SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT
VERMILION PARISH SCHOOL BOARD PROPERTY
SECTION 16 T15S R01E
EAST WHITE LAKE OIL AND GAS FIELD
VERMILLION PARISH, LOUISIANA

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

The screening-level ecological risk assessment (SLERA) developed for the Vermilion Parish School Board property (located in Section 16 of Township 15 South Range 01 East, within the East White Lake Oil and Gas Field) was conducted in accordance with Louisiana Department of Environmental Quality (LDEQ; 2003) and U.S. Environmental Protection Agency (USEPA; 1993, 1997, and 1998) guidance. Ecological risk assessments are developed within a risk management context to evaluate human-induced changes that are considered undesirable, such as altering important structural or functional characteristics or components of ecosystems, not impacts to individual organisms (USEPA 1998).

USEPA guidance uses a tiered approach to determine whether site constituents of ecological concern (COECs) present an unacceptable risk to ecological receptors. This SLERA focuses on chemical stressors associated with aquatic media (i.e., surface water and sediment). Consistent with the regulatory guidance framework, this document includes the following lines of evidence:

- A comparison of sediment COEC concentrations to sediment quality guidelines (SQGs) Effects Range - Low (ERL) and Effects Range - Median (ERM). These SQGs, which were developed for evaluation of the benthic macroinvertebrate community in estuarine and marine sediments, are not site-specific and do not constitute criteria or clean-up levels. They are intended to be conservative, and if exceeded, can serve as a point of departure for more detailed site-specific ecological risk analysis.
- A comparison of surface water COEC concentrations to Louisiana surface water numerical criteria and USEPA National Recommended Water Quality Criteria.
- For COECs that potentially bioaccumulate, quantification of potential risk to seven (7) selected semi-aquatic wildlife receptors (e.g., birds and mammals) using estimated plant and animal (prey) tissue concentrations as well as COEC concentrations in physical media:

Class	Major Feeding Guild		
	Herbivore	**Omnivore**	**Carnivore**
Mammals	Nutria	Marsh Rice Rat; Raccoon	Mink
Birds	N/A	Wood Duck	Snowy Egret; Belted Kingfisher

- A May 2010 site characterization conducted by Dr. John H. Rodgers, Jr., (Clemson University, Department of Forestry and Natural Resources).

Sediment Screening

Sediment samples were collected in 2006 and 2010 by ICON Environmental Services, Inc. and/or Michael Pisani & Associates, Inc. The COECs analyzed included total petroleum hydrocarbons (TPH), inorganics/metals, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Arsenic and chromium concentrations in sediment are below background levels. Cadmium, lead, and PAH sediment concentrations are below ERL SQGs. Mercury and zinc concentrations are below ERM SQGs.

Surface Water Screening

Surface water samples were collected in May 2010 by Michael Pisani & Associates, Inc. Arsenic, chromium, and strontium concentrations are below background levels. Lead, mercury, and zinc concentrations are below chronic aquatic life criteria.

Site-Specific Evaluation of Semi-aquatic Wildlife Receptors

To quantify risk to seven (7) selected wildlife receptors from potentially bioaccumulative COECs, cadmium, lead, mercury, selenium, zinc, and PAHs were further evaluated. Estimated tissue (prey) concentrations of these COECs were calculated using published uptake factors. The results of the evaluation demonstrate that acceptable wildlife exposure levels are not exceeded for any of these COECs.

Site Characterization

Rodgers (2010) concluded that the Site ecosystem is fully functioning. There is clear evidence of abundant healthy wildlife, and there is no evidence of adverse effects on wildlife or fish from past exploration and production activities.

Summary

The lines of evidence summarized above demonstrate that there are no unacceptable risks to the Site ecosystem. A no further action (NFA) determination for ecological receptors is therefore appropriate for the Vermilion Parish School Board property.

The Vermilion Parish School Board property (Site) is located in Section 16 of Township 15 South Range 01 East, within the East White Lake Oil and Gas Field in Vermilion Parish, Louisiana. The property is located approximately 0.5 miles east of White Lake and immediately south of Schooner Bayou (Figure 1). The Louisiana Land and Exploration Company was assigned an exploration and production lease in 1935. In 1940, the Union Oil Company of California (Unocal) began operations on the property and continued as the operator of record until 1995, when it divested its operations to Resource Acquisitions Corporation. Resource Acquisitions Corporation operated the property from 1995 to 2003, when Peak Operating Company became the operator of record.

The Site is located within a normally inundated, primarily intermediate marsh system. The areas of interest are located along canals and waterways in the subject property. A SLERA was therefore developed to determine whether excess risks to ecological receptors exist from historical releases of constituents of ecological concern (COECs) to surface water and sediment.

In 2006, ICON Environmental Services, Inc. collected sediment/soil samples using a 2-inch diameter polyvinyl chloride (PVC) pipe sampling tube ("syringe"), vibracore sampling system, or split-spoon core barrel. In February/March of 2010, ICON Environmental Services, Inc. collected additional sediment samples using a Russian Peat Borer sampler. Michael Pisani & Associates, Inc. collected split samples during the February/March 2010 sampling event. The 2006 and 2010 sediment/soil samples were collected from multiple depth intervals. Analytical results for the shallowest depth intervals were used for the SLERA in order to best approximate the biologically active zone (i.e., 0 to 6 inches). The general pattern for distribution of infaunal benthic invertebrates (whether estuarine, marine, or freshwater) is that the greatest numbers of organisms occur within 2 to 5 centimeters (1 to 2 inches) of the sediment surface, with very few numbers of organisms found deeper than 20 centimeters (8 inches) (Bosworth and Thibodeaux 1990).

In May 2010 Michael Pisani & Associates, Inc. collected surficial (i.e., 0 to 6 inch) sediment samples from ten (10) locations to confirm whether analytical results from the previously collected "shallow" sediment samples (e.g., 0 to 2 feet or 0 to 3 feet) reflect COEC concentrations in the biologically active zone. Eleven (11) background locations were also sampled in May 2010 for surface water and sediment. Laboratory analyses included petroleum hydrocarbons, inorganics/metals, VOCs, and SVOCs.

Human-induced changes that are considered undesirable are those that alter important structural or functional characteristics or components of ecosystems, not impacts to individual organisms (USEPA 1998). The community-level and wildlife receptors evaluated in this SLERA were therefore evaluated at a population level.

Problem formulation is a formal process for developing and evaluating hypotheses about why adverse ecological effects may occur due to the presence of physical, chemical, or biological stressors (USEPA 1998). This SLERA focuses on chemical stressors associated with aquatic media (e.g., surface water and sediment). Specific issues addressed in problem formulation include the environmental setting, potential receptors, exposure pathway analysis, and screening for direct exposures to identify COECs.

2.1 ENVIRONMENTAL SETTING

The Vermilion Parish School Board property (Figure 1) is located within a normally inundated, primarily intermediate marsh system. The predominant lowland areas are dominated by native and nonnative herbaceous wetland vegetation. Elevated areas, which are limited relative to the overall size of the property, are colonized by woody vegetation. Ecological receptors observed at the Site include deer (fresh tracks), ducks, egrets, herons, osprey, alligators, nutria, raccoons, fish, frogs, blue crabs, dragonflies, and mollusks (Rodgers 2010). The areas of interest for the SLERA are located along canals and waterways in the subject property.

2.2 BIOLOGICAL COMPONENTS (BIOTA)

This SLERA focuses on the probability of adverse effects on biological components which may be related to site COECs, with an emphasis on selected phylogenetic groups, often referred to as communities. The regulatory focus is on organisms that are generally recognized by the public to be of direct or indirect value to humans -- i.e., larger and typically more mobile animals ("wildlife"), as well as primary and secondary "producers" (plants and small animals that serve as forage and/or cover for semi-aquatic wildlife). Another reason for this focus is that relevant toxicological and ecological information is more abundant and available regarding these groups of organisms. Site sediment and surface water sample locations are presented in Figure 2 and Figure 3, respectively. Background surface water and sediment sample locations are presented in Figure 4. The site Conceptual Ecological Exposure Model is presented in Figure 5.

2.2.1 Plants

Two basic plant communities are addressed for the strictly-aquatic habitats at the site. The generally small (often microscopic) and relatively physiologically and structurally simple

group herein called "algae" exist primarily in the surface-water column, either suspended in the form of phytoplankton or in contact with sediment and/or other submerged substrates. The generally larger and physiologically and structurally complex plants are herein called "vascular plants," which may be rooted in sediments or floating on the water surface. The macrophytes rooted in sediment are generally confined to relatively shallow areas along some of the edges of the water bodies, because the surface water is often turbid so that penetration of adequate light to support the submerged parts of the plants is limited (both temporally and spatially). The dominant vegetation observed includes arrowhead (*Sagittaria* spp.), bulrush (*Schoenoplectus* spp.), cattails (*Typha* spp.), cordgrass (*Spartina* spp.), and sawgrass (*Cladium jamaicense*), in addition to invasive species such as alligator weed (*Alternanthera philoxeroides*), common reed (*Phragmites australis*), and Chinese tallow (*Triadica sebifera*). Rodgers (2010) provides a summary of wetland plant species noted in his May 2010 site characterization.

2.2.2 Invertebrates

There are two general groups of invertebrate animals associated with the strictly-aquatic habitats at the site. Of greatest interest are benthic invertebrates, which include a variety of worms, crustaceans (e.g., amphipods, isopods, decapods), mollusks (e.g., clams, snails), and larval insects (especially flies such as "gnats"). The benthic invertebrates spend most if not all of their time in direct contact with sediments, some of which are immersed in the matrix. The "benthos" community is generally regarded as a major source of secondary production in aquatic systems, providing important prey for many members of both of the last two major communities (nekton and wildlife). This SLERA addresses the potential adverse effects to benthic invertebrates by comparing sediment concentrations of COECs to published sediment quality guidelines (SQGs). These SQGs are not site-specific and do not constitute criteria or clean-up levels. The published values are intended to be conservative, and when exceeded can serve as a point of departure for more detailed site-specific ecological risk analysis.

The other major strictly-aquatic invertebrate group is herein referred to as zooplankton. In similar habitats these microscopic animals are suspended in the water column, and include crustaceans (e.g., copepods and cladocerans), protozoans, rotifers, and numerous early-life stages of a wide variety of invertebrate species (e.g., larvae of many species of crustaceans, mollusks, insects, and other taxa).

2.2.3 Nekton

Nektonic animals ("swimmers") are relatively large, physiologically and structurally complex animals that spend all (or virtually all) of their time in water. They generally respire by means of gills, although in some cases they are capable of obtaining oxygen via dermal and/or cloacal tissues from water or the atmosphere. In terms of taxonomic diversity the majority of nektonic animals are primarily bony (teleostean) fishes. Fishes typical of systems such as the site water bodies include gars (e.g., *Lepisosteus* spp.), bowfin (*Amia calva*), shads (e.g., *Dorosoma* spp.), minnows and carps (Cyprinidae), suckers (e.g., *Ictiobus* spp. [buffalos]), catfishes (Ictaluridae), topminnows (e.g., *Fundulus* spp.), livebearers (e.g., *Gambusia affinis* [mosquitofish], white and yellow basses (*Morone chrysops* and *M. mississippiensis*); sunfishes (Centrarchidae), and striped mullet (*Mugil cephalus*). Some of these fishes tend to spend most of their activity in the water column (e.g., gars, shads, minnows, topminnows, yellow bass, mullet) and others tend to spend much of their time close to, or in contact with, the bottoms (suckers and catfish).

2.2.4 Wildlife (Semi-Aquatic Vertebrates)

The final category of animals known or presumed to occur in the study area consists of semi-aquatic members of the Subphylum Vertebrata (vertebrates). These animals are relatively large and mobile, characterized by complex physiology and structure, and generally perceived by the public to be more charismatic or "important" from an anthropogenic perspective. For most people, to the extent that they are not domesticated, these vertebrates are considered *wildlife*. They belong to four phylogenetic classes: amphibians, reptiles, birds, and mammals. In this and most other ecological risk assessments, wildlife are treated as individual species (in contrast to the above discussed "communities" of animals and plants).

Owing to their mobility and size, wildlife species are exposed indirectly to COECs, primarily via ingestion of other organisms and physical media (surface water and sediment). There are other potential pathways (e.g., dermal contact and inhalation), although the latter typically is irrelevant unless COECs include highly volatile substances. Dermal contact is also ordinarily minimal because most "higher" vertebrates (birds and mammals) have feathers or fur to protect their skin. Therefore, this SLERA focuses on the ingestion pathway.

In order to address a variety of exposures via ingestion, a number of species are required. Feeding or trophic guilds are useful concepts to categorize the components of the diets (food

habits) and feeding mechanisms (behaviors) among wildlife species. Diverse diets and feeding methods are a major factor allowing variety among co-existing species. Numerous birds and several dozens of mammals known or presumed to use the aquatic habitats in the East White Lake Oil and Gas Field were evaluated as potential candidate wildlife receptors based on this trophic-guild approach. The following factors were considered in the selection process:

- Ecological relevance;
- Vulnerability to exposure;
- Sensitivity to toxicological effects of site COECs;
- Social and/or economic importance;
- Legally protected status (e.g., endangered species); and
- Availability of species-specific behavioral, physiological, and toxicological information.

Three birds and four mammalian "measurement receptors" (as defined by USEPA 1997) are selected to represent semi-aquatic wildlife in this SLERA:

- Wood Duck;
- Snowy Egret;
- Belted Kingfisher;
- Marsh Rice Rat;
- Nutria;
- Raccoon; and
- Mink.

The following paragraphs are profiles of the seven selected wildlife species, with an emphasis on morphological and behavioral traits that affect the potential degree of ingestion of prey or forage items related to available media and/substrates. Principle references include USEPA (1993) *Wildlife Exposure Factors Handbook*; the American Society of Mammalogists *Mammalian Species* series of reviews; and the online version of *The Birds of North America* series (Cornell University Laboratory of Ornithology).

Key considerations for each wildlife species are morphological and/or behavioral traits that: (1) provide a basis of estimating spatial dimensions affecting the extent of use of available aquatic habitats within the study area, and (2) constraints or activities affecting the degree to

which the animals deliberately or incidentally ingest sediments. Characteristics of the "microhabitats" used for foraging[1] are important for estimating areas of contaminated media (including foods). These are often based on species-specific "home ranges" or, if available, linear distances and other dimensions of boundaries of habitats. Traits affecting sediment ingestion include access, morphology and behaviors. For example, the belted kingfisher has a relatively long and narrow beak and feeds almost exclusively by diving in flight or from perches, so that the prey (e.g., fish) are removed from the water with minimal or no contact to the underlying sediment. On the other hand, raccoons usually grasp prey or fruits lying in or on sediments, allowing incidental swallowing of increments of the substrate (Kaufmann 1982).

2.2.4.1 Wood Duck (*Aix sponsa*)

The wood duck accounts for 10% of the waterfowl harvest in the Mississippi Flyway, numerically second only to mallards (Hepp and Bellrose 1995). The presence of *Aix sponsa* in the study area is conspicuous. Wood ducks are omnivores with a wide variety of diets. They are dabbling and gleaning feeders, focusing on seeds, fruits, and both aquatic and semi-terrestrial invertebrates. Aquatic invertebrates are mainly acquired in shallow waters (< 20 inches) in the littoral zones of the water bodies. Generally, when these ducks "dabble" (tip-up to access the substrate) in water they usually are searching for acorns (Hepp and Bellrose 1995; Lowery 1974a). On both aquatic and wetland substrates, the invertebrates sought by wood ducks are insects, snails, and various small crustaceans. Because of their foraging methods, wood ducks are expected to incidentally ingest substantial quantities of sediment. Individuals of *A. sponsa* satisfy their various types of forage by establishing relatively extensive "home ranges" (e.g., many hundreds or a few thousands of acres). The SLERA assumes that a given wood duck would obtain 100% of its diet from the study area.

2.2.4.2 Snowy Egret (*Egretta thula*)

The snowy egret, a small carnivorous wading bird that feeds primarily along open shorelines (Kushlan 1978), is a common regional resident associated with rookeries in the general vicinity of the site. They feed almost exclusively in shallow (< 6 inches) littoral habitats, taking mainly nektonic forage fishes and some larger benthic invertebrates (e.g., crayfish), as well as arthropods and frogs (Parsons and Master 2000; Custer and Osborn 1978; Kushlan

[1] In this SLERA the terms forage and foraging refer generally to all types of food and feeding activities (i.e., the

1978). Feeding is generally by stalking and/or ambushing, followed by spearing or grasping individual prey items. This procedure results in limited ingestion of sediments. Individuals of *Egretta thula* generally do not feed in close proximity to their rookeries, and seldom forage in precisely the same area every day. Rather, on a given day they will focus on locations where prey items are concentrated, sometimes moving substantial distances on the scale of miles. Individuals will, on occasion, establish loose and temporary "territories" on the scale of tens of yards (Parsons and Master 2000). For purposes of this SLERA it is assumed that a hypothetical individual would obtain 100% of its diet from the study area.

2.2.4.3 Belted Kingfisher (*Ceryle alcyon*)

The belted kingfisher is a medium-sized bird that, according to USEPA (1993), "eats primarily fish." *Ceryle alcyon* is a local resident that is often conspicuous along bayous and canals. As noted above, these birds typically feed from a few to several preferred perches, from which they dive onto prey (Kelly *et al.* 2009). The distribution of suitable perches therefore tends to limit the foraging area to be preferred. Because of its preying mechanism this species is expected to minimally ingest sediments. The kingfisher was selected to provide a largely piscivorous bird that is primarily associated with the local water bodies. Other carnivorous birds associated with shorelines are either (1) much larger and have a more variable diet (e.g., most wading or soaring birds), or (2) seldom eat nektonic prey at all (e.g., most shorebirds). Mated pairs of kingfishers establish strong feeding territories on the scale of about 0.5 to 0.8 miles during the breeding season (Kelly *et al.* 2009; Brooks and Davis 1987). Accordingly there are likely to be only a few individual kingfishers using the local water bodies; however, those present will probably obtain the bulk of their diets from the study area. It is therefore assumed that a hypothetical individual would obtain 100% of its diet from the study area. Limitations on this assumption are the tendency for turbidity and/or any extensive mats of floating plants.

2.2.4.4 Marsh Rice Rat (*Oryzomys palustris*)

The marsh rice rat is one of the smallest omnivorous rodents known to occur locally. It is selected as a measurement receptor because of its size and its tendency to have a very small home range (< 1 acre; Wolfe 1982; Lowery 1974b). *Oryzomys palustris* is one of the few mammals that can reasonably be assumed to obtain virtually all of its diet from the site. In

trophic categories herbivores, omnivores, and predators [including insectivores, piscivores, etc.]).

his review, Wolfe (1982) indicated that various studies have suggested that rice rats are predominantly carnivorous while others suggested that plants are more often consumed. In shallow littoral zones of water bodies, prey consists largely of adult insects, snails, and a variety of epibenthic invertebrates, whereas plant materials are mainly seeds of graminoids (e.g., grasses and other grass-like plants). The sources of food are generally divided evenly; therefore this SLERA assumes that all of the rice rat forage comes from the littoral parts of the water bodies. Since rice rats feed primarily by gleaning on substrates (as apposed to penetrating), a relatively low degree of incidental soil/sediment ingestion is assumed.

2.2.4.5 Nutria (*Myocastor coypus*)

The nutria is an introduced, medium-sized, strictly-herbivorous rodent (Woods *et al.* 1992; Lowery 1974b). *Myocastor coypus* is predominately a swimmer/wader expected to obtain virtually all of its diet from the local water bodies. Nutria generally feed by grazing or browsing on above-surface substrates and floating plants. However, they also feed on shallow roots and rhizomes of emergent aquatic vascular plants; accordingly, a relatively large amount of incidental sediment ingestion is assumed for this SLERA. Despite their size, nutria tend to have relatively small home ranges (usually < 15 acres), and therefore it is assumed that a given individual would attain all of its diet from water bodies within the study area.

2.2.4.6 Raccoon (*Procyon lotor*)

The raccoon is a medium-sized, omnivorous mammal expected to be common in the study area. *Procyon lotor* is selected as a measurement receptor to represent a littoral-zone/shoreline gleaning omnivore. Although highly opportunistic in their foraging behavior (Lotze and Anderson 1979), and likely to obtain some of their food (especially plant material) in upland areas at certain times, raccoons tend to focus most of their foraging activities on aquatic or semi-aquatic organisms when there is ready access to a water body (Lowery 1974b). *Procyon lotor* home ranges vary considerably depending upon region and particularly the relative quality of habitat, but are seldom less than 100 acres (Lotze and Anderson 1979; USEPA 1993). This SLERA assumes that a given individual raccoon might obtain virtually all of its diet in the study area. As noted above, due to their foraging mechanisms and diet, raccoons are assumed to incidentally ingest a relatively large quantity of sediment.

2.2.4.7 Mink (*Mustela vison*)

The mink is a medium-sized "mesopredator" known to occur in the vicinity of the study area. Like the raccoon, *Mustela vison* tends to prefer strictly-aquatic prey when occupying habitats with ready access to a water body (Lariviere 1999; Linscombe *et al.* 1982; Lowery 1974b). Another similar (and closely related) mammalian predator strongly associated with local aquatic habitats is the river otter (*Lontra canadensis*), but it is much larger and therefore less vulnerable to COEC exposures. Also, the mink typically forages by wading whereas the otter is more of a swimmer. Thus the mink also is likely to incidentally ingest more sediment. The mink typically has a linear "home range" shorter than a mile, and therefore a given individual is assumed to obtain all of its diet in the study area.

2.3 COEC SCREENING

COEC screening identifies constituents present at detectable levels, eliminates constituents not exceeding background levels (where available), eliminates non-bioaccumulative constituents which do not exceed ecological screening levels for community-level receptors, and identifies bioaccumulative constituents for wildlife evaluation. In 2006, ICON Environmental Services, Inc. collected sediment/soil samples using a 2-inch diameter polyvinyl chloride (PVC) pipe sampling tube ("syringe"), vibracore sampling system, or split-spoon core barrel. In February/March of 2010, ICON Environmental Services, Inc. collected additional sediment samples using a Russian Peat Borer sampler. Michael Pisani & Associates, Inc. collected split samples during the February/March 2010 sampling event. The 2006 and 2010 sediment/soil samples were collected from multiple depth intervals. Analytical results for the shallowest depth intervals were used for the SLERA in order to best approximate the biologically active zone (i.e., 0 to 6 inch).

In May 2010 Michael Pisani & Associates, Inc. collected surficial (0 to 6 inch) sediment samples from ten (10) locations to confirm whether analytical results from the previously collected "shallow" sediment samples (e.g., 0 to 2 feet or 0 to 3 feet) reflect COEC concentrations in the biologically active zone. Eleven (11) background locations were also sampled in May 2010 for surface water and sediment. Laboratory analyses included petroleum hydrocarbons, inorganics/metals, VOCs, and SVOCs.

Table 1 presents combined laboratory analytical results for the sediment sample events. Results from the samples collected by ICON Environmental Services, Inc. in February/March

2010 are not included in this evaluation since complete lab reports were not available for data validation (and splits samples from Michael Pisani & Associates, Inc. were available). Where necessary, the reported concentrations were converted from a wet-weight basis to a dry-weight basis for comparison to SQGs and evaluation of wildlife. Table 2 presents laboratory analytical results for acid volatile sulfides/simultaneously extracted metals (AVS/SEM) testing. Table 3 presents present maximum, 95% Upper Confidence Limit (UCL) of the arithmetic mean, and arithmetic mean sediment concentrations, as well as published SQGs (i.e., ERLs and ERMs) for benthic macroinvertebrates. The 95% UCL values were calculated using the USEPA approved software ProUCL when appropriate (i.e., eight or more samples were collected, and more than 10% of the collected samples had detections). The ProUCL input and output are presented in Appendix A. The SQGs for benthic macroinvertebrates and the associated screening results are discussed in Sections 2.3.1 and 2.3.2.

Table 4 presents surface water analytical results, and Table 5 presents surface water field measurements (e.g., temperature, conductivity). Maximum, 95% UCL, and arithmetic mean COEC concentrations in surface water are presented in Table 6, as are the Louisiana surface water numerical criteria and USEPA National Recommended Water Quality Criteria.

The published SQGs and surface water standards/criteria used in this SLERA do not address the potential for bioaccumulation in aquatic organisms nor the associated hazards to the wildlife species that consume the aquatic organisms. USEPA guidance (2000) identifies constituents with the potential for bioaccumulation into biological tissue. Of the inorganic (total) and organic COECs analyzed at the site, the following were identified as potentially bioaccumulative:

- Arsenic;
- Cadmium;
- Chromium;
- Lead;
- Mercury;
- Selenium;
- Zinc; and
- Polycyclic aromatic hydrocarbons (PAHs).

As discussed below in Section 2.3.2, arsenic and chromium are eliminated as COECs since the arithmetic mean or 95% UCL concentrations are below background levels in both surface water and sediment. Surface water and sediment were analyzed for total metals, and the bioaccumulative form of mercury is methylmercury. Methylmercury concentrations are therefore estimated as 0.73% of total mercury concentrations based on an extensive review of aquatic sites in Louisiana (DeLaune *et al.* 2009).

2.3.1 Screening Levels

Long *et al.* (1995) developed two numerical SQGs for evaluation of estuarine and marine benthic macroinvertebrates: (1) effects range-low (ERL); and, (2) effects range-median (ERM). Long and MacDonald (1998) suggest that users of the ERLs and ERMs primarily focus upon the mid-range (ERM) SQGs as benchmarks for effects and the low-range (ERL) values as benchmarks for no-effects. Long and MacDonald (1998) also concluded that toxicity cannot necessarily be expected in sediments in which only a single ERM was exceeded because those SQGs were not intended as toxicity thresholds or absolute predictors of toxicity; samples in which several (e.g., one to five) ERMs are exceeded should be viewed as medium-low priority.

SQGs are also not site-specific and do not constitute criteria or clean-up levels. The published values are intended to be conservative, and when exceeded can serve as a point of departure for more detailed site-specific ecological risk analysis. Applicable screening levels for surface water are Louisiana surface water numerical criteria (LAC Title 33, Part IX, Subpart 1, Section 1123) and USEPA National Recommended Water Quality Criteria (2009).

2.3.2 Screening Results

As previously discussed, COEC screening identifies constituents present at detectable levels, eliminates constituents not exceeding background levels (where available), eliminates non-bioaccumulative constituents which do not exceed ecological screening levels for community-level receptors (e.g., benthic macroinvertebrates), and identifies bioaccumulative constituents for wildlife evaluation. Human-induced changes that are considered undesirable are those that alter important structural or functional characteristics or components of ecosystems, not impacts to individual organisms (USEPA 1998). The 95% UCL concentration, a conservative estimate of the true mean of a data set, was therefore used to

evaluate COEC concentrations for the benthic macroinvertebrate community, aquatic life, and semi-aquatic wildlife since all are protected at a population level. Where a 95% UCL concentration could not be calculated, the arithmetic mean concentration was used instead.

Previous laboratory analytical results indicate that elevated levels of TPH are present in site sediments. However, due to the complexity of petroleum hydrocarbon mixtures, TPH analysis generally provides little information necessary for performing an ecological risk assessment because it does not elucidate the properties that determine potential fate and toxicity of the material. For the purposes of this SLERA, the VOC and SVOC analytical results are more useful. SQGs for Total PAHs (TPAH), rather than individual PAHs, are the most relevant for evaluating risk in a SLERA since PAHs almost always occur as mixtures in the environment. An SQG derived from the correlation of ecological effects with the concentration of an individual PAH in field-collected sediments greatly overestimates the effects actually caused by a single compound (Swartz 1999).

The 95% UCL TPAH concentration (1.252 mg/kg-DW) is below the ERL screening level of 4.022 mg/kg-DW for benthic macroinvertebrates (Table 3). PAHs were not detected in Site surface water. Since the PAHs are considered potentially bioaccumulative, they were retained for evaluation of potential hazards to wildlife.

The 95% UCL concentrations of arsenic (6.8 mg/kg-DW) and chromium (15.64 mg/kg-DW) in sediment are below background concentrations (7.57 mg/kg-DW and 19.73 mg/kg-DW, respectively; Table 3). The 95% UCL or arithmetic mean surface water concentrations of arsenic (0.0015 mg/L) and chromium (0.00283 mg/L) are below background levels (0.0032 mg/L and 0.0035 mg/L, respectively) (Table 6). Surface water concentrations of strontium (1.068 mg/L) are also below background levels (1.28 mg/L).

The 95% UCL concentrations of cadmium (0.485 mg/kg-DW) and lead (46.05 mg/kg-DW) are below the associated ERL screening levels for benthic macroinvertebrates (1.2 mg/kg-DW and 46.7 mg/kg-DW, respectively) (Table 3). The 95% UCL concentrations of mercury (0.407 mg/kg-DW) and zinc (197.1 mg/kg-DW) are below the ERM screening levels for benthic macroinvertebrates (0.71 mg/kg-DW and 410 mg/kg-DW, respectively). The surface water concentrations of lead, mercury, and zinc are below applicable surface water criteria (Table 6). The AVS/SEM data indicate that Site COECs cadmium, lead, nickel, and zinc are not bioavailable in sediment due to the presence of excess sulfides. Since cadmium, lead,

methylmercury and zinc are considered to be potentially bioaccumulative, they were retained for evaluation of potential hazards to wildlife.

Long *et al.* (1995) did not derive SQGs for certain site analytes, such as barium, selenium, strontium, or chlorides. Since selenium is considered to be potentially bioaccumulative, it was retained for evaluation of potential hazards to wildlife. The insoluble barium compound barium sulfate is not a COEC because barium sulfate does not release free barium ions that can be absorbed in the body. In natural waters at a pH of 9.3 or below (see Table 5), barium ion will react to form barium sulfate (Bodek *et al.* 1988). Barium was therefore not retained as a COEC. A SQG is not available for chlorides. However, Rodgers (2010) observed numerous plants, animals, and signs of wildlife during his site characterization, which indicates a healthy, thriving ecosystem. The 95% UCL concentrations of chlorides and total dissolved solids (TDS) in surface water are below background levels (Table 6).

The analysis phase of an ecological risk assessment supports the risk characterization through a quantification of:

- The exposure of a receptor of concern (i.e., measurement receptor) to a COEC; and
- The potential ecological effects (toxicity) of COECs.

3.1 EXPOSURE ASSESSMENT

3.1.1 Direct Exposures

Exposures to benthic macroinvertebrates are evaluated using 95% UCL (or when 95% UCL values are not available, arithmetic mean) COEC concentrations in sediment (Section 2.3.2). Exposures to aquatic life are similarly evaluated using 95% UCL concentrations in surface water.

3.1.2 Indirect (Dietary) Exposures

Dietary exposures for wildlife measurement receptors (e.g., birds and mammals) are based in part on food, water, and sediment ingestion rates, body weight, percent of local aquatic items in the overall diet, and dietary composition.

3.1.2.1 Dietary Composition

Table 7 presents the assumed dietary composition for the wildlife receptors discussed above. The assumed diets are based on published studies, professional judgment, and an awareness of forage and prey items most available in the study area.

3.1.2.2 Ingestion Rates

Table 8 presents the food, water, and incidental sediment ingestion rates. Food and water ingestion rates have been measured for few wildlife species. Such ingestion rates are therefore typically estimated using allometric equations developed for different trophic groups (e.g., wading birds) in order to extrapolate food and water ingestion rates to closely

related species on the basis of body weight. Incidental sediment ingestion rates are based on directly measured rates or professional judgment.

3.1.2.3 Body Weight

Body weight (Table 8) is an important factor because the variable is often used in calculating other exposure assumptions such as food and water ingestion. When a range is reported, selected literature values are representative of the low extreme for wild adults in Louisiana habitats.

3.1.2.4 Foraging Areas and Area Use Factors

Table 9 presents typical foraging areas for the selected wildlife receptors. Table 10 presents the associated area use factors (AUF). USEPA (1997) defines the AUF as the ratio of the entire area of known or assumed contamination (or the site area under investigation) to the area used by the animal (e.g., its home range, breeding range, or feeding/foraging range). As noted in Section 2.2.4, some of the measurement receptors are known or expected to focus on very limited spaces/substrates (e.g., marsh rice rat) and others tend to forage in a variety of local habitats (e.g., duck, raccoon). Regarding the latter the estimates of fractions of various substrates are generally more uncertain.

3.1.2.5 Uptake Factors

Table 11 presents sediment-to-tissue uptake factors for applicable bioaccumulative COECs (i.e., cadmium, lead, methylmercury, selenium, zinc, and PAHs). The uptake factors were converted, as necessary, to a dry weight basis for consistency with the food ingestion rates.

3.2 EFFECTS ASSESSMENT

3.2.1 Ingestion Pathway Toxicity Reference Values

Receptor-specific mammal and bird toxicity reference values (TRVs) were developed through a three-step process:

- *Literature search* for appropriate ingestion pathway toxicological endpoints;
- *Selection of an endpoint* to serve as a TRV for each COEC; and

- *Adjustment of the selected TRV* into an appropriate receptor-specific value.

3.2.1.1 Literature Search

A literature search was conducted for appropriate toxicological endpoints for ingestion pathway exposures to receptors of concern. Several databases, in addition to the peer-reviewed scientific literature, were consulted, including the ECOTOX database; the Hazardous Substances DataBase (HSDB); the Integrated Risk Information System (IRIS); the TOXicity NETwork (TOXNET [HSDB], which includes MEDTECS); and the Registry of Toxic Effects of Chemicals (RTECs). Also examined were Oak Ridge National Laboratory technical reports (Sample *et al.*, 1996); U.S. Fish and Wildlife Service *Contaminant Hazard Series* synopses (i.e., the "Eisler Documents"); RTI (1995); and available ATSDR *Toxicological Profiles*. These sources were used to provide the dietary toxicological endpoints necessary for selecting wildlife TRVs. Selection of TRVs was based on examination of the above sources and selection of appropriate values using the strategy outlined below.

Endpoints reported in the literature include the lowest observed adverse effect level (LOAEL) and the no observed adverse effect level (NOAEL). The LOAEL is the lowest dose that results in a statistically significant effect compared to a control. The NOAEL is the highest dose at which there is no statistically significant difference from the control response. By definition, the NOAEL represents a dose or concentration at or below which a risk is not expected to occur.

3.2.1.2 TRV Selection

Lethal dose values generally represent acutely toxic endpoints, although this must be examined in the context of the exposure duration and the test animal. For example, a lethal dose based on a 1- to 5-day exposure might be considered an acutely (i.e., short-term) toxic response, whereas a lethal dose reported for 50 or 100 days might be considered a chronic (i.e., long-term) response. Emphasis was placed on selection of chronic endpoints (i.e., NOAELs and LOAELs) or lethal doses over extended periods. Greater weight was given to multi-day or multi-week studies rather than single-dose studies. Additional weight was placed on those assays performed during a "critical life-stage" such as gestation, conception, and/or early development.

The general strategy for selecting (or deriving) a single NOAEL value as a TRV from among the many toxicological endpoints reported in the literature was as follows:

- Where literature values were identified for the specific ecological receptor, the highest NOAEL that did not exceed the lowest LOAEL was selected. The lowest appropriate LOAEL was also selected;
- Where values were not available for a specific ecological receptor, which is characteristic of the vast majority of literature values, values from laboratory test species were used;
- Weight was given to the duration of the study, as well as the toxicological endpoint. Preference was given to studies that were chronic or subchronic exposures versus single event or acute exposures. Where data were available for more than one dosing regime, chronic was selected first, subchronic second, and acute only if no other data were available. Critical life-stage tests also carried significant weight;
- Studies were considered based on the dosing regime. Intraperitoneal or intravenous studies were not used. Studies using gavage or oral intubation were not used when food studies were available; and
- Measures of effect considered include survival, growth and reproduction. Endpoints specifically related to survival, growth and reproduction such as fetotoxicity or infertility were also considered. Effects such as carcinogenesis, liver damage, kidney function, or enzyme induction were generally not considered appropriate measures.

Selected wildlife oral TRVs for cadmium, lead, methylmercury, selenium, zinc, and PAHs are presented in Table B-1 of Appendix B.

3.2.1.3 TRV Adjustments

Three types of TRV adjustments or uncertainty factors (UFs) were used for this evaluation: (1) from laboratory test species to wild animals; (2) from LOAELs to NOAELs; and (3) from subchronic to chronic exposures.

Interspecies Extrapolation. Allometric scaling was used to perform interspecies extrapolations. The underlying premise of allometric scaling is based on the assumption that smaller animals tend to have higher metabolic rates, which in turn leads to a faster processing of an equal mg/kg body weight dose of a toxicant when compared to a larger body species. Sample and Arenal (1999) evaluated such an approach for mammalian and avian test species to develop chemical-specific allometric regressions based on acute LD_{50} data (i.e., the lethal dose to 50% of the test organisms over a specific exposure period). When test results are reported as doses (mg/kg of body weight), the form of the allometric equation is as follows (Sample *et al.* 1996; Sample and Arenal 1999):

$$A_w = A_t \times \left(\frac{BW_t}{BW_w} \right)^{1-a}$$

where A_w is the toxicity value for the wildlife species, A_t is the toxicity value for the test species, BW_t is the body weight of the test species, BW_w is the body weight of the wildlife species, and a is the "scaling factor" or slope of the allometric regression presented by Sample and Arenal (1999). Since avian scaling factors for the majority of the chemicals evaluated were not significantly different from 1, interspecies extrapolation among birds was not performed for this SLERA.

Subchronic-to-Chronic Extrapolation. A subchronic-to-chronic UF of 5 was used for this evaluation. Weil and McCollister (1963) and McNamara (1976) independently reviewed the results of subchronic and chronic NOAELs in animal toxicity tests. When combined, these data reveal that 96% of the studies (68 out of 71) have a ratio of 5 or less for subchronic to chronic test results. Abt Associates (1995) also reviewed these data along with those that were reported after publication of Weil and McCollister (1963) and McNamara (1976). The results reported by Abt Associates, which are in good agreement with those previously reported by Weil and McCollister (1963) and McNamara (1976), also support the use of a subchronic-to-chronic UF of 5.

Toxicological Endpoint Extrapolation. UFs from U.S. EPA Region VIII (1997) were used in this evaluation since they allow for an adjustment based on the significance and severity of the LOAEL-based endpoint:

Toxicological Endpoint Extrapolations

TRV LOAEL Test Results	Non-Lethal		Lethal
	Mild	Severe	
No-observed effects level	0.75	1	2
No observed adverse effect level (e.g., ED_{01})	1	2	3
Lowest observed effects level	2	3	5
Lowest observed adverse effects level (e.g., ED_{10})	3	5	10
Frank-effects level (e.g., ED_{50})	5	10	15

Adjusted oral TRVs are presented in Table B-2 through Table B-8 of Appendix B. Table B-9 summarizes the adjusted and unadjusted oral TRVs.

3.2.2 Ingestion Pathway Dietary Exposures (Food Web Modeling)

Ingestion-pathway exposures for the selected wildlife receptors were estimated as average daily doses using the approach outlined in USEPA (1993):

$$Dose_{oral} = \frac{(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})}{BW}$$

where:

$Dose_{oral}$ = Dose from ingestion (mg COEC/kg body weight/day);

IR_{food} = Ingestion rate of food (kg/day);

C_{food} = COEC concentration in food (mg/kg);

IR_{water} = Ingestion rate of water (L/day);

C_{water} = COEC concentration in water (mg/L);

IR_{sed} = Ingestion rate of sediment (kg/day);

C_{sed} = COEC concentration in sediment (mg/kg);

BW = Body weight of receptor (kg).

The dose to wildlife from bioaccumulative COECs in water is typically negligible relative to exposures from these constituents in food and incidentally ingested sediment.

Examples of information gaps that contribute to overestimation of exposures and/or effects include, but are not limited to:

Information Gap	Specific Impact
No consideration of assimilation efficiency for most COECs (i.e., assuming 100% assimilation of materials ingested)	Per basic thermodynamic laws, assimilation cannot be complete; over-estimates absorbed dose
Extrapolation of effects from hypothetical individuals to higher levels of organization (e.g., populations)	In particular reference to territorial behavior (e.g., as manifested in egrets and mink) a worst-case exposure would be peculiar to a specific individual and, by definition other individuals (the remainder of the population) could not be as exposed.
Extrapolation from literature-based TRVs (specifically laboratory bioassay results, where chemicals are typically administered in forms and/or by methods intended to facilitate uptake)	Generally, this is more likely to overestimate bioavailability under field conditions (although this may not always be true)

The inability to quantitatively address amphibians and reptiles as ingestion-pathway receptors is an information gap. However, as a group these animals are not believed to be more sensitive than (in particular) birds. On balance, uncertainty in this SLERA is associated with the degree to which estimates of exposures and toxicities are conservative (e.g., overstated).

Risk characterization, the final phase of the risk assessment process, integrates data on exposures and effects into a statement about risk to the assessment endpoints established during problem formulation.

4.1 COMMUNITY-LEVEL RECEPTORS

As previously discussed, exposures to benthic invertebrates and aquatic life are evaluated using 95% UCL (or when 95% UCL values are not available, arithmetic mean) COEC concentrations in sediment or surface water.

The 95% UCL concentration of TPAH (1.252 mg/kg-DW) is below the ERL screening level of 4.022 mg/kg-DW for benthic macroinvertebrates (Table 3). PAHs were not detected in Site surface water. The 95% UCL concentrations of arsenic and chromium are below background concentrations in both surface water and sediment. The 95% UCL concentrations of cadmium and lead are below ERL screening levels and the 95% UCL concentrations of mercury and zinc are below ERM screening levels. ERLs and ERMs are not site-specific and do not constitute criteria or clean-up levels. The published values are intended to be conservative, and when exceeded can serve as a point of departure for more detailed site-specific ecological risk analysis.

The surface water concentrations of lead, mercury, and zinc are below applicable surface water criteria (Table 6). Cadmium was not detected in Site surface water, and surface water concentrations of strontium are below background levels. The 95% UCL concentrations of chlorides and TDS in surface water are below background levels.

4.2 WILDLIFE RECEPTORS

For dietary (indirect) exposures to wildlife measurement receptors risk estimation is quantified using the hazard quotient (HQ) method. A HQ is the ratio of the predicted exposure to an acceptable exposure, for a specific COEC and a specific representative measurement receptor:

$$HQ = \frac{Exposure}{TRV}$$

where:

Exposure = Measured or estimated exposure point concentration (e.g., mg/L, mg/kg, etc.) or dose (e.g., mg/kg body weight/day);

TRV = Toxicity reference value (e.g., based on a NOAEL or LOAEL) in units matching the exposure point concentration or dose.

For COECs with the same toxic mechanism (i.e., same mode and site of action), a hazard index (HI) is also calculated.

$$HI = \sum HQ_i$$

where:

$\sum HQ_i$ = The sum of all hazard quotients for COECs with a common toxic mechanism.

For this SLERA, the only suites or classes of COECs with the same toxic mechanism (Type I Narcosis) are the low and high molecular weight PAHs.

As previously discussed in Section 1.1, human-induced changes that are considered undesirable are those that alter important structural or functional characteristics or components of ecosystems, not impacts to individual organisms (USEPA 1998). The exposure point concentration represents the average exposure contracted by a receptor over an exposure area during an extended period of time. The 95% UCL, a conservative estimate of the true mean of a data set, is therefore an appropriate estimate of that exposure for wildlife.

Tables 12 through 19 present HQs for the selected wildlife receptors. All wildlife NOAEL-based HQs are below 1.0.

4.3 UNCERTAINTY EVALUATION

USEPA guidance (1997, 1998) requires a discussion on uncertainties inherent in an ecological risk assessment, such as the uncertainty in the parameters used to evaluate risk. Assumptions used in this SLERA are biased toward overestimating risk. An example is the assumption that wildlife receptors obtain 100% of their diet/exposure from the site.

The SLERA developed for the Vermilion Parish School Board property was conducted in accordance with Louisiana Department of Environmental Quality (LDEQ; 2003) requirements and U.S. Environmental Protection Agency (USEPA; 1993, 1997, and 1998) guidance.

USEPA guidance uses a tiered approach to determine whether site COECs present an unacceptable risk to ecological receptors. This SLERA focuses on chemical stressors associated with aquatic media (i.e., surface water and sediment). Consistent with the regulatory guidance framework, this document includes the following lines of evidence:

- A comparison of sediment COEC concentrations to the sediment quality guidelines ERLs and ERMs. These SQGs, which were developed for evaluation of the benthic macroinvertebrate community in estuarine and marine sediments, are not site-specific and do not constitute criteria or clean-up levels. They are intended to be conservative, and if exceeded, can serve as a point of departure for more detailed site-specific ecological risk analysis.
- A comparison of surface water COEC concentrations to Louisiana surface water numerical criteria and USEPA National Recommended Water Quality Criteria.
- For COECs that potentially bioaccumulate, quantification of potential risk to seven (7) selected semi-aquatic wildlife receptors (e.g., birds and mammals) using estimated plant and animal (prey) tissue concentrations as well as COEC concentrations in physical media. The selected wildlife receptors are as follows:

Class	Major Feeding Guild		
	Herbivore	**Omnivore**	**Carnivore**
Mammals	Nutria	Marsh Rice Rat; Raccoon	Mink
Birds	N/A	Wood Duck	Snowy Egret; Belted Kingfisher

- A May 2010 site characterization conducted by Dr. John H. Rodgers, Jr., (Clemson University, Department of Forestry and Natural Resources).

Sediment Screening

Sediment samples were collected in 2006 and 2010 by ICON Environmental Services, Inc. and/or Michael Pisani & Associates, Inc. The COECs analyzed included TPH, inorganics/metals, VOCs, and SVOCs. Arsenic and chromium concentrations in sediment are below background levels. Cadmium, lead, and PAH concentrations in sediment are below ERL SQGs. Mercury and zinc concentrations are below ERM SQGs.

Surface Water Screening

Surface water samples were collected in May 2010 by Michael Pisani & Associates, Inc. Arsenic, chromium, and strontium concentrations are below background levels. Lead, mercury, and zinc concentrations are below chronic aquatic life criteria.

Site-Specific Evaluation of Semi-aquatic Wildlife Receptors

To quantify risk to seven (7) selected wildlife receptors from potentially bioaccumulative COECs, cadmium, lead, mercury, selenium, zinc, and PAHs were further evaluated. Estimated tissue (prey) concentrations of these COECs were calculated using published uptake factors. The results of the evaluation demonstrate that acceptable wildlife exposure levels are not exceeded for any of these COECs.

Site Characterization

Rodgers (2010) concluded that the Site ecosystem is fully functioning. There is clear evidence of abundant healthy wildlife, and there is no evidence of adverse effects on wildlife or fish from past exploration and production activities.

Summary

The lines of evidence summarized above demonstrate that there are no unacceptable risks to the Site ecosystem. A no further action (NFA) determination for ecological receptors is therefore appropriate for the Vermilion Parish School Board property. This NFA determination contradicts the plaintiff's experts' reports (e.g., Barbee and Castille 2010; Miller 2010) that allege: (1) adverse ecological effects based on exceedances of the lowest SQGs (i.e., threshold effects levels [TELs] for freshwater sediment), which included

consideration of samples collected below the biologically active zone; and/or (2) presumed adverse effects to upper trophic level organisms via uptake of constituents through the food chain (with no quantitative analysis to support such a conclusion).

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TABLES

Table 1
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field																				
Sample ID	SED-1	SED-2	SED-3	SED-4	SED-5	SED-6	SED-7	SED-8	SED-8	SED-9	SED-9	SED-10	SED-11	SED-11	SED-12	SED-13	SED-13	SED-14	SED-15	SED-15	SED-115
Sample Depth (ft bgs)	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-2	0-0.5	0-2	0-0.5	0-2	0-2	0-0.5	0-2	0-2	0-0.5	0-2	0-2	0-0.5	0-0.5
Sample Date	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	2/25/10	5/6/10	2/25/10	5/5/10	2/25/10	2/25/10	5/6/10	2/25/10	2/26/10	5/6/10	2/26/10	2/26/10	5/6/10	5/6/10
Total Metals																					
Arsenic	3.93 B	5.17 B	8.82 B	1.58 B	6.18	3.31	3.47 B	4.42 B	4.062 B	3.92 B	6.612	4.37	7.68	4.386 B	3.43 B	4.47 B	5.018 B	3.56 B	6.01	6.748	4.815 B
Barium	379	334	335	342	123	227	726	741	496	457	671	691	2021	550	1016	632	909	1021	1777	943	781
Cadmium	0.04 B	1.26	<0.06	<0.01	<0.02	2.1	0.10 B	<0.03	<0.021	---	<0.027	---	---	<0.024	---	---	<0.030	---	0.43 B	<0.034	<0.030
Chromium	3.5	8.74	<0.16	5.27	<0.05	3.57	6.91	4.67	14.8	---	13.9	---	---	14.5	---	---	18.5	---	297.18	18	17.1
Lead	22.48	26.22	26.74	11.9	14.86	18.73	20.99	22.77	21.2	---	20.4	---	---	18.8	---	---	22	---	130.8	23.7	22.4
Mercury	0.09	0.06	0.14	0.04	0.04	0.88	0.08	0.07	0.098 U	0.06	0.115 U	0.09	0.09	0.096 U	0.07	0.07	0.105 U	0.07	0.61	0.167	0.148
Selenium	<1.17	<1.09	<1.74	<0.42	<0.50	<0.51	<0.80	<0.78	<0.643	<0.71	<0.822	<0.65	1.11 B	<0.731	1.53 B	1.65 B	<0.909	1.42 B	1.02 B	<1.016	<0.926
Strontium	59.81	54.78	79.17	59.09	36.2	80.2	47.13	48.91	41.1	---	46.1	---	---	44.2	---	---	55.3	---	136.01	65.4	53.0
Zinc	---	---	---	---	---	---	---	---	53.0	---	53.6	---	---	51.8	---	---	65.1	---	---	73.2	65.9
Polycyclic Aromatic Hydrocarbons																					
2-Methylnaphthalene	---	---	---	---	---	---	---	---	<0.044	---	<0.056	---	---	<0.053	---	---	<0.065	---	---	<0.069	<0.067
Acenaphthene	---	---	---	---	---	---	---	---	<0.046	---	<0.059	---	---	<0.056	---	---	<0.069	---	---	<0.073	<0.070
Acenaphthylene	---	---	---	---	---	---	---	---	<0.028	---	<0.036	---	---	<0.032	---	---	<0.040	---	---	<0.045	<0.041
Anthracene	---	---	---	---	---	---	---	---	<0.028	---	<0.036	---	---	<0.032	---	---	<0.044	---	---	<0.045	<0.044
Benzo(a)anthracene	---	---	---	---	---	---	---	---	<0.036	---	<0.046	---	---	<0.041	---	---	<0.051	---	---	<0.057	<0.052
Benzo(a)pyrene	---	---	---	---	---	---	---	---	<0.049	---	<0.063	---	---	<0.056	---	---	<0.069	---	---	<0.077	<0.070
Benzo(b)fluoranthene	---	---	---	---	---	---	---	---	<0.026	---	0.063 J	---	---	<0.029	---	---	<0.036	---	---	<0.041	<0.037
Benzo(k)fluoranthene	---	---	---	---	---	---	---	---	<0.039	---	<0.049	---	---	<0.044	---	---	<0.055	---	---	<0.061	<0.056
Chrysene	---	---	---	---	---	---	---	---	<0.028	---	0.069 J	---	---	<0.032	---	---	<0.040	---	---	<0.045	<0.041
Dibenz(a,h)anthracene	---	---	---	---	---	---	---	---	<0.023	---	<0.029	---	---	<0.026	---	---	<0.033	---	---	<0.036	<0.033
Fluoranthene	---	---	---	---	---	---	---	---	<0.018	---	<0.024	---	---	<0.021	---	---	<0.026	---	---	<0.029	<0.027
Fluorene	---	---	---	---	---	---	---	---	<0.026	---	<0.033	---	---	<0.029	---	---	<0.036	---	---	<0.040	<0.037
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	---	---	---	<0.033	---	0.313 J	---	---	<0.038	---	---	<0.047	---	---	<0.053	<0.048
Naphthalene	---	---	---	---	---	---	---	---	<0.028	---	<0.036	---	---	<0.032	---	---	<0.040	---	---	<0.045	<0.041
Phenanthrene	---	---	---	---	---	---	---	---	<0.033	---	<0.043	---	---	<0.038	---	---	<0.047	---	---	<0.053	<0.048
Pyrene	---	---	---	---	---	---	---	---	<0.118	---	<0.151	---	---	<0.135	---	---	<0.167	---	---	<0.187	<0.170
Other Parameters																					
Chlorides	7,617	5,522	5,160	1,869	1,558	1,573	5,287	4,361	2,121	4,006	2,138	2,432	3,812	3,099	3,053	6,429	3,542	3,950	2,161	3,837	3,507
Total Moisture (wt%)	78.6	77	85.6	40.6	50	51	68.6	67.9	61.1	64.8	69.6	61.8	65.9	65.8	67.9	73.4	72.5	71.9	53.9	75.4	73
AVS+ ∑ SEM (µmol/g)	---	---	---	---	---	---	---	---	---	---	18.36	---	---	27.94	---	---	81.28	---	---	93.52	55.09

Notes:

AVS - acid volatile sulfides

B - For inorganics, result is between Reporting Limit and Method Detection Limit

bgs - below ground surface

DW - dry weight

J - estimated value

JH - bias is likely high

SEM - simultaneously extracted metals

U - not detected based on quality control criteria

Sed 115 is a field duplicate of Sed 15.

Table 1
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field																						
Sample ID	SED-16	SED-17	SED-18	SED-19	SED-19	SED-20	SED-21	SED-22	SED-23	SED-24	SED-24	SED-25	SED-26	SED-26	SED-27	SED-28	SED-29	SED-30	SED-120	SED-31	SED-31	SED-32	SED-33
Sample Depth (ft bgs)	0-2	0-2	0-2	0-2	0-0.5	0-2	0-2	0-2	0-2	0-2	0-0.5	0-2	0-2	0-0.5	0-2	0-2	0-2	0-2	0-0.5	0-2	0-0.5	0-2	0-2
Sample Date	2/26/10	2/26/10	2/26/10	2/26/10	5/6/10	2/26/10	2/26/10	2/26/10	3/2/10	3/2/10	5/5/10	3/2/10	3/2/10	5/5/10	3/2/10	3/2/10	3/2/10	3/2/10	5/7/10	3/1/10	5/5/10	3/1/10	3/1/10
Total Metals																							
Arsenic	5.24 B	4.42 B	6.91	4.89	3.704 B	4.77 B	3.47 B	4.58 B	3.76 B	4.14 B	10.479	4.13 B	4.27 B	5.127	3.30 B	3.27 B	<1.06	3.60 B	3.657 B	1.16 B	8.031	2.21 B	2.60 B
Barium	324	1729	2139	4887	509	804	486	824	1234	885	1198	1449	1086	538	584	486	659	856	754	544	1097	473	670
Cadmium	---	---	---	<0.02	<0.038	---	---	---	---	---	0.026 BU	---	---	<0.026	---	0.22 B	0.11 B	0.27 B	0.217 BU	---	0.059 BU	---	---
Chromium	---	---	---	17.57	20.5	---	---	---	---	---	14.8	---	---	17.2	---	6.54	13.7	26.76	35.8	---	17	---	---
Lead	---	---	---	37.57	23.4	---	---	---	---	---	25.2	---	---	23.1	---	19.44	20.19	32.37	34	---	24.8	---	---
Mercury	0.09	0.07	0.12	0.21	0.176 U	0.08	0.04	0.07	0.07	0.11	0.111 U	0.08	0.32	0.159	0.08	0.61	0.11	0.08 B	0.411	0.04	0.159	0.04	0.08
Selenium	2.11 B	1.52 B	1.58 B	0.90 B	<1.157	1.24 B	1.17 B	1.54 B	1.61 B	1.72 B	<0.749	1.56 B	0.84 B	<0.796	0.97 B	<1.17	<1.20	<1.80	<1.429	0.88 B	<0.781	0.93 B	<1.25
Strontium	---	---	---	116.95	58.3	---	---	---	---	---	68.9	---	---	53.8	---	292.99	213.94	380.58	442.3	---	63.1	---	---
Zinc	---	---	---	---	70.4	---	---	---	---	---	62.0	---	---	64.0	---	---	---	---	414.3	---	64.7	---	---
Polycyclic Aromatic Hydrocarbons																							
2-Methylnaphthalene	---	---	---	---	<0.083	---	---	---	---	---	<0.051	---	---	<0.057	---	---	---	---	<0.103	---	<0.056	---	---
Acenaphthene	---	---	---	---	<0.088	---	---	---	---	---	<0.054	---	---	<0.061	---	---	---	---	<0.109	---	<0.059	---	---
Acenaphthylene	---	---	---	---	<0.051	---	---	---	---	---	<0.033	---	---	<0.035	---	---	---	---	<0.063	---	<0.034	---	---
Anthracene	---	---	---	---	<0.056	---	---	---	---	---	<0.033	---	---	<0.038	---	---	---	---	<0.069	---	<0.034	---	---
Benzo(a)anthracene	---	---	---	---	<0.065	---	---	---	---	---	<0.042	---	---	<0.045	---	---	---	---	<0.080	---	<0.044	---	---
Benzo(a)pyrene	---	---	---	---	<0.088	---	---	---	---	---	<0.057	---	---	<0.061	---	---	---	---	<0.109	---	<0.059	---	---
Benzo(b)fluoranthene	---	---	---	---	<0.046	---	---	---	---	---	<0.030	---	---	<0.032	---	---	---	---	<0.057	---	<0.031	---	---
Benzo(k)fluoranthene	---	---	---	---	<0.069	---	---	---	---	---	<0.045	---	---	<0.048	---	---	---	---	<0.086	---	<0.047	---	---
Chrysene	---	---	---	---	<0.051	---	---	---	---	---	0.036 J	---	---	<0.035	---	---	---	---	<0.063	---	<0.034	---	---
Dibenz(a,h)anthracene	---	---	---	---	<0.042	---	---	---	---	---	<0.027	---	---	<0.029	---	---	---	---	<0.052	---	<0.028	---	---
Fluoranthene	---	---	---	---	<0.034	---	---	---	---	---	<0.021	---	---	<0.023	---	---	---	---	<0.042	---	<0.023	---	---
Fluorene	---	---	---	---	<0.046	---	---	---	---	---	<0.030	---	---	<0.032	---	---	---	---	0.920 J	---	<0.031	---	---
Indeno(1,2,3-cd)pyrene	---	---	---	---	<0.060	---	---	---	---	---	<0.039	---	---	<0.041	---	---	---	---	<0.074	---	<0.041	---	---
Naphthalene	---	---	---	---	<0.051	---	---	---	---	---	<0.033	---	---	<0.035	---	---	---	---	<0.063	---	<0.034	---	---
Phenanthrene	---	---	---	---	<0.060	---	---	---	---	---	0.048 J	---	---	<0.041	---	---	---	---	<0.074	---	<0.041	---	---
Pyrene	---	---	---	---	<0.213	---	---	---	---	---	<0.138	---	---	<0.146	---	---	---	---	<0.263	---	<0.144	---	---
Other Parameters																							
Chlorides	6,703	3,795	5,290	2,384	5,139	3,144	3,098	5,481	2,763	2,902	2,482	4,162	2,378	2,869	5,591	9,299	10,144	16,043	10,400	9,286	2,469	6,797	14,200
Total Moisture (wt%)	81.5	69.7	74.1	64.6	78.4	69.4	68.3	68.8	64.6	65.2	66.6	66.6	65.3	68.6	72.1	78.6	79.2	86.1	82.5	70.6	68	71.9	80
AVS÷ ∑ SEM (µmol/g)	---	---	---	---	95.94	---	---	---	---	---	47.77	---	---	19.41	---	---	---	---	1.02	---	6.83	---	---

Notes:
AVS - acid volatile sulfides
B - For inorganics, result is between Reporting Limit and Method Detection Limit
bgs - below ground surface
DW - dry weight
J - estimated value
JH - bias is likely high
SEM - simultaneously extracted metals
U - not detected based on quality control criteria

Sed 120 (May 2010) corresponds to Sed 30 (March 2010).

Table 1
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field																								
Sample ID	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	SS12	SS13	SS14	SS15	B4	B5	B9	B12	B14	B17	B21	AB13	AB14
Sample Depth (ft bgs)	0-2.1	0-1	0-0.6	0-0.6	0-2.15	0-1.65	0-1.4	0-2	0-1.7	0-2	0-2.5	0-3.7	0-1	0-0.8	0-3	0-1	0-1.5	0-0.5	0-1.5	0-1	0-3	0-2	0-3'	0-3'
Sample Date	4/25/06	4/25/06	4/25/06	4/26/06	4/26/06	4/26/06	4/26/06	2/26/10	4/27/06	2/26/10	4/27/06	4/27/06	4/28/06	4/28/06	4/28/06	8/9/06	8/9/06	8/9/06	8/10/06	8/10/06	8/10/06	8/10/06	11/13/06	11/13/06
Total Metals																								
Arsenic	---	---	8.79	---	11.4	---	22	7.89	---	6.52	5.28	6.17	---	---	---	10	---	8.17	---	---	---	---	12.9	5.51
Barium	---	---	1600	---	7450	---	15700	1042	---	997	2750	2030	---	---	---	631	---	368	---	---	---	---	551	200
Cadmium	---	---	---	---	---	---	---	0.17 B	---	0.31 B	---	---	---	---	---	0.77	---	0.644	---	---	---	---	0.447	0.219
Chromium	---	---	17.9	---	21.8	---	20	4.96	---	4.64	25.1	12.7	---	---	---	---	---	---	---	---	---	---	7.73	12.8
Lead	---	---	28.8	---	117	---	67.5	35.18	---	23.31	63.6	49.9	---	---	---	28.7	---	23.1	---	---	---	---	8.11	14.4
Mercury	---	---	---	---	---	---	---	1.63	---	0.15	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Selenium	---	---	---	---	---	---	---	1.14 B	---	1.32 B	---	---	---	---	---	<4.72	---	<4.01	---	---	---	---	---	---
Strontium	---	---	74.3	---	140	---	231	74.52	---	61.26	64.8	72.9	---	---	---	59.3	---	64.1	---	---	---	---	459	121
Zinc	---	---	92.5	---	174	---	111	---	---	---	194	73.5	---	---	---	---	---	---	---	---	---	---	24.8	63.9
Polycyclic Aromatic Hydrocarbons																								
2-Methylnaphthalene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Acenaphthene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Acenaphthylene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Anthracene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Benzo(a)anthracene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Benzo(a)pyrene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Benzo(b)fluoranthene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Benzo(k)fluoranthene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Chrysene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Dibenz(a,h)anthracene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Fluoranthene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Fluorene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Naphthalene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Phenanthrene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Pyrene	---	---	<0.885	---	<0.776	---	<1.17	---	---	---	<0.466	<0.609	---	---	---	---	---	---	---	---	---	---	---	---
Other Parameters																								
Chlorides	1,950	1,600	825	3,850	1,430	1,700	2,050	---	1,500	---	540	610	1,900	2,250	1,400	10,000	5,800	7,390	7,360	2,750	7,950	3,700	73,800	15,500
Total Moisture (wt%)	62.6	53.5	62.7	75	57.5	70.8	71.7	63.9	61.7	69.8	29.2	45.8	65.8	43.9	64.3	78.4	71	74.4	76.8	50.2	81	76.4	86	62.8
AVS÷ ∑ SEM (µmol/g)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

AVS - acid volatile sulfides
B - For inorganics, result is between Reporting Limit and Method Detection Limit
bgs - below ground surface
DW - dry weight
J - estimated value
JH - bias is likely high
SEM - simultaneously extracted metals
U - not detected based on quality control criteria

Table 1
Sediment Analytical Data (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

					Background										
Sample ID	AB1	AB2	AB3	AB4	SED-BK-01	SED-BK-02	SED-BK-03	SED-BK-04	SED-BK-05	SED-BK-06	SED-BK-07	SED-BK-08	SED-BK-09	SED-BK-10	SED-BK-11
Sample Depth (ft bgs)	0-3	0-3'	0-3'	0-3'	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Sample Date	11/13/06	11/13/06	11/13/06	11/13/06	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/11/2010	5/10/2010	5/11/2010	5/11/2010	5/11/2010	5/19/2010	5/19/2010
Total Metals															
Arsenic	7.66	7.64	6.5	10	1.041 BJ	4.167 B	4.514 B	3.874 B	2.369 B	3.255 B	3.930 B	4.711 B	8.471	4.86 B	9.95
Barium	257	247	279	22.7	155 JH	288	347	582	388	768	463	383	264	274	319
Cadmium	0.406	0.316	0.312	0.356	<0.026	<0.025	0.049 B	0.099 B	<0.026	<0.028	<0.036	<0.034	<0.034	<0.0331	<0.042
Chromium	12.9	12.4	14.5	9.02	13.123	14.732	17.986	13.242	7.2	19.866	18.166	17.727	11.736	23.3	18.59
Lead	17.8	15.7	21	12.6	11.546	18.452	22.257	20.275	7.846	26.846	23.057	24.05	11.446	27.2	21.26
Mercury	---	---	---	---	0.104 JU	0.095 U	0.08 U	0.096	0.077 U	0.094 U	0.568	0.14	0.083 U	<0.011	<0.014
Selenium	---	---	---	---	<0.789	<0.744	<0.868	<0.687	<0.769	<0.839	<1.092	<1.033	<1.033	<0.996	<1.26
Strontium	106	87.2	63.9	100	69.401	44.643	45.833	41.758	84.308	59.396	61.135	64.463	84.711	103	100
Zinc	46.4	45.9	46.8	40.9	30.978	46.131	58.333	42.857	21.508	64.765	68.996	58.264	16.446	205 J	90.9
Polycyclic Aromatic Hydrocarbons															
2-Methylnaphthalene	---	---	---	---	<0.057	<0.051	<0.063	<0.047	<0.055	<0.057	<0.074	<0.074	<0.070	<0.068	<0.086
Acenaphthene	---	---	---	---	<0.060	<0.054	<0.066	<0.049	<0.058	<0.060	<0.079	<0.079	<0.074	<0.072	<0.091
Acenaphthylene	---	---	---	---	<0.035	<0.033	<0.038	<0.030	<0.034	<0.037	<0.048	<0.045	<0.045	<0.044	<0.056
Anthracene	---	---	---	---	<0.038	<0.033	<0.038	<0.030	<0.034	<0.037	<0.048	<0.045	<0.045	<0.044	<0.056
Benzo(a)anthracene	---	---	---	---	<0.044	<0.042	<0.049	<0.038	<0.043	<0.047	<0.061	<0.058	<0.058	<0.056	<0.071
Benzo(a)pyrene	---	---	---	---	<0.060	<0.057	<0.066	<0.052	<0.058	<0.064	<0.083	<0.079	<0.079	<0.076	<0.096
Benzo(b)fluoranthene	---	---	---	---	<0.032	<0.030	<0.035	<0.027	<0.031	<0.034	<0.044	<0.041	<0.041	<0.040	<0.051
Benzo(k)fluoranthene	---	---	---	---	<0.047	<0.045	<0.052	<0.041	<0.046	<0.050	<0.066	<0.062	<0.062	<0.060	<0.076
Chrysene	---	---	---	---	<0.035	<0.033	<0.038	<0.030	<0.034	<0.037	<0.048	<0.045	<0.045	<0.044	<0.056
Dibenz(a,h)anthracene	---	---	---	---	<0.028	<0.027	<0.031	<0.025	<0.028	<0.030	<0.039	<0.037	<0.037	<0.0356	<0.0452
Fluoranthene	---	---	---	---	<0.023	<0.021	<0.025	<0.020	<0.022	<0.024	<0.031	<0.030	<0.030	<0.029	<0.036
Fluorene	---	---	---	---	<0.032	<0.030	<0.035	<0.027	<0.031	<0.033	<0.043	<0.041	<0.041	<0.0397	<0.0504
Indeno(1,2,3-cd)pyrene	---	---	---	---	<0.041	<0.039	<0.045	<0.036	<0.040	<0.044	<0.057	<0.054	<0.054	<0.052	<0.066
Naphthalene	---	---	---	---	<0.035	<0.033	<0.038	<0.030	<0.034	<0.037	<0.048	<0.045	<0.045	<0.044	<0.056
Phenanthrene	---	---	---	---	<0.041	<0.039	<0.045	<0.036	<0.040	<0.044	<0.057	<0.054	<0.054	<0.052	<0.066
Pyrene	---	---	---	---	<0.145	<0.137	<0.160	<0.126	<0.142	<0.154	<0.201	<0.190	<0.190	<0.183	<0.232
Other Parameters															
Chlorides	10,500	10,000	10,800	13,800	1,139	1,750	1,024	687	1,406	3,826	961	1,950	1,054	2,382	1,626
Total Moisture (wt%)	81.9	85.6	82.8	86.1	68.3	66.4	71.2	63.6	67.5	70.2	77.1	75.8	75.8	74.9	80.2
AVS+ ∑ SEM (µmol/g)	---	---	---	---	0.34	64.52	89.39	41.82	4.23	15.79	45.26	67.54	0.30	0.23	1.35

Notes:
AVS - acid volatile sulfides
B - For inorganics, result is between Reporting Limit and Method Detection Limit
bgs - below ground surface
DW - dry weight
J - estimated value
JH - bias is likely high
SEM - simultaneously extracted metals
U - not detected based on quality control criteria

Table 2
Sediment AVS/SEM Data (umol/g-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Analyte	Sed 9	Sed 11	Sed 13	Sed 15	Sed 115	Sed 19	Sed 24	Sed 26	Sed 120	Sed 31
Sulfide, Acid-Volatile	9.5	20.1	56.5	33.6	15.1	60.9	13.8	16.9	1.66	4.7
Cadmium	<0.0024	0.0034	0.0031	<0.0023	<0.0021	0.0028	<0.0019	0.0039	<0.0031	0.0028
Copper	0.081	0.058	<0.008	<0.008	0.018	<0.009	0.021	0.02	<0.011	0.102
Lead	0.052	0.083	0.078	0.037	0.023	0.073	0.029	0.094	0.028	0.068
Nickel	0.057	0.077	0.049	0.032	0.021	0.05	0.029	0.088	<0.024	0.077
Zinc	0.325	0.498	0.557	0.28	0.21	0.5	0.208	0.665	1.559	0.438
AVS÷ ∑ SEM	18.36	27.94	81.28	93.52	55.09	95.94	47.77	19.41	1.02	6.83

Analyte	Sed Bk-01	Sed Bk-02	Sed Bk-03	Sed Bk-04	Sed Bk-05	Sed Bk-06	Sed Bk-07	Sed Bk-08	Sed Bk-09	Sed-Bk-10	Sed-Bk-11
Sulfide, Acid-Volatile	<0.052	20.4	20.3	8.9	0.617	4.8	14.5	15.4	<0.058	0.11	1.12
Cadmium	<0.0021	<0.0022	<0.0021	<0.0018	<0.0027	<0.0019	<0.0024	<0.002	<0.0022	<0.0031	<0.0027
Copper	0.01	0.052	0.044	0.019	0.011	0.01	0.014	0.015	0.016	0.016	<0.01
Lead	0.035	0.03	0.018	0.02	<0.015	0.036	0.027	0.022	0.031	0.062	0.044
Nickel	0.037	0.043	0.029	0.033	0.026	0.028	0.019	0.041	0.058	0.098	0.029
Zinc	0.067	0.189	0.134	0.139	0.091	0.228	0.258	0.148	0.083	0.308	0.745
AVS÷ ∑ SEM	0.34	64.52	89.39	41.82	4.23	15.79	45.26	67.54	0.30	0.23	1.35

Notes:
AVS - acid volatile sulfides
SEM - simultaneously extracted metals
DW - dry weight

Sed 115 is a field duplicate of Sed 15.

Table 3
Sediment Screening (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field				Background					Sediment Quality Guideline	
	Detection	Maximum	Arithmetic Mean	95% UCL	Detection	Maximum	Arithmetic Mean	std dev	Arithmetic Mean + Standard Deviation	ERL	ERM
Total Metals											
Arsenic	43/44	22	5.796	6.8	11/11	10	4.99	2.58	7.57	8.2	70
Barium	44/44	15700	1317	2956	11/11	768	343	112	456	--	--
Cadmium	15/25	2.1	0.279	0.485	3/11	0.406	0.063	0.076	0.139	1.2	9.6
Chromium	26/28	35.8	12.88	15.64	11/11	23.3	15.41	4.31	19.73	81	370
Lead	30/30	117	29.23	46.05	11/11	27.2	18.74	6.03	24.77	46.7	218
Mercury	35/35	1.63	0.185	0.407	9/11	0.568	0.124	0.152	0.276	0.15	0.71
Selenium	14/37	2.11	1.12	1.219	0/11	---	---	---	---	--	--
Strontium	30/30	459	109	197.1	11/11	106	71.1	21.7	92.8	--	--
Zinc	17/17	414.3	100.1	197.1	11/11	205	62.6	51.8	114	150	410
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	0/15	<0.103	---	---	0/11	<0.086	---	---	---	---	---
Acenaphthene	0/15	<0.109	---	---	0/11	<0.091	---	---	---	---	---
Acenaphthylene	0/15	<0.063	---	---	0/11	<0.056	---	---	---	---	---
Anthracene	0/15	<0.069	---	---	0/11	<0.056	---	---	---	---	---
Benzo(a)anthracene	0/15	<0.080	---	---	0/11	<0.071	---	---	---	---	---
Benzo(a)pyrene	0/15	<0.109	---	---	0/11	<0.096	---	---	---	---	---
Benzo(b)fluoranthene	1/15	<0.057	0.039	---	0/11	<0.051	---	---	---	---	---
Benzo(k)fluoranthene	0/15	<0.086	---	---	0/11	<0.076	---	---	---	---	---
Chrysene	2/15	<0.063	0.043	0.047	0/11	<0.056	---	---	---	---	---
Dibenz(a,h)anthracene	0/15	<0.052	---	---	0/11	<0.0452	---	---	---	---	---
Fluoranthene	0/15	<0.042	---	---	0/11	<0.036	---	---	---	---	---
Fluorene	1/15	0.92	0.122	---	0/11	<0.0504	---	---	---	---	---
Indeno(1,2,3-cd)pyrene	1/15	<0.074	0.074	---	0/11	<0.066	---	---	---	---	---
Naphthalene	0/15	<0.063	---	---	0/11	<0.056	---	---	---	---	---
Phenanthrene	1/15	<0.074	0.048	---	0/11	<0.066	---	---	---	---	---
Pyrene	0/15	<0.263	---	---	0/11	<0.232	---	---	---	---	---
Total LPAHs	---	1.401	0.421	0.902	---	0.461	0.338	0.064	0.401	---	---
Total HPAHs	---	0.826	0.552	0.646	---	0.729	0.531	0.102	0.633	---	---
Total PAHs	---	2.227	0.973	1.252	---	1.191	0.868	0.166	1.034	4.022	44.792
Other Parameters											
Chlorides	55/55	73,800	5,678	6,635	11/11	13,800	2,160	2,577	4738	---	---
Total Moisture (wt%)	57/57	86	67.7	70.25	11/11	86.1	72.92	5.87	78.8	---	---
AVS÷ $\sum$ SEM (µmol/g)	9/9	95.94	41.43	63.02	11/11	89.39	30.07	32.92	62.99	---	---

Notes:
AVS - acid volatile sulfides
DW - dry weight
ERL - Effects Range-Low for marine/estuarine sediments (Long *et al.* 1995)
ERM - Effects Range-Median for marine/estuarine sediments (Long *et al.* 1995)
HPAH - high molecular weight PAH
LPAH - low molecular weight PAH
PAH - polycyclic aromatic hydrocarbon
SEM - simultaneously extracted metals
UCL - upper confidence limit

Table 4
Surface Water Analytical Data (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field											Background										
Sample ID	SW-01	SW-02	SW-03	SW-04	SW-05	SW-06	SW-07	SW-09	SW-109	SW-10	SW-20	SW BK-01	SW BK-02	SW BK-03	SW BK-04	SW BK-05	SW BK-06	SW BK-07	SW BK-08	SW BK-09	SW-BK-10	SW-BK-11
Sample Date	5/6/2010	5/5/2010	5/5/2010	5/5/2010	5/5/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/7/2010	5/10/2010	5/10/2010	5/10/2010	5/10/2010	5/11/2010	5/11/2010	5/11/2010	5/11/2010	5/11/2010	5/19/2010	5/19/2010
Total Metals (Total Recoverable)																						
Arsenic	<0.00079	<0.00079	<0.00079	<0.00079	**0.0019 B**	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	**0.013**	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	**0.0024 B**	<0.00079	<0.00079	**0.004 B**	**0.0035 B**	**0.0054 B**
Barium	**0.28**	**0.29**	**0.3**	**0.27**	**0.29**	**0.39**	**0.45**	**0.42**	**0.41**	**0.38**	**1.23**	**0.3**	**0.31**	**0.3**	**0.32**	**0.31**	**0.43**	**0.44**	**0.34**	**0.31**	**0.22**	**0.25**
Cadmium	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	**0.00021 B**	<0.00016	0.00051 BU	0.00056 BU
Chromium	**0.0026 B**	**0.0023 B**	**0.0026 B**	**0.0022 B**	**0.0025 B**	**0.0025 B**	**0.0025 B**	**0.0027 B**	**0.0027 B**	**0.0022 B**	**0.0075 B**	**0.0035 B**	**0.0035 B**	**0.0027 B**	**0.0038 B**	**0.0034 B**	**0.0041 B**	**0.0026 B**	**0.0046 B**	**0.0039 B**	**0.0041 B**	**0.004 B**
Iron	**1.26**	**0.8**	**1.09**	**0.49**	**0.85**	**0.94**	**0.94**	**1.12**	**1.11**	**1.09**	**11.3**	**0.58**	**0.7**	**0.71**	**0.94**	**0.71**	**1.55**	**1.07**	**1.76**	**1.14**	---	---
Lead	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	**0.021**	**0.0017 B**	<0.0015	<0.0015	**0.0015 B**	<0.0015	**0.0019 B**	<0.0015	**0.003 B**	**0.0034 B**	**0.0058 B**	**0.0042 B**
Magnesium	**88.2**	**100**	**98.3**	**103**	**99.1**	**127**	**130**	**140**	**141**	**120**	**149**	**157**	**166**	**126**	**161**	**156**	**244**	**138**	**162**	**152**	**52.3**	**76.2**
Manganese	**0.23**	**0.27**	**0.3**	**0.16**	**0.31**	**0.46**	**0.61**	**0.51**	**0.5**	**0.48**	**0.83**	**0.15**	**0.23**	**0.34**	**0.29**	**0.16**	**0.88**	**0.59**	**0.25**	**0.24**	---	---
Mercury	0.00007 U	0.00009 U	0.00007 U	0.00009 U	0.00009 U	0.00008 U	0.00008 U	0.00011 U	0.00006 U	0.00007 U	0.0001 U	<0.000055	<0.000055	<0.000055	<0.000055	<0.000055	<0.000055	<0.000055	**0.00007 B**	<0.000055	<0.000055	<0.000055
Selenium	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037
Strontium	**0.64**	**0.71**	**0.7**	**0.72**	**0.72**	**0.9**	**0.95**	**0.99**	**1.01**	**0.86**	**1.74**	**1.04**	**1.13**	**0.95**	**1.09**	**1.04**	**1.65**	**0.96**	**1.03**	**1.05**	**0.38**	**0.52**
Zinc	**0.0062 B**	**0.0045 B**	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	**0.067**	**0.0045 B**	**0.13**	**0.013 B**	**0.01 B**	**0.0074 B**	**0.0092 B**	<0.004	**0.0085 B**	**0.0076 B**	**0.013 B**	**0.0097 B**
Total Metals (Dissolved)																						
Arsenic	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	**0.0075 B**	<0.00079	<0.00079	<0.00079	<0.00079	<0.00079	**0.0047 B**	**0.0033 B**	<0.00079	<0.00079	**0.003 B**	**0.0029 B**
Barium	**0.28**	**0.28**	**0.29**	**0.26**	**0.26**	**0.37**	**0.42**	**0.37**	**0.38**	**0.35**	**1.1**	**0.28**	**0.3**	**0.28**	**0.29**	**0.3**	**0.39**	**0.4**	**0.31**	**0.33**	**0.14**	**0.18**
Cadmium	0.00026 U	0.00027 U	<0.00016	0.00035 U	<0.00016	0.0002 U	0.00024 U	<0.00016	0.00027 U	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	<0.00016	**0.00086 B**	**0.00078 B**
Chromium	**0.0017 B**	**0.0016 B**	**0.0018 B**	**0.0017 B**	**0.0018 B**	**0.0021 B**	**0.002 B**	**0.0024 B**	**0.0022 B**	**0.0022 B**	**0.0051 B**	**0.0032 B**	**0.0033 B**	**0.0025 B**	**0.003 B**	**0.003 B**	**0.0036 B**	**0.0024 B**	**0.0028 B**	**0.003 B**	**0.00071 B**	**0.0011 B**
Lead	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	**0.0088**	**0.0023 B**	<0.0015	<0.0015	<0.0015	<0.0015	**0.0021 B**	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015
Mercury	<0.000055	**0.00009 B**	**0.00009 B**	**0.00006 B**	**0.00007 B**	**0.0001 B**	**0.00009 B**	**0.0001 B**	**0.00006 B**	**0.00012 B**	<0.000055	**0.00006 B**	<0.000055	<0.000055	**0.00006 B**	<0.000055	<0.000055	<0.000055	<0.000055	<0.000055	<0.000055	<0.000055
Selenium	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037
Strontium	**0.69**	**0.74**	**0.71**	**0.73**	**0.69**	**0.91**	**0.93**	**1**	**1.03**	**0.88**	**1.66**	**1.05**	**1.12**	**0.84**	**1.06**	**1.04**	**1.56**	**0.95**	**1.04**	**1.06**	**0.34**	**0.52**
Zinc	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	**0.0095 B**	<0.004	<0.004	**0.023**	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Polycyclic Aromatic Hydrocarbons																						
2-Methylnaphthalene	<0.0000519	<0.0000527	<0.0000527	<0.0000525	<0.0000514	<0.0000522	<0.0000519	<0.0000519	<0.0000519	<0.0000519	<0.0000514	<0.0000522	<0.0000522	<0.0000525	<0.0000519	<0.0000519	<0.0000519	<0.000053	<0.0000519	<0.0000519	<0.0000519	<0.0000536
Acenaphthene	<0.0000137	<0.0000139	<0.0000139	<0.0000138	<0.0000135	<0.0000137	<0.0000137	<0.0000137	<0.0000137	<0.0000137	<0.0000135	<0.0000137	<0.0000137	<0.0000138	<0.0000137	<0.0000137	**0.000131**	<0.000014	<0.0000137	<0.0000137	<0.0000137	<0.0000141
Acenaphthylene	<0.0000149	<0.0000151	<0.0000151	<0.0000151	<0.0000147	<0.000015	<0.0000149	<0.0000149	<0.0000149	<0.0000149	<0.0000147	<0.000015	<0.000015	<0.0000151	<0.0000149	<0.0000149	<0.0000149	<0.0000152	<0.0000149	<0.0000149	<0.0000149	<0.0000154
Anthracene	<0.00000918	<0.00000933	<0.00000933	<0.00000928	<0.00000909	<0.00000923	<0.00000918	<0.00000918	<0.00000918	<0.00000918	<0.00000909	<0.00000923	<0.00000923	<0.00000928	<0.00000918	<0.00000918	<0.00000918	<0.0000938	<0.00000918	<0.00000918	<0.00000918	<0.00000947
Benzo(a)anthracene	<0.0000503	<0.0000511	<0.0000511	<0.0000508	<0.0000498	<0.0000506	<0.0000503	<0.0000503	<0.0000503	<0.0000503	<0.0000498	<0.0000506	<0.0000506	<0.0000508	<0.0000503	<0.0000503	<0.0000503	<0.0000514	<0.0000503	<0.0000503	<0.0000503	<0.0000519
Benzo(a)pyrene	<0.0000137	<0.0000139	<0.0000139	<0.0000138	<0.0000135	<0.0000137	<0.0000137	<0.0000137	<0.0000137	<0.0000137	<0.0000135	<0.0000137	<0.0000137	<0.0000138	<0.0000137	<0.0000137	<0.0000137	<0.000014	<0.0000137	<0.0000137	<0.0000137	<0.0000141
Benzo(b)fluoranthene	<0.0000328	<0.0000333	<0.0000333	<0.0000331	<0.0000324	<0.0000329	<0.0000328	<0.0000328	<0.0000328	<0.0000328	<0.0000324	<0.0000329	<0.0000329	<0.0000331	<0.0000328	<0.0000328	<0.0000328	<0.0000334	<0.0000328	<0.0000328	<0.0000328	<0.0000338
Benzo(k)fluoranthene	<0.0000223	<0.0000227	<0.0000227	<0.0000226	<0.0000221	<0.0000225	<0.0000223	<0.0000223	<0.0000223	<0.0000223	<0.0000221	<0.0000225	<0.0000225	<0.0000226	<0.0000223	<0.0000223	<0.0000223	<0.0000228	<0.0000223	<0.0000223	<0.0000223	<0.0000231
Chrysene	<0.0000043	<0.0000436	<0.0000436	<0.0000434	<0.0000425	<0.0000432	<0.0000043	<0.0000043	<0.0000043	<0.0000043	<0.0000425	<0.0000432	<0.0000432	<0.0000434	<0.0000043	<0.0000043	<0.0000043	<0.0000439	<0.000043	<0.000043	<0.0000043	<0.0000443
Dibenz(a,h)anthracene	<0.0000195	<0.0000198	<0.0000198	<0.0000197	<0.0000193	<0.0000196	<0.0000195	<0.0000195	<0.0000195	<0.0000195	<0.0000193	<0.0000196	<0.0000196	<0.0000197	<0.0000195	<0.0000195	<0.0000195	<0.0000199	<0.0000195	<0.0000195	<0.0000195	<0.0000201
Fluoranthene	<0.0000134	<0.0000136	<0.0000136	<0.0000135	<0.0000132	<0.0000134	<0.0000134	<0.0000134	<0.0000134	<0.0000134	<0.0000132	<0.0000134	<0.0000134	<0.0000135	<0.0000134	<0.0000134	<0.0000134	<0.0000136	<0.0000134	<0.0000134	<0.0000134	<0.0000138
Fluorene	<0.0000184	<0.0000187	<0.0000187	<0.0000186	<0.0000182	<0.0000185	<0.0000184	<0.0000184	<0.0000184	<0.0000184	<0.0000182	<0.0000185	<0.0000185	<0.0000186	<0.0000184	<0.0000184	<0.0000184	<0.0000188	<0.0000184	<0.0000184	<0.0000184	<0.0000189
Indeno(1,2,3-cd)pyrene	<0.0000171	<0.0000174	<0.0000174	<0.0000173	<0.000017	<0.0000172	<0.0000171	<0.0000171	<0.0000171	<0.0000171	<0.000017	<0.0000172	<0.0000172	<0.0000173	<0.0000171	<0.0000171	<0.0000171	<0.0000175	<0.0000171	<0.0000171	<0.0000171	<0.0000177
Naphthalene	<0.0000285	<0.0000287	<0.0000287	<0.0000286	<0.000028	<0.0000284	<0.0000283	<0.0000283	<0.0000283	<0.0000283	<0.000028	<0.0000284	<0.0000284	<0.0000286	<0.0000283	<0.0000283	<0.0000283	<0.0000289	<0.0000283	<0.0000283	<0.0000283	<0.0000292
Phenanthrene	<0.0000166	<0.0000169	<0.0000169	<0.0000168	<0.0000165	<0.0000167	<0.0000166	<0.0000166	<0.0000166	<0.0000166	<0.0000165	<0.0000167	<0.0000167	<0.0000168	<0.0000166	<0.0000166	<0.0000166	<0.000017	<0.0000166	<0.0000166	<0.0000166	<0.0000172
Pyrene	<0.0000181	<0.0000183	<0.0000183	<0.0000182	<0.0000179	<0.0000182	<0.0000181	<0.0000181	<0.0000181	<0.0000181	<0.0000179	<0.0000182	<0.0000182	<0.0000182	<0.0000181	<0.0000181	<0.0000181	<0.0000184	<0.0000181	<0.0000181	<0.0000181	<0.0000186
Other Parameters																						
Bicarbonate Alkalinity (mg/L CaCO3)	---	---	---	---	---	60 R	---	---	67.4	---	---	---	64.6	---	---	63.5	---	75.1	---	---	---	---
Carbonate Alkalinity (mg/L CaCO3)	---	---	---	---	---	<0.17	---	---	<0.17	---	---	---	<0.17	---	---	<0.17	---	<0.17	---	---	---	---
Calcium	**39.4**	**44.1**	**43.3**	**44.6**	**43.1**	**54.3**	**56.1**	**58.6**	**59.4**	**50.6**	**73.9**	**65.8**	**71.5**	**52.8**	**66.4**	**65.9**	**97.7**	**57**	**70**	**63.2**	**24.6**	**35.7**
Chloride	**1,210**	**1,330**	**1,250**	**1,420**	**1,290**	**1,610**	**1,640**	**1,870**	**1,840**	**1,610**	**2,220**	**2,510**	**2,680**	**2,060**	**2,660**	**2,550**	**3,690**	**2,210**	**2,490**	**2,530**	**834**	**1,240**
Hardness	**378**	**432**	**424**	**441**	**425**	**541**	**554**	**591**	**597**	**619**	**677**	**811**	**863**	**652**	**828**	**808**	**1,250**	**709**	**840**	**785**	**277**	**403**
Potassium	**29.2**	**33.3**	**32.7**	**34.4**	**33.1**	**38.6 JH**	**40.7**	**42.6**	**42.9**	**37.2**	**59.6**	**52**	**54.7**	**42.2**	**53.4**	**53**	**70.4**	**42.9**	**50.3**	**50.5**	---	---
Salinity (ppt)	**2.4**	---	---	---	---	---	---	**3.7**	---	**3.2**	---	**4.5**	---	---	**4.5**	---	**6.3**	---	---	---	---	---
Sodium	**631**	**727**	**771**	**808**	**769**	**935**	**981**	**915**	**1100**	**917**	**1230**	**1230**	**1320**	**1050**	**1340**	**1270**	**2010**	**1080**	**1180**	**1230**	---	---
Sulfate	**105**	---	---	---	---	---	---	**83.9**	---	**106**	---	**149**	---	---	**215**	---	**187**	---	---	---	---	---
Total Dissolved Solids (TDS)	**2,710**	**2,900**	**2,780**	**3,050**	**2,880**	**3,800**	**3,590**	**4,220**	**4,150**	**3,520**	**4,920**	**4,800**	**5,080**	**3,820**	**4,840**	**4,660**	**6,580**	**4,010**	**4,720**	**4,870**	**1,530**	**2,330**

Notes:

B - For inorganics, result is between Reporting Limit and Method Detection Limit

JH - bias is likely high

U - not detected based on quality control criteria

SW 109 is a field duplicate of SW 09.

Table 5
Surface Water Field Measurements
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Location	Date	Temperature (°C)	pH	Conductivity (uS/cm)	Turbidity (NTU)	RDO (mg/L)	ORP (mV)	TDS (mg/L)	Water Depth	Sample Intake
SW-05	5/5/2010	29.8	7.97	5,053	NA	NA	202	3,896	2' 4"	1'
SW-03	5/5/2010	30	7.68	5,356	NA	NA	166	4,145	1' 10"	6"
SW-02	5/5/2010	31.7	8.86	5,253	NA	NA	154	4,030	2' 5"	1' 2"
SW-04	5/5/2010	31.2	8.25	5,430	NA	NA	57	4,178	1' 11"	1'
SW-01[1]	5/6/2010	27.24	8.24	4,909	118	9.23	211	NA	3' 6"	1' 7"
SW-06[1]	5/6/2010	28.32	7.9	6,293	59.67	10	183	NA	1' 11"	1'
SW-07[1]	5/6/2010	29.76	8.05	6,769	47.43	10.14	159	NA	4' 5"	2' 2"
SW-10	5/6/2010	31.6	7.51	6,348	NA	NA	191	4,972	4' 6"	2'3"
SW-09	5/6/2010	31.7	7.98	6,478	NA	NA	186	5,047	3'3"	1' 6"
SW-20	5/7/2010	NA	NA	NA	NA	NA	NA	NA	4"	4"
SW Bk-06	5/10/2010	NA	NA	NA	NA	NA	NA	NA	2' 5"	1' 2"
SW Bk-01	5/10/2010	28.2	7.27	8,082	NA	NA	198	6,529	2' 11"	1' 5"
SW Bk-02	5/10/2010	27.4	7.44	8,433	NA	NA	213	6,863	2' 11"	1' 6"
SW Bk-03	5/10/2010	28.6	7.91	6,495	NA	NA	190	5,129	4'	2'
SW Bk-04	5/10/2010	27.7	7.97	7,942	NA	NA	196	6,430	1' 5"	0.75'
SW Bk-09	5/11/2010	26.2	7.79	7,846	NA	NA	188	6,319	1' 4"	8,,
SW Bk-05	5/11/2010	26.9	7.42	7,851	NA	NA	212	6,302	13'	6' 5"
SW Bk-05	5/11/2010	28.3	7.57	8,000	NA	NA	186	6,432	13'	11'
SW Bk-07	5/11/2010	30.1	8.01	7,004	NA	NA	183	5,521	5' 3"	2' 6"
SW Bk-08	5/11/2010	30.9	8.08	7,791	NA	NA	185	6,207	2' 8"	1' 4"
SW Bk-11[1]	5/19/2010	31.54	6.5	4,588	294.3	7.56	148	NA	3' 1,,	1' 5"
SW Bk-10[1]	5/19/2010	31.58	7.34	3,119	231.5	7.4	215	NA	2' 6"	1' 3"

Notes:
ORP - oxidation reduction potential
RDO - rugged dissolved oxygen
TDS - total dissolved solids

Surface water field measurements were taken with an In-Situ Troll 95001 or an Ultrameter II.

June 2010

Table 6
Surface Water Screening (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	East White Lake Oil and Gas Field				Background					Aquatic Life Criteria - Chronic			
	Detection	Maximum	Arithmetic Mean	95% UCL	Detection	Maximum	Arithmetic Mean	std dev	Arithmetic Mean + Standard Deviation	Freshwater	Marine Water	Brackish Water	
Total Metals (Total Recoverable)													
Arsenic	2/10	0.013	0.0021	0.00574	4/11	0.0056 B	0.0019	0.0017	0.0036	—	—	—	
Barium	10/10	1.23	0.43	0.597	11/11	0.44	0.32	0.07	0.39	—	—	—	
Cadmium	0/10	—	—	—	3/11	0.00056 B	0.00023	0.00015	0.00038	—	—	—	
Chromium	10/10	0.0075 B	0.0030	0.00389	11/11	0.0046 B	0.0037	0.0006	0.0043	—	—	—	
Iron	10/10	11.3	1.99	6.507	9/9	1.76	1.02	0.41	1.43	—	—	—	
Lead	1/10	0.021	0.0035	—	7/11	0.0058 B	0.0025	0.0014	0.0039	—	—	—	
Magnesium	10/10	149	116	127.4	11/11	244	145	49.8	194	—	—	—	
Manganese	10/10	0.83	0.42	0.533	9/9	0.88	0.35	0.24	0.59	—	—	—	
Mercury	0/10	—	—	—	1/11	0.00007 B	0.00006	0.000005	0.00006	0.000012	0.000025	0.000012	1
Potassium	10/10	59.6	38.2	43.28	9/9	70.4	52.2	8.2	60.3	—	—	—	
Selenium	0/10	—	—	—	0/11	—	—	—	—	0.005	—	0.005	2
Sodium	10/10	1230	878	977.7	9/9	2010	1301	283	1584	—	—	—	
Strontium	10/10	1.74	0.89	1.083	11/11	1.65	0.98	0.33	1.31	—	—	—	
Zinc	3/10	0.067	0.011	0.0242	10/11	0.13	0.020	0.037	0.056	—	—	—	
Total Metals (Dissolved)													
Arsenic	1/10	0.0075 B	0.0015	—	4/11	0.0047 B	0.0018	0.0014	0.0032	0.150	0.036	0.036	1
Barium	10/10	1.1	0.40	0.545	11/11	0.4	0.291	0.077	0.368	—	—	—	
Cadmium	0/10	—	—	—	2/11	0.00086 B	0.00028	0.00027	0.00055	0.00287	0.010	0.00287	1
Chromium	10/10	0.0051 B	0.0022	0.00283	11/11	0.0036 B	0.0026	0.0009	0.0035	0.554	0.103	0.103	1
Lead	1/10	0.0088	0.0022	—	2/11	0.0023 B	0.0016	0.0003	0.0019	0.01094	0.00808	0.00808	1
Mercury	8/10	0.00012 B	0.00008	0.000094	2/11	0.00006 B	0.00006	0.000002	0.00006	0.00077	0.00094	0.00077	2
Selenium	0/10	—	—	—	0/11	—	—	—	—	—	0.071	0.071	2
Strontium	10/10	1.66	0.90	1.068	11/11	1.56	0.96	0.32	1.28	—	—	—	
Zinc	2/10	0.023	0.0062	0.0124	0/11	—	—	—	—	0.338	0.081	0.081	1
Polycyclic Aromatic Hydrocarbons													
2-Methylnaphthalene	0/10	<0.0000527	—	—	0/11	<0.0000519	—	—	—	—	—	—	
Acenaphthene	0/10	<0.0000139	—	—	1/11	0.000131	0.000024	0.000035	0.000060	—	—	—	
Acenaphthylene	0/10	<0.0000151	—	—	0/11	<0.0000149	—	—	—	—	—	—	
Anthracene	0/10	<0.00000933	—	—	0/11	<0.00000918	—	—	—	—	—	—	
Benzo(a)anthracene	0/10	<0.0000511	—	—	0/11	<0.0000503	—	—	—	—	—	—	
Benzo(a)pyrene	0/10	<0.0000139	—	—	0/11	<0.0000137	—	—	—	—	—	—	
Benzo(b)fluoranthene	0/10	<0.0000333	—	—	0/11	<0.0000328	—	—	—	—	—	—	
Benzo(k)fluoranthene	0/10	<0.0000227	—	—	0/11	<0.0000223	—	—	—	—	—	—	
Chrysene	0/10	<0.0000436	—	—	0/11	<0.000043	—	—	—	—	—	—	
Dibenz(a,h)anthracene	0/10	<0.0000198	—	—	0/11	<0.0000195	—	—	—	—	—	—	
Fluoranthene	0/10	<0.0000136	—	—	0/11	<0.0000134	—	—	—	—	—	—	
Fluorene	0/10	<0.0000187	—	—	0/11	<0.0000184	—	—	—	—	—	—	
Indeno(1,2,3-cd)pyrene	0/10	<0.0000174	—	—	0/11	<0.0000171	—	—	—	—	—	—	
Naphthalene	0/10	<0.0000287	—	—	0/11	<0.0000283	—	—	—	—	—	—	
Phenanthrene	0/10	<0.0000169	—	—	0/11	<0.0000166	—	—	—	—	—	—	
Pyrene	0/10	<0.0000183	—	—	0/11	<0.0000181	—	—	—	—	—	—	
Other Parameters													
Bicarbonate Alkalinity (mg/L CaCO3)	1/1	67.4	67.4	—	3/3	75.1	67.7	6.4	74.1	—	—	—	
Carbonate Alkalinity (mg/L CaCO3)	0/2	—	—	—	0/3	—	—	—	—	—	—	—	
Calcium	10/10	73.9	50.7	56.83	11/11	97.7	61.0	19.2	80.1	—	—	—	
Hardness	10/10	677	509	567.3	11/11	1,250	748	253	1,001	—	—	—	
Magnesium	10/10	149	116	127.4	11/11	344	145	49.8	194	—	—	—	
Chloride	10/10	2,220	1,544	1,726	11/11	3,690	2,314	757	3,071	—	—	—	
Salinity (ppt)	3/3	3.7	3.1	—	3/3	6.3	5.1	1.0	6.1	—	—	—	
Sulfate	3/3	106	98.3	—	3/3	215	184	33	217	—	—	—	
Total Dissolved Solids (TDS)	10/10	4,920	3,434	3,849	11/11	6,580	4,295	1,373	5,667	—	—	—	

Notes:
UCL - upper confidence limit
Brackish criteria are the lower of freshwater and marine water, where criteria for both are available.
(1) - Louisiana aquatic life criteria from Title 33, Part IX, Subpart 1, Section 1113. A hardness of 400 mg/L CaCO3 (the maximum allowed) was used to derive freshwater criteria for applicable metals. Depending on the inorganic/metal, the criteria are expressed in terms of the dissolved metal or total recoverable metal in the water column. The Louisiana criteria for mercury is based on methylmercury. Laboratory analyses for East White Lake (as presented above) are based on total (inorganic and organic) mercury. The concentration of methylmercury in surface water can be estimated by multiplying the above results by 0.0087 (0.87%) based upon a state-wide study of methylmercury fractions in Louisiana sediments (DeLaune *et al.* 2009).
(2) - National Recommended Water Quality Criteria (USEPA 2009). Depending on the inorganic/metal, the criteria are expressed in terms of the dissolved metal or total recoverable metal in the water column. The national criteria for mercury was derived from data for inorganic mercury (II) but is applied as total mercury.

Table 7
Wildlife Diets
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Common Name	Scientific Name	Note	Percent of Diet (by Volume/Mass)[1]		
			Aquatic Plants	Benthic Invertebrates	Forage Fish
Birds					
Wood duck	*Aix sponsa*	2	50	50	
Snowy egret	*Egretta thula*	3		35	65
Belted kingfisher	*Ceryle alcyon*	4		15	85
Mammals					
Marsh rice rat	*Oryzomys palustris*	5	50	50	
Nutria	*Myocastor coypus*	6	100		
Raccoon	*Procyon lotor*	7		80	20
Mink	*Mustela vison*	8		35	65

1. Based on information from references noted below, field observations by locally-experienced ecologist, and professional judgment. Information from references is simplified to reduce diet to broad component categories, primarily to focus on aquatic prey.
2. Hepp and Belrose (1995)
3. Kushlan (1978)
4. Hamas (1994)
5. Wolfe (1982)
6. Woods *et al.* (1992)
7. Lotze and Anderson (1979); Kaufmann (1982)
8. Linscombe *et al.* (1982); Lariviere (1999)

Table 8
Wildlife Ingestion-Pathway Exposures
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Common Name	Scientific Name	Feeding Behavior and Trophic Guild Representation	Body Weight (BW)(kg)[1]	Food Ingestion Rate (kg/day-DW)	Note	Water Ingestion Rate L/day	Note	Soil/Sediment Ingestion Rate (kg/day-DW)[2]	
Birds									
Wood duck	*Aix sponsa*	Littoral/riparian zone dabbling/gleaning omnivore	0.658	0.0443	a	0.0445	f	0.0049	11%
Snowy egret	*Egretta thula*	Littoral/riparian zone ambushing/stalking carnivore	0.371	0.0139	b	0.0304	f	0.0003	2%
Belted kingfisher	*Ceryle alcyon*	Littoral/riparian zone diving/plunging carnivore (piscivore)	0.148	0.0167	a	0.0164	f	0.0002	1%
Mammals									
Marsh rice rat	*Oryzomys palustris*	Littoral/riparian zone foraging/gleaning omnivore	0.051	0.0057	e	0.0068	g	0.0002	3%
Nutria	*Myocastor coypus*	Littoral/riparian zone foraging herbivore	9	0.4324	d	0.7152	g	0.0432	10%
Raccoon	*Procyon lotor*	Littoral/riparian zone gleaning omnivore	3.91	0.2107	c	0.3378	g	0.0198	9.4%
Mink	*Mustela vison*	Littoral/riparian zone pursuing carnivore (piscivore)	1	0.0687	c	0.0990	g	0.0034	5%

1. Adult body mass as midpoint of extremes from references noted below. All bird values taken from Dunning (1993). rat and nutria values from Davis and Schmidly (1994); raccoon values from Silva and Downing (1995); and mink values from Linscombe *et al.* (1982).
2. Additional (incidental) ingestion of sediment and/or soil expressed as percentage of food ingestion rate; obtained from Beyer *et al.* (1994) [wood duck, raccoon], Hamilton (1940) [mink] or estimated based on professional judgment considering feeding behavior. Percentages used are indicated in parentheses.

a. Based on allometric equation for all birds: kg/day = $0.0582 * BW^{0.651}$ (kg) [Equation 3-3 in USEPA (1993)]
b. Based on allometric relationship developed for wading birds by Kushlan (1978), [g WW/day]:log FI = (0.966 * log BW) -0.640 (g).
c. Based on allometric equation for all mammals: kg/day = $0.0687\ BW^{0.822}$ (kg) [Equation 3-7 in USEPA (1993)]
d. Based on allometric equation for herbivorous mammals: g/day = $0.577\ BW^{0.577}$ (g) [Equation 3-9 in USEPA 1993)]
e. Based on allometric equation for rodents: g/day = $0.621\ BW^{0.564}$ (g) [Equation 3-8 in USEPA (1993)]
f. Based on allometric equation for birds: L/day = $0.059\ BW^{0.67}$ (kg) [Equation 3-15 in USEPA (1993)]
g. Based on allometric equation for mammals: L/day = $0.099\ BW^{0.90}$ (kg) [Equation 3-17 in USEPA (1993)]

Table 9
Wildlife Foraging Areas
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Receptor	Foraging Area (acres or miles of shoreline)	References/Comments
Birds		
Wood Duck	900 acres	Average of breeding females in southern Georgia (Hartke and Hepp 2004)
Snowy Egret	1.2 miles of shoreline	Based on typical daily flight distance (Custer and Osborn 1978)
Belted Kingfisher	0.6 mile of shoreline	Brooks and Davis (1987)
Mammals		
Marsh Rice Rat	0.64 acre	Average home range reported by Wolfe (1982)
Nutria	4 acres	Average home range reported by Woods *et al.* (1992)
Raccoon	128 acres	Home range in coastal marsh (Lotze and Anderson 1979)
Mink	0.8 mile	"Typical home range" in coastal streams (Lariviere 1999)

Table 10
Wildlife Area Use Factors
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Receptor	Trophic Guild Representation	Area Use Factor [1] (%)	Comments/Rationale [2]
Birds			
Wood duck	Littoral/riparian zone dabbling/gleaning omnivore	100	Will likely focus mainly on bayou/canals at depths <3 ft
Snowy egret	Littoral/riparian zone ambushing/stalking carnivore	100	Will likely focus mainly on shallow edges of bayou/canals
Belted kingfisher	Littoral/riparian zone diving/plunging carnivore (piscivore)	100	Will likely focus on surface of open parts of bayou/canals
Mammals			
Marsh rice rat	Littoral/riparian zone foraging/gleaning omnivore	100	Will likely focus mainly on shallow edges of bayou/canals
Nutria	Littoral/riparian zone foraging herbivore	100	Will likely focus mainly on shallow edges of bayou/canals
Raccoon	Littoral/riparian zone gleaning omnivore	100	Will likely focus mainly on shallow edges of bayou/canals
Mink	Littoral/riparian zone pursuing carnivore (piscivore)	100	Will likely focus mainly on shallow edges of bayou/canals

Notes:

1. Fraction of total study area; a conservatively biased estimate based on animals' typical foraging behavior, morphological constraints, and relative availability of habitat type(s).
2. Narrative summarizing bases for foraging habitats, based on literature regarding diets and foraging behaviors, as well as professional judgment (see text).

Table 11
Uptake Factors
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Constituent	BAF_{AVP}[1] (mg COC/kg dry tissue) / (mg COC/kg dry sediment)		BAF_{BI}[2] (mg COC/kg dry tissue) / (mg COC/kg dry sediment)		BAF_{Fish}[3] (mg COC/kg dry tissue) / (mg COC/kg dry sediment)	
Metals						
Cadmium	0.586	a	0.600	b	0.273	e
Lead	0.0389	a	0.071	b	0.069	e
Mercury	0.866	c	1.41	c	2.49	c
Selenium	0.672	a	1.0	d	2.293	e
Zinc	0.366	a	1.936	b	1.396	e
SVOCs[4]						
Total LPAHs	0.274	f	0.35	g	1.00	d
Total HPAHs	1.14	f	1.5	g	0.12	h

1. BAF_{AVP} = bioaccumulation (uptake) factor from sediment to aquatic vascular plants.
2. BAF_{BI} = bioaccumulation (uptake) factor from sediment to benthic invertebrates.
3. BAF_{Fish} = bioaccumulation (uptake) factor from sediment to fish.
4. Total Low-Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs) and Total High-Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs).

a. BJC 1998a (table 6).
b. BJC 1998b (table 2).
c Chumchal *et al.* 2008. Sediment and whole-body tissue concentrations of methylmercury (table 3 - water hyacinth; unionid mussel, belostomatid; golden topminnow and pirate perch).
d. Default BAF of 1.0.
e. Giggleman *et al*. 1998. Mean of ratios between whole-body fish tissue concentrations of gizzard shad and co-located bulk-sediment concentrations. Tissue values were converted to dry-weight concentrations by multiplying by 5 (assumed moisture content of 80%).a. USEPA (1999; table C-2).
f. USEPA (1999; table C-2). Values were derived using the relationship *log* BCF = 1.588 - 0.578 x *log* Kow; log Kow = 3.72 (2-methylnaphthalene) and 6.11 (benzo(a)pyrene).
g. Meador *et al*. (1995; figure 3). LPAH and HPAH BSAFs for *Armandia brevis* were converted to BAFs assuming average 10% lipid content and 2% organic carbon (i.e., BAF = 5*BSAF).
h. Liang *et al.* (2007). log BSAF = 2.28-0.638 log Kow for 2-methylnaphthalene and benzo(a)pyrene. BSAFs were converted to BAFs assuming 10% lipid content and 2% organic carbon (i.e., BAF = 5*BSAF).

Table 12
Wildlife HQs - Wood Duck
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Wood Duck

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetic Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	2.1		0.485		0.279		0.28	0.3	0.13
Lead	117	0.021	46.05		29.23	0.0035	1.79	3.3	3.18
Mercury	0.0119		0.0030		0.001		0.0026	0.0042	0.0074
Selenium	2.11		1.219		1.12		0.82	1.2	2.80
Zinc	414.3	0.067	197.1	0.0242	100.1	0.011	72.1	382	275
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.023	1.45	20	0.016	0.001
Lead	0.171	3.85	19.25	0.044	0.009
Mercury	0.00025	0.013	0.064	0.019	0.004
Selenium	0.078	0.4	0.8	0.194	0.097
Zinc	16.7	55	105	0.304	0.159
SVOCs					
Total LPAHs	0.012	212	1,060	0.000	0.000
Total HPAHs	0.053	7.02	35.1	0.008	0.002

$$\text{Total Daily Dose} = \frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed}) \times AUF}{BW}$$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}} \qquad HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$$

Shaded values exceed an HQ of 1.0

Diet			
	$Diet_{AP}$	50	%
	$Diet_{BI}$	50	%
	$Diet_{FF}$	0	%
Ingestion-Pathway Exposures	IR_{food}	0.0443	kg/day DW
	IR_{water}	0.0445	L/day
	IR_{sed}	0.0049	kg/day DW
	AUF	100	%
	BW	0.658	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:

AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al.* (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 13
Wildlife HQs - Snowy Egret
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Snowy Egret

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetic Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{sed} (mg/kg DW)	C_{sw} (mg/L)	C_{sed} (mg/kg DW)	C_{sw} (mg/L)	C_{SED} (mg/kg DW)	C_{sw} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	2.1		0.485		0.279		0.28	0.3	0.13
Lead	117	0.021	46.05		29.33	0.0095	1.79	3.3	3.18
Mercury	0.0119		0.0030		0.001		0.0026	0.0042	0.0074
Selenium	2.11		1.219		1.12		0.82	1.2	2.80
Zinc	414.3	0.067	197.1	0.0242	100.1	0.011	72.1	382	275
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.007	1.45	20	0.005	0.000
Lead	0.069	3.85	19.25	0.018	0.004
Mercury	0.000124	0.013	0.064	0.010	0.002
Selenium	0.085	0.4	0.8	0.213	0.106
Zinc	11.9	55	105	0.216	0.113
SVOCs					
Total LPAHs	0.013	212	1,060	0.000	0.000
Total HPAHs	0.018	7.02	35.1	0.002	0.000

$$\text{Total Daily Dose} = \frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}} \qquad HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$$

Shaded values exceed an HQ of 1.0

Diet	$Diet_{AP}$	0	%
	$Diet_{BI}$	35	%
	$Diet_{FF}$	65	%
Ingestion-Pathway Exposures	IR_{food}	0.0139	kg/day DW
	IR_{water}	0.0304	L/day
	IR_{sed}	0.0003	kg/day DW
	AUF	100	%
	BW	0.371	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:
AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2005). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al.* (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 14
Wildlife HQs - Belted Kingfisher
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Belted Kingfisher

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetic Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	2.1		0.485		0.279		0.28	0.3	0.13
Lead	117	0.021	46.05		29.25	0.0035	1.79	3.3	3.18
Mercury	0.0119		0.0030		0.001		0.0026	0.0042	0.0074
Selenium	2.11		1.219		1.12		0.82	1.2	2.80
Zinc	414.3	0.067	197.1	0.0242	100.1	0.011	72.1	382	275
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.018	1.45	20	0.013	0.001
Lead	0.196	3.85	19.25	0.051	0.010
Mercury	0.00078	0.013	0.064	0.060	0.012
Selenium	0.290	0.4	0.8	0.726	0.363
Zinc	35.1	55	105	0.602	0.315
SVOCs					
Total LPAHs	0.043	212	1,060	0.000	0.000
Total HPAHs	0.021	7.02	35.1	0.003	0.001

Total Daily Dose = $\frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}}$ $\quad$ $HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$

Shaded values exceed an HQ of 1.0

Diet			
	$Diet_{AP}$	0	%
	$Diet_{BI}$	15	%
	$Diet_{FF}$	85	%
Ingestion-Pathway Exposures	IR_{food}	0.0167	kg/day DW
	IR_{water}	0.0164	L/day
	IR_{sed}	0.0002	kg/day DW
	AUF	100	%
	BW	0.148	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:
AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Sample *et al.* (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 15
Wildlife HQs - Marsh Rice Rat
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Marsh Rice Rat

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetic Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{sed} (mg/kg DW)	C_{sw} (mg/L)	C_{sed} (mg/kg DW)	C_{sw} (mg/L)	C_{sed} (mg/kg DW)	C_{sw} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	2.1		0.485		0.279		0.28	0.3	0.13
Lead	117	0.021	46.05		29.23	0.0035	1.79	3.3	3.18
Mercury	0.0119		0.0030		0.001		0.0026	0.0042	0.0074
Selenium	2.11		1.219		1.12		0.82	1.2	2.80
Zinc	414.3	0.067	197.1	0.0242	100.1	0.011	72.1	382	275
SVOCs									
Total LPAHs	1.491				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.034	1.2	12.3	0.028	0.003
Lead	0.187	20	202	0.009	0.001
Mercury	0.00039	0.036	0.059	0.011	0.007
Selenium	0.119	0.22	0.37	0.539	0.321
Zinc	26.1	213	426	0.123	0.061
SVOCs					
Total LPAHs	0.016	46	80	0.000	0.000
Total HPAHs	0.084	1.3	9.7	0.064	0.009

Total Daily Dose = $\frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}}$ $\quad$ $HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$

Shaded values exceed an HQ of 1.0

Diet			
	$Diet_{AP}$	50	%
	$Diet_{BI}$	50	%
	$Diet_{FF}$	0	%
Ingestion-Pathway Exposures	IR_{food}	0.0057	kg/day DW
	IR_{water}	0.0068	L/day
	IR_{sed}	0.0002	kg/day DW
	AUF	100	%
	BW	0.051	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:
AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Sueddel *et al.* (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 16
Wildlife HQs - Nutria
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Nutria

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetic Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	2.1		0.485		0.279		0.28	0.3	0.13
Lead	117	0.021	46.05		29.23	0.0035	1.79	3.3	3.18
Mercury	0.0119		0.0030		0.001		0.0026	0.0042	0.0074
Selenium	2.11		1.219		1.12		0.82	1.2	2.80
Zinc	414.3	0.067	197.1	0.0242	100.1	0.011	72.1	382	275
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.016	0.7	7.1	0.023	0.002
Lead	0.098	15	148	0.007	0.001
Mercury	0.00014	0.026	0.043	0.005	0.003
Selenium	0.045	0.16	0.27	0.283	0.167
Zinc	4.4	99	197	0.045	0.022
SVOCs					
Total LPAHs	0.008	34	58	0.000	0.000
Total HPAHs	0.033	0.9	7.1	0.037	0.005

$$\text{Total Daily Dose} = \frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}} \qquad HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$$

Shaded values exceed an HQ of 1.0

Diet			
	$Diet_{AP}$	100	%
	$Diet_{BI}$	0	%
	$Diet_{FF}$	0	%
Ingestion-Pathway Exposures	IR_{food}	0.4324	kg/day DW
	IR_{water}	0.7152	L/day
	IR_{sed}	0.0432	kg/day DW
	AUF	100	%
	BW	9	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:

AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Suedel *et al.*, (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 17
Wildlife HQs - Raccoon
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Raccoon

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetic Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{sed} (mg/kg DW)	C_{sw} (mg/L)	C_{sed} (mg/kg DW)	C_{sw} (mg/L)	C_{sed} (mg/kg DW)	C_{sw} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FF} (mg/kg DW)
Inorganics									
Cadmium	2.1		0.485		0.279		0.28	0.3	0.13
Lead	117	0.021	46.05		29.23	0.0035	1.79	3.3	3.18
Mercury	0.0119		0.0030		0.001		0.0026	0.0042	0.0074
Selenium	2.11		1.219		1.12		0.82	1.2	2.80
Zinc	414.3	0.067	197.1	0.0242	100.1	0.011	72.1	382	275
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.016	0.8	7.7	0.021	0.002
Lead	0.146	16	136	0.009	0.001
Mercury	0.00028	0.028	0.046	0.010	0.006
Selenium	0.089	0.17	0.29	0.523	0.306
Zinc	20.4	112	223	0.182	0.092
SVOCs					
Total LPAHs	0.013	35	61	0.000	0.000
Total HPAHs	0.039	1.0	7.5	0.039	0.005

Total Daily Dose = $\frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{soil} \times AUF}{BW}$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FF} \times Diet_{FF}$

$HQ_{NOAEL} = \frac{Total\ Daily\ Dose}{NOAEL}$ $\quad$ $HQ_{LOAEL} = \frac{Total\ Daily\ Dose}{LOAEL}$

Shaded values exceed an HQ of 1.0

Diet			
	$Diet_{AP}$	0	%
	$Diet_{BI}$	80	%
	$Diet_{FF}$	20	%
Ingestion-Pathway Exposures	IR_{food}	0.2107	kg/day DW
	IR_{water}	0.3378	L/day
	IR_{sed}	0.0198	kg/day DW
	AUF	100	%
	BW	3.91	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:
AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Soil} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FF} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FF}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.75% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Steidel *et al.* (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 18
Wildlife HQs - Mink
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Mink

Chemical of Ecological Concern	Physical Media - Maximum Concentration *		Physical Media - 95% UCL Concentration *		Physical Media - Arithmetic Mean Concentration *		Modeled Tissue (Prey) Concentration		
	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{SED} (mg/kg DW)	C_{SW} (mg/L)	C_{AP} (mg/kg DW)	C_{BI} (mg/kg DW)	C_{FP} (mg/kg DW)
Inorganics									
Cadmium	2.1		0.485		0.279		0.28	0.3	0.13
Lead	117	0.021	46.05		29.23	0.0035	1.79	3.3	3.18
Mercury	0.0119		0.0030		0.001		0.0026	0.0042	0.0074
Selenium	2.11		1.219		1.12		0.82	1.2	2.80
Zinc	414.3	0.067	197.1	0.0242	100.1	0.011	72.1	382	275
SVOCs									
Total LPAHs	1.401				0.421		0.115	0.15	0.42
Total HPAHs	0.826				0.552		0.630	0.83	0.07

Chemical of Ecological Concern	Total Daily Dose (mg/kg BW-day)	Toxicity Reference Value		Hazard Quotient	
		NOAEL (mg/kg BW-day)	LOAEL (mg/kg BW-day)	HQ_{NOAEL} (unitless)	HQ_{LOAEL} (unitless)
Inorganics					
Cadmium	0.015	0.9	8.9	0.016	0.002
Lead	0.149	17	169	0.009	0.001
Mercury	0.00044	0.03	0.049	0.015	0.009
Selenium	0.158	0.19	0.31	0.833	0.511
Zinc	22.1	137	274	0.162	0.081
SVOCs					
Total LPAHs	0.024	38	67	0.001	0.000
Total HPAHs	0.025	1.1	8.1	0.023	0.003

Total Daily Dose = $\frac{[(IR_{food} \times C_{food}) + (IR_{water} \times C_{water}) + (IR_{sed} \times C_{sed})] \times AUF}{BW}$

where, $C_{food} = C_{AP} \times Diet_{AP} + C_{BI} \times Diet_{BI} + C_{FP} \times Diet_{FP}$

$HQ_{NOAEL} = \frac{\text{Total Daily Dose}}{\text{NOAEL}}$ $\quad$ $HQ_{LOAEL} = \frac{\text{Total Daily Dose}}{\text{LOAEL}}$

Shaded values exceed an HQ of 1.0

Diet			
	$Diet_{AP}$	0	%
	$Diet_{BI}$	35	%
	$Diet_{FP}$	65	%
Ingestion-Pathway Exposures	IR_{food}	0.0687	kg/day DW
	IR_{water}	0.099	L/day
	IR_{sed}	0.0034	kg/day DW
	AUF	100	%
	BW	1	kg
	Pb Bioavail. - Sed	25	%
	Pb Bioavail. - SW/Food	50	%

Notes:
AUF - Area Use Factor
BW - body weight (kg)
C_{SW} - COC concentration in surface water (mg/L)
C_{Sed} - COC concentration in sediment (mg/kg DW)
C_{AP} - COC concentration in aquatic plants (mg/kg DW)
C_{BI} - COC concentration in benthic invertebrates (mg/kg DW)
C_{FP} - COC concentration in forage fish (mg/kg DW)
COEC - constituent of ecological concern
$Diet_{AP}$ - fraction of aquatic plants in wildlife diet (%)
$Diet_{BI}$ - fraction of benthic invertebrates in wildlife diet (%)
$Diet_{FP}$ - fraction of forage fish in wildlife diet (%)
DW - dry weight
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
IR_{food} - food ingestion rate (kg/day DW)
IR_{sed} - sediment ingestion rate (kg/day DW)
IR_{water} - water ingestion rate (L/day)
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
Pb Bioavail. - Sed. - bioavailability of lead in sediment (%)
Pb Bioavail. - SW/Food - bioavailability of lead in surface water and food (%)

* Mercury concentrations in physical media shown here represent the estimated methylmercury fraction (0.73% per DeLaune *et al.* 2009). The associated uptake factors and wildlife TRVs are similarly based on methylmercury. For lead, a 25% bioavailability factor for lead in sediment is applied based on Stuedel *et al.* (2006). A 50% bioavailability for lead in food and water is per USEPA default.

Table 19
Summary of Wildlife HQs
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Chemical of Ecological Concern	Wood duck		Snowy egret		Belted kingfisher	
	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}
Metals						
Cadmium	0.016	0.001	0.005	0.000	0.013	0.001
Lead	0.044	0.009	0.018	0.004	0.051	0.010
Mercury	0.019	0.004	0.018	0.004	0.060	0.012
Selenium	0.194	0.097	0.213	0.106	0.726	0.363
Zinc	0.304	0.159	0.216	0.113	0.602	0.315
SVOCs						
Total LPAHs	0.000	0.000	0.000	0.000	0.000	0.000
Total HPAHs	0.008	0.002	0.002	0.000	0.003	0.001

Chemical of Ecological Concern	Marsh rice rat		Nutria		Raccoon		Mink	
	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}	HQ_{NOAEL}	HQ_{LOAEL}
Metals								
Cadmium	0.028	0.003	0.023	0.002	0.021	0.002	0.016	0.002
Lead	0.009	0.001	0.007	0.001	0.009	0.001	0.009	0.001
Mercury	0.011	0.007	0.005	0.003	0.010	0.006	0.015	0.009
Selenium	0.539	0.321	0.283	0.167	0.523	0.306	0.833	0.511
Zinc	0.123	0.061	0.045	0.022	0.182	0.092	0.162	0.081
SVOCs								
Total LPAHs	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
Total HPAHs	0.064	0.009	0.037	0.005	0.039	0.005	0.023	0.003

Notes:
HPAH - high molecular weight PAH
HQ_{NOAEL} - hazard quotient, NOAEL-based
HQ_{LOAEL} - hazard quotient, LOAEL-based
LOAEL - lowest observed adverse effect level
LPAH - low molecular weight PAH
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon
SVOC - semivolatile organic compound

Shaded values exceed an HQ of 1.0

FIGURES

URS
10550 Richmond, Suite 155
Houston, TX 77042
Tel: 713.914.6699
Fax: 713.789.8404

Legend

Section 16

USGS High Resolution State Orthoimagery for the Louisiana Coastal Area, 2008

0 1,000 2,000 4,000 Feet

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Title:	Site Location Map
Project:	Screening-Level Ecological Risk Assessment East White Lake Oil and Gas Field Vermilion Parish, Louisiana

Drawn By:	Date:	Project No.:	Figure:
NWH	06/16/10	25012585	1

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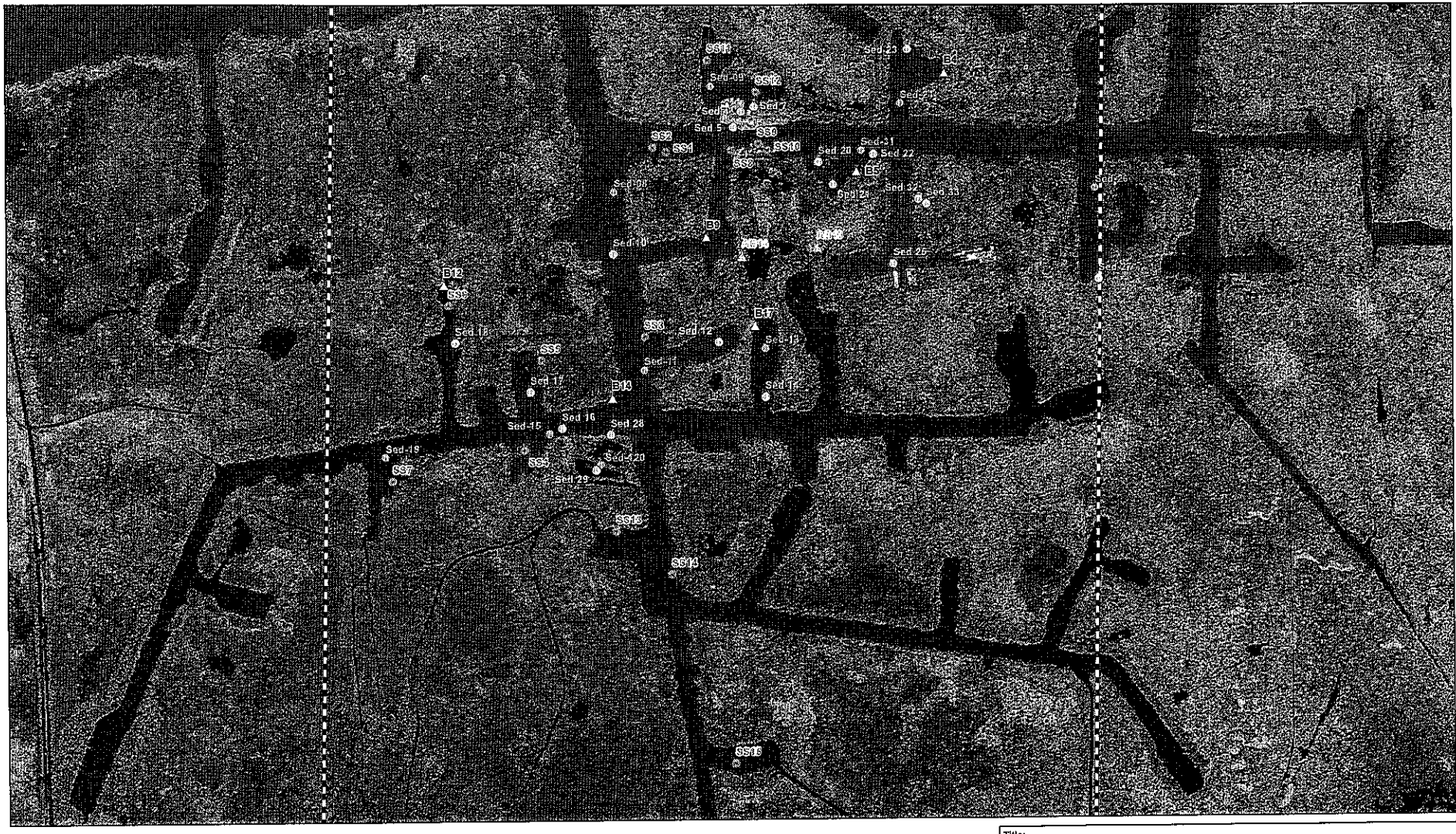

Legend

- △ 2006 Vibracore Sediment Sample Location (ICON)
- 2006 Mud Rotary/Split Spoon Sediment Sample Location (ICON)
- ◎ 2006 Sludge Syringe Sediment Sample Location (ICON)
- ◍ 1Q 2010 Sediment Sample Location (MPA)
- ◍ 2Q 2010 Sediment Sample Location (MPA)
- Section 16

USGS High Resolution State Orthoimagery for the Louisiana Coastal Area, 2008

0 375 750 1,500 Feet

N W E S

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Title: Site Sediment Sample Locations

Project: Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Drawn By:	Date:	Project No.:	Figure:
NWH	06/16/10	25012585	2

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Legend

- 2Q 2010 Surface Water Sample Location (MPA)
- 2Q 2010 Surface Water Field Screening Location (MPA)
- Section 16

USGS High Resolution State Orthoimagery for the Louisiana Coastal Area, 2008

0 250 500 1,000 Feet

N W E S

Title: Site Surface Water Sample Locations

Project: Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Drawn By:	Date:	Project No.:	Figure:
NWH	06/16/10	25012585	3

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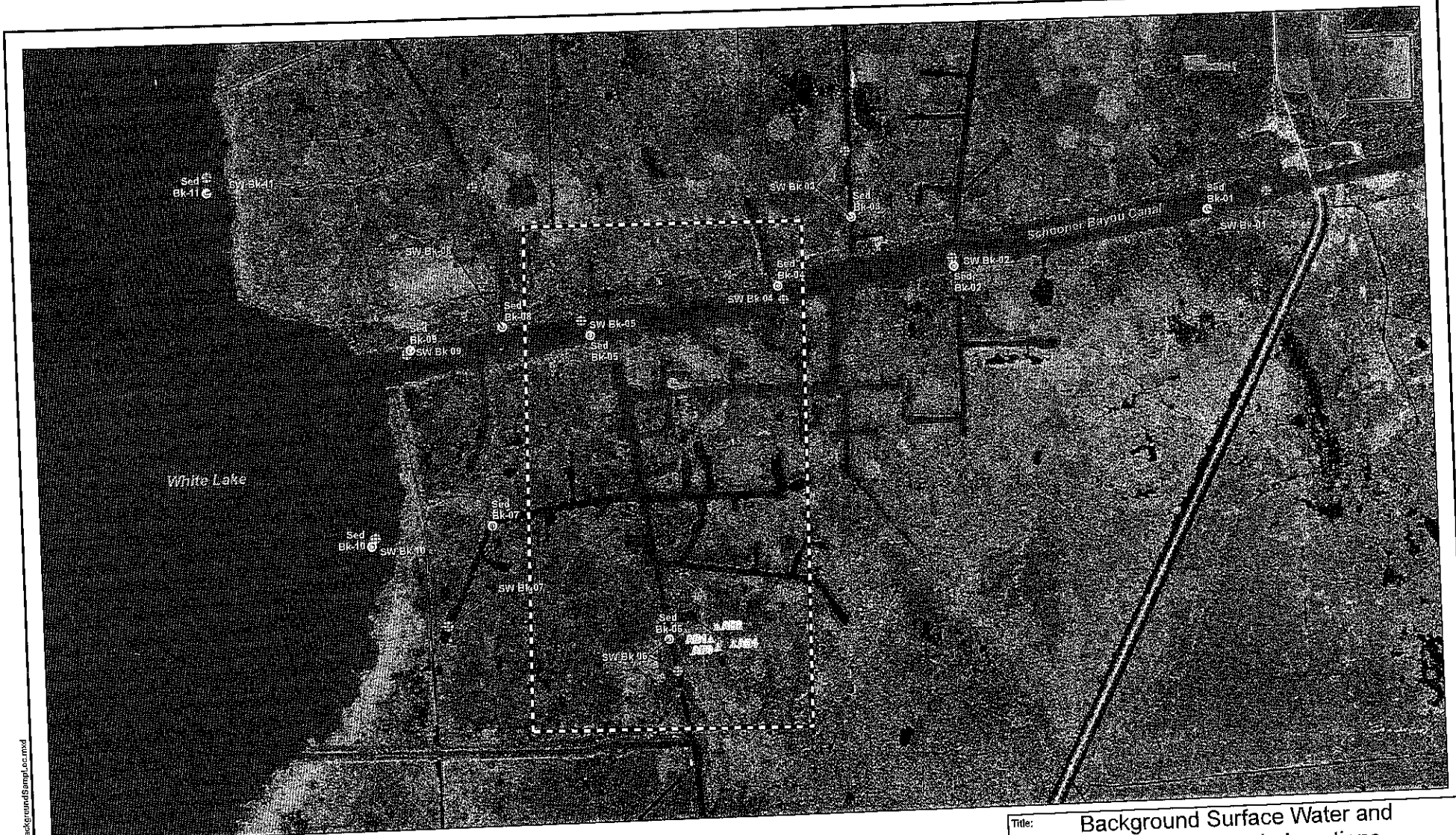

Legend

- 2Q 2010 Background Surface Water Sample Location (MPA)
- 2Q 2010 Background Sediment Sample Location (MPA)
- 2Q 2010 Background Surface Water Field Screening Location (MPA)
- 2006 Mud Rotary/Split Spoon Sediment Sample Location (iCON)
- Section 16

USGS High Resolution State Orthoimagery for the Louisiana Coastal Area, 2008

0 1,000 2,000 4,000 Feet

N W E S

URS
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Houston, TX 77042
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Title:	Background Surface Water and Sediment Sample Locations		
Project:	Screening-Level Ecological Risk Assessment East White Lake Oil and Gas Field Vermilion Parish, Louisiana		
Drawn By: NWH	Date: 06/16/10	Project No.: 25012585	Figure: 4

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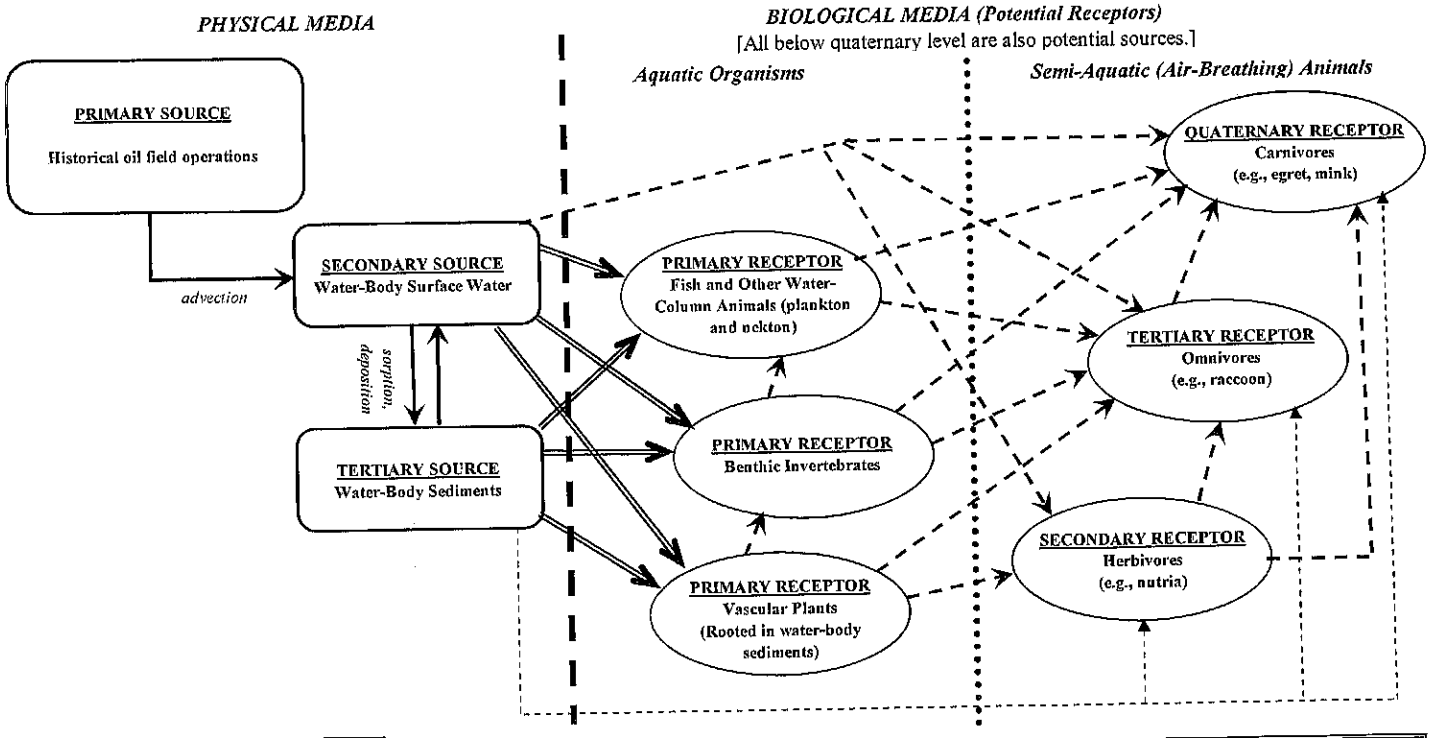
Figure 5
Conceptual Ecological Exposure Model
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana



June 2010

APPENDIX A

ProUCL Input and Output

95% UCL Input File for COCs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Arsenic	D_Arsenic
SED-1	3.93	1
SED-2	5.17	1
SED-3	8.82	1
SED-4	1.58	1
SED-5	6.18	1
SED-6	3.31	1
SED-7	3.47	1
SED-8	4.062	1
SED-9	6.612	1
SED-10	4.37	1
SED-11	4.386	1
SED-12	3.43	1
SED-13	5.018	1
SED-14	3.56	1
SED-15 (avg)	5.782	1
SED-16	5.24	1
SED-17	4.42	1
SED-18	6.91	1
SED-19	3.704	1
SED-20	4.77	1
SED-21	3.47	1
SED-22	4.58	1
SED-23	3.76	1
SED-24	10.479	1
SED-25	4.13	1
SED-26	5.127	1
SED-27	3.3	1
SED-28	3.27	1
SED-29	1.06	0
SED-120 (SED-30)	3.657	1
SED-31	8.031	1
SED-32	2.21	1
SED-33	2.6	1
SS3	8.79	1
SS5	11.4	1
SS7	22	1
SS8	7.89	1
SS10	6.52	1
SS11	5.28	1
SS12	6.17	1
B4	10	1
B9	8.17	1
AB13	12.9	1
AB14	5.51	1

Sample ID	Barium	D_Barium
SED-1	379.44	1
SED-2	333.91	1
SED-3	334.72	1
SED-4	341.75	1
SED-5	122.8	1
SED-6	226.53	1
SED-7	726.11	1
SED-8	496	1
SED-9	671	1
SED-10	691.1	1
SED-11	550	1
SED-12	1015.58	1
SED-13	909	1
SED-14	1021.35	1
SED-15 (avg)	862	1
SED-16	324.32	1
SED-17	1729.37	1
SED-18	2139	1
SED-19	509	1
SED-20	803.92	1
SED-21	485.8	1
SED-22	823.72	1
SED-23	1234.46	1
SED-24	1198	1
SED-25	1449.1	1
SED-26	538	1
SED-27	584.23	1
SED-28	485.98	1
SED-29	658.65	1
SED-120 (SED-30)	754	1
SED-31	1097	1
SED-32	473.31	1
SED-33	670	1
SS3	1600	1
SS5	7450	1
SS7	15700	1
SS8	1041.55	1
SS10	996.69	1
SS11	2750	1
SS12	2030	1
B4	631	1
B9	368	1
AB13	551	1
AB14	200	1

Sample ID	Cadmium	D_Cadmium
SED-1	0.04	1
SED-2	1.26	1
SED-3	0.06	0
SED-4	0.01	0
SED-5	0.02	0
SED-6	2.1	1
SED-7	0.1	1
SED-8	0.021	0
SED-9	0.027	0
SED-11	0.024	0
SED-13	0.03	0
SED-15 (avg)	0.032	0
SED-19	0.038	0
SED-24	0.026	1
SED-26	0.026	0
SED-28	0.22	1
SED-29	0.11	1
SED-120 (SED-30)	0.217	1
SED-31	0.059	1
SS8	0.17	1
SS10	0.31	1
B4	0.77	1
B9	0.644	1
AB13	0.447	1
AB14	0.219	1

Sample ID	Chromium	D_Chromium
SED-1	3.5	1
SED-2	8.74	1
SED-3	0.16	0
SED-4	5.27	1
SED-5	0.05	0
SED-6	3.57	1
SED-7	6.91	1
SED-8	14.8	1
SED-9	13.9	1
SED-11	14.5	1
SED-13	18.5	1
SED-15 (avg)	17.5	1
SED-19	20.5	1
SED-24	14.8	1
SED-26	17.2	1
SED-28	6.54	1
SED-29	13.7	1
SED-120 (SED-30)	35.8	1
SED-31	17	1
SS3	17.9	1
SS5	21.8	1
SS7	20	1
SS8	4.96	1
SS10	4.64	1
SS11	25.1	1
SS12	12.7	1
AB13	7.73	1
AB14	12.8	1

95% UCL Input File for COCs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Lead	D_Lead
SED-1	22.48	1
SED-2	26.22	1
SED-3	26.74	1
SED-4	11.9	1
SED-5	14.86	1
SED-6	18.73	1
SED-7	20.99	1
SED-8	21.2	1
SED-9	20.4	1
SED-11	18.8	1
SED-13	22	1
SED-15 (avg)	23.1	1
SED-19	23.4	1
SED-24	25.2	1
SED-26	23.1	1
SED-28	19.44	1
SED-29	20.19	1
SED-120 (SED-30)	34	1
SED-31	24.8	1
SS3	28.8	1
SS5	117	1
SS7	67.5	1
SS8	35.18	1
SS10	23.31	1
SS11	63.6	1
SS12	49.9	1
B4	28.7	1
B9	23.1	1
AB13	8.11	1
AB14	14.4	1

Sample ID	Mercury	D_Mercury
SED-1	0.09	1
SED-2	0.06	1
SED-3	0.14	1
SED-4	0.04	1
SED-5	0.04	1
SED-6	0.88	1
SED-7	0.08	1
SED-8	0.098	1
SED-9	0.115	1
SED-10	0.09	1
SED-11	0.096	1
SED-12	0.07	1
SED-13	0.105	1
SED-14	0.07	1
SED-15 (avg)	0.158	1
SED-16	0.09	1
SED-17	0.07	1
SED-18	0.12	1
SED-19	0.176	1
SED-20	0.08	1
SED-21	0.04	1
SED-22	0.07	1
SED-23	0.07	1
SED-24	0.111	1
SED-25	0.08	1
SED-26	0.159	1
SED-27	0.08	1
SED-28	0.61	1
SED-29	0.11	1
SED-120 (SED-30)	0.411	1
SED-31	0.159	1
SED-32	0.04	1
SED-33	0.08	1
SS8	1.63	1
SS10	0.15	1

Sample ID	Selenium	D_Selenium
SED-1	1.17	0
SED-2	1.09	0
SED-3	1.74	0
SED-4	0.42	0
SED-5	0.5	0
SED-6	0.51	0
SED-7	0.8	0
SED-8	0.643	0
SED-9	0.822	0
SED-10	0.65	0
SED-11	0.731	0
SED-12	1.53	1
SED-13	0.909	0
SED-14	1.42	1
SED-15 (avg)	0.971	0
SED-16	2.11	1
SED-17	1.52	1
SED-18	1.58	1
SED-19	1.157	0
SED-20	1.24	1
SED-21	1.17	1
SED-22	1.54	1
SED-23	1.61	1
SED-24	0.749	0
SED-25	1.56	1
SED-26	0.796	0
SED-27	0.97	1
SED-28	1.17	0
SED-29	1.2	0
SED-120 (SED-30)	1.429	0
SED-31	0.781	0
SED-32	0.93	1
SED-33	1.25	0
SS8	1.14	1
SS10	1.32	1

Sample ID	Strontium	D_Strontium
SED-1	59.81	1
SED-2	54.78	1
SED-3	79.17	1
SED-4	59.09	1
SED-5	36.2	1
SED-6	80.2	1
SED-7	47.13	1
SED-8	41.1	1
SED-9	46.1	1
SED-11	44.2	1
SED-13	55.3	1
SED-15 (avg)	59.2	1
SED-19	58.3	1
SED-24	68.9	1
SED-26	53.8	1
SED-28	292.99	1
SED-29	213.94	1
SED-120 (SED-30)	442.3	1
SED-31	63.1	1
SS3	74.3	1
SS5	140	1
SS7	231	1
SS8	74.52	1
SS10	61.26	1
SS11	64.8	1
SS12	72.9	1
B4	59.3	1
B9	64.1	1
AB13	459	1
AB14	121	1

95% UCL Input File for COCs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Zinc	D Zinc
SED-8	53.0	1
SED-9	53.6	1
SED-11	51.8	1
SED-13	65.1	1
SED-15 (avg)	69.5	1
SED-19	70.4	1
SED-24	62.0	1
SED-26	64.0	1
SED-120 (SED-30)	414.3	1
SED-31	64.7	1
SS3	92.5	1
SS5	174	1
SS7	111	1
SS11	194	1
SS12	73.5	1
AB13	24.8	1
AB14	63.9	1

Sample ID	Benzo(b)fluoranthene	D Benzo(b)fluoranthene
SED-8	0.026	0
SED-9	0.063	1
SED-11	0.029	0
SED-13	0.036	0
SED-15 (avg)	0.039	0
SED-19	0.046	0
SED-24	0.03	0
SED-26	0.032	0
SED-120 (SED-30)	0.057	0
SED-31	0.031	0

Sample ID	Chrysene	D Chrysene
SED-8	0.028	0
SED-9	0.069	1
SED-11	0.032	0
SED-13	0.04	0
SED-15 (avg)	0.043	0
SED-19	0.051	0
SED-24	0.036	1
SED-26	0.035	0
SED-120 (SED-30)	0.063	0
SED-31	0.034	0

95% UCL Input File for COCs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Fluorene	D_Fluorene
SED-8	0.026	0
SED-9	0.033	0
SED-11	0.029	0
SED-13	0.036	0
SED-15 (avg)	0.039	0
SED-19	0.046	0
SED-24	0.03	0
SED-26	0.032	0
SED-120 (SED-30)	0.92	1
SED-31	0.031	0

Sample ID	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene
SED-8	0.033	0
SED-9	0.313	1
SED-11	0.038	0
SED-13	0.047	0
SED-15 (avg)	0.051	0
SED-19	0.06	0
SED-24	0.039	0
SED-26	0.041	0
SED-120 (SED-30)	0.074	0
SED-31	0.041	0

Sample ID	Phenanthrene	D_Phenanthrene
SED-8	0.033	0
SED-9	0.043	0
SED-11	0.038	0
SED-13	0.047	0
SED-15 (avg)	0.051	0
SED-19	0.06	0
SED-24	0.048	1
SED-26	0.041	0
SED-120 (SED-30)	0.074	0
SED-31	0.041	0

95% UCL Input File for COCs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Total LPAHs	Total HPAHs	Total PAHs
SED-8	0.233	0.37	0.603
SED-9	0.299	0.807	1.106
SED-11	0.272	0.422	0.694
SED-13	0.341	0.524	0.865
SED-15 (avg)	0.359	0.56	0.919
SED-19	0.435	0.668	1.103
SED-24	0.282	0.435	0.717
SED-26	0.299	0.46	0.759
SED-120 (SED-30)	1.401	0.826	2.227
SED-31	0.289	0.451	0.74

Sample ID	Chlorides	D_Chlorides
SED-1	7616.82	1
SED-2	5521.74	1
SED-3	5159.72	1
SED-4	1868.69	1
SED-5	1558	1
SED-6	1573.47	1
SED-7	5286.62	1
SED-8	2121	1
SED-9	2138	1
SED-10	2431.94	1
SED-11	3099	1
SED-12	3052.96	1
SED-13	3542	1
SED-14	3950.18	1
SED-15 (avg)	3672	1
SED-16	6702.7	1
SED-17	3795.38	1
SED-18	5289.58	1
SED-19	5139	1
SED-20	3143.79	1
SED-21	3097.79	1
SED-22	5480.77	1
SED-23	2762.71	1
SED-24	2482	1
SED-25	4161.68	1
SED-26	2869	1
SED-27	5591.4	1
SED-28	9299.07	1
SED-29	10144.23	1
SED-120 (SED-30)	10400	1
SED-31	2469	1
SED-32	6797.15	1
SED-33	14200	1
SS1	1,950	1
SS2	1,600	1
SS3	825	1
SS4	3,850	1
SS5	1,430	1
SS6	1,700	1
SS7	2,050	1
SS9	1,500	1
SS11	540	1
SS12	610	1
SS13	1,900	1
SS14	2,250	1
SS15	1,400	1
B4	10,000	1
B5	5,800	1
B9	7,390	1
B12	7,360	1
B14	2,750	1
B17	7,950	1
B21	3,700	1
AB13	73,800	1
AB14	15,500	1

Sample ID	%Moisture (wt%)	D_%Moisture (wt%)
SED-1	78.6	1
SED-2	77	1
SED-3	85.6	1
SED-4	40.6	1
SED-5	50	1
SED-6	51	1
SED-7	68.6	1
SED-8	61.1	1
SED-9	69.6	1
SED-10	61.8	1
SED-11	65.8	1
SED-12	67.9	1
SED-13	72.5	1
SED-14	71.9	1
SED-15 (avg)	74.2	1
SED-16	81.5	1
SED-17	69.7	1
SED-18	74.1	1
SED-19	78.4	1
SED-20	69.4	1
SED-21	68.3	1
SED-22	68.8	1
SED-23	64.6	1
SED-24	66.6	1
SED-25	66.6	1
SED-26	68.6	1
SED-27	72.1	1
SED-28	78.6	1
SED-29	79.2	1
SED-120 (SED-30)	82.5	1
SED-31	68	1
SED-32	71.9	1
SED-33	80	1
SS1	62.6	1
SS2	53.5	1
SS3	62.7	1
SS4	75	1
SS5	57.5	1
SS6	70.8	1
SS7	71.7	1
SS8	63.9	1
SS9	61.7	1
SS10	69.8	1
SS11	29.2	1
SS12	45.8	1
SS13	65.8	1
SS14	43.9	1
SS15	64.3	1
B4	78.4	1
B5	71	1
B9	74.4	1
B12	76.8	1
B14	50.2	1
B17	81	1
B21	76.4	1
AB13	86	1
AB14	62.8	1

95% UCL Input File for COCs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	AVS/SEM [(umol/g)/(umol/g)]
Sed 9	18.36
Sed 11	27.94
Sed 13	81.28
Sed 15 (avg)	74.30
Sed 19	95.94
Sed 24	47.77
Sed 26	19.41
Sed 120	1.02
Sed 31	6.83

95% UCL Output File -- Arsenic in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Data	44
Number of Distinct Detected Data	42
Number of Detected Data	43
Number of Non-Detect Data	1
Percent Non-Detects	2.27%

Raw Statistics

Minimum Detected	1.58
Maximum Detected	22
Mean of Detected	5.906
SD of Detected	3.563
Minimum Non-Detect	1.06
Maximum Non-Detect	1.06

Log-transformed Statistics

Minimum Detected	0.457
Maximum Detected	3.091
Mean of Detected	1.646
SD of Detected	0.497
Minimum Non-Detect	0.0583
Maximum Non-Detect	0.0583

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.785
5% Shapiro Wilk Critical Value	0.943

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.981
5% Shapiro Wilk Critical Value	0.943

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	5.784
SD	3.614
95% DL/2 (t) UCL	6.7

Maximum Likelihood Estimate(MLE) Method

Mean	5.757
SD	3.623
95% MLE (t) UCL	6.675
95% MLE (Tiku) UCL	6.648

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	1.594
SD	0.6
95% H-Stat (DL/2) UCL	6.75

Log ROS Method

Mean in Log Scale	1.617
SD in Log Scale	0.527
Mean in Original Scale	5.805
SD in Original Scale	3.585
95% Percentile Bootstrap UCL	6.783
95% BCA Bootstrap UCL	6.919

95% UCL Output File -- Arsenic in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	3.728
Theta Star	1.584
nu star	320.6
A-D Test Statistic	0.825
5% A-D Critical Value	0.753
K-S Test Statistic	0.753
5% K-S Critical Value	0.135

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1E-09
Maximum	22
Mean	5.772
Median	4.894
SD	3.633
k star	0.895
Theta star	6.452
Nu star	78.72
AppChi2	59.28
95% Gamma Approximate UCL	7.665
95% Adjusted Gamma UCL	7.74

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	5.808
SD	3.541
SE of Mean	0.54
95% KM (t) UCL	6.716
95% KM (z) UCL	6.696
95% KM (jackknife) UCL	6.706
95% KM (bootstrap t) UCL	7.102
95% KM (BCA) UCL	6.8
95% KM (Percentile Bootstrap) UCL	6.751
95% KM (Chebyshev) UCL	8.162
97.5% KM (Chebyshev) UCL	9.181
99% KM (Chebyshev) UCL	11.18

Potential UCLs to Use

95% KM (BCA) UCL	6.8

95% UCL Output File -- Barium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Number of Valid Observations 44

Number of Distinct Observations 44

Raw Statistics

Minimum	122.8
Maximum	15700
Mean	1317
Median	681.1
SD	2493
Coefficient of Variation	1.893
Skewness	5.018

Log-transformed Statistics

Minimum of Log Data	4.811
Maximum of Log Data	9.661
Mean of log Data	6.644
SD of log Data	0.869

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.397
Shapiro Wilk Critical Value	0.944

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.933
Shapiro Wilk Critical Value	0.944

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1949

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	2239
95% Modified-t UCL	1997

Assuming Lognormal Distribution

95% H-UCL	1505
95% Chebyshev (MVUE) UCL	1825
97.5% Chebyshev (MVUE) UCL	2135
99% Chebyshev (MVUE) UCL	2745

Gamma Distribution Test

k star (bias corrected)	1.006
Theta Star	1309
MLE of Mean	1317
MLE of Standard Deviation	1313
nu star	88.55
Approximate Chi Square Value (.05)	67.85
Adjusted Level of Significance	0.0445
Adjusted Chi Square Value	67.24

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	1936
95% Jackknife UCL	1949
95% Standard Bootstrap UCL	1921

95% UCL Output File -- Barium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	3.256
Anderson-Darling 5% Critical Value	0.776
Kolmogorov-Smirnov Test Statistic	0.215
Kolmogorov-Smirnov 5% Critical Value	0.137

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1719
95% Adjusted Gamma UCL	1735

95% Bootstrap-t UCL	3791
95% Hall's Bootstrap UCL	4610
95% Percentile Bootstrap UCL	1982
95% BCA Bootstrap UCL	2398
95% Chebyshev(Mean, Sd) UCL	2956
97.5% Chebyshev(Mean, Sd) UCL	3665
99% Chebyshev(Mean, Sd) UCL	5057

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 2956

95% UCL Output File -- Cadmium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Number of Valid Data	25	Number of Detected Data	15
Number of Distinct Detected Data	15	Number of Non-Detect Data	10
		Percent Non-Detects	40.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.026	Minimum Detected	-3.65
Maximum Detected	2.1	Maximum Detected	0.742
Mean of Detected	0.446	Mean of Detected	-1.483
SD of Detected	0.568	SD of Detected	1.249
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.06	Maximum Non-Detect	-2.813

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	13
Number treated as Detected	12
Single DL Non-Detect Percentage	52.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.725	Shapiro Wilk Test Statistic	0.984
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.273	Mean	-2.623
SD	0.485	SD	1.738
95% DL/2 (t) UCL	0.439	95% H-Stat (DL/2) UCL	0.958
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.688
		SD in Log Scale	1.787
		Mean in Original Scale	0.272
		SD in Original Scale	0.485

95% UCL Output File -- Cadmium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

95% Percentile Bootstrap UCL	0.441
95% BCA Bootstrap UCL	0.489

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.739
Theta Star	0.603
nu star	22.18
A-D Test Statistic	0.339
5% A-D Critical Value	0.769
K-S Test Statistic	0.769
5% K-S Critical Value	0.229

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.026
Maximum	2.1
Mean	0.325
Median	0.176
SD	0.462
k star	0.898
Theta star	0.362
Nu star	44.9
AppChi2	30.53
95% Gamma Approximate UCL	0.477
95% Adjusted Gamma UCL	0.49

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.278
SD	0.472
SE of Mean	0.0977
95% KM (t) UCL	0.445
95% KM (z) UCL	0.439
95% KM (jackknife) UCL	0.439
95% KM (bootstrap t) UCL	0.616
95% KM (BCA) UCL	0.485
95% KM (Percentile Bootstrap) UCL	0.451
95% KM (Chebyshev) UCL	0.704
97.5% KM (Chebyshev) UCL	0.889
99% KM (Chebyshev) UCL	1.251

Potential UCLs to Use

95% KM (BCA) UCL	0.485

95% UCL Output File -- Chromium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium

General Statistics

Number of Valid Data	28	Number of Detected Data	26
Number of Distinct Detected Data	26	Number of Non-Detect Data	2
		Percent Non-Detects	7.14%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	3.5	Minimum Detected	1.253
Maximum Detected	35.83	Maximum Detected	3.579
Mean of Detected	13.86	Mean of Detected	2.461
SD of Detected	7.609	SD of Detected	0.628
Minimum Non-Detect	0.05	Minimum Non-Detect	-2.996
Maximum Non-Detect	0.16	Maximum Non-Detect	-1.833

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	2
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	26
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	7.14%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.932	Shapiro Wilk Test Statistic	0.929
5% Shapiro Wilk Critical Value	0.92	5% Shapiro Wilk Critical Value	0.92
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	12.87	Mean	2.063
SD	8.169	SD	1.588
95% DL/2 (t) UCL	15.5	95% H-Stat (DL/2) UCL	54.2
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	12.61	Mean in Log Scale	2.359
SD	8.532	SD in Log Scale	0.711
95% MLE (t) UCL	15.36	Mean in Original Scale	13.07
95% MLE (Tiku) UCL	15.37	SD in Original Scale	7.876

95% UCL Output File -- Chromium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

95% Percentile Bootstrap UCL	15.52
95% BCA Bootstrap UCL	15.73

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	2.8
Theta Star	4.949
nu star	145.6
A-D Test Statistic	0.596
5% A-D Critical Value	0.75
K-S Test Statistic	0.75
5% K-S Critical Value	0.172

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1E-09
Maximum	35.83
Mean	12.87
Median	13.82
SD	8.175
k star	0.362
Theta star	35.5
Nu star	20.3
AppChi2	11.07
95% Gamma Approximate UCL	23.59
95% Adjusted Gamma UCL	24.53

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	13.12
SD	7.669
SE of Mean	1.478
95% KM (t) UCL	15.64
95% KM (z) UCL	15.55
95% KM (jackknife) UCL	15.63
95% KM (bootstrap t) UCL	15.91
95% KM (BCA) UCL	15.64
95% KM (Percentile Bootstrap) UCL	15.61
95% KM (Chebyshev) UCL	19.56
97.5% KM (Chebyshev) UCL	22.35
99% KM (Chebyshev) UCL	27.83

Potential UCLs to Use

95% KM (t) UCL	15.64
95% KM (Percentile Bootstrap) UCL	15.61

95% UCL Output File – Lead in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Number of Valid Observations 30

Number of Distinct Observations 30

Raw Statistics

Minimum	8.11
Maximum	117
Mean	29.23
Median	23.08
SD	21.13
Coefficient of Variation	0.723
Skewness	2.95

Log-transformed Statistics

Minimum of Log Data	2.093
Maximum of Log Data	4.762
Mean of log Data	3.221
SD of log Data	0.519

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.653
Shapiro Wilk Critical Value	0.927

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.905
Shapiro Wilk Critical Value	0.927

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	35.79

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	37.8
95% Modified-t UCL	36.13

Assuming Lognormal Distribution

95% H-UCL	34.64
95% Chebyshev (MVUE) UCL	40.84
97.5% Chebyshev (MVUE) UCL	46.17
99% Chebyshev (MVUE) UCL	56.65

Gamma Distribution Test

k star (bias corrected)	3.083
Theta Star	9.481
MLE of Mean	29.23
MLE of Standard Deviation	16.65
nu star	185
Approximate Chi Square Value (.05)	154.5
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	152.9

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	35.58
95% Jackknife UCL	35.79
95% Standard Bootstrap UCL	35.3

95% UCL Output File – Lead in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	2.005
Anderson-Darling 5% Critical Value	0.751
Kolmogorov-Smirnov Test Statistic	0.239
Kolmogorov-Smirnov 5% Critical Value	0.161

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	34.99
95% Adjusted Gamma UCL	35.36

95% Bootstrap-t UCL	40.62
95% Hall's Bootstrap UCL	59.52
95% Percentile Bootstrap UCL	36.42
95% BCA Bootstrap UCL	38.69
95% Chebyshev(Mean, Sd) UCL	46.05
97.5% Chebyshev(Mean, Sd) UCL	53.32
99% Chebyshev(Mean, Sd) UCL	67.62

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 46.05

95% UCL Output File -- Mercury in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Number of Valid Observations 35

Number of Distinct Observations 21

Raw Statistics

Minimum	0.04
Maximum	1.63
Mean	0.185
Median	0.09
SD	0.302
Coefficient of Variation	1.634
Skewness	3.866

Log-transformed Statistics

Minimum of Log Data	-3.219
Maximum of Log Data	0.489
Mean of log Data	-2.188
SD of log Data	0.826

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.461
Shapiro Wilk Critical Value	0.934

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.831
Shapiro Wilk Critical Value	0.934

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.271

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.304
95% Modified-t UCL	0.277

Assuming Lognormal Distribution

95% H-UCL	0.217
95% Chebyshev (MVUE) UCL	0.261
97.5% Chebyshev (MVUE) UCL	0.307
99% Chebyshev (MVUE) UCL	0.397

Gamma Distribution Test

k star (bias corrected)	1.059
Theta Star	0.174
MLE of Mean	0.185
MLE of Standard Deviation	0.18
nu star	74.16
Approximate Chi Square Value (.05)	55.33
Adjusted Level of Significance	0.0425
Adjusted Chi Square Value	54.56

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.269
95% Jackknife UCL	0.271
95% Standard Bootstrap UCL	0.268

95% UCL Output File -- Mercury in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	4.008
Anderson-Darling 5% Critical Value	0.773
Kolmogorov-Smirnov Test Statistic	0.292
Kolmogorov-Smirnov 5% Critical Value	0.153

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.248
95% Adjusted Gamma UCL	0.251

95% Bootstrap-t UCL	0.424
95% Hall's Bootstrap UCL	0.518
95% Percentile Bootstrap UCL	0.277
95% BCA Bootstrap UCL	0.31
95% Chebyshev(Mean, Sd) UCL	0.407
97.5% Chebyshev(Mean, Sd) UCL	0.503
99% Chebyshev(Mean, Sd) UCL	0.692

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 0.407

95% UCL Output File – Selenium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Selenium

General Statistics

Number of Valid Data	35	Number of Detected Data	14
Number of Distinct Detected Data	14	Number of Non-Detect Data	21
		Percent Non-Detects	60.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.93	Minimum Detected	-0.0726
Maximum Detected	2.11	Maximum Detected	0.747
Mean of Detected	1.403	Mean of Detected	0.316
SD of Detected	0.306	SD of Detected	0.22
Minimum Non-Detect	0.42	Minimum Non-Detect	-0.868
Maximum Non-Detect	1.74	Maximum Non-Detect	0.554

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	34
Number treated as Detected	1
Single DL Non-Detect Percentage	97.14%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.934	Shapiro Wilk Test Statistic	0.945
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.84	Mean	-0.371
SD	0.519	SD	0.649
95% DL/2 (t) UCL	0.988	95% H-Stat (DL/2) UCL	1.033
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	0.00272
		SD in Log Scale	0.298
		Mean in Original Scale	1.05
		SD in Original Scale	0.351

95% UCL Output File – Selenium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

95% Percentile Bootstrap UCL	1.15
95% BCA Bootstrap UCL	1.164

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	17.92
Theta Star	0.0783
nu star	501.8
A-D Test Statistic	0.412
5% A-D Critical Value	0.734
K-S Test Statistic	0.734
5% K-S Critical Value	0.228

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.93
Maximum	2.11
Mean	1.402
Median	1.325
SD	0.215
k star	40.65
Theta star	0.0345
Nu star	2845
AppChi2	2723
95% Gamma Approximate UCL	1.466
95% Adjusted Gamma UCL	1.469

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1.129
SD	0.297
SE of Mean	0.0531
95% KM (t) UCL	1.219
95% KM (z) UCL	1.217
95% KM (jackknife) UCL	1.207
95% KM (bootstrap t) UCL	1.221
95% KM (BCA) UCL	1.344
95% KM (Percentile Bootstrap) UCL	1.293
95% KM (Chebyshev) UCL	1.361
97.5% KM (Chebyshev) UCL	1.461
99% KM (Chebyshev) UCL	1.658

Potential UCLs to Use

95% KM (t) UCL	1.219
95% KM (Percentile Bootstrap) UCL	1.293

95% UCL Output File – Strontium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Strontium

General Statistics

Number of Valid Observations 30

Number of Distinct Observations 30

Raw Statistics

Minimum	36.2
Maximum	459
Mean	109.3
Median	63.61
SD	110.3
Coefficient of Variation	1.01
Skewness	2.357

Log-transformed Statistics

Minimum of Log Data	3.589
Maximum of Log Data	6.129
Mean of log Data	4.404
SD of log Data	0.679

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.607
Shapiro Wilk Critical Value	0.927

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.803
Shapiro Wilk Critical Value	0.927

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	143.5

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	151.7
95% Modified-t UCL	144.9

Assuming Lognormal Distribution

95% H-UCL	134.5
95% Chebyshev (MVUE) UCL	161.5
97.5% Chebyshev (MVUE) UCL	187.2
99% Chebyshev (MVUE) UCL	237.7

Gamma Distribution Test

k star (bias corrected)	1.709
Theta Star	63.94
MLE of Mean	109.3
MLE of Standard Deviation	83.58
nu star	102.5
Approximate Chi Square Value (.05)	80.16
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	79.02

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	142.4
95% Jackknife UCL	143.5
95% Standard Bootstrap UCL	141.8

95% UCL Output File – Strontium in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	3.378
Anderson-Darling 5% Critical Value	0.76
Kolmogorov-Smirnov Test Statistic	0.327
Kolmogorov-Smirnov 5% Critical Value	0.162

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	139.7
95% Adjusted Gamma UCL	141.8

Potential UCL to Use

95% Bootstrap-t UCL	167.5
95% Hall's Bootstrap UCL	156.5
95% Percentile Bootstrap UCL	143.5
95% BCA Bootstrap UCL	150.6
95% Chebyshev(Mean, Sd) UCL	197.1
97.5% Chebyshev(Mean, Sd) UCL	235.1
99% Chebyshev(Mean, Sd) UCL	309.7

Use 95% Chebyshev (Mean, Sd) UCL 197.1

95% UCL Output File – Zinc in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Number of Valid Observations	17	Number of Distinct Observations	17

Raw Statistics

Minimum	24.8
Maximum	414.3
Mean	100.1
Median	65.09
SD	91.73
Coefficient of Variation	0.916
Skewness	2.862

Log-transformed Statistics

Minimum of Log Data	3.211
Maximum of Log Data	6.027
Mean of log Data	4.375
SD of log Data	0.633

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.618
Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.872
Shapiro Wilk Critical Value	0.892

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	139

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	153.2
95% Modified-t UCL	141.5

Assuming Lognormal Distribution

95% H-UCL	137
95% Chebyshev (MVUE) UCL	163.1
97.5% Chebyshev (MVUE) UCL	192.2
99% Chebyshev (MVUE) UCL	249.4

Gamma Distribution Test

k star (bias corrected)	1.948
Theta Star	51.41
MLE of Mean	100.1
MLE of Standard Deviation	71.74
nu star	66.22
Approximate Chi Square Value (.05)	48.49
Adjusted Level of Significance	0.0346
Adjusted Chi Square Value	46.9

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	136.7
95% Jackknife UCL	139
95% Standard Bootstrap UCL	135.8

95% UCL Output File – Zinc in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	1.517
Anderson-Darling 5% Critical Value	0.748
Kolmogorov-Smirnov Test Statistic	0.294
Kolmogorov-Smirnov 5% Critical Value	0.211

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	136.7
95% Adjusted Gamma UCL	141.3

95% Bootstrap-t UCL	187.1
95% Hall's Bootstrap UCL	261.5
95% Percentile Bootstrap UCL	141.2
95% BCA Bootstrap UCL	158.6
95% Chebyshev(Mean, Sd) UCL	197.1
97.5% Chebyshev(Mean, Sd) UCL	239.1
99% Chebyshev(Mean, Sd) UCL	321.5

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 197.1

95% UCL Output File -- Benzo(b)fluoranthene in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Benzo(b)fluoranthene was not processed!

95% UCL Output File – Chrysene in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene

General Statistics

Number of Valid Data	10	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	8
		Percent Non-Detects	80.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.036	Minimum Detected	-3.324
Maximum Detected	0.069	Maximum Detected	-2.674
Mean of Detected	0.0525	Mean of Detected	-2.999
SD of Detected	0.0233	SD of Detected	0.46
Minimum Non-Detect	0.028	Minimum Non-Detect	-3.576
Maximum Non-Detect	0.063	Maximum Non-Detect	-2.765

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	9
Number treated as Detected	1
Single DL Non-Detect Percentage	90.00%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A

95% UCL Output File – Chrysene in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0268
SD	0.0164
95% DL/2 (t) UCL	0.0363
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-3.74
SD	0.48
95% H-Stat (DL/2) UCL	0.0329
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0393
SD	0.0099
SE of Mean	0.00443
95% KM (t) UCL	0.0474
95% KM (z) UCL	0.0466
95% KM (jackknife) UCL	0.0623
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	0.069
95% KM (Percentile Bootstrap) UCL	0.069
95% KM (Chebyshev) UCL	0.0586
97.5% KM (Chebyshev) UCL	0.0669
99% KM (Chebyshev) UCL	0.0834

Potential UCLs to Use

95% KM (t) UCL	0.0474
95% KM (% Bootstrap) UCL	0.069

95% UCL Output File -- Fluorene in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluorene

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Fluorene was not processed!

95% UCL Output File -- Indeno(1,2,3-cd)pyrene in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Indeno(1,2,3-cd)pyrene was not processed!

95% UCL Output File -- Phenanthrene in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Phenanthrene was not processed!

95% UCL Output File -- Total LPAHs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_DW_TPAHs.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total LPAHs

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 9

Raw Statistics

Minimum	0.233
Maximum	1.401
Mean	0.421
Median	0.299
SD	0.349
Coefficient of Variation	0.828
Skewness	3.017

Log-transformed Statistics

Minimum of Log Data	-1.457
Maximum of Log Data	0.337
Mean of log Data	-1.028
SD of log Data	0.509

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.509
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.623

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.715
95% Modified-t UCL	0.641

Gamma Distribution Test

k star (bias corrected)	2.331
Theta Star	0.181
MLE of Mean	0.421
MLE of Standard Deviation	0.276
nu star	46.62
Approximate Chi Square Value (.05)	31.95
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	29.85

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.677
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	0.595
95% Chebyshev (MVUE) UCL	0.688
97.5% Chebyshev (MVUE) UCL	0.813
99% Chebyshev (MVUE) UCL	1.056

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.602
95% Jackknife UCL	0.623

95% UCL Output File – Total LPAHs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	1.716
Anderson-Darling 5% Critical Value	0.732
Kolmogorov-Smirnov Test Statistic	0.336
Kolmogorov-Smirnov 5% Critical Value	0.268

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.614
95% Adjusted Gamma UCL	0.657

95% Standard Bootstrap UCL	0.595
95% Bootstrap-t UCL	1.682
95% Hall's Bootstrap UCL	1.487
95% Percentile Bootstrap UCL	0.63
95% BCA Bootstrap UCL	0.743
95% Chebyshev(Mean, Sd) UCL	0.902
97.5% Chebyshev(Mean, Sd) UCL	1.11
99% Chebyshev(Mean, Sd) UCL	1.518

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 0.902

95% UCL Output File -- Total HPAHs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_DW_TPAHs.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total HPAHs

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 10

Raw Statistics

Minimum	0.37
Maximum	0.826
Mean	0.552
Median	0.492
SD	0.162
Coefficient of Variation	0.294
Skewness	0.874

Log-transformed Statistics

Minimum of Log Data	-0.994
Maximum of Log Data	-0.191
Mean of log Data	-0.63
SD of log Data	0.278

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.871
Shapiro Wilk Critical Value	0.842

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.914
Shapiro Wilk Critical Value	0.842

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.646

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.652
95% Modified-t UCL	0.649

Assuming Lognormal Distribution

95% H-UCL	0.664
95% Chebyshev (MVUE) UCL	0.764
97.5% Chebyshev (MVUE) UCL	0.856
99% Chebyshev (MVUE) UCL	1.037

Gamma Distribution Test

k star (bias corrected)	9.884
Theta Star	0.0559
MLE of Mean	0.552
MLE of Standard Deviation	0.176
nu star	197.7
Approximate Chi Square Value (.05)	166.2
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	161.1

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	0.637
95% Jackknife UCL	0.646
95% Standard Bootstrap UCL	0.631

95% UCL Output File – Total HPAHs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.491
Anderson-Darling 5% Critical Value	0.725
Kolmogorov-Smirnov Test Statistic	0.217
Kolmogorov-Smirnov 5% Critical Value	0.266

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.657
95% Adjusted Gamma UCL	0.678

Potential UCL to Use

95% Bootstrap-t UCL	0.682
95% Hall's Bootstrap UCL	0.656
95% Percentile Bootstrap UCL	0.636
95% BCA Bootstrap UCL	0.654
95% Chebyshev(Mean, Sd) UCL	0.776
97.5% Chebyshev(Mean, Sd) UCL	0.873
99% Chebyshev(Mean, Sd) UCL	1.063

Use 95% Student's-t UCL 0.646

95% UCL Output File – Total PAHs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_DW_TPAHs.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total PAHs

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics

Minimum	0.603
Maximum	2.227
Mean	0.973
Median	0.812
SD	0.472
Coefficient of Variation	0.485
Skewness	2.464

Log-transformed Statistics

Minimum of Log Data	-0.506
Maximum of Log Data	0.801
Mean of log Data	-0.101
SD of log Data	0.373

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.691
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.842
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1.247

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	1.343
95% Modified-t UCL	1.266

Assuming Lognormal Distribution

95% H-UCL	1.252
95% Chebyshev (MVUE) UCL	1.462
97.5% Chebyshev (MVUE) UCL	1.678
99% Chebyshev (MVUE) UCL	2.104

Gamma Distribution Test

k star (bias corrected)	4.91
Theta Star	0.198
MLE of Mean	0.973
MLE of Standard Deviation	0.439
nu star	98.19
Approximate Chi Square Value (.05)	76.33
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	72.99

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	1.219
95% Jackknife UCL	1.247
95% Standard Bootstrap UCL	1.208

95% UCL Output File -- Total PAHs in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.828	95% Bootstrap-t UCL	1.62
Anderson-Darling 5% Critical Value	0.728	95% Hall's Bootstrap UCL	2.149
Kolmogorov-Smirnov Test Statistic	0.219	95% Percentile Bootstrap UCL	1.223
Kolmogorov-Smirnov 5% Critical Value	0.267	95% BCA Bootstrap UCL	1.369
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.623
		97.5% Chebyshev(Mean, Sd) UCL	1.905
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2.457
95% Approximate Gamma UCL	1.252		
95% Adjusted Gamma UCL	1.309		
Potential UCL to Use		Use 95% Approximate Gamma UCL	1.252

95% UCL Output File -- Chlorides in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chlorides

General Statistics

Number of Valid Observations	55	Number of Distinct Observations	55

Raw Statistics

Minimum	540
Maximum	73800
Mean	5678
Median	3542
SD	9905
Coefficient of Variation	1.744
Skewness	6.261

Log-transformed Statistics

Minimum of Log Data	6.292
Maximum of Log Data	11.21
Mean of log Data	8.192
SD of log Data	0.847

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.302
Lilliefors Critical Value	0.119

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.077
Lilliefors Critical Value	0.119

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	7913

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	9079
95% Modified-t UCL	8101

Assuming Lognormal Distribution

95% H-UCL	6635
95% Chebyshev (MVUE) UCL	8021
97.5% Chebyshev (MVUE) UCL	9274
99% Chebyshev (MVUE) UCL	11735

Gamma Distribution Test

k star (bias corrected)	1.19
Theta Star	4771
MLE of Mean	5678
MLE of Standard Deviation	5205
nu star	130.9
Approximate Chi Square Value (.05)	105.5
Adjusted Level of Significance	0.0456
Adjusted Chi Square Value	104.9

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	7874
95% Jackknife UCL	7913
95% Standard Bootstrap UCL	7839

95% UCL Output File – Chlorides in Sediment (mg/kg-DW)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	1.933
Anderson-Darling 5% Critical Value	0.774
Kolmogorov-Smirnov Test Statistic	0.136
Kolmogorov-Smirnov 5% Critical Value	0.123

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	7047
95% Adjusted Gamma UCL	7088

95% Bootstrap-t UCL	12002
95% Hall's Bootstrap UCL	16245
95% Percentile Bootstrap UCL	8235
95% BCA Bootstrap UCL	9356
95% Chebyshev(Mean, Sd) UCL	11499
97.5% Chebyshev(Mean, Sd) UCL	14018
99% Chebyshev(Mean, Sd) UCL	18966

Potential UCL to Use

Use 95% H-UCL 6635

95% UCL Output File – Total Moisture in Sediment (wt%)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_Surf_DW_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total Moisture (wt%)

General Statistics

Number of Valid Observations	57	Number of Distinct Observations	51

Raw Statistics

Minimum	29.2
Maximum	86
Mean	67.72
Median	69.4
SD	11.38
Coefficient of Variation	0.168
Skewness	-1.127

Log-transformed Statistics

Minimum of Log Data	3.374
Maximum of Log Data	4.454
Mean of log Data	4.199
SD of log Data	0.196

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.123
Lilliefors Critical Value	0.117

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.174
Lilliefors Critical Value	0.117

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	70.25

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	69.96
95% Modified-t UCL	70.21

Assuming Lognormal Distribution

95% H-UCL	71.02
95% Chebyshev (MVUE) UCL	75.62
97.5% Chebyshev (MVUE) UCL	78.98
99% Chebyshev (MVUE) UCL	85.58

Gamma Distribution Test

k star (bias corrected)	28.17
Theta Star	2.404
MLE of Mean	67.72
MLE of Standard Deviation	12.76
nu star	3211
Approximate Chi Square Value (.05)	3081
Adjusted Level of Significance	0.0458
Adjusted Chi Square Value	3077

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	70.2
95% Jackknife UCL	70.25
95% Standard Bootstrap UCL	70.2

95% UCL Output File – Total Moisture in Sediment (wt%)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	2.028
Anderson-Darling 5% Critical Value	0.748
Kolmogorov-Smirnov Test Statistic	0.155
Kolmogorov-Smirnov 5% Critical Value	0.118

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	70.6
95% Adjusted Gamma UCL	70.67

Potential UCL to Use

Use 95% Student's-t UCL	70.25
or 95% Modified-t UCL	70.21

95% Bootstrap-t UCL	70
95% Hall's Bootstrap UCL	69.86
95% Percentile Bootstrap UCL	70.22
95% BCA Bootstrap UCL	70.03
95% Chebyshev(Mean, Sd) UCL	74.29
97.5% Chebyshev(Mean, Sd) UCL	77.14
99% Chebyshev(Mean, Sd) UCL	82.72

95% UCL Output File – AVS/SEM in Sediment [(umol/g)/(umol/g)]
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SED_DW_AVS-SEM.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

AVS/SEM

General Statistics

Number of Valid Observations	9	Number of Distinct Observations	9

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.021	Minimum of Log Data	0.0212
Maximum	95.94	Maximum of Log Data	4.564
Mean	41.43	Mean of log Data	3.143
Median	27.94	SD of log Data	1.45
SD	34.84		
Coefficient of Variation	0.841		
Skewness	0.488		

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.906	Shapiro Wilk Test Statistic	0.876
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	63.02	95% H-UCL	606.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	174.5
95% Adjusted-CLT UCL	62.54	97.5% Chebyshev (MVUE) UCL	226.3
95% Modified-t UCL	63.34	99% Chebyshev (MVUE) UCL	327.9
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.737	**Data appear Normal at 5% Significance Level**	
Theta Star	56.24		

95% UCL Output File – AVS/SEM in Sediment [(umol/g)/(umol/g)]
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

MLE of Mean	41.43
MLE of Standard Deviation	48.27
nu star	13.26
Approximate Chi Square Value (.05)	6.068
Adjusted Level of Significance	0.0231
Adjusted Chi Square Value	5.079
Anderson-Darling Test Statistic	0.276
Anderson-Darling 5% Critical Value	0.744
Kolmogorov-Smirnov Test Statistic	0.167
Kolmogorov-Smirnov 5% Critical Value	0.287

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	90.53
95% Adjusted Gamma UCL	108.2

Nonparametric Statistics

95% CLT UCL	60.53
95% Jackknife UCL	63.02
95% Standard Bootstrap UCL	59.47
95% Bootstrap-t UCL	65.69
95% Hall's Bootstrap UCL	58.13
95% Percentile Bootstrap UCL	60.16
95% BCA Bootstrap UCL	60.9
95% Chebyshev(Mean, Sd) UCL	92.04
97.5% Chebyshev(Mean, Sd) UCL	113.9
99% Chebyshev(Mean, Sd) UCL	157

Potential UCL to Use

Use 95% Student's-t UCL 63.02

95% UCL Input File for COCs in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Inorganics (Total)														
	Arsenic-T	D_Arsenic-T	Barium-T	Calcium-T	Chromium-T	Iron-T	Lead-T	D_Lead-T	Magnesium-T	Manganese-T	Potassium-T	Sodium-T	Strontium-T	Zinc-T	D_Zinc-T
SW-01	0.00079	0	0.28	38.4	0.0026	1.26	0.0015	0	88.2	0.23	29.2	631	0.64	0.0062	1
SW-02	0.00079	0	0.29	44.1	0.0023	0.8	0.0015	0	100	0.27	33.3	727	0.71	0.0045	1
SW-03	0.00079	0	0.3	43.3	0.0026	1.08	0.0015	0	98.3	0.3	32.7	771	0.7	0.004	0
SW-04	0.00079	0	0.27	44.6	0.0022	0.49	0.0015	0	103	0.16	34.4	808	0.72	0.004	0
SW-05	0.0019	1	0.29	43.1	0.0025	0.85	0.0015	0	99.1	0.31	33.1	769	0.72	0.004	0
SW-06	0.00079	0	0.39	54.3	0.0025	0.94	0.0015	0	127	0.46	38.6	935	0.9	0.004	0
SW-07	0.00079	0	0.45	56.1	0.0025	0.94	0.0015	0	130	0.61	40.7	981	0.95	0.004	0
SW-09 (avg)	0.00079	0	0.415	59	0.0027	1.115	0.0015	0	140.5	0.505	42.75	1007.5	1	0.004	0
SW-10	0.00079	0	0.38	50.6	0.0022	1.09	0.0015	0	120	0.48	37.2	917	0.86	0.004	0
SW-20	0.013	1	1.23	73.9	0.0075	11.3	0.021	1	149	0.83	59.6	1230	1.74	0.067	1

95% UCL Input File for COCs in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Sample ID	Inorganics (Dissolved)										
	Arsenic-D	D_Arsenic-D	Barium-D	Chromium-D	Lead-D	D_Lead-D	Mercury-D	D_Mercury-D	Strontium-D	Zinc-D	D_Zinc-D
SW-01	0.00079	0	0.28	0.0017	0.0015	0	0.000055	0	0.69	0.004	0
SW-02	0.00079	0	0.28	0.0016	0.0015	0	0.00009	1	0.74	0.004	0
SW-03	0.00079	0	0.29	0.0018	0.0015	0	0.00009	1	0.71	0.004	0
SW-04	0.00079	0	0.26	0.0017	0.0015	0	0.00006	1	0.73	0.004	0
SW-05	0.00079	0	0.26	0.0018	0.0015	0	0.00007	1	0.69	0.004	0
SW-06	0.00079	0	0.37	0.0021	0.0015	0	0.0001	1	0.91	0.004	0
SW-07	0.00079	0	0.42	0.002	0.0015	0	0.00009	1	0.93	0.004	0
SW-09 (avg)	0.00079	0	0.375	0.0023	0.0015	0	0.00008	1	1.015	0.00675	1
SW-10	0.00079	0	0.35	0.0022	0.0015	0	0.00012	1	0.88	0.004	0
SW-20	0.0075	1	1.1	0.0051	0.0088	1	0.000055	0	1.66	0.023	1

95% UCL Input File for COCs in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

	Total PAHs			Other Parameters				
Sample ID	Total LPAHs	Total HPAHs	Total PAHs	Calcium	Hardness	Magnesium	Chloride	TDS
SW-01	0.000153	0.000230	0.000383	38.4	378	88.2	1210	2710
SW-02	0.000155	0.000234	0.000389	44.1	432	100	1330	2900
SW-03	0.000155	0.000234	0.000389	43.3	424	98.3	1250	2780
SW-04	0.000155	0.000232	0.000387	44.6	441	103	1420	3050
SW-05	0.000151	0.000228	0.000379	43.1	425	99.1	1290	2880
SW-06	0.000154	0.000231	0.000385	54.3	541	127	1610	3800
SW-07	0.000153	0.000230	0.000383	56.1	554	130	1640	3590
SW-09 (avg)	0.000153	0.000230	0.000383	59	594	140.5	1855	4185
SW-10	0.000153	0.000230	0.000383	50.6	619	120	1610	3520
SW-20	0.000151	0.000228	0.000379	73.9	677	149	2220	4920

95% UCL Output File – Arsenic (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic-T

General Statistics

Number of Valid Data	10	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	8
		Percent Non-Detects	80.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0019	Minimum Detected	-6.266
Maximum Detected	0.013	Maximum Detected	-4.343
Mean of Detected	0.00745	Mean of Detected	-5.304
SD of Detected	0.00785	SD of Detected	1.36
Minimum Non-Detect	0.00079	Minimum Non-Detect	-7.143
Maximum Non-Detect	0.00079	Maximum Non-Detect	-7.143

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

95% UCL Output File – Arsenic (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00181
SD	0.00396
95% DL/2 (t) UCL	0.0041
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-7.33
SD	1.16
95% H-Stat (DL/2) UCL	0.00404
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00301
SD	0.00333
SE of Mean	0.00149
95% KM (t) UCL	0.00574
95% KM (z) UCL	0.00546
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.0095
97.5% KM (Chebyshev) UCL	0.0123
99% KM (Chebyshev) UCL	0.0178

Potential UCLs to Use

95% KM (BCA) UCL	N/A

95% UCL Output File – Barium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium-T

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 9

Raw Statistics

Minimum	0.27
Maximum	1.23
Mean	0.43
Median	0.34
SD	0.288
Coefficient of Variation	0.672
Skewness	2.88

Log-transformed Statistics

Minimum of Log Data	-1.309
Maximum of Log Data	0.207
Mean of log Data	-0.964
SD of log Data	0.451

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.563
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.597

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.668
95% Modified-t UCL	0.611

Gamma Distribution Test

k star (bias corrected)	3.118
Theta Star	0.138
MLE of Mean	0.43
MLE of Standard Deviation	0.243
nu star	62.35
Approximate Chi Square Value (.05)	45.19
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	42.66

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.722
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	0.583
95% Chebyshev (MVUE) UCL	0.681
97.5% Chebyshev (MVUE) UCL	0.795
99% Chebyshev (MVUE) UCL	1.018

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.58
95% Jackknife UCL	0.597

95% UCL Output File – Barium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	1.362
Anderson-Darling 5% Critical Value	0.729
Kolmogorov-Smirnov Test Statistic	0.298
Kolmogorov-Smirnov 5% Critical Value	0.268

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.593
95% Adjusted Gamma UCL	0.628

Potential UCL to Use

Use 95% Student's-t UCL	0.597
or 95% Modified-t UCL	0.611

95% Standard Bootstrap UCL	0.574
95% Bootstrap-t UCL	1.004
95% Hall's Bootstrap UCL	1.158
95% Percentile Bootstrap UCL	0.586
95% BCA Bootstrap UCL	0.687
95% Chebyshev(Mean, Sd) UCL	0.827
97.5% Chebyshev(Mean, Sd) UCL	0.999
99% Chebyshev(Mean, Sd) UCL	1.337

95% UCL Output File – Chromium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium-T

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	6

Raw Statistics

Minimum	0.0022
Maximum	0.0075
Mean	0.00296
Median	0.0025
SD	0.0016
Coefficient of Variation	0.542
Skewness	3.095

Log-transformed Statistics

Minimum of Log Data	-6.119
Maximum of Log Data	-4.893
Mean of log Data	-5.9
SD of log Data	0.361

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.465
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.549
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.00389

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.00432
95% Modified-t UCL	0.00397

Assuming Lognormal Distribution

95% H-UCL	0.00374
95% Chebyshev (MVUE) UCL	0.00436
97.5% Chebyshev (MVUE) UCL	0.00499
99% Chebyshev (MVUE) UCL	0.00623

Gamma Distribution Test

k star (bias corrected)	4.702
Theta Star	0.0006295
MLE of Mean	0.00296
MLE of Standard Deviation	0.00137
nu star	94.04
Approximate Chi Square Value (.05)	72.68
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	69.42

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.00379
95% Jackknife UCL	0.00389

95% UCL Output File – Chromium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	2.226
Anderson-Darling 5% Critical Value	0.728
Kolmogorov-Smirnov Test Statistic	0.441
Kolmogorov-Smirnov 5% Critical Value	0.267

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.00383
95% Adjusted Gamma UCL	0.00401

95% Standard Bootstrap UCL	0.00375
95% Bootstrap-t UCL	0.00881
95% Hall's Bootstrap UCL	0.00898
95% Percentile Bootstrap UCL	0.00396
95% BCA Bootstrap UCL	0.00447
95% Chebyshev(Mean, Sd) UCL	0.00517
97.5% Chebyshev(Mean, Sd) UCL	0.00613
99% Chebyshev(Mean, Sd) UCL	0.00801

Potential UCL to Use

Use 95% Student's-t UCL	0.00389
or 95% Modified-t UCL	0.00397

95% UCL Output File -- Iron (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron-T

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 9

Raw Statistics

Minimum	0.49
Maximum	11.3
Mean	1.987
Median	1.01
SD	3.279
Coefficient of Variation	1.651
Skewness	3.137

Log-transformed Statistics

Minimum of Log Data	-0.713
Maximum of Log Data	2.425
Mean of log Data	0.171
SD of log Data	0.834

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.428
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.66
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 3.887

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	4.792
95% Modified-t UCL	4.059

Assuming Lognormal Distribution

95% H-UCL	3.631
95% Chebyshev (MVUE) UCL	3.53
97.5% Chebyshev (MVUE) UCL	4.362
99% Chebyshev (MVUE) UCL	5.995

Gamma Distribution Test

k star (bias corrected)	0.841
Theta Star	2.362
MLE of Mean	1.987
MLE of Standard Deviation	2.166
nu star	16.82
Approximate Chi Square Value (.05)	8.543
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	7.54

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	3.692
95% Jackknife UCL	3.887

95% UCL Output File – Iron (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	2.154
Anderson-Darling 5% Critical Value	0.746
Kolmogorov-Smirnov Test Statistic	0.446
Kolmogorov-Smirnov 5% Critical Value	0.273

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	3.911
95% Adjusted Gamma UCL	4.431

95% Standard Bootstrap UCL	3.628
95% Bootstrap-t UCL	24.74
95% Hall's Bootstrap UCL	18.29
95% Percentile Bootstrap UCL	4.001
95% BCA Bootstrap UCL	4.147
95% Chebyshev(Mean, Sd) UCL	6.507
97.5% Chebyshev(Mean, Sd) UCL	8.463
99% Chebyshev(Mean, Sd) UCL	12.3

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 6.507

95% UCL Output File – Lead (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead-T

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Lead-T was not processed!

95% UCL Output File -- Magnesium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Magnesium-T

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 10

Raw Statistics

Minimum	88.2
Maximum	149
Mean	115.5
Median	111.5
SD	20.59
Coefficient of Variation	0.178
Skewness	0.354

Log-transformed Statistics

Minimum of Log Data	4.48
Maximum of Log Data	5.004
Mean of log Data	4.735
SD of log Data	0.177

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.924
Shapiro Wilk Critical Value	0.842

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.93
Shapiro Wilk Critical Value	0.842

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 127.4

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	127
95% Modified-t UCL	127.6

Assuming Lognormal Distribution

95% H-UCL	129.1
95% Chebyshev (MVUE) UCL	143.7
97.5% Chebyshev (MVUE) UCL	156
99% Chebyshev (MVUE) UCL	180

Gamma Distribution Test

k star (bias corrected)	24.91
Theta Star	4.637
MLE of Mean	115.5
MLE of Standard Deviation	23.14
nu star	498.2
Approximate Chi Square Value (.05)	447.4
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	439.1

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	126.2
95% Jackknife UCL	127.4
95% Standard Bootstrap UCL	125.5

95% UCL Output File -- Magnesium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.426	95% Bootstrap-t UCL	128.5
Anderson-Darling 5% Critical Value	0.724	95% Hall's Bootstrap UCL	125.4
Kolmogorov-Smirnov Test Statistic	0.23	95% Percentile Bootstrap UCL	125.6
Kolmogorov-Smirnov 5% Critical Value	0.266	95% BCA Bootstrap UCL	126.7
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	143.9
		97.5% Chebyshev(Mean, Sd) UCL	156.2
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	180.3
95% Approximate Gamma UCL	128.6		
95% Adjusted Gamma UCL	131.1		
Potential UCL to Use		Use 95% Student's-t UCL	127.4

95% UCL Output File -- Manganese (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese-T

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.16	Minimum of Log Data	-1.833
Maximum	0.83	Maximum of Log Data	-0.186
Mean	0.416	Mean of log Data	-0.986
Median	0.385	SD of log Data	0.496
SD	0.203		
Coefficient of Variation	0.487		
Skewness	0.849		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.936	Shapiro Wilk Test Statistic	0.979
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.533	95% H-UCL	0.609
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.706
95% Adjusted-CLT UCL	0.539	97.5% Chebyshev (MVUE) UCL	0.832
95% Modified-t UCL	0.536	99% Chebyshev (MVUE) UCL	1.078

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	3.425	**Data appear Normal at 5% Significance Level**
Theta Star	0.121	
MLE of Mean	0.416	
MLE of Standard Deviation	0.225	
nu star	68.49	
Approximate Chi Square Value (.05)	50.44	**Nonparametric Statistics**
Adjusted Level of Significance	0.0267	95% CLT UCL 0.521
Adjusted Chi Square Value	47.76	95% Jackknife UCL 0.533
		95% Standard Bootstrap UCL 0.516

95% UCL Output File -- Manganese (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.215
Anderson-Darling 5% Critical Value	0.729
Kolmogorov-Smirnov Test Statistic	0.176
Kolmogorov-Smirnov 5% Critical Value	0.268

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.564
95% Adjusted Gamma UCL	0.596

Potential UCL to Use

Use 95% Student's-t UCL	0.533

95% Bootstrap-t UCL	0.568
95% Hall's Bootstrap UCL	0.561
95% Percentile Bootstrap UCL	0.521
95% BCA Bootstrap UCL	0.534
95% Chebyshev(Mean, Sd) UCL	0.695
97.5% Chebyshev(Mean, Sd) UCL	0.815
99% Chebyshev(Mean, Sd) UCL	1.053

95% UCL Output File – Potassium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Potassium-T

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	29.2	Minimum of Log Data	3.374
Maximum	59.6	Maximum of Log Data	4.088
Mean	38.16	Mean of log Data	3.622
Median	35.8	SD of log Data	0.199
SD	8.575		
Coefficient of Variation	0.225		
Skewness	1.938		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.809	Shapiro Wilk Test Statistic	0.886
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	43.13	95% H-UCL	43.26
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	48.61
95% Adjusted-CLT UCL	44.39	97.5% Chebyshev (MVUE) UCL	53.15
95% Modified-t UCL	43.4	99% Chebyshev (MVUE) UCL	62.08

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	18.31	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	2.084	
MLE of Mean	38.16	
MLE of Standard Deviation	8.916	
nu star	366.2	
Approximate Chi Square Value (.05)	322.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.0267	95% CLT UCL 42.62
Adjusted Chi Square Value	315.8	95% Jackknife UCL 43.13
		95% Standard Bootstrap UCL 42.49

95% UCL Output File – Potassium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.569
Anderson-Darling 5% Critical Value	0.725
Kolmogorov-Smirnov Test Statistic	0.175
Kolmogorov-Smirnov 5% Critical Value	0.266

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	43.28
95% Adjusted Gamma UCL	44.25

95% Bootstrap-t UCL	46.47
95% Hall's Bootstrap UCL	62.41
95% Percentile Bootstrap UCL	42.97
95% BCA Bootstrap UCL	44.54
95% Chebyshev(Mean, Sd) UCL	49.97
97.5% Chebyshev(Mean, Sd) UCL	55.09
99% Chebyshev(Mean, Sd) UCL	65.14

Potential UCL to Use

Use 95% Approximate Gamma UCL 43.28

95% UCL Output File – Sodium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Sodium-T

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics

Minimum	631
Maximum	1230
Mean	877.7
Median	862.5
SD	172.6
Coefficient of Variation	0.197
Skewness	0.703

Log-transformed Statistics

Minimum of Log Data	6.447
Maximum of Log Data	7.115
Mean of log Data	6.76
SD of log Data	0.193

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.955
Shapiro Wilk Critical Value	0.842

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	977.7

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	980.4
95% Modified-t UCL	979.7

Gamma Distribution Test

k star (bias corrected)	20.93
Theta Star	41.93
MLE of Mean	877.7
MLE of Standard Deviation	191.8
nu star	418.6
Approximate Chi Square Value (.05)	372.2
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	364.6

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.977
Shapiro Wilk Critical Value	0.842

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	991.6
95% Chebyshev (MVUE) UCL	1111
97.5% Chebyshev (MVUE) UCL	1212
99% Chebyshev (MVUE) UCL	1411

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	967.4
95% Jackknife UCL	977.7
95% Standard Bootstrap UCL	962

95% UCL Output File – Sodium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.224
Anderson-Darling 5% Critical Value	0.724
Kolmogorov-Smirnov Test Statistic	0.149
Kolmogorov-Smirnov 5% Critical Value	0.266

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	987.1
95% Adjusted Gamma UCL	1008

Potential UCL to Use

Use 95% Student's-t UCL 977.7

95% Bootstrap-t UCL	999.4
95% Hall's Bootstrap UCL	1007
95% Percentile Bootstrap UCL	963.4
95% BCA Bootstrap UCL	972.9
95% Chebyshev(Mean, Sd) UCL	1116
97.5% Chebyshev(Mean, Sd) UCL	1218
99% Chebyshev(Mean, Sd) UCL	1421

95% UCL Output File – Strontium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Strontium-T

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 9

Raw Statistics

Minimum	0.64
Maximum	1.74
Mean	0.894
Median	0.79
SD	0.321
Coefficient of Variation	0.359
Skewness	2.376

Log-transformed Statistics

Minimum of Log Data	-0.446
Maximum of Log Data	0.554
Mean of log Data	-0.156
SD of log Data	0.291

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.705
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1.08

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	1.143
95% Modified-t UCL	1.093

Gamma Distribution Test

k star (bias corrected)	8.217
Theta Star	0.109
MLE of Mean	0.894
MLE of Standard Deviation	0.312
nu star	164.3
Approximate Chi Square Value (.05)	135.7
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	131.2

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.817
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	1.08
95% Chebyshev (MVUE) UCL	1.248
97.5% Chebyshev (MVUE) UCL	1.403
99% Chebyshev (MVUE) UCL	1.707

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	1.061
95% Jackknife UCL	1.08

95% UCL Output File -- Strontium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.868
Anderson-Darling 5% Critical Value	0.725
Kolmogorov-Smirnov Test Statistic	0.23
Kolmogorov-Smirnov 5% Critical Value	0.267

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1.083
95% Adjusted Gamma UCL	1.12

Potential UCL to Use

95% Standard Bootstrap UCL	1.05
95% Bootstrap-t UCL	1.292
95% Hall's Bootstrap UCL	1.707
95% Percentile Bootstrap UCL	1.069
95% BCA Bootstrap UCL	1.135
95% Chebyshev(Mean, Sd) UCL	1.337
97.5% Chebyshev(Mean, Sd) UCL	1.528
99% Chebyshev(Mean, Sd) UCL	1.904

Use 95% Approximate Gamma UCL 1.083

95% UCL Output File – Zinc (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc-T

General Statistics

Number of Valid Data	10	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	7
		Percent Non-Detects	70.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.0045	Minimum Detected	-5.404
Maximum Detected	0.067	Maximum Detected	-2.703
Mean of Detected	0.0259	Mean of Detected	-4.397
SD of Detected	0.0356	SD of Detected	1.475
Minimum Non-Detect	0.004	Minimum Non-Detect	-5.521
Maximum Non-Detect	0.004	Maximum Non-Detect	-5.521

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.77	Shapiro Wilk Test Statistic	0.838
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00917	Mean	-5.669
SD	0.0204	SD	1.12
95% DL/2 (t) UCL	0.021	95% H-Stat (DL/2) UCL	0.0201

95% UCL Output File – Zinc (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Log ROS Method	
Mean in Log Scale	-8.75
SD in Log Scale	3.631
Mean in Original Scale	0.00785
SD in Original Scale	0.0209
95% Percentile Bootstrap UCL	0.0207
95% BCA Bootstrap UCL	0.0279

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0109
SD	0.0187
SE of Mean	0.00724
95% KM (t) UCL	0.0242
95% KM (z) UCL	0.0228
95% KM (jackknife) UCL	0.0216
95% KM (bootstrap t) UCL	0.254
95% KM (BCA) UCL	0.067
95% KM (Percentile Bootstrap) UCL	0.067
95% KM (Chebyshev) UCL	0.0425
97.5% KM (Chebyshev) UCL	0.0561
99% KM (Chebyshev) UCL	0.083

Potential UCLs to Use

95% KM (t) UCL	0.0242
95% KM (Percentile Bootstrap) UCL	0.067

95% UCL Output File – Arsenic (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic-D

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Arsenic-D was not processed!

95% UCL Output File – Barium (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium-D

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	8

Raw Statistics

Minimum	0.26
Maximum	1.1
Mean	0.399
Median	0.32
SD	0.253
Coefficient of Variation	0.634
Skewness	2.886

Log-transformed Statistics

Minimum of Log Data	-1.347
Maximum of Log Data	0.0953
Mean of log Data	-1.028
SD of log Data	0.429

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.563
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.716
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.545

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.608
95% Modified-t UCL	0.557

Assuming Lognormal Distribution

95% H-UCL	0.532
95% Chebyshev (MVUE) UCL	0.622
97.5% Chebyshev (MVUE) UCL	0.723
99% Chebyshev (MVUE) UCL	0.921

Gamma Distribution Test

k star (bias corrected)	3.436
Theta Star	0.116
MLE of Mean	0.399
MLE of Standard Deviation	0.215
nu star	68.72
Approximate Chi Square Value (.05)	50.64
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	47.95

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.53
95% Jackknife UCL	0.545

95% UCL Output File -- Barium (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	1.375
Anderson-Darling 5% Critical Value	0.729
Kolmogorov-Smirnov Test Statistic	0.294
Kolmogorov-Smirnov 5% Critical Value	0.268

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.541
95% Adjusted Gamma UCL	0.571

95% Standard Bootstrap UCL	0.524
95% Bootstrap-t UCL	0.92
95% Hall's Bootstrap UCL	1.046
95% Percentile Bootstrap UCL	0.543
95% BCA Bootstrap UCL	0.622
95% Chebyshev(Mean, Sd) UCL	0.747
97.5% Chebyshev(Mean, Sd) UCL	0.897
99% Chebyshev(Mean, Sd) UCL	1.193

Potential UCL to Use

Use 95% Student's-t UCL	0.545
or 95% Modified-t UCL	0.557

95% UCL Output File -- Chromium (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium-D

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 8

Raw Statistics

Minimum	0.0016
Maximum	0.0051
Mean	0.00223
Median	0.0019
SD	0.00103
Coefficient of Variation	0.464
Skewness	2.871

Log-transformed Statistics

Minimum of Log Data	-6.438
Maximum of Log Data	-5.279
Mean of log Data	-6.169
SD of log Data	0.335

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.577
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.703
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 0.00283

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	0.00309
95% Modified-t UCL	0.00288

Assuming Lognormal Distribution

95% H-UCL	0.00277
95% Chebyshev (MVUE) UCL	0.00323
97.5% Chebyshev (MVUE) UCL	0.00367
99% Chebyshev (MVUE) UCL	0.00454

Gamma Distribution Test

k star (bias corrected)	5.759
Theta Star	0.0003873
MLE of Mean	0.00223
MLE of Standard Deviation	0.0009293
nu star	115.2
Approximate Chi Square Value (.05)	91.4
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	87.72

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.00277
95% Jackknife UCL	0.00283

95% UCL Output File – Chromium (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	1.398
Anderson-Darling 5% Critical Value	0.727
Kolmogorov-Smirnov Test Statistic	0.319
Kolmogorov-Smirnov 5% Critical Value	0.267

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.00281
95% Adjusted Gamma UCL	0.00293

Potential UCL to Use

Use 95% Student's-t UCL	0.00283
or 95% Modified-t UCL	0.00288

95% Standard Bootstrap UCL	0.00274
95% Bootstrap-t UCL	0.00424
95% Hall's Bootstrap UCL	0.00485
95% Percentile Bootstrap UCL	0.00285
95% BCA Bootstrap UCL	0.00315
95% Chebyshev(Mean, Sd) UCL	0.00366
97.5% Chebyshev(Mean, Sd) UCL	0.00427
99% Chebyshev(Mean, Sd) UCL	0.00549

95% UCL Output File – Lead (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead-D

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Lead-D was not processed!

95% UCL Output File – Mercury (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury-D

General Statistics

Number of Valid Data	10	Number of Detected Data	8
Number of Distinct Detected Data	6	Number of Non-Detect Data	2
		Percent Non-Detects	20.00%

Raw Statistics

Minimum Detected	0.00006
Maximum Detected	0.00012
Mean of Detected	0.0000875
SD of Detected	1.832E-05
Minimum Non-Detect	0.000055
Maximum Non-Detect	0.000055

Log-transformed Statistics

Minimum Detected	-9.721
Maximum Detected	-9.028
Mean of Detected	-9.363
SD of Detected	0.213
Minimum Non-Detect	-9.808
Maximum Non-Detect	-9.808

Warning: There are only 8 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.962
5% Shapiro Wilk Critical Value	0.818

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	0.0000755
SD	3.002E-05
95% DL/2 (t) UCL	9.29E-05

Maximum Likelihood Estimate(MLE) Method

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.964
5% Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	-9.591
SD	0.515
95% H-Stat (DL/2) UCL	9.556E-05

Log ROS Method

95% UCL Output File – Mercury (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Mean	7.842E-05
SD	2.427E-05
95% MLE (t) UCL	9.249E-05
95% MLE (Tiku) UCL	9.309E-05

Mean in Log Scale	-9.466
SD in Log Scale	0.288
Mean in Original Scale	8.029E-05
SD in Original Scale	2.224E-05
95% Percentile Bootstrap UCL	9.093E-05
95% BCA Bootstrap UCL	9.146E-05

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	16.2
Theta Star	5.402E-06
nu star	259.1
A-D Test Statistic	0.27
5% A-D Critical Value	0.716
K-S Test Statistic	0.716
5% K-S Critical Value	0.294

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	5.721E-05
Maximum	0.00012
Mean	8.258E-05
Median	0.000085
SD	1.939E-05
k star	14.41
Theta star	5.729E-06
Nu star	288.3
AppChi2	250
95% Gamma Approximate UCL	9.524E-05
95% Adjusted Gamma UCL	9.766E-05

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.000082
SD	1.887E-05
SE of Mean	6.379E-06
95% KM (t) UCL	9.369E-05
95% KM (z) UCL	9.249E-05
95% KM (jackknife) UCL	9.339E-05
95% KM (bootstrap t) UCL	9.379E-05
95% KM (BCA) UCL	0.000095
95% KM (Percentile Bootstrap) UCL	0.000094
95% KM (Chebyshev) UCL	0.0001098
97.5% KM (Chebyshev) UCL	0.0001218
99% KM (Chebyshev) UCL	0.0001455

Potential UCLs to Use

95% KM (t) UCL	9.369E-05
95% KM (Percentile Bootstrap) UCL	0.000094

95% UCL Output File -- Strontium (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Strontium-D

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 9

Raw Statistics

Minimum	0.69
Maximum	1.66
Mean	0.896
Median	0.81
SD	0.293
Coefficient of Variation	0.327
Skewness	2.308

Log-transformed Statistics

Minimum of Log Data	-0.371
Maximum of Log Data	0.507
Mean of log Data	-0.147
SD of log Data	0.269

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.707
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1.065

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	1.12
95% Modified-t UCL	1.076

Gamma Distribution Test

k star (bias corrected)	9.649
Theta Star	0.0928
MLE of Mean	0.896
MLE of Standard Deviation	0.288
nu star	193
Approximate Chi Square Value (.05)	161.8
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	156.9

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.8
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	1.066
95% Chebyshev (MVUE) UCL	1.224
97.5% Chebyshev (MVUE) UCL	1.368
99% Chebyshev (MVUE) UCL	1.651

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	1.048
95% Jackknife UCL	1.065

95% UCL Output File -- Strontium (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.876
Anderson-Darling 5% Critical Value	0.725
Kolmogorov-Smirnov Test Statistic	0.223
Kolmogorov-Smirnov 5% Critical Value	0.266

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1.068
95% Adjusted Gamma UCL	1.102

Potential UCL to Use

Use 95% Approximate Gamma UCL 1.068

95% Standard Bootstrap UCL	1.035
95% Bootstrap-t UCL	1.252
95% Hall's Bootstrap UCL	1.648
95% Percentile Bootstrap UCL	1.049
95% BCA Bootstrap UCL	1.125
95% Chebyshev(Mean, Sd) UCL	1.299
97.5% Chebyshev(Mean, Sd) UCL	1.473
99% Chebyshev(Mean, Sd) UCL	1.816

95% UCL Output File – Zinc (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc-D

General Statistics

Number of Valid Data	10	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	8
		Percent Non-Detects	80.00%

Raw Statistics

Minimum Detected	0.00675
Maximum Detected	0.023
Mean of Detected	0.0149
SD of Detected	0.0115
Minimum Non-Detect	0.004
Maximum Non-Detect	0.004

Log-transformed Statistics

Minimum Detected	-4.998
Maximum Detected	-3.772
Mean of Detected	-4.385
SD of Detected	0.867
Minimum Non-Detect	-5.521
Maximum Non-Detect	-5.521

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

95% UCL Output File -- Zinc (Dissolved) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00458
SD	0.00664
95% DL/2 (t) UCL	0.00843
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.849
SD	0.824
95% H-Stat (DL/2) UCL	0.00772
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00838
SD	0.00488
SE of Mean	0.00218
95% KM (t) UCL	0.0124
95% KM (z) UCL	0.012
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.0179
97.5% KM (Chebyshev) UCL	0.022
99% KM (Chebyshev) UCL	0.0301

Potential UCLs to Use

95% KM (t) UCL	0.0124
95% KM (% Bootstrap) UCL	N/A

95% UCL Output File -- Calcium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Calcium-T

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics

Minimum	38.4
Maximum	73.9
Mean	50.74
Median	47.6
SD	10.51
Coefficient of Variation	0.207
Skewness	1.188

Log-transformed Statistics

Minimum of Log Data	3.648
Maximum of Log Data	4.303
Mean of log Data	3.909
SD of log Data	0.195

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.896
Shapiro Wilk Critical Value	0.842

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.935
Shapiro Wilk Critical Value	0.842

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	56.83

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	57.54
95% Modified-t UCL	57.04

Assuming Lognormal Distribution

95% H-UCL	57.38
95% Chebyshev (MVUE) UCL	64.36
97.5% Chebyshev (MVUE) UCL	70.27
99% Chebyshev (MVUE) UCL	81.87

Gamma Distribution Test

k star (bias corrected)	19.92
Theta Star	2.548
MLE of Mean	50.74
MLE of Standard Deviation	11.37
nu star	398.3
Approximate Chi Square Value (.05)	353.1
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	345.7

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	56.21
95% Jackknife UCL	56.83
95% Standard Bootstrap UCL	56.05

95% UCL Output File -- Calcium (Total) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.397
Anderson-Darling 5% Critical Value	0.725
Kolmogorov-Smirnov Test Statistic	0.229
Kolmogorov-Smirnov 5% Critical Value	0.266
Data appear Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	57.24
95% Adjusted Gamma UCL	58.47
Potential UCL to Use	

95% Bootstrap-t UCL	59.18
95% Hall's Bootstrap UCL	59.53
95% Percentile Bootstrap UCL	56.01
95% BCA Bootstrap UCL	57.11
95% Chebyshev(Mean, Sd) UCL	65.22
97.5% Chebyshev(Mean, Sd) UCL	71.49
99% Chebyshev(Mean, Sd) UCL	83.8
Use 95% Student's-t UCL	56.83

95% UCL Output File -- Hardness in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Hardness

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 10

Raw Statistics

Minimum	378
Maximum	677
Mean	508.5
Median	491
SD	101.4
Coefficient of Variation	0.199
Skewness	0.363

Log-transformed Statistics

Minimum of Log Data	5.935
Maximum of Log Data	6.518
Mean of log Data	6.214
SD of log Data	0.198

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.914
Shapiro Wilk Critical Value	0.842

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.919
Shapiro Wilk Critical Value	0.842

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	567.3

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	565.2
95% Modified-t UCL	567.9

Assuming Lognormal Distribution

95% H-UCL	576.7
95% Chebyshev (MVUE) UCL	647.6
97.5% Chebyshev (MVUE) UCL	707.9
99% Chebyshev (MVUE) UCL	826.2

Gamma Distribution Test

k star (bias corrected)	19.93
Theta Star	25.51
MLE of Mean	508.5
MLE of Standard Deviation	113.9
nu star	398.6
Approximate Chi Square Value (.05)	353.4
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	345.9

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	561.3
95% Jackknife UCL	567.3
95% Standard Bootstrap UCL	559.6

95% UCL Output File – Hardness in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.491
Anderson-Darling 5% Critical Value	0.725
Kolmogorov-Smirnov Test Statistic	0.251
Kolmogorov-Smirnov 5% Critical Value	0.266

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	573.7
95% Adjusted Gamma UCL	586

Potential UCL to Use

Use 95% Student's-t UCL	567.3

95% Bootstrap-t UCL	572.1
95% Hall's Bootstrap UCL	559.8
95% Percentile Bootstrap UCL	557.8
95% BCA Bootstrap UCL	561
95% Chebyshev(Mean, Sd) UCL	648.3
97.5% Chebyshev(Mean, Sd) UCL	708.8
99% Chebyshev(Mean, Sd) UCL	827.6

95% UCL Output File – Chloride in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloride

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	9

Raw Statistics

Minimum	1210
Maximum	2220
Mean	1544
Median	1515
SD	315.4
Coefficient of Variation	0.204
Skewness	1.111

Log-transformed Statistics

Minimum of Log Data	7.098
Maximum of Log Data	7.705
Mean of log Data	7.324
SD of log Data	0.193

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.896
Shapiro Wilk Critical Value	0.842

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.929
Shapiro Wilk Critical Value	0.842

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1726

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	1745
95% Modified-t UCL	1732

Assuming Lognormal Distribution

95% H-UCL	1744
95% Chebyshev (MVUE) UCL	1954
97.5% Chebyshev (MVUE) UCL	2132
99% Chebyshev (MVUE) UCL	2482

Gamma Distribution Test

k star (bias corrected)	20.33
Theta Star	75.93
MLE of Mean	1544
MLE of Standard Deviation	342.3
nu star	406.6
Approximate Chi Square Value (.05)	360.8
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	353.3

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	1708
95% Jackknife UCL	1726

95% UCL Output File -- Chloride in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.371
Anderson-Darling 5% Critical Value	0.725
Kolmogorov-Smirnov Test Statistic	0.164
Kolmogorov-Smirnov 5% Critical Value	0.266

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1739
95% Adjusted Gamma UCL	1776

Potential UCL to Use

Use 95% Student's-t UCL 1726

95% Standard Bootstrap UCL	1700
95% Bootstrap-t UCL	1797
95% Hall's Bootstrap UCL	1847
95% Percentile Bootstrap UCL	1707
95% BCA Bootstrap UCL	1739
95% Chebyshev(Mean, Sd) UCL	1978
97.5% Chebyshev(Mean, Sd) UCL	2166
99% Chebyshev(Mean, Sd) UCL	2536

95% UCL Output File – Total Dissolved Solids (TDS) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\95UCL temp\95UCL_Input_SW_MPA May2010_MDL.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TDS

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 10

Raw Statistics

Minimum	2710
Maximum	4920
Mean	3434
Median	3285
SD	717.2
Coefficient of Variation	0.209
Skewness	1.027

Log-transformed Statistics

Minimum of Log Data	7.905
Maximum of Log Data	8.501
Mean of log Data	8.123
SD of log Data	0.198

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.891
Shapiro Wilk Critical Value	0.842

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.916
Shapiro Wilk Critical Value	0.842

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	3849

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	3885
95% Modified-t UCL	3862

Assuming Lognormal Distribution

95% H-UCL	3892
95% Chebyshev (MVUE) UCL	4370
97.5% Chebyshev (MVUE) UCL	4776
99% Chebyshev (MVUE) UCL	5574

Gamma Distribution Test

k star (bias corrected)	19.38
Theta Star	177.2
MLE of Mean	3434
MLE of Standard Deviation	780
nu star	387.6
Approximate Chi Square Value (.05)	342.9
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	335.6

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	3807
95% Jackknife UCL	3849
95% Standard Bootstrap UCL	3786

95% UCL Output File – Total Dissolved Solids (TDS) in Surface Water (mg/L)
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Anderson-Darling Test Statistic	0.421
Anderson-Darling 5% Critical Value	0.725
Kolmogorov-Smirnov Test Statistic	0.207
Kolmogorov-Smirnov 5% Critical Value	0.266

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	3880
95% Adjusted Gamma UCL	3965

Potential UCL to Use

Use 95% Student's-t UCL	3849

95% Bootstrap-t UCL	3991
95% Hall's Bootstrap UCL	3996
95% Percentile Bootstrap UCL	3816
95% BCA Bootstrap UCL	3842
95% Chebyshev(Mean, Sd) UCL	4422
97.5% Chebyshev(Mean, Sd) UCL	4850
99% Chebyshev(Mean, Sd) UCL	5690

APPENDIX B

Wildlife Toxicity Reference Values (TRVs)

Table B-1
Summary of Unadjusted TRVs
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Test Species	Endpoint	Effect(s)	Dose (mg/kg-day)	Reference
Cadmium				
Rat	NOAEL	reproduction	1	Sutou *et al*. 1980 as cited in Sample *et al*. 1996.
Rat	LOAEL	reproduction	10	Sutou *et al*. 1980 as cited in Sample *et al*. 1996.
Mallard duck	NOAEL	reproduction	1.45	White and Finley 1978 as cited in Sample *et al*. 1996.
Mallard duck	LOAEL	reproduction	20	White and Finley 1978 as cited in Sample *et al*. 1996.
Lead				
Rat	NOAEL	reproduction	18	Barratt *et al*. 1989 as cited in USEPA 2005
Rat	LOAEL	reproduction	180	Barratt et al. 1989 as cited in USEPA 2005
American Kestrels	NOAEL	reproduction	3.85	Pattee 1984 as cited in Sample *et al*. 1996.
American Kestrels	LOAEL	reproduction	19.25	NOAEL x 5
Methylmercury				
Mink	NOAEL (subchronic)	mortality,weight loss, behavior	0.150	Wobeser *et al*. 1976 as cited in Sample *et al*. 1996
Mink	LOAEL (subchronic)	mortality,weight loss, behavior	0.247	Wobeser *et al*. 1976 as cited in Sample *et al*. 1996
Mallard duck	NOAEL	reproduction	0.013	LOAEL ÷ 5
Mallard duck	LOAEL	reproduction	0.064	Heinz 1979 as cited in Sample *et al*. 1996
Selenium				
Rat	NOAEL	reproduction	0.2	Rosenfeld and Beath 1954 as cited in Sample *et al*. 1996
Rat	LOAEL	reproduction	0.33	Rosenfeld and Beath 1954 as cited in Sample *et al*. 1996
Mallard duck	NOAEL	reproduction	0.4	Heinz *et al*. 1989 as cited in Sample *et al*. 1996
Mallard duck	LOAEL	reproduction	0.8	Heinz *et al*. 1989 as cited in Sample *et al*. 1996
Zinc				
Rat	NOAEL	reproduction	160	Schlicker and Cox 1968 as cited in Sample *et al*. 1996
Rat	LOAEL	reproduction	320	Schlicker and Cox 1968 as cited in Sample *et al*. 1996
Chicken	NOAEL	reproduction	55	Jackson *et al*. 1986 as cited in USEPA 2007
Chicken	LOAEL	reproduction	105	Jackson et al. 1986 as cited in USEPA 2007
Low Molecular Weight PAHs				
Rat	NOAEL	growth, mortality	41	Schmahl 1955 as cited in IRIS 1998 (naphthalene).
Rat	LOAEL	growth	71	NTP 1980 as cited in USEPA 1990 (naphthalene)
Mallard duck	NOAEL	growth, mortality	212	Patton and Dieter 1980 (LPAH mixture)
Mallard duck	LOAEL (NOAEL x 5)	no adverse effects	1,060	NOAEL x 5
High Molecular Weight PAHs				
Mouse	NOAEL	reproduction	1.3	Neal and Rigdon 1967 as cited in ATSDR 1995 (benzo(a)pyrene)
Mouse	LOAEL	reproduction	10	Kristensen *et al*. 1995 as cited in Cal/EPA OEHHA 1997 (benzo(a)pyrene)
Chicken	NOAEL	reproduction	7.02	Rigdon and Neal 1963 (benzo(a)pyrene)
Chicken	LOAEL (NOAEL x 5)	reproduction	35.1	NOAEL x 5

LOAEL - lowest observed adverse effect level
NOAEL - no observed adverse effect level
PAH - polycyclic aromatic hydrocarbon

Table B-2
Adjusted TRVs - Mammals and Cadmium
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Wildlife Species			Test Species				NOAEL to LOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final LOAEL (Scaled)
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)				
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	10	1	1	1	12.3
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	10	1	1	1	7.1
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	10	1	1	1	7.7
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	10	1	1	1	8.9

Wildlife Species			Test Species				LOAEL to NOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final NOAEL (Scaled)
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)				
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	1	1	1	1	1.2
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	1	1	1	1	0.7
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	1	1	1	1	0.8
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	1	1	1	1	0.9

LOAEL TRV based on reproductive effects
NOAEL TRV based on no effect to reproduction
Specific cadmium (chloride) scaling factor for mammals = 0.893 (Sample and Arenal 1999)
Rat body weight = 0.35 kg (USEPA 1988 as cited in Sample *et al*. 1996)

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
TRV = Toxicity Reference Value
UF = Uncertainty Factor

Table B-3
Adjusted TRVs - Mammals and Lead
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	NOAEL to LOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final LOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	180	1	1	1	202
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	180	1	1	1	148
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	180	1	1	1	156
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	180	1	1	1	169

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	LOAEL to NOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final NOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	18	1	1	1	20
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	18	1	1	1	15
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	18	1	1	1	16
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	18	1	1	1	17

LOAEL TRV based on reproductive effects
NOAEL TRV based on no effect to reproduction
There is no specific lead scaling factor for mammals; default = 0.94 (Sample and Arenal 1999)
Rat body weight = 0.35 kg (USEPA 1988 as cited in Sample *et al*. 1996)

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
TRV = Toxicity Reference Value
UF = Uncertainty Factor

Table B-4
Adjusted TRVs - Mammals and Methlymercury
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	NOAEL to LOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final LOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Mink	*Mustela vison*	1.0	0.247	1	1	5	0.059
Nutria	*Myocastor coypus*	9	Mink	*Mustela vison*	1.0	0.247	1	1	5	0.043
Raccoon	*Procyon lotor*	3.91	Mink	*Mustela vison*	1.0	0.247	1	1	5	0.046
Mink	*Mustela vison*	1	Mink	*Mustela vison*	1.0	0.247	1	1	5	0.049

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	LOAEL to NOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final NOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Mink	*Mustela vison*	1.0	0.150	1	1	5	0.036
Nutria	*Myocastor coypus*	9	Mink	*Mustela vison*	1.0	0.150	1	1	5	0.026
Raccoon	*Procyon lotor*	3.91	Mink	*Mustela vison*	1.0	0.150	1	1	5	0.028
Mink	*Mustela vison*	1	Mink	*Mustela vison*	1.0	0.150	1	1	5	0.030

Subchronic LOAEL TRV based on mortality, weight loss, behavior
Subchronic NOAEL TRV based on mortality, weight loss, behavior
There is no specific lead scaling factor for mammals; default = 0.94 (Sample and Arenal 1999)
Mink body weight = 1 kg (USEPA 1993 as cited in Sample *et al*. 1996)

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
TRV = Toxicity Reference Value
UF = Uncertainty Factor

Table B-5
Adjusted TRVs - Mammals and Selenium
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	NOAEL to LOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final LOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	0.33	1	1	1	0.37
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	0.33	1	1	1	0.27
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	0.33	1	1	1	0.29
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	0.33	1	1	1	0.31

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	LOAEL to NOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final NOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	0.2	1	1	1	0.22
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	0.2	1	1	1	0.16
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	0.2	1	1	1	0.17
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	0.2	1	1	1	0.19

LOAEL TRV based on reproductive effects
NOAEL TRV based on no effect to reproduction
There is no specific selenium scaling factor for mammals; default = 0.94 (Sample and Arenal 1999)
Rat body weight = 0.35 kg (USEPA 1988 as cited in Sample *et al*. 1996)

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
TRV = Toxicity Reference Value
UF = Uncertainty Factor

Table B-6
Adjusted TRVs - Mammals and Zinc
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	NOAEL to LOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final LOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	320	1	1	1	426
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	320	1	1	1	197
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	320	1	1	1	223
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	320	1	1	1	274

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	LOAEL to NOAEL UF	Acute to Chronic UF	Subchronic to Chronic UF	Final NOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	160	1	1	1	213
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	160	1	1	1	99
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	160	1	1	1	112
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	160	1	1	1	137

LOAEL TRV based on reproductive effects
NOAEL TRV based on no effect to reproduction
Specific zinc (chloride) scaling factor for mammals = 0.851 (Sample and Arenal 1999)
Rat body weight = 0.35 kg (USEPA 1988 as cited in Sample *et al*. 1996)

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
TRV = Toxicity Reference Value
UF = Uncertainty Factor

Table B-7
Adjusted TRVs - Mammals and LPAHs
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	NOAEL to LOAEL UF	Acute to Chronic UF	Subchronic to Chronic U	Final LOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	71	1	1	1	80
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	71	1	1	1	58
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	71	1	1	1	61
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	71	1	1	1	67

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	LOAEL to NOAEL UF	Acute to Chronic UF	Subchronic to Chronic U	Final NOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Rat	*Rattus rattus*	0.35	41	1	1	1	46
Nutria	*Myocastor coypus*	9	Rat	*Rattus rattus*	0.35	41	1	1	1	34
Raccoon	*Procyon lotor*	3.91	Rat	*Rattus rattus*	0.35	41	1	1	1	35
Mink	*Mustela vison*	1	Rat	*Rattus rattus*	0.35	41	1	1	1	38

LOAEL TRV based on growth effects (naphthalene)
NOAEL TRV based on no effect to growth or mortality (naphthalene)
There is no specific low molecular weight PAH scaling factor for mammals; default = 0.94 (Sample and Arenal 1999)
Rat body weight = 0.35 kg (USEPA 1988 as cited in Sample *et al*. 1996)

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
TRV = Toxicity Reference Value
UF = Uncertainty Factor
PAH - Polycyclic Aromatic Hydrocarbon
LPAH - Low molecular weight PAHs

Table B-8
Adjusted TRVs - Mammals and HPAHs
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	NOAEL to LOAEL UF	Acute to Chronic UF	Subchronic to Chronic U	Final LOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Mouse	*Mus musculus*	0.03	10	1	1	1	9.7
Nutria	*Myocastor coypus*	9	Mouse	*Mus musculus*	0.03	10	1	1	1	7.1
Raccoon	*Procyon lotor*	3.91	Mouse	*Mus musculus*	0.03	10	1	1	1	7.5
Mink	*Mustela vison*	1	Mouse	*Mus musculus*	0.03	10	1	1	1	8.1

Wildlife Species			Test Species							
Common Name	Scientific Name	Body Weight (kg)	Common Name	Scientific Name	Body Weight (kg)	Dose (mg/kg-BW-day)	LOAEL to NOAEL UF	Acute to Chronic UF	Subchronic to Chronic U	Final NOAEL (Scaled)
Marsh rice rat	*Oryzomys palustris*	0.051	Mouse	*Mus musculus*	0.03	1.3	1	1	1	1.3
Nutria	*Myocastor coypus*	9	Mouse	*Mus musculus*	0.03	1.3	1	1	1	0.9
Raccoon	*Procyon lotor*	3.91	Mouse	*Mus musculus*	0.03	1.3	1	1	1	1.0
Mink	*Mustela vison*	1	Mouse	*Mus musculus*	0.03	1.3	1	1	1	1.1

LOAEL TRV based on reproductive effects (benzo(a)pyrene)
NOAEL TRV based on no effect to reproduction (benzo(a)pyrene)
There is no specific high molecular weight PAH scaling factor for mammals; default = 0.94 (Sample and Arenal 1999)
Mouse body weight = 0.03 kg (USEPA 1988 as cited in Sample *et al*. 1996)

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
TRV = Toxicity Reference Value
UF = Uncertainty Factor
PAH - Polycyclic Aromatic Hydrocarbon
HPAH - High molecular weight PAHs

Table B-9
Summary of Wildlife TRVs
Screening-Level Ecological Risk Assessment
East White Lake Oil and Gas Field
Vermilion Parish, Louisiana

Chemical of Concern	Birds						Mammals							
	Wood duck		Snowy egret		Belted kingfisher		Marsh rice rat		Nutria		Raccoon		Mink	
	NOAEL TRV (mg/kg-day)	LOAEL TRV (mg/kg-day)	NOAEL TRV (mg/kg-day)	LOAEL TRV (mg/kg-day)	NOAEL TRV (mg/kg-day)	LOAEL TRV (mg/kg-day)	NOAEL TRV (mg/kg-day)	LOAEL TRV (mg/kg-day)	NOAEL TRV (mg/kg-day)	LOAEL TRV (mg/kg-day)	NOAEL TRV (mg/kg-day)	LOAEL TRV (mg/kg-day)	NOAEL TRV (mg/kg-day)	LOAEL TRV (mg/kg-day)
Inorganics														
Cadmium	1.45	20	1.45	20	1.45	20	1.2	12.3	0.7	7.1	0.8	7.7	0.9	8.9
Lead	3.85	19.25	3.85	19.25	3.85	19.25	20	202	15	148	16	156	17	169
Mercury	0.013	0.064	0.013	0.064	0.013	0.064	0.036	0.059	0.026	0.043	0.028	0.046	0.030	0.049
Selenium	0.4	0.8	0.4	0.8	0.4	0.8	0.22	0.37	0.16	0.27	0.17	0.29	0.19	0.31
Zinc	55	105	55	105	55	105	213	426	99	197	112	223	137	274
SVOCs														
Total LPAHs	212	1,060	212	1,060	212	1,060	46	80	34	58	35	61	38	67
Total HPAHs	7.02	35.1	7.02	35.1	7.02	35.1	1.3	9.7	0.9	7.1	1.0	7.5	1.1	8.1

NOAEL - no observed adverse effect level
LOAEL - lowest observed adverse effect level
PAHs - polycyclic aromatic hydrocarbons
TRV - toxicity reference value
Bird TRVs are unadjusted (NOAEL or LOAEL for wildlife species = NOAEL or LOAEL for test species);
mammal TRVs are scaled according to Sample and Arenal (1999); subchronic-to-chronic and/or
LOAEL-to-NOAEL uncertainty factors are also incorporated when needed.
Mercury TRVs are for methylmercury.