Significance Level	

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.644	KM Standard Error of Mean	0.349
90KM SD	0.956	95% KM (BCA) UCL	1.233
95% KM (t) UCL	1.293	95% KM (Percentile Bootstrap) UCL	1.216
95% KM (z) UCL	1.218	95% KM Bootstrap t UCL	3.494
90% KM Chebyshev UCL	1.692	95% KM Chebyshev UCL	2.166
97.5% KM Chebyshev UCL	2.825	99% KM Chebyshev UCL	4.119

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.332	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.202	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.346	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	0.61	k star (bias corrected MLE)	0.416
Theta hat (MLE)	1.542	Theta star (bias corrected MLE)	2.261
nu hat (MLE)	7.326	nu star (bias corrected)	4.996
Mean (detects)	0.941		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.631
Maximum	2.7	Median	0.0603
SD	1.023	CV	1.622
k hat (MLE)	0.372	k star (bias corrected MLE)	0.322
Theta hat (MLE)	1.694	Theta star (bias corrected MLE)	1.957
nu hat (MLE)	6.703	nu star (bias corrected)	5.802
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (5.80, α)	1.539	Adjusted Chi Square Value (5.80, β)	1.125
95% Gamma Approximate UCL	2.378	95% Gamma Adjusted UCL	3.255

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.644	SD (KM)	0.956
Variance (KM)	0.915	SE of Mean (KM)	0.349
k hat (KM)	0.453	k star (KM)	0.376
nu hat (KM)	8.156	nu star (KM)	6.771
theta hat (KM)	1.421	theta star (KM)	1.712
80% gamma percentile (KM)	1.031	90% gamma percentile (KM)	1.838
95% gamma percentile (KM)	2.732	99% gamma percentile (KM)	4.996

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.77, α)	2.046	Adjusted Chi Square Value (6.77, β)	1.544
95% KM Approximate Gamma UCL	2.131	95% KM Adjusted Gamma UCL	2.823

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**	
10% Shapiro Wilk Critical Value	0.826	Detected Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
10% Lilliefors Critical Value	0.298	Detected Data appear Lognormal at 10% Significance Level	

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.644	Mean in Log Scale	-1.719
SD in Original Scale	1.014	SD in Log Scale	1.708
95% t UCL (assumes normality of ROS data)	1.273	95% Percentile Bootstrap UCL	1.197
95% BCA Bootstrap UCL	1.359	95% Bootstrap t UCL	3.714
95% H-UCL (Log ROS)	15.42		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.73	KM Geo Mean	0.177
KM SD (logged)	1.626	95% Critical H Value (KM-Log)	4.756
KM Standard Error of Mean (logged)	0.599	95% H-UCL (KM -Log)	10.22
KM SD (logged)	1.626	95% Critical H Value (KM-Log)	4.756
KM Standard Error of Mean (logged)	0.599		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.648	Mean in Log Scale	-1.648
SD in Original Scale	1.012	SD in Log Scale	1.654
95% t UCL (Assumes normality)	1.275	95% H-Stat UCL	12.73

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.293

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc (mg/kg-dry) (laa3-ep sra)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	80.7	Mean	157.7
Maximum	231	Median	158.1
SD	62.87	Std. Error of Mean	22.23
Coefficient of Variation	0.399	Skewness	0.00301

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.749	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.333	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	199.8	95% Adjusted-CLT UCL (Chen-1995)	194.3
		95% Modified-t UCL (Johnson-1978)	199.8

Gamma GOF Test

A-D Test Statistic	0.48	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

k hat (MLE)	6.668	k star (bias corrected MLE)	4.251
Theta hat (MLE)	23.65	Theta star (bias corrected MLE)	37.09
nu hat (MLE)	106.7	nu star (bias corrected)	68.02
MLE Mean (bias corrected)	157.7	MLE Sd (bias corrected)	76.47
		Approximate Chi Square Value (0.05)	50.04
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	46.16

Assuming Gamma Distribution

95% Approximate Gamma UCL	214.3	95% Adjusted Gamma UCL	232.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.851	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.214	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.265	Data appear Lognormal at 10% Significance Level

Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal Statistics

Minimum of Logged Data	4.391	Mean of logged Data	4.984
Maximum of Logged Data	5.442	SD of logged Data	0.429

Assuming Lognormal Distribution

95% H-UCL	230.1	90% Chebyshev (MVUE) UCL	230.6
95% Chebyshev (MVUE) UCL	263.5	97.5% Chebyshev (MVUE) UCL	309.1
99% Chebyshev (MVUE) UCL	398.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	194.2	95% BCA Bootstrap UCL	193.4
95% Standard Bootstrap UCL	192.3	95% Bootstrap-t UCL	198.9
95% Hall's Bootstrap UCL	185.1	95% Percentile Bootstrap UCL	191.8
90% Chebyshev(Mean, Sd) UCL	224.4	95% Chebyshev(Mean, Sd) UCL	254.6
97.5% Chebyshev(Mean, Sd) UCL	296.5	99% Chebyshev(Mean, Sd) UCL	378.8

Suggested UCL to Use

95% Student's-t UCL 199.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ATTACHMENT H HQ INPUT FACTORS CALCULATIONS

November 2022

ATTACHMENT H-1
Summary: Total Mercury Soil to Plant Bioconcentration Factors
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Reference	Geometric Means	
Fernández-Martínez et al., 2015	Geometric Mean Total Mercury Plant BCF	0.02
Rodriguez et al., 2007	Geometric Mean Total Mercury Plant BCF	0.95
Hamilton et al., 2008	Geometric Mean Total Mercury Plant BCF	1.02
	Total Geometric Mean Total Mercury Plant BCF	0.27

Note:
BCF=Bioconcentration Factor

References:

Fernández-Martínez, R. et al. 2015. Mercury accumulation and speciation in plants and soils from abandoned cinnabar mines. Geoderma 253–254, 30–38.

Rodriguez, L. et al. 2007. Capability of Selected Crop Plants for Shoot Mercury Accumulation from Polluted Soils: Phytoremediation Perspectives. Journal of Phytoremediation, 9:1–13, 2007.

Hamilton, M. et al. 2008. Determination and comparison of heavy metals in selected seafood, water,vegetation and sediments by inductively coupled plasma-optical emission spectrometry from an industrialized and pristine waterway in Southwest Louisiana. Microchemical Journal 88 (2008) 52–55.

ATTACHMENT H-2
Total Mercury in Soils and Plants near Cinnabar Mines and Bioconcentration Factor Calculations (Fernández-Martínez et. al., 2015)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Mining area	Sampling Location	Plant species	Soil to Plant BCF
La Soterraña	P1-E1	*Crupina vulgaris*	0.029
	P3-E4	*Typha latifolia*	0.014
	P3-E5	*Phyllitis scolopendrium*	0.013
	P3-H6	*Dryopteris filix-mas*	0.186
Los Rueldos	P8-E7	*Calluna vulgaris*	0.010
	P8-H7	*Dryopteris affinis*	0.017
		Geometric Mean Total Hg Plant BCF	0.02

Reference:

Fernández-Martínez, R. et al. 2015. Mercury accumulation and speciation in plants and soils from abandoned cinnabar mines. Geoderma 253–254, 30–38.

ATTACHMENT H-3
Total Mercury in Soils and Plants Bioconcentration Factor Calculations (Rodriguez et al., 2007)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Media: Soil and Vegetation	Total Mercury mg/kg	Soil to Plant BCF
Soil	33.56	
Lupine	30.65	0.91
Lentil	33.25	0.99
Chickpea	31	0.92
Barley	32.53	0.97
	Geometric Mean Total Hg Plant BCF	0.95

Reference:

Rodriguez, L. et al. 2007. Capability of Selected Crop Plants for Shoot Mercury Accumulation from Polluted Soils: Phytoremediation Perspectives. Journal of Phytoremediation, 9:1–13, 2007.

ATTACHMENT H-4
Total Mercury in Southwest Louisiana Soils and Plants and Bioconcentration Factor Calculations (Hamilton et. al., 2008)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Sample Location	Total Hg mg/kg	Sample Location	Total Hg mg/kg
Vegetation 63–64, Site 1	6.41	Sediments 75, 78, Site 1	6.2
Vegetation 65–66, Site 2	6.69	Sediments 76, 79, Site 2	6.22
Vegetation 67–68, Site 3	6.36		
Vegetation 69–70, Site 4	6.25		
Vegetation 71–72, Site 5	6.25		
Vegetation 73–74, Site 6	6.14		
Geometric Veg. Mean	6.35	Geometric Sed. Mean	6.21
		Geometric Mean Hg Plant BCF (conc. in veg/conc. in sed.)	1.02

Reference:

Hamilton, M. et al. 2008. Determination and comparison of heavy metals in selected seafood, water,vegetation and sediments by inductively coupled plasma-optical emission spectrometry from an industrialized and pristine waterway in Southwest Louisiana. Microchemical Journal 88 (2008) 52–55.

ATTACHMENT H-5
Summary: Total Mercury Sediment to Benthic Invertebrate Bioconcentration Factors
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Location	Geometric Mean Total Mercury Sed. to Invert. BCF	Reference
St. Lawrence, Canada	0.035	Razavi, 2013
Lavaca, TX	1.1	USFW, 1994
EWL, LA (EWL Site)	0.90	ERM, 2019
EWL, LA (EWL Reference)	2.2	ERM, 2019
St. Lawrence, Cornwall Zooplankton	0.40	Ridal et. al., 2010
St.Lawrence, Cornwall Benthos	0.40	Ridal et al., 2010
Total Mercury Sediment to Invertebrate BCF	0.48	

Note:
BCF=Bioconcentration Factor

References:

Razavi, R. 2013. Ebullition Rates And Mercury Concentrations In St. Lawrence River Sediments And a Benthic Invertebrate. Environmental Toxicology and Chemistry, Vol. 32, No. 4, pp. 857–865.

U.S. Fish And Wildlife Service. 1994. Accumulation Of Mercury In Sediments, Prey, And Shorebirds of Lavaca Bay, Texas, Phase II Report.

ERM. 2019. East White Lake Ecological Risk Assessment, Section 16 Property, East White Lake Oil and Gas Field, Vermilion Parish, Louisiana. September 16, 2019.

Ridal, J. et al. 2010. Potential causes of enhanced transfer of mercury to St. Lawrence River Biota: implications for sediment management strategies at Cornwall, Ontario, Canada. Hydrobiologia 647:81–98.

Total Mercury in St. Lawrence Sediments and Benthic Invertebrates and Bioconcentration Factor Calculations (Razavi, 2013)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Media: Invertebrates and Sediments	Mean Total Mercury (ng/g dw)	Bioconcentration Factor (BCF) Total Mercury Sediment to Invertebrates (amphipod total Hg conc. ÷ sediment total Hg conc.)
Amphipods	173	**0.035**
Sediments	5000	

Reference:

Razavi, R. 2013. Ebullition Rates And Mercury Concentrations In St. Lawrence River Sediments And a Benthic Invertebrate. Environmental Toxicology and Chemistry, Vol. 32, No. 4, pp. 857–865.

ATTACHMENT H-7
Total Mercury in Lavaca Bay, TX. Sediments and Benthic Invertebrates and Bioconcentration Factor Calculations (USFW, 1994)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Matrix / Biota	**Mean Total Mercury mg/kg dw**	**Bioconcentration Factor (BCF) Total Mercury Sediment to Invertebrates (invertebrate total mercury conc.÷ total mercury sediment conc.)**
Sediment	0.26	
Mussel	0.27	1.0
Oyster	0.26	1.0
Polychaete	0.20	0.77
Xanthid crab	0.18	0.69
Fiddler crab	0.83	3.2
Geometric Mean Total Mercury Invertebrate BCF		1.1

Reference:
U.S. Fish And Wildlife Service. 1994. Accumulation Of Mercury In Sediments, Prey, And Shorebirds of Lavaca Bay, Texas, Phase II Report.

ATTACHMENT H-8
Total Mercury in EWL Sediments and Crabs and Bioconcentration Factor Calculations (ERM, 2019)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Area	Sample ID	Total Mercury Concentration in Crab Tissue	Total Mercury Concentration in Sediment	Total Mercury Sediment to Crab BCF (Conc. in Crab Tissue ÷ Conc. in Sediment)
EWL Site	EWL-T-01A-C	0.055		
EWL Site	EWL-T-01-C	0.055		
EWL Site	EWL-T-02-C	0.047		
EWL Site	EWL-T-03-C	0.063		
EWL Site	EWL-T-04-C	0.043		
EWL Site	EWL-T-05-C	0.050		
EWL Site	EWL-T-06-C	0.055		
EWL Site	EWL-T-07-C	0.046		
EWL Site	EWL-T-08-C	0.049		
EWL Site	EWL-T-09-C	0.046		
EWL Site	EWL-T-10-C	0.058		
EWL Site	EWL-T-11-C	0.047		
EWL Site	EWL-T-12-C	0.042		
EWL Site Geometric Mean		**0.050**	**0.055**	**0.90**
EWL Reference	EWL-TR-01-C	0.045		
EWL Reference	EWL-TR-02-C	0.036		
EWL Reference	EWL-TR-03A-C	0.063		
EWL Reference	EWL-TR-03-C	0.043		
EWL Reference	EWL-TR-04-C	0.057		
EWL Reference	EWL-TR-05-C	0.035		
EWL Reference	EWL-TR-06-C	0.072		
EWL Reference	EWL-TR-07-C	0.038		
EWL Reference	EWL-TR-08-C	0.035		
EWL Reference	EWL-TR-09-C	0.046		
EWL Reference Geometric Mean		**0.046**	**0.020**	**2.2**

Notes:
Concentrations are in mg/kg wet weight.
Concentrations for crab are for tissue.
Crab sampling was performed in December 2010/January 2011.
Sediment data are from 0-2 feet and collected in 2010 at EWL.
BCF=Bioconcentration Factor
EWL=East White Lake

Reference:
ERM. 2019. East White Lake Ecological Risk Assessment, Section 16 Property, East White Lake Oil and Gas Field, Vermilion Parish, Louisiana. September 16, 2019.

ATTACHMENT H-9
Total Mercury in St. Lawrence River Sediments and Benthic Invertebrates and Bioconcentration Factor Calculations (Ridal et al., 2010)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Matrix / Biota	Sample Location				Total Mercury Bioconcentration Factors (conc. in invert. ÷ conc. in sed.)
	1	2	3	4	
Zooplankton (ng/g dw)	502	608	245	111	
Sediment (ng/g dw) Top 10 cm	774	2238	1744	104	**Geometric Mean Total Mercury Zooplankton BCF**
Total Hg BCF Zooplankton	0.65	0.27	0.14	1.1	0.40
Benthos (ng/g dw)	338	300	666	118	
Sediment (ng/g dw) Top 10 cm	774	2238	1744	104	**Geometric Mean Total Mercury Benthos BCF**
Total Hg BCF Benthos	0.44	0.13	0.38	1.1	0.40

Note:
BCF=Bioconcentration Factor

Reference:
Ridal, J. et al. 2010. Potential causes of enhanced transfer of mercury to St. Lawrence River Biota: implications for sediment management strategies at Cornwall, Ontario, Canada. Hydrobiologia 647:81–98.

ATTACHMENT H-10
Summary: Total Mercury Sediment to Fish Bioconcentration Factors
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Location	Geometric Mean Total Mercury Sediment to Fish BCF	Reference
White Lake at Abbeville, LA	3.9	LDEQ LEAU database, 2019
Upper Prong Schooner Bayou, LA	3.9	LDEQ LEAU database, 2019
EWL, LA. Site	0.20	ERM, 2019
EWL, LA. Reference	0.51	ERM, 2019
Total Mercury Sediment to Fish BCF	1.1	

References:
LDEQ. 2019. Data taken from the LDEQ's Louisiana Environmental Assessment Utility (LEAU) database. https://waterdata.deq.louisiana.gov/

ERM. 2019. East White Lake Ecological Risk Assessment, Section 16 Property, East White Lake Oil and Gas Field, Vermilion Parish, Louisiana. September 16, 2019.

ATTACHMENT H-11
Total Mercury in Fish and Sediments in White Lake and Schooner Bayou as Collected by LDEQ
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Site	LDEQ Site 310: White Lake at Abbeville, LA				LDEQ Site 756: Upper Prong Schooner Bayou			
Date	4/2/1998	7/23/2003	7/12/2004	7/10/2008	8/31/1998	9/30/2002	8/4/2004	6/22/2009
Fish Tissue Concentration	0.15	0.41	0.06	0.1978	0.08	0.72	0.51	0.0661
	0.05	0.15	0.22	0.6438	0.24	0.21	0.06	0.0577
	0.02	0.4	0.28	0.2286	0.19	0.41	0.2	0.0572
	0.04	0.37	0.3	0.3809	0.35	0.2	0.27	0.0948
	0.03	0.24	0.72	0.2693		0.61	0.08	0.0688
	0.03	0.41	0.04	0.2242		0.5	0.11	0.0543
	0.0001	0.27	0.28	0.2079		0.62	0.24	0.0785
	0.05	0.17	0.47	0.2628		0.27	0.12	0.1467
	0.07	0.58	0.23	0.1911		0.24	0.44	
	0.33	0.29	0.44	0.573		0.21	0.09	
	0.02	0.13	0.21	0.2966			0.4	
	0.05	0.17	0.69	0.2683			0.06	
	0.14	0.3		0.2659				
	0.18	0.17		0.2729				
				0.1996				
				0.1778				
				0.2325				
				0.2288				
Geometric Mean Fish Tissue Concentration	0.038	0.264	0.251	0.266	0.189	0.355	0.165	0.074
Sediment Concentration	0.01	0.05895	0.0849	0.0575	0.13	0.05466	0.02558	NA
Geometric Mean Sediment to Fish BCF[a]	3.85	4.47	2.95	4.62	1.45	6.50	6.44	NA
Geometric Mean Sediment to Fish BCF for LDEQ Site	3.9				3.9			

Notes:
[a]Fish Tissue Concentration ÷ Sediment Concentration
Concentrations are in mg/kg.
Data from LDEQ's Louisiana Environmental Assessment Utility (LEAU) database. https://waterdata.deq.louisiana.gov/

ATTACHMENT H-12
Total Mercury in Fish and Sediments and Bioconcentration Factor Calculations (ERM, 2019)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Area	Sample ID	Total Mercury Concentration in Fish Tissue	Total Mercury Concentration in Sediment	Total Mercury Sediment to Fish BCF Conc. in Fish Tissue ÷ Conc. in Sediment
EWL Site	EWL-T-01A-F	NA		
EWL Site	EWL-T-01-F	0.0119		
EWL Site	EWL-T-02-F	0.0105		
EWL Site	EWL-T-03-F	0.0098		
EWL Site	EWL-T-04-F	0.0131		
EWL Site	EWL-T-05-F	0.0117		
EWL Site	EWL-T-06-F	0.0109		
EWL Site	EWL-T-07-F	0.0102		
EWL Site	EWL-T-08-F	0.0097		
EWL Site	EWL-T-09-F	0.0104		
EWL Site	EWL-T-10-F	0.0125		
EWL Site	EWL-T-11-F	0.0114		
EWL Site	EWL-T-12-F	0.0106		
EWL Site Geometric Mean		**0.0110**	**0.0555**	**0.20**
EWL Reference	EWL-TR-01-F	NA		
EWL Reference	EWL-TR-02-F	0.0120		
EWL Reference	EWL-TR-03A-F	NA		
EWL Reference	EWL-TR-03-F	0.0098		
EWL Reference	EWL-TR-04-F	0.0116		
EWL Reference	EWL-TR-05-F	0.0104		
EWL Reference	EWL-TR-06-F	0.0101		
EWL Reference	EWL-TR-07-F	0.0098		
EWL Reference	EWL-TR-08-F	0.0101		
EWL Reference	EWL-TR-09-F	0.0101		
EWL Reference Geometric Mean		**0.0105**	**0.0205**	**0.51**

Notes:
Concentrations are in mg/kg wet weight.
Concentrations for shad fish are for tissue.
Fish sampling was performed in December 2010/January 2011.
Sediment data are from 0-2 feet and collected in 2010 at EWL.
BCF=Bioconcentration Factor
EWL=East White Lake

Reference:
ERM. 2019. East White Lake Ecological Risk Assessment, Section 16 Property, East White Lake Oil and Gas Field, Vermilion Parish, Louisiana. September 16, 2019.

ATTACHMENT H-13
Summary: Total Mercury Soil/Sediment Bioavailability Factors
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Location	Geometric Mean Total Mercury Soil/Sed. Bioavailability Factors (conc. in porewater ÷ conc. in sed.)	Reference
Savannah River	0.00009	Xu et al., 2019
Spiked Sediment	0.018	Chibunda et al., 2009
Chloralkalai Plant	0.00002	Chalmers et al., 2013
Geometric Mean	**0.00031**	

References:

Xu, X. et al. 2019. Mercury speciation, bioavailability, and biomagnification in contaminated streams on the Savannah River Site (SC, USA), Science of The Total Environment. 668, 261-270.

Chibunda, R. T. et al. 2009. Chronic Toxicity of Mercury (HgCl2) to the Benthic Midge *Chironomus riparius.* Int. J. Environ. Res., 3(3):455-462

Chalmers, A. et al. 2013. Characterization of Mercury Contamination in the Androscoggin River, Coos County, New Hampshire, USGS, USEPA, USDOI

ATTACHMENT H-14
Total Mercury In Savannah River Soil/Sediment/Porewaters and Bioavailabilty Calculations (Xu et al., 2019)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Area	Soil Total Mercury	Soil Methylmercury	MeHg	Total Mercury in Porewater	Total Mercury Soil/Sed. Bioavailability (Total Hg porewater conc.÷Total Hg sediment conc.)
units	ng/kg dw	ng/g dw	%	ng/L	
MB-a	50000	0.9	1.8	6.9	0.00014
MB-b	51000	0.6	1.1	4	0.00008
MB-c	52000	0.6	1.1	4	0.00008
FMC-a	77000	1.2	1.5	7.2	0.00009
FMC-b	76000	1	1.3	4.5	0.00006
FMC-c	58000	1.4	2.5	8.4	0.00014
Geometric Mean Total Mercury Soil/Sediment Bioavailability Factor					0.00009

Reference:

Xu, X. et al. 2019. Mercury speciation, bioavailability, and biomagnification in contaminated streams on the Savannah River Site (SC, USA), Science of The Total Environment. 668, 261-270.

ATTACHMENT H-15
Total Mercury in Spiked Soil/Sediment/Porewater and Bioavailability Calculations (Chibunda et al., 2009)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Conc. in Sediment mg /Kg dry weight	Conc. in Porewater mg/L	Total Mercury Soil/Sed. Bioavailability Factor (conc. in porewater ÷ conc. in sediment)
0.59	0.00001	0.00002
0.93	0.09	0.09
2.42	0.14	0.06
3.84	0.32	0.08
7.20	0.51	0.07
12.68	0.80	0.06
Geometric Mean Total Mercury Soil/Sed. Bioavailability Factor		0.018

Reference:

Chibunda, R. T. et al. 2009. Chronic Toxicity of Mercury (HgCl2) to the Benthic Midge *Chironomus riparius.* Int. J. Environ. Res., 3(3):455-462.

ATTACHMENT H-16
Total Mercury In Soil/Sediment/Porewater near a Chloralkali Plant and Bioavailabilty Calculations (Chalmers et al., 2013)
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field
Iberville Parish, Louisiana

Location	Total Mercury Soil/Sediment Concentration mg/kg	Total Mercury Porewater Concentration mg/L	Soil/Sediment Bioavailability Factor
Sed. Reference 1 Location	0.03	0.0000007	0.000023
Sed. Downstream	0.114	0.00000172	0.000015
Sed. Reference 2 Location	0.026	0.0000007	0.000027
Sed. Nearstream Reach	0.117	0.00000132	0.000011
Sed. Farstream	0.111	0.00000172	0.000015

Total Geometric Mean Total Mercury Soil/Sed. Bioavailability Factor	0.00002

Note:
Sediment and porewater are median concentrations.

Reference:
Chalmers, A. et al. 2013. Characterization of Mercury Contamination in the Androscoggin River, Coos County, New Hampshire, USGS, USEPA, USDOI.

ATTACHMENT I HQ CALCULATIONS

November 2022

ATTACHMENT I-1. Table 1
Soil HQ Calculations (Average Conc.): HA-4 (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.045	BW
Soil ingestion proportion	0.093	Ps
Food ingestion Rate (kg/kgBW/d)	0.19	FIR
Proportion of diet, plants	0.71	Pp
Proportion of diet, soil inverts	0.29	Pi
Spatial factor	0.0015	SF
Temporal factor	0.3	TF
Area use factor	0.00045	AUF

Calculations based on average values

			Absorbed Fraction (AF)			**Absorbed Concentration from Medium and Biota**			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Zinc	124	66.1	0.1	0.366	3.201	0.219	6.12	21.9	0.000192
Zinc Sulfide	124	894	0.1	0.366	3.201	0.219	6.12	21.9	0.0000142

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-4.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-1. Table 2
Soil HQ Calculations (Average Conc.): HA-4 (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Zinc	124	66.1	0.1	0.366	3.201	0.0327	2.46	30.9	0.0124
Zinc Sulfide	124	894	0.1	0.366	3.201	0.0327	2.46	30.9	0.000919

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-4.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

<u>Where:</u>

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-1. Table 3
Soil HQ Calculations (Average Conc.): HA-4 (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper							
Parameter	**Value**	**Symbol**	**Calculations based on average values**				
Body weight (kg)	0.0425	BW					
Soil ingestion proportion	0.17	Ps					
Food ingestion Rate (kg/kgBW/d)	0.196	FIR					
Proportion of diet, benthic inverts	1	Pbi					
Spatial factor	0.0063	SF					
Temporal factor	0.3	TF					
Area use factor	0.0019	AUF					
			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Zinc	124	66.1	0.1	2.33	0.413	56.6	0.00163
Zinc Sulfide	124	894	0.1	2.33	0.413	56.6	0.000121

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-4.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-1. Table 4
Soil HQ Calculations (Average Conc.): HA-4 (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.00012	SF
Temporal factor	0.3	TF
Area use factor	0.000036	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Zinc	124	66.1	0.1	0.366	2.33	0.0205	1.13	7.22	0.00000456
Zinc Sulfide	124	894	0.1	0.366	2.33	0.0205	1.13	7.22	0.000000337

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-4.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-1. Table 5
Soil HQ Calculations (Average Conc.): HA-4 (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0001	SF
Temporal factor	0.3	TF
Area use factor	0.00003	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Zinc	124	66.1	0.1	2.33	0.138	0.00719	3.35	1.79	0.00000234
Zinc Sulfide	124	894	0.1	2.33	0.138	0.00719	3.35	1.79	0.000000173

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-4.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-1. Table 6
Soil HQ Calculations (Average Conc.): HA-4 (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit		
Parameter	**Value**	**Symbol**
Body weight (kg)	2.118	BW
Soil ingestion proportion	0.063	Ps
Food ingestion Rate (kg/kgBW/d)	0.13	FIR
Proportion of diet, plants	1	Pp
Spatial factor	0.0063	SF
Temporal factor	0.3	TF
Area use factor	0.0019	AUF

Calculations based on average values

			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**Soil/ Sediment**	**Plants**	**HQ**
Zinc	124	75.4	0.1	0.366	0.102	5.9	0.0002
Zinc Sulfide	124	894	0.1	0.366	0.102	5.9	0.0000127

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-4.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-1. Table 7
Soil HQ Calculations (Average Conc.): HA-4 (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0625	BW
Soil ingestion proportion	0.094	Ps
Food ingestion Rate (kg/kgBW/d)	0.112	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.076	SF
Temporal factor	0.3	TF
Area use factor	0.023	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	BCF benthic inverts	Soil/ Sediment	Plants	Benthic Inverts	HQ
Zinc	124	75.4	0.1	0.366	2.33	0.131	2.54	16.2	0.00571
Zinc Sulfide	124	894	0.1	0.366	2.33	0.131	2.54	16.2	0.000481

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-4.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-1. Table 8
Soil HQ Calculations (Average Conc.): HA-4 (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on average values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Benthic Inverts**	**Fish**	**HQ**
Zinc	124	75.4	0.1	0.7717	2.33	0.138	0.00849	2.88	25.3	0.328	0.0000261
Zinc Sulfide	124	894	0.1	0.7717	2.33	0.138	0.00849	2.88	25.3	0.328	0.0000022

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-4.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai} \;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-2. Table 1
Soil HQ Calculations (Maximum Conc.): HA-4 (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.045	BW
Soil ingestion proportion	0.093	Ps
Food ingestion Rate (kg/kgBW/d)	0.19	FIR
Proportion of diet, plants	0.71	Pp
Proportion of diet, soil inverts	0.29	Pi
Spatial factor	0.0015	SF
Temporal factor	0.3	TF
Area use factor	0.00045	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Zinc	199	66.1	0.1	0.366	3.201	0.352	9.83	35.1	0.000308
Zinc Sulfide	199	894	0.1	0.366	3.201	0.352	9.83	35.1	0.0000228

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-4.

$$\frac{\left([Soil_a \ x\ P_s \ x\ FIR \ x\ AF_{as}] + [\sum_i^N B_i \ x\ P_i \ x\ FIR \ x\ AF_{ai}\ ]\right) x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-2. Table 2
Soil HQ Calculations (Maximum Conc.): HA-4 (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Zinc	199	66.1	0.1	0.366	3.201	0.0525	3.94	49.6	0.0199
Zinc Sulfide	199	894	0.1	0.366	3.201	0.0525	3.94	49.6	0.00147

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-4.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-2. Table 3
Soil HQ Calculations (Maximum Conc.): HA-4 (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper			
Parameter	Value	Symbol	
Body weight (kg)	0.0425	BW	
Soil ingestion proportion	0.17	Ps	
Food ingestion Rate (kg/kgBW/d)	0.196	FIR	**Calculations based on maximum values**
Proportion of diet, benthic inverts	1	Pbi	
Spatial factor	0.0063	SF	
Temporal factor	0.3	TF	
Area use factor	0.0019	AUF	

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF benthic inverts	Soil/ Sediment	Benthic Inverts	HQ
Zinc	199	66.1	0.1	2.33	0.663	90.9	0.0026
Zinc Sulfide	199	894	0.1	2.33	0.663	90.9	0.000194

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-4.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-2. Table 4
Soil HQ Calculations (Maximum Conc.): HA-4 (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.00012	SF
Temporal factor	0.3	TF
Area use factor	0.000036	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Zinc	199	66.1	0.1	0.366	2.33	0.0328	1.82	11.6	0.00000733
Zinc Sulfide	199	894	0.1	0.366	2.33	0.0328	1.82	11.6	0.000000542

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-4.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-2. Table 5
Soil HQ Calculations (Maximum Conc.): HA-4 (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret			
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.371	BW	
Soil ingestion proportion	0.005	Ps	
Food ingestion Rate (kg/kgBW/d)	0.116	FIR	**Calculations based on maximum values**
Proportion of diet, benthic inverts	0.1	Pbi	
Proportion of diet, fish	0.9	Pf	
Spatial factor	0.0001	SF	
Temporal factor	0.3	TF	
Area use factor	0.00003	AUF	

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF benthic inverts	BCF fish	Soil/ Sediment	Benthic Inverts	Fish	HQ
Zinc	199	66.1	0.1	2.33	0.138	0.0115	5.38	2.87	0.00000375
Zinc Sulfide	199	894	0.1	2.33	0.138	0.0115	5.38	2.87	0.000000277

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-4.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) \; x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-2. Table 6
Soil HQ Calculations (Maximum Conc.): HA-4 (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit			
Parameter	**Value**	**Symbol**	
Body weight (kg)	2.118	BW	
Soil ingestion proportion	0.063	Ps	
Food ingestion Rate (kg/kgBW/d)	0.13	FIR	**Calculations based on maximum values**
Proportion of diet, plants	1	Pp	
Spatial factor	0.0063	SF	
Temporal factor	0.3	TF	
Area use factor	0.0019	AUF	

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**Soil/ Sediment**	**Plants**	**HQ**
Zinc	199	75.4	0.1	0.366	0.163	9.47	0.000241
Zinc Sulfide	199	894	0.1	0.366	0.163	9.47	0.0000204

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-4.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-2. Table 7
Soil HQ Calculations (Maximum Conc.): HA-4 (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0625	BW
Soil ingestion proportion	0.094	Ps
Food ingestion Rate (kg/kgBW/d)	0.112	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.076	SF
Temporal factor	0.3	TF
Area use factor	0.023	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	BCF benthic inverts	Soil/ Sediment	Plants	Benthic Inverts	HQ
Zinc	199	75.4	0.1	0.366	2.33	0.21	4.08	26	0.009
Zinc Sulfide	199	894	0.1	0.366	2.33	0.21	4.08	26	0.000772

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-4.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-2. Table 8
Soil HQ Calculations (Maximum Conc.): HA-4 (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Benthic Inverts**	**Fish**	**HQ**
Zinc	199	75.4	0.1	0.7717	2.33	0.138	0.0136	4.63	40.7	0.527	0.000042
Zinc Sulfide	199	894	0.1	0.7717	2.33	0.138	0.0136	4.63	40.7	0.527	0.00000354

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-4.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-3. Table 1
Soil HQ Calculations (Average Conc.): HA-5 (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.045	BW
Soil ingestion proportion	0.093	Ps
Food ingestion Rate (kg/kgBW/d)	0.19	FIR
Proportion of diet, plants	0.71	Pp
Proportion of diet, soil inverts	0.29	Pi
Spatial factor	0.0015	SF
Temporal factor	0.3	TF
Area use factor	0.00045	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	BCF soil inverts	Soil/ Sediment	Plants	Soil Inverts	HQ
Cadmium	1.32	1.47	0.036	0.586	7.708	0.00084	0.104	0.561	0.000204
Cadmium Sulfide	1.32	79	0.036	0.586	7.708	0.00084	0.104	0.561	0.00000379

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-5.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-3. Table 2
Soil HQ Calculations (Average Conc.): HA-5 (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Cadmium	1.32	1.47	0.036	0.586	7.708	0.000125	0.0419	0.792	0.014
Cadmium Sulfide	1.32	79	0.036	0.586	7.708	0.000125	0.0419	0.792	0.00026

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-5.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-3. Table 3
Soil HQ Calculations (Average Conc.): HA-5 (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0425	BW
Soil ingestion proportion	0.17	Ps
Food ingestion Rate (kg/kgBW/d)	0.196	FIR
Proportion of diet, benthic inverts	1	Pbi
Spatial factor	0.0063	SF
Temporal factor	0.3	TF
Area use factor	0.0019	AUF

Calculations based on average values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Cadmium	1.32	1.47	0.036	0.614	0.00158	0.159	0.000206
Cadmium Sulfide	1.32	79	0.036	0.614	0.00158	0.159	0.00000384

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-5.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-3. Table 4
Soil HQ Calculations (Average Conc.): HA-5 (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.00012	SF
Temporal factor	0.3	TF
Area use factor	0.000036	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	BCF benthic inverts	Soil/ Sediment	Plants	Benthic Inverts	HQ
Cadmium	1.32	1.47	0.036	0.586	0.614	0.0000784	0.0193	0.0203	0.000000972
Cadmium Sulfide	1.32	79	0.036	0.586	0.614	0.0000784	0.0193	0.0203	1.81E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-5.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-3. Table 5
Soil HQ Calculations (Average Conc.): HA-5 (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0001	SF
Temporal factor	0.3	TF
Area use factor	0.00003	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Cadmium	1.32	1.47	0.036	0.614	0.42	0.0000276	0.0094	0.0579	0.00000137
Cadmium Sulfide	1.32	79	0.036	0.614	0.42	0.0000276	0.0094	0.0579	2.56E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-5.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) \ x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-3. Table 6
Soil HQ Calculations (Average Conc.): HA-5 (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit							
Parameter	**Value**	**Symbol**					
Body weight (kg)	2.118	BW					
Soil ingestion proportion	0.063	Ps					
Food ingestion Rate (kg/kgBW/d)	0.13	FIR			**Calculations based on average values**		
Proportion of diet, plants	1	Pp					
Spatial factor	0.0063	SF					
Temporal factor	0.3	TF					
Area use factor	0.0019	AUF					
			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**Soil/ Sediment**	**Plants**	**HQ**
Cadmium	1.32	0.77	0.036	0.586	0.000389	0.101	0.000249
Cadmium Sulfide	1.32	79	0.036	0.586	0.000389	0.101	0.00000243

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-5.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-3. Table 7
Soil HQ Calculations (Average Conc.): HA-5 (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0625	BW
Soil ingestion proportion	0.094	Ps
Food ingestion Rate (kg/kgBW/d)	0.112	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.076	SF
Temporal factor	0.3	TF
Area use factor	0.023	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	1.32	0.77	0.036	0.586	0.614	0.0005	0.0433	0.0454	0.00264
Cadmium Sulfide	1.32	79	0.036	0.586	0.614	0.0005	0.0433	0.0454	0.0000257

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-5.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-3. Table 8
Soil HQ Calculations (Average Conc.): HA-5 (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on average values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Benthic Inverts**	**Fish**	**HQ**
Cadmium	1.32	0.77	0.036	0.3333	0.614	0.42	0.0000326	0.0133	0.0711	0.0106	0.00000852
Cadmium Sulfide	1.32	79	0.036	0.3333	0.614	0.42	0.0000326	0.0133	0.0711	0.0106	0.000000083

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in HA-5.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-4. Table 1
Soil HQ Calculations (Maximum Conc.): HA-5 (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.045	BW
Soil ingestion proportion	0.093	Ps
Food ingestion Rate (kg/kgBW/d)	0.19	FIR
Proportion of diet, plants	0.71	Pp
Proportion of diet, soil inverts	0.29	Pi
Spatial factor	0.0015	SF
Temporal factor	0.3	TF
Area use factor	0.00045	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Cadmium	0.85	1.47	0.036	0.586	7.708	0.000541	0.0672	0.361	0.000131
Cadmium Sulfide	0.85	79	0.036	0.586	7.708	0.000541	0.0672	0.361	0.00000244

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-5.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-4. Table 2
Soil HQ Calculations (Maximum Conc.): HA-5 (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Cadmium	0.85	1.47	0.036	0.586	7.708	0.0000808	0.027	0.51	0.00899
Cadmium Sulfide	0.85	79	0.036	0.586	7.708	0.0000808	0.027	0.51	0.000167

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-5.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-4. Table 3
Soil HQ Calculations (Maximum Conc.): HA-5 (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper							
Parameter	**Value**	**Symbol**	**Calculations based on maximum values**				
Body weight (kg)	0.0425	BW					
Soil ingestion proportion	0.17	Ps					
Food ingestion Rate (kg/kgBW/d)	0.196	FIR					
Proportion of diet, benthic inverts	1	Pbi					
Spatial factor	0.0063	SF					
Temporal factor	0.3	TF					
Area use factor	0.0019	AUF					
			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Cadmium	0.85	1.47	0.036	0.614	0.00102	0.102	0.000132
Cadmium Sulfide	0.85	79	0.036	0.614	0.00102	0.102	0.00000246

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-5.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-4. Table 4
Soil HQ Calculations (Maximum Conc.): HA-5 (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.00012	SF
Temporal factor	0.3	TF
Area use factor	0.000036	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	0.85	1.47	0.036	0.586	0.614	0.0000505	0.0125	0.013	0.000000626
Cadmium Sulfide	0.85	79	0.036	0.586	0.614	0.0000505	0.0125	0.013	1.16E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-5.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-4. Table 5
Soil HQ Calculations (Maximum Conc.): HA-5 (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0001	SF
Temporal factor	0.3	TF
Area use factor	0.00003	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Cadmium	0.85	1.47	0.036	0.614	0.42	0.0000177	0.00605	0.0373	0.000000885
Cadmium Sulfide	0.85	79	0.036	0.614	0.42	0.0000177	0.00605	0.0373	1.65E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-5.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-4. Table 6
Soil HQ Calculations (Maximum Conc.): HA-5 (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit							
Parameter	Value	Symbol					
Body weight (kg)	2.118	BW					
Soil ingestion proportion	0.063	Ps					
Food ingestion Rate (kg/kgBW/d)	0.13	FIR	**Calculations based on maximum values**				
Proportion of diet, plants	1	Pp					
Spatial factor	0.0063	SF					
Temporal factor	0.3	TF					
Area use factor	0.0019	AUF					
			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	Soil/ Sediment	Plants	HQ
Cadmium	0.85	0.77	0.036	0.586	0.000251	0.0648	0.00016
Cadmium Sulfide	0.85	79	0.036	0.586	0.000251	0.0648	0.00000156

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-5.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-4. Table 7
Soil HQ Calculations (Maximum Conc.): HA-5 (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0625	BW
Soil ingestion proportion	0.094	Ps
Food ingestion Rate (kg/kgBW/d)	0.112	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.076	SF
Temporal factor	0.3	TF
Area use factor	0.023	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	BCF benthic inverts	Soil/ Sediment	Plants	Benthic Inverts	HQ
Cadmium	0.85	0.77	0.036	0.586	0.614	0.000322	0.0279	0.0292	0.0017
Cadmium Sulfide	0.85	79	0.036	0.586	0.614	0.000322	0.0279	0.0292	0.0000166

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-5.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-4. Table 8
Soil HQ Calculations (Maximum Conc.): HA-5 (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Benthic Inverts**	**Fish**	**HQ**
Cadmium	0.85	0.77	0.036	0.3333	0.614	0.42	0.000021	0.00854	0.0458	0.00685	0.00000549
Cadmium Sulfide	0.85	79	0.036	0.3333	0.614	0.42	0.000021	0.00854	0.0458	0.00685	5.35E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in HA-5.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-5. Table 1
Soil HQ Calculations (Average Conc.): SB-06R (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.045	BW
Soil ingestion proportion	0.093	Ps
Food ingestion Rate (kg/kgBW/d)	0.19	FIR
Proportion of diet, plants	0.71	Pp
Proportion of diet, soil inverts	0.29	Pi
Spatial factor	0.0015	SF
Temporal factor	0.3	TF
Area use factor	0.00045	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Cadmium	0.92	1.47	0.036	0.586	7.708	0.000585	0.0727	0.391	0.000142
Cadmium Sulfide	0.92	79	0.036	0.586	7.708	0.000585	0.0727	0.391	0.00000264

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-06R.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-5. Table 2
Soil HQ Calculations (Average Conc.): SB-06R (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Cadmium	0.92	1.47	0.036	0.586	7.708	0.0000874	0.0292	0.552	0.00973
Cadmium Sulfide	0.92	79	0.036	0.586	7.708	0.0000874	0.0292	0.552	0.000181

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-06R.

$$\frac{\left([Soil_a \ x\ P_s \ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i \ x\ P_i \ x\ FIR\ x\ AF_{ai}\ ]\right) x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-5. Table 3
Soil HQ Calculations (Average Conc.): SB-06R (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper							
Parameter	**Value**	**Symbol**					
Body weight (kg)	0.0425	BW					
Soil ingestion proportion	0.17	Ps					
Food ingestion Rate (kg/kgBW/d)	0.196	FIR	**Calculations based on average values**				
Proportion of diet, benthic inverts	1	Pbi					
Spatial factor	0.0063	SF					
Temporal factor	0.3	TF					
Area use factor	0.0019	AUF					
			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Cadmium	0.92	1.47	0.036	0.614	0.0011	0.111	0.000144
Cadmium Sulfide	0.92	79	0.036	0.614	0.0011	0.111	0.00000268

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-06R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-5. Table 4
Soil HQ Calculations (Average Conc.): SB-06R (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.00012	SF
Temporal factor	0.3	TF
Area use factor	0.000036	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	0.92	1.47	0.036	0.586	0.614	0.0000546	0.0135	0.0141	0.000000677
Cadmium Sulfide	0.92	79	0.036	0.586	0.614	0.0000546	0.0135	0.0141	1.26E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-06R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

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August Levert_BP Plan_009866

ATTACHMENT I-5. Table 5
Soil HQ Calculations (Average Conc.): SB-06R (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0001	SF
Temporal factor	0.3	TF
Area use factor	0.00003	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Cadmium	0.92	1.47	0.036	0.614	0.42	0.0000192	0.00655	0.0403	0.000000957
Cadmium Sulfide	0.92	79	0.036	0.614	0.42	0.0000192	0.00655	0.0403	1.78E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-06R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-5. Table 6
Soil HQ Calculations (Average Conc.): SB-06R (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit		
Parameter	**Value**	**Symbol**
Body weight (kg)	2.118	BW
Soil ingestion proportion	0.063	Ps
Food ingestion Rate (kg/kgBW/d)	0.13	FIR
Proportion of diet, plants	1	Pp
Spatial factor	0.0063	SF
Temporal factor	0.3	TF
Area use factor	0.0019	AUF

Calculations based on average values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**Soil/ Sediment**	**Plants**	**HQ**
Cadmium	0.92	0.77	0.036	0.586	0.000271	0.0701	0.0002
Cadmium Sulfide	0.92	79	0.036	0.586	0.000271	0.0701	0.00000168

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-06R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-5. Table 7
Soil HQ Calculations (Average Conc.): SB-06R (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat									
Parameter	**Value**	**Symbol**							
Body weight (kg)	0.0625	BW							
Soil ingestion proportion	0.094	Ps							
Food ingestion Rate (kg/kgBW/d)	0.112	FIR				**Calculations based on average values**			
Proportion of diet, plants	0.5	Pp							
Proportion of diet, benthic inverts	0.5	Pbi							
Spatial factor	0.076	SF							
Temporal factor	0.3	TF							
Area use factor	0.023	AUF							
			Absorbed Fraction (AF)			**Absorbed Concentration from Medium and Biota**			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	0.92	0.77	0.036	0.586	0.614	0.000349	0.0302	0.0316	0.00184
Cadmium Sulfide	0.92	79	0.036	0.586	0.614	0.000349	0.0302	0.0316	0.0000179

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-06R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-5. Table 8
Soil HQ Calculations (Average Conc.): SB-06R (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on average values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Benthic Inverts**	**Fish**	**HQ**
Cadmium	0.92	0.77	0.036	0.3333	0.614	0.42	0.0000227	0.00924	0.0495	0.00741	0.00000593
Cadmium Sulfide	0.92	79	0.036	0.3333	0.614	0.42	0.0000227	0.00924	0.0495	0.00741	5.78E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-06R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai} \;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-6. Table 1
Soil HQ Calculations (Maximum Conc.): SB-06R (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.045	BW
Soil ingestion proportion	0.093	Ps
Food ingestion Rate (kg/kgBW/d)	0.19	FIR
Proportion of diet, plants	0.71	Pp
Proportion of diet, soil inverts	0.29	Pi
Spatial factor	0.0015	SF
Temporal factor	0.3	TF
Area use factor	0.00045	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	BCF soil inverts	Soil/ Sediment	Plants	Soil Inverts	HQ
Cadmium	1.7	1.47	0.036	0.586	7.708	0.00108	0.134	0.722	0.000262
Cadmium Sulfide	1.7	79	0.036	0.586	7.708	0.00108	0.134	0.722	0.00000488

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-06R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-6. Table 2
Soil HQ Calculations (Maximum Conc.): SB-06R (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	BCF soil inverts	Soil/ Sediment	Plants	Soil Inverts	HQ
Cadmium	1.7	1.47	0.036	0.586	7.708	0.000162	0.0539	1.02	0.018
Cadmium Sulfide	1.7	79	0.036	0.586	7.708	0.000162	0.0539	1.02	0.000334

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-06R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-6. Table 3
Soil HQ Calculations (Maximum Conc.): SB-06R (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0425	BW
Soil ingestion proportion	0.17	Ps
Food ingestion Rate (kg/kgBW/d)	0.196	FIR
Proportion of diet, benthic inverts	1	Pbi
Spatial factor	0.0063	SF
Temporal factor	0.3	TF
Area use factor	0.0019	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF benthic inverts	Soil/ Sediment	Benthic Inverts	HQ
Cadmium	1.7	1.47	0.036	0.614	0.00204	0.205	0.0003
Cadmium Sulfide	1.7	79	0.036	0.614	0.00204	0.205	0.00000495

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-06R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-6. Table 4
Soil HQ Calculations (Maximum Conc.): SB-06R (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.00012	SF
Temporal factor	0.3	TF
Area use factor	0.000036	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	1.7	1.47	0.036	0.586	0.614	0.000101	0.0249	0.0261	0.00000125
Cadmium Sulfide	1.7	79	0.036	0.586	0.614	0.000101	0.0249	0.0261	2.33E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-06R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-6. Table 5
Soil HQ Calculations (Maximum Conc.): SB-06R (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0001	SF
Temporal factor	0.3	TF
Area use factor	0.00003	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Cadmium	1.7	1.47	0.036	0.614	0.42	0.0000355	0.0121	0.0745	0.00000177
Cadmium Sulfide	1.7	79	0.036	0.614	0.42	0.0000355	0.0121	0.0745	3.29E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-06R.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-6. Table 6
Soil HQ Calculations (Maximum Conc.): SB-06R (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit			
Parameter	**Value**	**Symbol**	
Body weight (kg)	2.118	BW	
Soil ingestion proportion	0.063	Ps	
Food ingestion Rate (kg/kgBW/d)	0.13	FIR	**Calculations based on maximum values**
Proportion of diet, plants	1	Pp	
Spatial factor	0.0063	SF	
Temporal factor	0.3	TF	
Area use factor	0.0019	AUF	

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**Soil/ Sediment**	**Plants**	**HQ**
Cadmium	1.7	0.77	0.036	0.586	0.000501	0.13	0.00032
Cadmium Sulfide	1.7	79	0.036	0.586	0.000501	0.13	0.00000312

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-06R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-6. Table 7
Soil HQ Calculations (Maximum Conc.): SB-06R (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0625	BW
Soil ingestion proportion	0.094	Ps
Food ingestion Rate (kg/kgBW/d)	0.112	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.076	SF
Temporal factor	0.3	TF
Area use factor	0.023	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	1.7	0.77	0.036	0.586	0.614	0.000644	0.0558	0.0585	0.003
Cadmium Sulfide	1.7	79	0.036	0.586	0.614	0.000644	0.0558	0.0585	0.0000332

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-06R.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-6. Table 8
Soil HQ Calculations (Maximum Conc.): SB-06R (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF mammals	BCF benthic inverts	BCF fish	Soil/ Sediment	Mammals	Benthic Inverts	Fish	HQ
Cadmium	1.7	0.77	0.036	0.3333	0.614	0.42	0.0000419	0.0171	0.0915	0.0137	0.000011
Cadmium Sulfide	1.7	79	0.036	0.3333	0.614	0.42	0.0000419	0.0171	0.0915	0.0137	0.000000107

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-06R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-7. Table 1
Soil HQ Calculations (Average Conc.): SB-07R (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.045	BW
Soil ingestion proportion	0.093	Ps
Food ingestion Rate (kg/kgBW/d)	0.19	FIR
Proportion of diet, plants	0.71	Pp
Proportion of diet, soil inverts	0.29	Pi
Spatial factor	0.0015	SF
Temporal factor	0.3	TF
Area use factor	0.00045	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Cadmium	0.9	1.47	0.036	0.586	7.708	0.000573	0.0711	0.382	0.000139
Cadmium Sulfide	0.9	79	0.036	0.586	7.708	0.000573	0.0711	0.382	0.00000258

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-07R.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-7. Table 2
Soil HQ Calculations (Average Conc.): SB-07R (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	BCF soil inverts	Soil/ Sediment	Plants	Soil Inverts	HQ
Cadmium	0.9	1.47	0.036	0.586	7.708	0.0000855	0.0285	0.54	0.00952
Cadmium Sulfide	0.9	79	0.036	0.586	7.708	0.0000855	0.0285	0.54	0.000177

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-07R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-7. Table 3
Soil HQ Calculations (Average Conc.): SB-07R (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper			
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.0425	BW	
Soil ingestion proportion	0.17	Ps	
Food ingestion Rate (kg/kgBW/d)	0.196	FIR	**Calculations based on average values**
Proportion of diet, benthic inverts	1	Pbi	
Spatial factor	0.0063	SF	
Temporal factor	0.3	TF	
Area use factor	0.0019	AUF	

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	Average Soil Concentration (0-3')	TRV	Soil bio-factor	BCF benthic inverts	Soil/ Sediment	Benthic Inverts	HQ
Cadmium	0.9	1.47	0.036	0.614	0.00108	0.108	0.00014
Cadmium Sulfide	0.9	79	0.036	0.614	0.00108	0.108	0.00000261

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-07R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-7. Table 4
Soil HQ Calculations (Average Conc.): SB-07R (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard			
Parameter	**Value**	**Symbol**	
Body weight (kg)	1.134	BW	
Soil ingestion proportion	0.033	Ps	
Food ingestion Rate (kg/kgBW/d)	0.05	FIR	**Calculations based on average values**
Proportion of diet, plants	0.5	Pp	
Proportion of diet, benthic inverts	0.5	Pbi	
Spatial factor	0.00012	SF	
Temporal factor	0.3	TF	
Area use factor	0.000036	AUF	

			Absorbed Fraction (AF)			**Absorbed Concentration from Medium and Biota**			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	0.9	1.47	0.036	0.586	0.614	0.0000535	0.0132	0.0138	0.000000663
Cadmium Sulfide	0.9	79	0.036	0.586	0.614	0.0000535	0.0132	0.0138	1.23E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-07R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-7. Table 5
Soil HQ Calculations (Average Conc.): SB-07R (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0001	SF
Temporal factor	0.3	TF
Area use factor	0.00003	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Soil Concentration (0-3')	TRV	Soil bio-factor	BCF benthic inverts	BCF fish	Soil/ Sediment	Benthic Inverts	Fish	HQ
Cadmium	0.9	1.47	0.036	0.614	0.42	0.0000188	0.00641	0.0395	0.000000937
Cadmium Sulfide	0.9	79	0.036	0.614	0.42	0.0000188	0.00641	0.0395	1.74E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-07R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-7. Table 6
Soil HQ Calculations (Average Conc.): SB-07R (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit			
Parameter	**Value**	**Symbol**	
Body weight (kg)	2.118	BW	
Soil ingestion proportion	0.063	Ps	
Food ingestion Rate (kg/kgBW/d)	0.13	FIR	**Calculations based on average values**
Proportion of diet, plants	1	Pp	
Spatial factor	0.0063	SF	
Temporal factor	0.3	TF	
Area use factor	0.0019	AUF	

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	Average Soil Concentration (0-3')	TRV	Soil bio-factor	BCF plants	Soil/ Sediment	Plants	HQ
Cadmium	0.9	0.77	0.036	0.586	0.000265	0.0686	0.0002
Cadmium Sulfide	0.9	79	0.036	0.586	0.000265	0.0686	0.00000165

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-07R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-7. Table 7
Soil HQ Calculations (Average Conc.): SB-07R (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0625	BW
Soil ingestion proportion	0.094	Ps
Food ingestion Rate (kg/kgBW/d)	0.112	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.076	SF
Temporal factor	0.3	TF
Area use factor	0.023	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	0.9	0.77	0.036	0.586	0.614	0.000341	0.0295	0.0309	0.0018
Cadmium Sulfide	0.9	79	0.036	0.586	0.614	0.000341	0.0295	0.0309	0.0000175

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-07R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-7. Table 8
Soil HQ Calculations (Average Conc.): SB-07R (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on average values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	Average Soil Concentration (0-3')	TRV	Soil bio-factor	BCF mammals	BCF benthic inverts	BCF fish	Soil/ Sediment	Mammals	Benthic Inverts	Fish	HQ
Cadmium	0.9	0.77	0.036	0.3333	0.614	0.42	0.0000222	0.00904	0.0485	0.00725	0.00000581
Cadmium Sulfide	0.9	79	0.036	0.3333	0.614	0.42	0.0000222	0.00904	0.0485	0.00725	5.66E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-07R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-8. Table 1
Soil HQ Calculations (Maximum Conc.): SB-07R (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.045	BW
Soil ingestion proportion	0.093	Ps
Food ingestion Rate (kg/kgBW/d)	0.19	FIR
Proportion of diet, plants	0.71	Pp
Proportion of diet, soil inverts	0.29	Pi
Spatial factor	0.0015	SF
Temporal factor	0.3	TF
Area use factor	0.00045	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Cadmium	1.63	1.47	0.036	0.586	7.708	0.00104	0.129	0.692	0.000252
Cadmium Sulfide	1.63	79	0.036	0.586	7.708	0.00104	0.129	0.692	0.00000468

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-07R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-8. Table 2
Soil HQ Calculations (Maximum Conc.): SB-07R (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Cadmium	1.63	1.47	0.036	0.586	7.708	0.000155	0.0517	0.978	0.0172
Cadmium Sulfide	1.63	79	0.036	0.586	7.708	0.000155	0.0517	0.978	0.000321

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-07R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-8. Table 3
Soil HQ Calculations (Maximum Conc.): SB-07R (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0425	BW
Soil ingestion proportion	0.17	Ps
Food ingestion Rate (kg/kgBW/d)	0.196	FIR
Proportion of diet, benthic inverts	1	Pbi
Spatial factor	0.0063	SF
Temporal factor	0.3	TF
Area use factor	0.0019	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	Maximum Soil Concentration (0-3')	TRV	Soil bio-factor	BCF benthic inverts	Soil/ Sediment	Benthic Inverts	HQ
Cadmium	1.63	1.47	0.036	0.614	0.00196	0.196	0.0003
Cadmium Sulfide	1.63	79	0.036	0.614	0.00196	0.196	0.00000474

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-07R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-8. Table 4
Soil HQ Calculations (Maximum Conc.): SB-07R (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.00012	SF
Temporal factor	0.3	TF
Area use factor	0.000036	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	1.63	1.47	0.036	0.586	0.614	0.0000968	0.0239	0.025	0.0000012
Cadmium Sulfide	1.63	79	0.036	0.586	0.614	0.0000968	0.0239	0.025	2.23E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-07R.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-8. Table 5
Soil HQ Calculations (Maximum Conc.): SB-07R (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0001	SF
Temporal factor	0.3	TF
Area use factor	0.00003	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Cadmium	1.63	1.47	0.036	0.614	0.42	0.000034	0.0116	0.0715	0.0000017
Cadmium Sulfide	1.63	79	0.036	0.614	0.42	0.000034	0.0116	0.0715	3.16E-08

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-07R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-8. Table 6
Soil HQ Calculations (Maximum Conc.): SB-07R (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit								
Parameter	**Value**	**Symbol**	**Calculations based on maximum values**					
Body weight (kg)	2.118	BW						
Soil ingestion proportion	0.063	Ps						
Food ingestion Rate (kg/kgBW/d)	0.13	FIR						
Proportion of diet, plants	1	Pp						
Spatial factor	0.0063	SF						
Temporal factor	0.3	TF						
Area use factor	0.0019	AUF						
			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**Soil/ Sediment**	**Plants**	**HQ**
Cadmium	1.63	0.77	0.036	0.586	0.000481	0.124	0.000306
Cadmium Sulfide	1.63	79	0.036	0.586	0.000481	0.124	0.00000298

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-07R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-8. Table 7
Soil HQ Calculations (Maximum Conc.): SB-07R (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat			Calculations based on maximum values
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.0625	BW	
Soil ingestion proportion	0.094	Ps	
Food ingestion Rate (kg/kgBW/d)	0.112	FIR	
Proportion of diet, plants	0.5	Pp	
Proportion of diet, benthic inverts	0.5	Pbi	
Spatial factor	0.076	SF	
Temporal factor	0.3	TF	
Area use factor	0.023	AUF	

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Cadmium	1.63	0.77	0.036	0.586	0.614	0.000618	0.0535	0.056	0.003
Cadmium Sulfide	1.63	79	0.036	0.586	0.614	0.000618	0.0535	0.056	0.0000318

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-07R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-8. Table 8
Soil HQ Calculations (Maximum Conc.): SB-07R (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Benthic Inverts**	**Fish**	**HQ**
Cadmium	1.63	0.77	0.036	0.3333	0.614	0.42	0.0000402	0.0164	0.0878	0.0131	0.0000105
Cadmium Sulfide	1.63	79	0.036	0.3333	0.614	0.42	0.0000402	0.0164	0.0878	0.0131	0.000000102

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-07R.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-9. Table 1
Soil HQ Calculations (Average Conc.): SB-14 (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.045	BW
Soil ingestion proportion	0.093	Ps
Food ingestion Rate (kg/kgBW/d)	0.19	FIR
Proportion of diet, plants	0.71	Pp
Proportion of diet, soil inverts	0.29	Pi
Spatial factor	0.0015	SF
Temporal factor	0.3	TF
Area use factor	0.00045	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Mercury	0.847	3.25	0.00031	0.27	1.693	0.00000464	0.0309	0.079	0.0000152

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-14.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-9. Table 2
Soil HQ Calculations (Average Conc.): SB-14 (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Mercury	0.847	3.25	0.00031	0.27	1.693	0.000000693	0.0124	0.112	0.000942

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-14.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-9. Table 3
Soil HQ Calculations (Average Conc.): SB-14 (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper							
Parameter	**Value**	**Symbol**					
Body weight (kg)	0.0425	BW					
Soil ingestion proportion	0.17	Ps					
Food ingestion Rate (kg/kgBW/d)	0.196	FIR	**Calculations based on average values**				
Proportion of diet, benthic inverts	1	Pbi					
Spatial factor	0.0063	SF					
Temporal factor	0.3	TF					
Area use factor	0.0019	AUF					
			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Mercury	0.847	3.25	0.00031	0.48	0.00000875	0.0797	0.0000464

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-14.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai} \;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-9. Table 4
Soil HQ Calculations (Average Conc.): SB-14 (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard			Calculations based on average values
Parameter	**Value**	**Symbol**	
Body weight (kg)	1.134	BW	
Soil ingestion proportion	0.033	Ps	
Food ingestion Rate (kg/kgBW/d)	0.05	FIR	
Proportion of diet, plants	0.5	Pp	
Proportion of diet, benthic inverts	0.5	Pbi	
Spatial factor	0.00012	SF	
Temporal factor	0.3	TF	
Area use factor	0.000036	AUF	

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Mercury	0.847	3.25	0.00031	0.27	0.48	0.000000433	0.00572	0.0102	0.000000176

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-14.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-9. Table 5
Soil HQ Calculations (Average Conc.): SB-14 (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0001	SF
Temporal factor	0.3	TF
Area use factor	0.00003	AUF

Calculations based on average values

			Absorbed Fraction (AF)			**Absorbed Concentration from Medium and Biota**			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Mercury	0.847	3.25	0.00031	0.48	1.1	0.000000152	0.00472	0.0973	0.000000942

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-14.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-9. Table 6
Soil HQ Calculations (Average Conc.): SB-14 (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit			
Parameter	**Value**	**Symbol**	
Body weight (kg)	2.118	BW	
Soil ingestion proportion	0.063	Ps	
Food ingestion Rate (kg/kgBW/d)	0.13	FIR	**Calculations based on average values**
Proportion of diet, plants	1	Pp	
Spatial factor	0.0063	SF	
Temporal factor	0.3	TF	
Area use factor	0.0019	AUF	

			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**Soil/ Sediment**	**Plants**	**HQ**
Mercury	0.847	1.01	0.00031	0.27	0.00000215	0.0297	0.0000556

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-14.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai} \;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-9. Table 7
Soil HQ Calculations (Average Conc.): SB-14 (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat			
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.0625	BW	
Soil ingestion proportion	0.094	Ps	**Calculations based on average values**
Food ingestion Rate (kg/kgBW/d)	0.112	FIR	
Proportion of diet, plants	0.5	Pp	
Proportion of diet, benthic inverts	0.5	Pbi	
Spatial factor	0.076	SF	
Temporal factor	0.3	TF	
Area use factor	0.023	AUF	

			Absorbed Fraction (AF)			**Absorbed Concentration from Medium and Biota**			
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Mercury	0.847	1.01	0.00031	0.27	0.48	0.00000276	0.0128	0.0228	0.000804

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-14.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-9. Table 8
Soil HQ Calculations (Average Conc.): SB-14 (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on average values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Average Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Benthic Inverts**	**Fish**	**HQ**
Mercury	0.847	1.01	0.00031	0.0534	0.48	1.1	0.00000018	0.00136	0.0356	0.0179	0.00000375

Notes:
Soil concentrations are in mg/kg dry weight.
Average soil concentrations in SB-14.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-10. Table 1
Soil HQ Calculations (Maximum Conc.): SB-14 (0-3'): Northern Cardinal
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Northern Cardinal			
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.045	BW	**Calculations based on maximum values**
Soil ingestion proportion	0.093	Ps	
Food ingestion Rate (kg/kgBW/d)	0.19	FIR	
Proportion of diet, plants	0.71	Pp	
Proportion of diet, soil inverts	0.29	Pi	
Spatial factor	0.0015	SF	
Temporal factor	0.3	TF	
Area use factor	0.00045	AUF	

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Mercury	1.47	3.25	0.00031	0.27	1.693	0.00000805	0.0535	0.137	0.0000264

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-14.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-10. Table 2
Soil HQ Calculations (Maximum Conc.): SB-14 (0-3'): American Robin
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.082	SF
Temporal factor	0.3	TF
Area use factor	0.025	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Mercury	1.47	3.25	0.00031	0.27	1.693	0.0000012	0.0215	0.194	0.00163

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-14.

$$\frac{([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]) \ x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-10. Table 3
Soil HQ Calculations (Maximum Conc.): SB-14 (0-3'): Spotted Sandpiper
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Spotted Sandpiper		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0425	BW
Soil ingestion proportion	0.17	Ps
Food ingestion Rate (kg/kgBW/d)	0.196	FIR
Proportion of diet, benthic inverts	1	Pbi
Spatial factor	0.0063	SF
Temporal factor	0.3	TF
Area use factor	0.0019	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Mercury	1.47	3.25	0.00031	0.48	0.0000152	0.138	0.0000803

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-14.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai} \;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-10. Table 4
Soil HQ Calculations (Maximum Conc.): SB-14 (0-3'): Mallard
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Mallard		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.00012	SF
Temporal factor	0.3	TF
Area use factor	0.000036	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			**Absorbed Concentration from Medium and Biota**			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Mercury	1.47	3.25	0.00031	0.27	0.48	0.000000752	0.00992	0.0176	0.000000305

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-14.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-10. Table 5
Soil HQ Calculations (Maximum Conc.): SB-14 (0-3'): Snowy Egret
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Snowy Egret			
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.371	BW	
Soil ingestion proportion	0.005	Ps	
Food ingestion Rate (kg/kgBW/d)	0.116	FIR	**Calculations based on maximum values**
Proportion of diet, benthic inverts	0.1	Pbi	
Proportion of diet, fish	0.9	Pf	
Spatial factor	0.0001	SF	
Temporal factor	0.3	TF	
Area use factor	0.00003	AUF	

			Absorbed Fraction (AF)			**Absorbed Concentration from Medium and Biota**			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Mercury	1.47	3.25	0.00031	0.48	1.1	0.000000264	0.00818	0.169	0.00000164

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-14.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-10. Table 6
Soil HQ Calculations (Maximum Conc.): SB-14 (0-3'): Swamp Rabbit
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Swamp Rabbit							
Parameter	**Value**	**Symbol**					
Body weight (kg)	2.118	BW					
Soil ingestion proportion	0.063	Ps					
Food ingestion Rate (kg/kgBW/d)	0.13	FIR	**Calculations based on maximum values**				
Proportion of diet, plants	1	Pp					
Spatial factor	0.0063	SF					
Temporal factor	0.3	TF					
Area use factor	0.0019	AUF					
			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**Soil/ Sediment**	**Plants**	**HQ**
Mercury	1.47	1.01	0.00031	0.27	0.00000373	0.0516	0.0000966

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-14.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-10. Table 7
Soil HQ Calculations (Maximum Conc.): SB-14 (0-3'): Marsh Rice Rat
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

Marsh Rice Rat		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0625	BW
Soil ingestion proportion	0.094	Ps
Food ingestion Rate (kg/kgBW/d)	0.112	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.076	SF
Temporal factor	0.3	TF
Area use factor	0.023	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Mercury	1.47	1.01	0.00031	0.27	0.48	0.0000048	0.0222	0.0395	0.00139

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-14.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

ATTACHMENT I-10. Table 8
Soil HQ Calculations (Maximum Conc.): SB-14 (0-3'): American Mink
August J. Levert, Jr., Family, LLC, et al. v. BP America Production Company
Grand River Oil & Gas Field, Iberville Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.00023	SF
Temporal factor	0.3	TF
Area use factor	0.000069	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)				**Absorbed Concentration from Medium and Biota**				
COPEC	**Maximum Soil Concentration (0-3')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Benthic Inverts**	**Fish**	**HQ**
Mercury	1.47	1.01	0.00031	0.0534	0.48	1.1	3.12E-07	0.00237	0.0619	0.031	0.00000651

Notes:
Soil concentrations are in mg/kg dry weight.
Maximum soil concentrations in SB-14.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

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