

OAKS BOTTOM WILDLIFE REFUGE
SEDIMENT AND WATER QUALITY EVALUATION
REPORT



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US Army Corps
of Engineers®
Portland District

EPA	Environmental Protection Agency
USACE	U.S. Army Corps of Engineers
USFWS	U. S. Fish & Wildlife Service
NOAA	National Oceanic & Atmospheric Administration
SquiRT	Screening Quick Reference Tables (NOAA Reference Tables)
WDOE	Washington Department of Ecology
ODEQ	Oregon Department of Environmental Quality
WDNR	Washington Department of Natural Resources
DMEF	Dredge Material Evaluation Framework
CRM	Columbia River Mile
NPL	National Priority List
Superfund	An EPA-NPL contaminated site, scheduled for cleanup.
DQO	Data Quality Objectives
NES	Newly Exposed Surface
QA/QC	Quality Assurance/Quality Control
MDL	Method Detection Limit
CoC	Contaminate of concern
TEL	Threshold Effects Level
PWT	Pacific Wood Treating
TOC	Total Organic Carbon
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
MRL	Method Reporting Limit
TVS	Total Volatile Solids
PCP	Pentachlorophenol
PWT	Pacific Wood Treatment
MTCA	(Washington State) Model Toxics Control Act
PSDDA	Puget Sound Dredged Disposal Analysis
TEF	Toxicity Equivalent Factor
TEQ	Toxicity Equivalent Quotient
ND	non-detect
pptr	parts per trillion – ng/kg
As	Arsenic
Cd	Cadmium
Ni	Nickel
Cu	Copper
Sb	Antimony
Cr	Chromium
Pb	Lead
Hg	Mercury
Ni	Nickel
Ag	Silver
Zn	Zinc

Introduction

The Oaks Bottom project site is located within the boundaries of the Oaks Bottom Wildlife Refuge in Portland, Oregon. Oaks Bottom is a 160-acre natural area that is located on the east bank of the Willamette River at river mile 15 and is owned by the City of Portland. Different communities describe the refuge including: the south fill (grassland habitat over a land fill), north fill (open water habitat with shallow emergent wetlands and a man-made reservoir), wetland swamp (open water, mudflat, and emergent marsh habitat), riparian habitat, and upland forest on the eastern edge of the refuge. Oaks Bottom separated from the Willamette River by a railroad berm and is hydraulically connected to the Willamette River by a five-foot diameter culvert within the railroad berm.

The proposed project at Oaks Bottom Wildlife Refuge would relocate the existing water control structure closer to the mouth of the 60-acre reservoir, replace the culvert with a larger one, and restore lands north of the reservoir through excavation of channels, riparian restoration, and wetland creation for the re-establishment of critical wildlife habitat. A second culvert is proposed for installation under the railroad berm approximately 1,000 feet north of the existing culvert. The improved water flow within the proposed excavated channels, along with management of vegetation adjacent to the excavated channels will serve to enhance fish passage, and wildlife habitat.

Previous Sampling and Analyses

On December 20, 2001, The City of Portland collected one surface water sample from a south fill seep located at the southern end of the reservoir. The sample was analyzed for volatile organic compounds (VOCs), ammonia, sulfate, total metals, RCRA metals, and pH. VOCs were not identified above method detection limits with the exception of chlorobenzene (1.14 ug/L). Ammonia (1.85 ug/L), sulfate (15.7 ug/L), and metals including iron (22.4 ug/L), arsenic (0.20 ug/L), barium (258 ug/L), chromium (0.72 ug/L), and lead (1.62 ug/L) were also identified above method detection limits. The pH was determined to be 6.8.

An Oaks Bottom Wildlife Refuge Habitat Assessment report was prepared by Montgomery Watson Harza (MWH) for the City of Portland in January 2002. MWH performed ecological, recreational, and engineering analyses of the aquatic and terrestrial habitats and human amenities of Oaks Bottom. Results of the assessment identified projects to improve the current conditions at Oaks Bottom. The report also summarized the history and previous sampling events at the project site. According to the report, the Oregon Department of Environmental Quality (ODEQ) conducted monitoring of the seep area associated with the southern landfill. Analyses included nutrients, anions, iron, and manganese. In 1995, the ODEQ conducted monitoring of the seep and analyses included nutrients, semi-volatile organic compounds (SVOCs), VOCs, and metals. In 1999, the Portland Bureau of Environmental Services (BES) sampled the seep area and the water

within the reservoir. Results were compared with drinking water MCLs and PRGs available at the time. The studies concluded that the water quality was acceptable and further action was not necessary. The MWH assessment recommended water and soil (sediment) sampling to identify the presence and nature of contamination associated with the recognized environmental conditions associated with the south fill area. The report also recommended that the results be compared to the US EPA's Ambient Water Quality Criteria (AWQC) for the protection of freshwater organisms and to the Oregon soil cleanup standards found in OAR 340-122-045.

Current Sampling Event

The purpose of the current water and sediment sampling event was to characterize existing conditions at the project site prior to the implementation of the proposed projects to improve the conditions at Oaks Bottom Wildlife Refuge. Sediment sampling had not been conducted, or the data was not available, at the project site. Previous water sampling was not sufficient to determine the presence and nature of contamination associated with recognized environmental conditions at the project site. Water and sediment sampling was conducted at the recommendation of the January 2002 MWH report.

Water samples were collected from seeps, the open water (reservoir and channel leaving the wetland), and from the outfall to the Willamette River. Sediment samples were collected from two upland locations and three wetland locations within Oaks Bottom Wildlife Refuge using a hand auger (HA). A total of five sediment samples and six water samples were collected from eight sampling stations on September 23, 2003 (Table 1).

Table 1. Sample Location and Numbering

Sediment Sample ID	Water Sample ID	Location	Coordinates
OAKB-HA-01	3WLR60001	Landfill seep, southwestern side of reservoir	45° 28' 17.4" 122° 39' 34.3"
OAKB-HA-02	3WLR60002	Open water, reservoir	45° 28' 20.3" 122° 39' 24.8"
OAKB-HA-03	3WLR60003	Open water, in channel	45° 28' 36.6" 122° 39' 20.2"
OAKB-HA-04		Low point in pond	45° 28' 38.3" 122° 39' 18.9"
	3WLR60004	Southwest corner of reservoir	45° 28' 17.9" 122° 39' 37.5"
OAKB-HA-05		North end of site, between ponds (upland)	45° 28' 42.4" 122° 39' 17.6"
	3WLR60005	Seep, bridge below mausoleum	45° 28' 26.6" 122° 39' 10.4"
	3WLR60006	Storm water outfall to Willamette River	45° 28' 38.4" 122° 39' 26.4"

All six water grab samples (3WLR60001 to 3WLR60006) were analyzed for the following parameters: VOCs (EPA 8260B), SVOCs (EPA 8270C), chlorinated herbicides (EPA 8151), organochlorine pesticides (EPA 8081A), PCBs (EPA 8082), total metals (EPA 6020/7470), anions (EPA 300.0), ammonia (EPA 350.1), hardness (EPA 130.2), corrosivity (EPA 150.0), total kjeldahl nitrogen (EPA 351.3), and total phosphorus (EPA 365.1). Samples 1,2 and 4-6 were also analyzed for diesel range organic (NWTPH-Dx Modified). Sample 3 was not analyzed because it was broken when received by the laboratory.

All five sediment samples (OAKB-HA-01 to OAKB-HA-05) were analyzed for VOCs (EPA 8260B), SVOCs (EPA 8270C), chlorinated herbicides (EPA 8151), organochlorine pesticides (EPA 8081A), PCBs (EPA 8082), total metals (EPA 6020/7471), NWTPH-HCID, and physical parameters. The sediment and water samples were collected using laboratory provided sample containers, packed in ice, and delivered to the laboratory and analyzed within the specified holding times.

Results

Laboratory analytical results are presented in tabular format in Appendix 1. Samples found to contain chemical concentrations above the method reporting limit (MRL) or method detection limit (MDL) were compared to published screening levels and are presented in Appendix 2.

Water sample results were compared to the freshwater criterion maximum concentration (CMC¹) and the freshwater criterion continuous concentration (CCC²) listed in the EPA National Recommended Water Quality Criteria (NRWQC) for 2002 (EPA-822-R-02-047). Water results were also compared to the Oregon DEQ Water Quality Criteria Summary (OAR 340-41) freshwater acute criteria and freshwater chronic criteria.

Sediment samples were compared to DMEF screening levels and to Oregon Hazardous Substance Remedial Action Rules, residential maximum allowable soil concentrations (OAR 340-122-045), as requested by the 2002 MWH report.

Sediment and water results were also compared the DEQ Guidance for Ecological Risk Assessment, Level II Screening Level Values (December 2001) and the 1999 NOAA Screening Quick Reference Tables (SQuiRT). NOAA values were only included in the water results tables if the values differed from the EP's CMC and CCC criteria.

¹ The criteria maximum concentration (CMC) is defined as an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect.

² The criterion continuous concentration (CCC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

Volatile Organic Compounds (EPA Method 5030/8260B)

Chloroethane was detected above the MRL but below the PQL at a concentration of 0.577 ug/L in water sample 3WLR60001. The data was flagged as an estimated quantity by the laboratory. Chlorobenzene (3.35 ug/L) and 1,4-dichlorobenzene (1.35 ug/L) were detected above the MRL and PQL in sample 3WLR60001. The chlorobenzene concentration was below the NOAA CMC (250 ug/L) and CCC (50 ug/L) values. Acetone was detected above the MRL but below the PQL at 4.76 ug/L in sample 3WLR60002 and above the PQL at a concentration of 7.87 ug/L in sample 3WLR60004. VOCs were not detected above the MRL in samples 3WLR60003, 3WLR60005, or 3WLR60006. VOC standards were not identified for the other VOCs.

Acetone was detected above the PQL in sediment samples OAKB-HA-01, -02, and -03 with the highest concentration detected at 83.3 ug/kg in sample OAKB-HA-02. The most prevalent VOC was methylene chloride, which was found at detectable concentrations in sediment samples OAKB-HA-01, -02, -03, and -05. The highest concentration, an estimated quantity, was identified in sample OAKB-HA-02 at 5.08 ug/kg. All of the sediment samples were found to be below the soil clean up level for methylene chloride (7 mg/kg). A detectable concentration of 2-butanone (39.3 ug/kg) was also detected in sample OAKB-HA-02 and a 1,4-dichlorobenzene was identified in sample OAKB-HA-01 at 3.54 ug/kg. VOC standards were identified for the other VOCs.

Semivolatile Organic Compounds (EPA Method 8270C)

Several SVOCs were detected above the laboratory MRLs in water samples 3WLR60001, 3WLR60002, and 3WLR60004 and all five sediment samples. This data is represented in Tables 4 and 5. SVOCs were not found above published criteria or screening levels.

Chlorinated Herbicides (EPA Method 8151)

The chlorinated herbicide analyte 4-nitrophenol was identified in water sample 3WLR60005 at 0.112 ug/L and 3WLR60006 at 0.143 ug/L. This value is below the chronic and acute freshwater criteria. Chlorinated herbicides were not identified above method detection limits in any of the five (5) sediment samples.

Organochlorine Pesticides (EPA Method 8081A), PCBs (EPA Method 8082)

The organochlorine pesticides were detected in water samples 3WLR60001 and 3WLR60004. Pesticide 4,4-DDT was found at 0.0479 ug/l in sample 3WLR60001, above the EPA and NOAA CCC value for DDT (0.0005 ug/l) and above the DEQ Level II screening level value for ecological risk assessment and DEQ freshwater chronic criteria (0.001 ug/l) for total DDT. Dieldrin was detected in both samples above the DEQ freshwater chronic criteria and DEQ Level II screening level value for ecological risk assessment but below the DEQ freshwater acute criteria. Heptachlor (0.00772 ug/l) was detected above the DEQ freshwater chronic criteria of 0.0038 ug/l in sample 3WLR60001 and Alpha-chlordane (0.0148 ug/l) was detected above the DEQ freshwater chronic criteria of 0.0043 ug/l in sample 3WLR60004. PCBs were only detected above laboratory MRLs in sample 3WLR60001. PCB Aroclor 1242 was detected at 0.0302 ug/l,



this is above the EPA CCC for total PCBs of 0.014 ug/l but below the DEQ Level II screening level value for ecological risk assessment of 0.053 ug/l.

Pesticides 4,4-DDD, 4,4-DDE, and 4,4-DDT were found in all five sediment samples. DDD concentrations ranged from 6.09 ug/kg in sediment sample OAKB-HA-04 to 16.8 ug/kg in sample OAKB-HA-02. DDE concentrations ranged from 12.3 ug/kg in sample OAKB-HA-03 to 65.9 ug/kg in sample OAKB-HA-05. DDT concentrations ranged from 8.37 ug/kg in sample OAKB-HA-03 to an estimated quantity of 126 ug/kg in sample OAKB-HA-05. These values were compared to total DDT screening levels and found to be above the DMEF screening level (6.9 ug/kg for total DDT) and the DEQ Level II screening level value for ecological risk assessment (7 ug/kg for total DDT). NOAA TEL and PEL values were not provided but total DDT concentrations were above the NOAA Upper Effects Threshold (UET) of <50 ug/kg.

Dieldrin (1.9 ug/kg) and heptachlor (0.744 ug/kg) were also identified in sample OAKB-HA-02. Alpha-chlordane was found in sample OAKB-HA-03 at an estimated concentration of 0.518 ug/kg. Gamma-chlordane was found in samples OAKB-HA-02 (1.77 ug/kg), OAKB-HA-03 (1.38 ug/kg), and OAKB-HA-04 (8.12 ug/kg). Gamma-chlordane was compared to chlordane screening levels and was found to be above the DEQ Level II screening level value for ecological risk assessment (4.5 ug/kg) and NOAA TEL value (4.5 ug/kg). The other pesticide concentrations are below the published screening levels.

PCB Aroclor 1242 was identified in sample OAKB-HA-01 at 0.0335 ug/kg. Aroclor 1260 was identified in samples OAKB-HA-01 (0.0103 ug/kg), OAKB-HA-04 (0.00896 ug/kg), and OAKB-HA-05 (0.0227 ug/kg). PCBs were compared to total PCB values and were found to be below the published screening levels.

Hydrocarbon Identification (NWTPH-HCID), Diesel Range Organics (NWTPH-Dx Modified)

Diesel range organics were detected above the MRLs in samples 3WLR60001, 3WLR60002, and 3WLR60004. In sample 3WLR60001, the analysis found #2 diesel above the PQL at 0.704 mg/L and an estimated quantity of motor oil slightly below the PQL at 0.465 mg/L. The data was flagged as being fuel oil or a similar product as identified by chromatogram analysis. An estimated quantity of 0.14 mg/L of #2 diesel fuel was identified above the PQL in sample 3WLR60002. A concentration of 0.316 mg/L #2 diesel and an estimated quantity of 0.42 mg/L of motor oil were identified in sample 3WLR60004. Both analytes were flagged as not appearing to be a typical product but the laboratory did not suggest an alternative product. Hydrocarbon criteria for water quality were not identified but no visible sheen or product was observed in the water samples.

Hydrocarbons were not identified above laboratory method detection limits in any of the five (5) sediment samples collected. Water sample 3WLR60003 was not analyzed



because it was broken when received by the laboratory. The samples were requested for HCID analysis but the samples did not receive the correct surrogate compound spike for HCID analysis. The samples receive the correct surrogate spike for diesel range organic analyses and the Corps authorized the change from HCID analysis to diesel range organics.

Total Metals (EPA Methods 6020/7470)

Mercury was not detected above the MRL of 0.0001 mg/L in any of the six (6) water samples. Several of the other metals were identified in all six of the water samples and are presented in Table 11. None of the metals were identified above the freshwater criteria.

Antimony, cadmium, and silver were not identified above the MRLs in any of the five (5) sediment samples. Several of the other metals were identified in all five of the sediment samples and are presented in Table 12. None of the metals were detected above the DMEF screening levels.

Anions (EPA Method 300.0), Ammonia (EPA Method 350.1), Total Kjeldahl Nitrogen (EPA Method 351.3), Total Phosphorus (EPA Method 365.1)

Phosphate was identified above the MRL in water samples 3WLR60002, 3WLR60004, and 3WLR60005. Water criteria were not identified for phosphate. Nitrate+nitrite was identified in samples 3WLR60002, 3WLR60003, 3WLR60005, and 3WLR60006 above the MRL but below the EPA drinking water criteria of 10 mg/L.

Ammonia nitrogen was detected in all six (6) water samples and ranged from 0.06 mg/L in sample 3WLR60005 to 1.9 mg/L in sample 3WLR60001. According to the EPA Criteria, the acute criterion for ammonia is dependent on pH and fish species, and the chronic criterion is dependent on pH and temperature. Acute Ammonia toxicity to fish also increases as temperature decreases. Although, water temperature information was not gathered during the current site visit, the air temperature was warm (over 80°F) Water samples 3WLR60002, 3, and 4 were collected from shallow open water. Water samples 3WLR60001 and 5 were collected from cooler water at seeps. Water sample 3WLR60006 was collected from an outfall to the Willamette River on the northwestern portion of the property. For calculation purposes, the water temperature was estimated to be 20°C. The CMC and CCC for ammonia nitrogen were calculated for sample 3WLR6001, the highest concentration identified.

Calculation of Freshwater Ammonia Criterion

The CMC was calculated using the following formula and assuming that salmonid fish are present:

$$CMC = \frac{0.275}{1 + 10^{7.204-pH}} + \frac{39.0}{1 + 10^{pH-7.204}}$$

pH = 6.23

CMC = 35.29 mg/L for sample 3WLR60001.

The CCC was calculated using the following formula and assuming early fish life stages are present:

$$CCC = \frac{(0.0577)}{1 + 10^{7.688 - \text{pH}}} + \frac{2.487}{1 + 10^{\text{pH} - 7.688}} \times 2.85$$

CCC = 2.405 mg/L for sample 3WLR60001.

Total Kjeldahl nitrogen was detected in all of the water samples with the exception of 3WLR60005. Concentrations ranged from 1.4 mg/L in sample 3WLR60003 to 10 in sample 3WLR60004. Total kjeldahl nitrogen water criteria were not identified.

Total phosphorus was detected in all six (6) water samples and ranged from 0.13 mg/L in sample 3WLR60005 to 8.2 mg/L in sample 3WLR60001. Phosphorus is associated with accelerated eutrophication of waters that can stimulate excessive growth of algae if total phosphorus concentrations exceed 25 ug/L in streams entering a lake or reservoir or 50 ug/L within the lake or reservoir (EPA, 1986). The EPA recommends that total phosphorus concentrations should be less than 0.1 mg/L (100 ug/L) in rivers and less than 0.05 mg/L (50 ug/L) where rivers enter lakes and reservoirs.

Hardness (EPA Method 130.2), Corrosivity (EPA Method 150.1)

Two (2) water samples, 3WLR60001 and 3WLR60003, were analyzed for hardness. Hardness values were found to be 500 mg/L (very hard) in sample 3WLR60001 and 85 mg/L (moderately hard) in sample 3WLR60003. Corrosivity values (pH) ranged from 6.23 in sample 3WLR60001 to 9.30 in sample 3WLR60002.

Conclusions

A total of five sediment samples and six water samples were collected from eight sampling stations on September 23, 2003. All samples were submitted for chemical analyses. Pesticide 4,4-DDT was found at 0.0479 ug/l in sample 3WLR60001, above the EPA and NOAA CCC value for DDT (0.0005 ug/l) and above the DEQ Level II screening level value for ecological risk assessment and DEQ freshwater chronic criteria (0.001 ug/l) for total DDT. Dieldrin was detected in both samples above the DEQ freshwater chronic criteria and DEQ Level II screening level value for ecological risk assessment but below the DEQ freshwater acute criteria. Heptachlor (0.00772 ug/l) was detected above the DEQ freshwater chronic criteria of 0.0038 ug/l in sample 3WLR60001 and Alpha-chlordane (0.0148 ug/l) was detected above the DEQ freshwater chronic criteria of 0.0043 ug/l in sample 3WLR60004. PCBs were only detected above laboratory MRLs in sample 3WLR60001. PCB Aroclor 1242 was detected at 0.0302 ug/l, this is above the EPA CCC for total PCBs of 0.014 ug/l but below the DEQ Level II screening level value for ecological risk assessment of 0.053 ug/l.

Pesticides 4,4-DDD, 4,4-DDE, and 4,4-DDT were found in all five sediment samples at levels above the DMEF screening level (6.9 ug/kg for total DDT) and the DEQ Level II screening level value for ecological risk assessment (7 ug/kg for total DDT). NOAA TEL and PEL values were not provided but total DDT concentrations were above the NOAA Upper Effects Threshold (UET) of <50 ug/kg. Gamma-chlordane was found. Gamma-chlordane was compared to chlordane screening levels and was found to be above the DEQ Level II screening level value for ecological risk assessment and NOAA TEL value (4.5 ug/kg) in sample OAKB-HA-04 (8.12 ug/kg).

REFERENCES

1. *Ambient Water Quality Criteria Recommendations (Information Supporting the Development of State and Tribal Nutrient Criteria), Rivers and Streams in Nutrient Ecoregion I.* EPA, Office of Water, EPA 822-B-01-012, December 2001.
2. *Dredge Material Evaluation Framework for the Lower Columbia River Management Area.* U.S. Army Corps of Engineers, Portland District and Seattle District; U.S. Environmental Protection Agency, Region 10; Oregon Department of Environmental Quality; Washington State Department of Natural Resources and Department of Ecology. November 1998 Final.
3. *Guidance for Ecological Risk Assessment, Level II Screening Level Values.* Oregon DEQ, December 2001.
4. *Hazardous Substance Remedial Action Rules, Numerical Soil Cleanup Levels.* Oregon DEQ, OAR 340-122-045. July 2000.
5. *National Primary Drinking Water Regulations.* Title 40, Part 141. EPA
6. *National Recommended Water Quality Criteria: 2002.* EPA, Office of Water, EPA-822-R-02-047. November 2002.
7. *Quality Criteria for Water (1986); "The Gold Book".* EPA, Office of Water, EPA 440/5-86-001. May 1986.
8. *Screening Quick Reference Tables (SQuiRT),* NOAA. September 1999.
9. *Water Quality Standards and Beneficial Uses, Table 20: Water Quality Criteria Summary.* Oregon DEQ, OAR-340-041.

APPENDIX 1: LABORATORY DATA

Table 2: Volatile Organic Compounds						
Water samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge						
Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006
Analyte	ug/L					
Dichloro-difluoromethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	<1	<1	<1	<1	<1	<1
Vinyl chloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25
Chloroethane	0.577^J	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloro-fluoromethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Carbon disulfide	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acetone	<2.5	4.76^J	<2.5	7.87	<2.5	<2.5
Methylene chloride	<1	<1	<1	<1	<1	<1
Trans- 1,2-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1- Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,2-Dichloropropane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Butanone	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Cis-1,2-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromochloromethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,1- Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Carbon tetrachloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloropropene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromomethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table 2: Volatile Organic Compounds (continued)

Water samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge

Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006
	ug/L						
Cis-1,3-Dichloropropene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-Mehtyl-2-pentanone		<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Toluene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trans-1,3-dichloropropene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-trichloroethane		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-dichloropropane		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Hexanone		<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Dibromochloro-methane		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-dibromoethane		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene		3.35	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,1,2-tetrachloroethane		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
m,p-xylene		<1	<1	<1	<1	<1	<1
o-xylene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Isopropylbenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
bromobenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
n-Propylbenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,3-Trichloropropane		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chlorotoluene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3,5-Trimethylbenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table 2: Volatile Organic Compounds (continued)

Water samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge

Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006
	ug/L						
4-Chlorotoluene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
t-Butylbenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,4-Trimethylbenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
sec-Butylbenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-Isopropyltoluene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene		1.35	<0.5	<0.5	<0.5	<0.5	<0.5
n-Butylbenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dibromo-3-chloropropane		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2,4-Trichlorobenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobutadiene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene		<1	<1	<1	<1	<1	<1
1,2,3-Trichlorobenzene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Qualifier Codes:

J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.

Table 3: Volatile Organic Compounds

Sediment samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge

Analyte	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-04	OAKB-HA-05
		ug/kg				
Dichloro-difluoromethane		<1.23	<2.79	<1.44	<0.98	<0.891
Chloromethane		<1.23	<2.79	<1.44	<0.98	<0.891
Vinyl chloride		<1.23	<2.79	<1.44	<0.98	<0.891
Bromomethane		<6.16	<2.79	>7.22	<4.9	<4.46
Chloroethane		<1.23	<2.79	<1.44	<0.98	<0.891
Trichloro-fluoromethane		<1.23	<2.79	<1.44	<0.98	<0.891
1,1-Dichloroethene		<1.23	<2.79	<1.44	<0.98	<0.891
Carbon disulfide		<1.23	<2.79	<1.44	<0.98	<0.891
Acetone		36.5	83.3	16.3^J	<9.8	<0.891
Methylene chloride		2.52	5.08^J	1.57^J	<0.98	0.906^J
Trans- 1,2-Dichloroethene		<1.23	<2.79	<1.44	<0.98	<0.891
1,1- Dichloroethane		<1.23	<2.79	<1.44	<0.98	<0.891
2,2-Dichloropropane		<1.23	<2.79	<1.44	<0.98	<0.891
2-Butanone		<1.23	39.3^J	<1.44	<9.8	<8.91
Cis-1,2-Dichloroethene		<1.23	<2.79	<1.44	<0.98	<0.891
Bromochloromethane		<1.23	<2.79	<1.44	<0.98	<0.891
Chloroform		<1.23	<2.79	<1.44	<9.8	<0.891
1,1,1- Trichloroethane		<1.23	<2.79	<1.44	<0.98	<8.91
Carbon tetrachloride		<1.23	<2.79	<1.44	<9.8	<0.891
1,1-Dichloropropene		<1.23	<2.79	<1.44	<0.98	<0.891
Benzene		<1.23	<2.79	<1.44	<0.98	<0.891
1,2-Dichloroethane		<1.23	<2.79	<1.44	<0.98	<0.891
Trichloroethene		<1.23	<2.79	<1.44	<9.8	<0.891
1,2-Dichloropropane		<1.23	<2.79	<1.44	<0.98	<0.891
Dibromomethane		<1.23	<2.79	<1.44	<0.98	<0.891
Cis-1,3-Dichloropropene		<1.23	<2.79	<1.44	<0.98	<0.891
4-Mehtyl-2-pentanone		<6.16	<13.9	<7.22	<4.9	<4.46
Toluene		<1.23	<2.79	<1.44	<0.98	<0.891

Table 3: Volatile Organic Compounds (continued)
Sediment samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge

Analyte	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-04	OAKB-HA-05
		ug/kg				
Trans-1,3-dichloropropene		<1.23	<2.79	<1.44	<9.8	<0.891
1,1,2-trichloroethane		<1.23	<2.79	<1.44	<0.98	<0.891
Tetrachloroethene		<1.23	<2.79	<1.44	<0.98	<0.891
1,3-dichloropropane		<1.23	<2.79	<1.44	<0.98	<0.891
2-Hexanone		<6.16	<13.9	<7.22	<4.9	<4.46
Dibromochloromethane		<1.23	<2.79	<1.44	<0.98	<0.891
1,2-dibromoethane		<1.23	<2.79	<1.44	<0.98	<0.891
Chlorobenzene		<1.23	<2.79	<1.44	<0.98	<0.891
Ethylbenzene		<1.23	<2.79	<1.44	<0.98	<0.891
1,1,1,2-tetrachloroethane		<1.23	<2.79	<1.44	<0.98	<0.891
m,p-xylene		<2.46	<5.58	<2.89	<1.96	<1.78
o-xylene		<1.23	<2.79	<1.44	<0.98	<0.891
Styrene		<1.23	<2.79	<1.44	<0.98	<0.891
Bromoform		<1.23	<2.79	<1.44	<0.98	<0.891
Isopropylbenzene		<1.23	<2.79	<1.44	<0.98	<0.891
bromobenzene		<1.23	<2.79	<1.44	<0.98	<0.891
n-Propylbenzene		<1.23	<2.79	<1.44	<0.98	<0.891
1,1,2,2-Tetrachloroethane		<1.23	<2.79	<1.44	<0.98	<0.891
1,2,3-Trichloropropane		<1.23	<2.79	<1.44	<0.98	<0.891
2-Chlorotoluene		<1.23	<2.79	<1.44	<0.98	<0.891
1,3,5-Trimethylbenzene		<1.23	<2.79	<1.44	<0.98	<0.891
4-Chlorotoluene		<1.23	<2.79	<1.44	<0.98	<0.891
t-Butylbenzene		<1.23	<2.79	<1.44	<0.98	<0.891
1,2,4-Trimethylbenzene		<1.23	<2.79	<1.44	<0.98	<0.891
sec-Butylbenzene		<1.23	<2.79	<1.44	<0.98	<0.891
1,3-Dichlorobenzene		<1.23	<2.79	<1.44	<0.98	<0.891

Table 3: Volatile Organic Compounds (continued)

Sediment samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge

Analyte	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-04	OAKB-HA-05
		ug/kg				
4-Isopropyltoluene		<1.23	<2.79	<1.44	<0.98	<0.891
1,4-Dichlorobenzene		3.54	<2.79	<1.44	<0.98	<0.891
n-Butylbenzene		<1.23	<2.79	<1.44	<0.98	<0.891
1,2-Dichlorobenzene		<1.23	<2.79	<1.44	<0.98	<0.891
1,2-Dibromo-3-chloropropane		<1.23	<5.58	<2.89	<1.96	<1.78
1,2,4-Trichlorobenzene		<1.23	<2.79	<1.44	<0.98	<0.891
Hexachlorobutadiene		<1.23	<2.79	<1.44	<0.98	<0.891
Naphthalene		<1.23	<2.79	<1.44	<0.98	<0.891
1,2,3-Trichlorobenzene		<1.23	<2.79	<1.44	<0.98	<0.891

Qualifier Codes:

J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.

Table 4: Semivolatile Organic Compounds							
Water sampled collected September 23, 2003 –Oaks Bottom Wildlife Refuge							
Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006
		ug/L					
Phenol		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
1,3-Dichlorobenzene		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
1,4-Dichlorobenzene		0.71	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
Benzyl Alcohol		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
1,2-Dichloroenezene		0.121^J	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
2-Methylphenol		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
3-&4-Methylphenol		<0.201	<0.197	<0.197	<0.199	<0.196	<0.203
Hexachloroethane		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
2,4-Dimethylphenol		<0.502	<0.492	<0.492	<0.498	<0.491	<0.509
Benzoic Acid		<0.502	<0.492	<0.492	<0.498	<0.491	<0.509
1,2,4-Trichlorobenzene		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
Naphthalene		0.0612	<0.0295	<0.0295	<0.0299	<0.294	<0.0305
Hexachlorobutadiene		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
2-Methylnaphthalene		<0.0251	<0.0246	<0.246	<0.0249	<0.0245	<0.0254
Dimethylphthalate		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
Acenaphthylene		<0.0251	<0.0246	<0.246	<0.0249	<0.0245	<0.0254
Acenaphthene		4.69	<0.0246	<0.246	0.22	<0.0245	<0.0254
Dibenzofuran		1.04	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
Diethylphthalate		0.159^J	0.108^J	<0.0983	<0.0995	<0.0981	<0.102
Fluorene		1.74	<0.0246	<0.246	0.147	<0.0245	<0.0254
N-Nitrosodiphenylamine		3.33	<0.0246	<0.0983	<0.0995	<0.0981	<0.102
Hexachlorobenzene		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
Pentachlorophenol		<0.326	<0.32	<0.32	<0.323	<0.319	<0.331
Phenanthrene		<0.0251	0.0276^J	<0.0246	0.0579	<0.0245	<0.0254
Anthracene		<0.0251	<0.0246	<0.0246	<0.0249	<0.0245	<0.0254
Di-n-butylphthalate		0.18^J	0.235	<0.0983	<0.0995	<0.0981	<0.102
Fluoranthene		0.106	0.0508	<0.0246	0.0548	<0.0245	<0.0254

Table 4: Semivolatile Organic Compounds (continued)

Water sampled collected September 23, 2003 –Oaks Bottom Wildlife Refuge

Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006
		ug/L					
Pyrene		<0.0251	0.0501	<0.0246	<0.0249	<0.0245	<0.0254
Butylbenzylphthalate		0.165^J	0.183^J	<0.147	0.174^J	<0.147	<0.153
Benzo(a)anthracene		<0.0251	<0.0246	<0.0246	<0.0249	<0.0245	<0.0254
Chrysene		0.027^J	0.0302^J	<0.0246	<0.0249	<0.0245	<0.0254
Bis(2-ethylhexyl)phthalate		<0.753	<0.738	<0.737	<0.746	<0.736	<0.763
Di-n-octylphthalate		<0.1	<0.0984	<0.0983	<0.0995	<0.0981	<0.102
Benzofluoranthenes		<0.0502	0.0546^J	<0.0492	<0.498	<0.0491	<0.0509
Benzo(a)pyrene		<0.0251	0.0311^J	<0.0246	0.142	<0.0245	<0.0254
Indeno (1,2,3-cd)pyrene		<0.0251	0.0285^J	<0.0246	<0.0249	<0.0245	<0.0254
Dibenz(a,h)anthracene		<0.0251	<0.0246	<0.0246	<0.0249	<0.0245	<0.0254
Benzo (g,h,i)perylene		<0.0251	0.037^J	<0.0246	<0.0249	<0.0245	<0.0254
Qualifier Codes:							
J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.							

Table 5: Semivolatile Organic Compounds						
Sediment samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge						
Analyte	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-04	OAKB-HA-05
		ug/kg				
Phenol		<17.9	<39.8	<21.2	<11.6	17.9^J
1,3-Dichlorobenzene		<17.9	<39.8	<21.2	<11.6	<12.6
1,4-Dichlorobenzene		<17.9	<39.8	<21.2	<11.6	<12.6
Benzyl Alcohol		<22.3	<49.8	<26.5	<14.5	<15.8
1,2-Dichloroene		<17.9	<39.8	<21.2	<11.6	<12.6
2-Methylphenol		<17.9	<39.8	<21.2	<11.6	<12.6
3-&4-Methylphenol		<35.7	<79.6	<42.4	<23.2	<25.3
Hexachloroethane		<17.9	<39.8	<21.2	<11.6	<12.6
2,4-Dimethylphenol		<17.9	<39.8	<21.2	<11.6	<12.6
Benzoic Acid		<89.3	<199	<106	<58	<63.2
1,2,4-Trichlorobenzene		<17.9	<39.8	<21.2	<11.6	<12.6
Naphthalene		<4.46	<9.96	<5.3	<2.9	3.45^J
Hexachlorobutadiene		<17.9	<39.8	<21.2	<11.6	<12.6
2-Methylnaphthalene		<4.46	<9.96	<5.3	<2.9	<3.16
Dimethylphthalate		<17.9	<39.8	<21.2	<11.6	<12.6
Acenaphthylene		<4.46	<9.96	<5.3	<2.9	5.89^J
Acenaphthene		35.8	<9.96	<21.2	<2.9	<3.16
Dibenzofuran		<17.9	<39.8	<21.2	<11.6	<12.6
Diethylphthalate		<17.9	<39.8	<21.2	<11.6	<12.6
Fluorene		14.6	<9.96	<5.3	<2.9	<3.16
N-Nitrosodiphenylamine		28.1^J	<39.8	<21.2	<11.6	<12.6
Hexachlorobenzene		<17.9	<39.8	<21.2	<11.6	<12.6
Pentachlorophenol		<17.9	<39.8	<21.2	<11.6	<12.6
Phenanthrene		<4.46	<9.96	<5.3	7.66	17.7
Anthracene		<4.46	<9.96	<5.3	<2.9	14.6
Di-n-butylphthalate		<17.9	<39.8	<21.2	<11.6	<12.6
Fluoranthene		7.38^J	<9.96	6.99^J	15.3	36.2

Table 5: Semivolatile Organic Compounds (continued)

Sediment samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge

Analyte	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-04	OAKB-HA-05
		ug/kg				
Pyrene		6.75 ^J	<9.96	8.9 ^J	17.4	57
Butylbenzylphthalate		<22.3	<49.8	<26.5	<14.5	<15.8
Benzo(a)anthracene		<4.46	<9.96	<5.3	7.44	20.8
Chrysene		<4.46	<9.96	<5.3	10.1	42.3
Bis(2-ethylhexyl) phthalate		<17.9	54.5 ^J	<21.2	14.1 ^J	47.3
Di-n-octylphthalate		<17.9	<39.8	<21.2	<11.6	<12.6
Benzofluoranthenes		<4.46	<9.96	7.69 ^J	<2.9	96.4
Benzo(a)pyrene		<4.46	<9.96	5.6 ^J	10.8	48.2
Indeno (1,2,3-cd) pyrene		<4.46	<9.96	<5.3	9.5	<3.16
Dibenz(a,h)anthracene		<4.46	<9.96	<5.3	<2.9	77.9
Benzo (g,h,i)perylene		<4.46	<9.96	6.2 ^J	12.7	38

Qualifier Codes:

J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.

Table 6: Chlorinated Herbicides							
Water samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge							
	Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006
Analyte		ug/L					
Dalapon		<0.0632	<0.0612	<0.0625	<0.0646	<0.0605	<0.0648
4-Nitrophenol		<0.0368	<0.0356	<0.0364	<0.0376	0.112^J	0.143
Dicamba		<0.00638	<0.00618	<0.00631	<0.00652	<0.00611	<0.00654
MCPP		<0.0313	<0.0303	<0.0309	<0.032	<0.03	<0.0321
MCPA		<0.00977	<0.00946	<0.00966	<0.00999	<0.00935	<0.01
Dichloroprop		<0.0109	<0.0106	<0.0108	<0.0112	<0.0104	<0.0112
2,4-D		<0.0164	<0.0159	<0.0162	<0.0168	<0.0157	<0.0168
Pentachlorophenol		<0.0114	<0.0111	<0.0113	<0.0117	<0.0109	<0.0117
Silvex		<0.0121	<0.0117	<0.0119	<0.0123	<0.0115	<0.0124
2,4,5-T		<0.00533	<0.00516	<0.00527	<0.00545	<0.0051	<0.00546
Dinoseb		<0.0194	<0.0188	<0.0192	<0.0199	<0.0186	<0.099
2,4-DB		<0.0225	<0.0218	<0.0223	<0.023	<0.0216	<0.0231
Qualifier Codes: J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity. Notes: Chlorinated herbicides were not identified above the laboratory method detection limits in any of the five sediment samples collected from Oaks Bottom and are, therefore, not depicted in a tabular format.							

Table 7: Organochlorine Pesticides and PCBs
Water samples collectd September 23, 2003 –Oaks Bottom Wildlife Refuge

Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006
		ug/L					
Pesticides	Aldrin	0.00958 ^{C1}	<0.00101	<0.00101	0.00575 ^{C2}	<0.00102	<0.00104
	Gamma-BHC	0.0112 ^{C2}	<0.00101	<0.00101	0.0112 ^{C2}	<0.00102	<0.00104
	4,4-DDD	<0.00199	<0.00201	<0.00202	0.0146 ^{C1}	<0.00204	<0.00208
	4,4-DDE	0.0172 ^{C2}	<0.00201	<0.00202	0.0117 ^{C1}	<0.00204	<0.00208
	4,4-DDT	0.0479 ^{C2}	<0.00201	<0.00202	<0.00208	<0.00204	<0.00208
	Dieldrin	0.00505 ^{C1}	<0.00201	<0.00202	0.0104 ^{C2}	<0.00204	<0.00208
	Heptachlor Alpha-	0.00772 ^{C1}	<0.00101	<0.00101	<0.00104	<0.00102	<0.00104
	Chlordane Gamma- Chlordane	0.00344 ^{C2}	<0.00101	<0.00101	0.0148 ^{C2}	<0.00102	<0.00104
		<0.000995	<0.00101	<0.00101	<0.00104	<0.00102	<0.00104
PCBs	Aroclor 1016	<0.0052	<0.00486	<0.00493	<0.00513	<0.00492	<0.00516
	Aroclor 1221	<0.00104	<0.00972	<0.00985	<0.0103	<0.00984	<0.0103
	Aroclor 1232	<0.0052	<0.00486	<0.00493	<0.00513	<0.00492	<0.00516
	Aroclor 1242	0.0302 ^{C1}	<0.00486	<0.00493	<0.00513	<0.00492	<0.00516
	Aroclor 1248	<0.0052	<0.00486	<0.00493	<0.00513	<0.00492	<0.00516
	Aroclor 1254	<0.0052	<0.00486	<0.00493	<0.00513	<0.00492	<0.00516
	Aroclor 1260	<0.0052	<0.00486	<0.00493	<0.00513	<0.00492	<0.00516
Qualifier Codes: C1: Second column confirmation was performed. The relative percent difference value between the results on the two columns was evaluated and determined to be <40%. C2: Second column confirmation was performed. The relative percent difference value between the results on the two columns was evaluated and determined to be >40%.							

Table 8: Organochlorine Pesticides and PCBs						
Sediment samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge						
Analyte	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-04	OAKB-HA-05
		ug/kg				
Pesticides	Aldrin	<0.526	<0.553	<0.468	<0.566	<0.56
	Gamma-BHC	<0.526	<0.553	<0.468	<0.566	<0.56
	4,4-DDD	12.4^{C1}	16.8^{C1}	6.83^{C1}	6.09^{C1}	7.39^{C1}
	4,4-DDE	13.4^{C1}	23.2^{C1}	12.3^{C1}	26^{C1}	65.9^{C1}
	4,4-DDT	11.6^{C1}	61.8^{C1}	8.37^{C1}	18.7^{C1}	126^{C1E}
	Dieldrin	<1.05	1.9^{JC2}	<0.937	<1.13	<1.12
	Heptachlor Alpha-Chlordane	<0.526	0.744^{JC2}	<0.468	<0.566	<0.56
	Gamma-Chlordane	<0.526	1.77^{C1}	1.34^{C1}	8.12^{C2}	<0.56
PCBs	Aroclor 1016	<0.00966	<0.019	<0.0106	<0.00611	<0.00632
	Aroclor 1221	<0.0193	<0.0381	<0.0211	<0.0122	0.0126
	Aroclor 1232	<0.00966	<0.019	<0.0106	<0.00611	<0.00632
	Aroclor 1242	0.0335^{C1}	<0.019	<0.0106	<0.00611	<0.00632
	Aroclor 1248	<0.00966	<0.019	<0.0106	<0.00611	<0.00632
	Aroclor 1254	<0.00966	<0.019	<0.0106	<0.00611	<0.00632
	Aroclor 1260	0.0103^{JC2}	<0.019	<0.0106	0.00896^{JC1}	0.0227^{C1}
<p>Qualifier Codes:</p> <p>C1: Second column confirmation was performed. The relative percent difference value between the results on the two columns was evaluated and determined to be <40%.</p> <p>C2: Second column confirmation was performed. The relative percent difference value between the results on the two columns was evaluated and determined to be >40%.</p> <p>E: The concentration of this analyte exceeded the instrument calibration range and should be considered an estimated quantity.</p> <p>J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.</p>						

Table 9: Diesel Range Organics						
Water samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge						
	Sample ID	3WLR60001	3WLR60002	3WLR60004	3WLR60005	3WLR60006
Analyte		ug/L				
#2 Diesel		0.704 ^{X1}	0.14 ^J	0.316 ^{X2}	<0.118	<0.128
Motor Oil		0.465 ^{JX1}	<0.241	0.42 ^{JX2}	<0.236	<0.256
Qualifier Codes: J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity. X1: Contamination does not appear to be a typical product. Chromatogram suggests this might be fuel oil or similar product. X2: Contamination does not appear to be a typical product. Notes: 1. Sample 3WLR60003 was received broken at the laboratory and was, therefore, not analyzed for DRO. 2. Hydrocarbons were not identified above the laboratory method detection limits in any of the five sediment samples collected from Oaks Bottom and are, therefore, not depicted in a tabular format.						

Table 10: Metals							
Water samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge							
Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006
		ug/L					
As		<0.00125	0.00241^J	<0.00125	0.00433	<0.00125	0.00196^J
Sb		0.00167^J	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125
Cd		<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125
Cu		0.0113	0.00663	0.00387	0.018	0.00176^J	0.00895
Pb		0.0189	0.00817	0.00342	0.0108	0.00132^J	0.00681
Ni		0.00888	0.00429	0.00262	0.00473	0.00173^J	0.00541
Ag		<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125
Zn		0.0846	0.0239	0.0113	0.0284	0.00378	0.0241
Hg		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Qualifier Codes:							
J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.							

Table 11: Metals						
Sediment samples collected September 23, 2003 –Oaks Bottom Wildlife Refuge						
Analyte	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-04	OAKB-HA-05
		ug/kg				
As		2.97	4.1	3.18	4.23	4.03
Sb		<2.77	<5.44	<2.77	<1.78	<1.84
Cd		<0.462	<0.907	<0.461	<0.297	<0.306
Cu		26.2	38.5	33.9	35.9	37.7
Pb		15.3	38.6	22.5	26.5	32.6
Ni		19	27.6	21.7	23.4	22.8
Ag		<4.62	<0.907	<0.461	<0.297	<0.306
Zn		81.4	84.1	85.9	85.7	98.4
Hg		0.0375	0.0756	0.051	0.0749	0.0706
Qualifier Codes:						
J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.						

Table 12: Anions, Ammonia, Hardness, Corrosivity, Total Kjeldahl Nitrogen, and Total Phosphorus							
Sampled September 23, 2003 –Oaks Bottom Wildlife Refuge							
	Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006
Analyte	mg/L (except pH)						
Phosphate	<0.075	0.115^J	<0.075	0.173	0.079^J	<0.075	
Nitrate/Nitrite	<0.3	0.99	3.62	<0.3	4.59	3.5	
Ammonia Nitrogen	1.9	0.15	0.23	0.16	0.06	0.27	
Hardness	500	NA	85	NA	NA	NA	
pH	6.23	9.30	7.16	8.10	7.01	7.13	
Total Kjeldahl Nitrogen	5	2.6	1.4	10	<0.5	1.9	
Total Phosphorus	8.2	0.38	0.18	0.90	0.13	0.27	
Qualifier Codes:							
J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.							
NA: Sample was not analyzed for hardness.							

APPENDIX 2:

Table 2A: Volatile Organic Compounds - Water

Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60004	DEQ SLV	DEQ Acute/Chronic	EPA CMC/CCC	NOAA CMC/CCC
		ug/L						
Chloroethane		0.577 ^J	<0.5	<0.5	-	-	-	-
Acetone		<2.5	4.76 ^J	7.87	1,500	-	-	-
Chlorobenzene		3.35	<0.5	<0.5	50	-	-	250*/50*
Qualifier Codes: J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity. -: A value was not provided. SLV: Level II Screening Level Value *: The value is listed as the LOEL.								



Table 3A: Volatile Organic Compounds - Sediment

	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-05	DEQ SLV	DEQ Soil Cleanup Level	DMEF Screening Level	NOAA TEL
Analyte		ug/kg							
Acetone		36.5	83.3	16.3 ^J	<0.891	-	-	-	-
Methylene chloride		2.52	5.08 ^J	1.57 ^J	0.906 ^J	-	7,000	-	-
2-Butanone		<1.23	39.3 ^J	<1.44	<8.91	-	-	-	-
1,4-Dichlorobenzene		3.54	<2.79	<1.44	<0.891	-	-	-	-
Qualifier Codes: J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity. -: A value was not provided.									

Table 4A: Semivolatile Organic Compounds - Water

Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60004	DEQ SLV	DEQ Acute/ Chronic	EPA CMC/CCC	NOAA CMC/CCC
		ug/L						
1,4-Dichlorobenzene		0.71	<0.0984	<0.0995	15	1,120*/763 ^{1*}		1,120*/763*
1,2-Dichlorobenzene		0.121 ^J	<0.0984	<0.0995	14	1,120*/763 ^{1*}	-	1,120*/763*
Naphthalene		0.0612	<0.0295	<0.0299	620	2,300*/620*	-	2,300*/620*
Acenaphthene		4.69	<0.0246	0.22	520	1,700*/520*	-	1,700*/520*
Dibenzofuran		1.04	<0.0984	<0.0995	3.7	-	-	-
Diethylphthalate		0.159 ^J	0.108 ^J	<0.0995	210	-	-	940*/3*
Fluorene		1.74	<0.0246	0.147	3.9	-	-	-
Phenanthrene		<0.0251	0.0276 ^J	0.0579	6.3	-	-	940*/3*
Di-n-butylphthalate		0.18 ^J	0.235	<0.0995	35	-	-	
Fluoranthene		0.106	0.0508	0.0548	6.15	3,980*/-	-	3,980*/-
Pyrene		<0.0251	0.0501	<0.0249	-	-	-	30p/6.3p
Butylbenzylphthalate		0.165 ^J	0.183 ^J	0.174 ^J	19	-	-	940*/3*
Chrysene		0.027 ^J	0.0302 ^J	<0.0249	-	-	-	-
Benzofluoranthenes		<0.0502	0.0546 ^J	<0.498	-	-	-	-
Benzo(a)pyrene		<0.0251	0.0311 ^J	0.142	0.019	-	-	-
Indeno (1,2,3-cd) pyrene		<0.0251	0.0285 ^J	<0.0249	-	-	-	-
Benzo (g,h,i)perylene		<0.0251	0.037 ^J	<0.0249	-	-	-	-

Qualifier Codes:

J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.

-: A value was not provided.

1: The Oregon DEQ summary lists the acute and chronic concentrations for dichlorobenzenes and does not distinguish between different types.

*: The value is listed as the LOEL.

p: Proposed

Table 5A: Semivolatile Organic Compounds - Sediment

Analyte	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-04	OAKB-HA-05	DEQ SLV	DEQ Soil Cleanup Level	DMEF Screening Level	NOAA TEL
		ug/kg								
Phenol		<17.9	<39.8	<21.2	<11.6	17.9^J	48	-	540	-
Naphthalene		<4.46	<9.96	<5.3	<2.9	3.45^J	176	10 ⁶	2,100	-
Acenaphthylene		<4.46	<9.96	<5.3	<2.9	5.89^J	160	-	560	-
Acenaphthene		35.8	<9.96	<21.2	<2.9	<3.16	290	2 x 10 ⁷	500	-
Fluorene		14.6	<9.96	<5.3	<2.9	<3.16	77	10 ⁷	540	-
N-Nitrosodiphenylamine		28.1^J	<39.8	<21.2	<11.6	<12.6	-	-	28	-
Phenanthrene		<4.46	<9.96	<5.3	7.66	17.7	42	-	1,500	41.9
Anthracene		<4.46	<9.96	<5.3	<2.9	14.6	57	8 x 10 ⁷	960	-
Fluoranthene		7.38^J	<9.96	6.99^J	15.3	36.2	111	10 ⁷	1,700	111
Pyrene		6.75^J	<9.96	8.9^J	17.4	57	53	8 x 10 ⁶	2,600	53
Butylbenzylphthalate		< 22.3	<49.8	<26.5	<14.5	<15.8	-	-	970	-
Benzo(a)anthracene		<4.46	<9.96	<5.3	7.44	20.8	32	100	1,300	31.7
Chrysene		<4.46	<9.96	<5.3	10.1	42.3	57	100	1,400	57.1

Table 5A: Semivolatile Organic Compounds – Sediment (continued)

Analyte	Sample ID	OAKB-HA-01	OAKB-HA-02	OAKB-HA-03	OAKB-HA-04	OAKB-HA-05	DEQ SLV	DEQ Soil Cleanup Level	DMEF Screening Level	NOAA TEL
		ug/kg								
Bis (2-ethylhexyl) phthalate		<17.9	54.5^J	<21.2	14.1^J	47.3	75	5 x 10 ⁴	8,300	-
Di-n-octylphthalate		<17.9	<39.8	<21.2	<11.6	<12.6	-	-	6,200	-
Benzofluoranthenes		<4.46	<9.96	7.69^J	<2.9	96.4	-	-	3,200	-
Benzo(a)pyrene		<4.46	<9.96	5.6^J	10.8	48.2	32	100	1,600	31.9
Indeno (1,2,3-cd) pyrene		<4.46	<9.96	<5.3	9.5	<3.16	17	100	600	-
Dibenz(a,h)anthracene		<4.46	<9.96	<5.3	<2.9	77.9	33	100	230	-
Benzo (g,h,i)perylene		<4.46	<9.96	6.2^J	12.7	38	300	-	670	-
Qualifier Codes: J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity. -: A value was not provided.										

Table 6A: Chlorinated Herbicides - Water

	Sample ID	3WLR60005	3WLR60006	DEQ SLV	DEQ Acute/Chronic	EPA CMC/CCC
Analyte		ug/L				
4-Nitrophenol		0.112^J	0.143	150	230*/150 ^{2*}	-
Qualifier Codes: J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity. 2: 4-Nitrophenol was compared to Nitrophenols. *: The values are listed as the LOEL.						

Table 7A: Organochlorine Pesticides and PCBs - Water

Analyte	Sample ID	3WLR60001	3WLR60004	DEQ SLV	DEQ Acute/Chronic	EPA CMC/CCC	NOAA CMC/CCC
		ug/L					
Pesticides	Aldrin	0.00958 ^{C1}	0.00575 ^{C2}	0.06	-	3.0/-	1.5/-
	Gamma-BHC	0.0112 ^{C2}	0.0112 ^{C2}	0.08	100/- ^{3*}	0.95/-	0.95/0.08
	4,4-DDD	<0.00199	0.0146 ^{C1}	0.001	0.06*/-	0.6*/-	0.6*/-
	4,4-DDE	0.0172 ^{C2}	0.0117 ^{C1}	-	1,050/-*	1,050*/-	1,050*/-
	4,4-DDT	0.0479 ^{C2}	<0.00208	0.001	1.1/0.001 (total)	0.55/0.0005	0.55/0.0005
	Dieldrin	0.00505 ^{C1}	0.0104 ^{C2}	0.056	2.5/0.0019	0.24/0.056	0.24/0.056
	Heptachlor Alpha- Chlordane	0.00772 ^{C1}	<0.00104	0.0038	0.52/0.0038	0.52/0.0038	0.26/0.0019
PCBs	Aroclor 1242	0.00344 ^{C2}	0.0148 ^{C2}	0.0043 ⁴	2.4/0.0043 ⁴	2.4/0.0043 ⁴	1.2/0.00215 ⁴
		0.0302 ^{C1}	<0.00513	0.053	2/0.014 (total)	-/0.014 (total)	2/0.014 (total)

Qualifier Codes:
C1: Second column confirmation was performed. The relative percent difference value between the results on the two columns was evaluated and determined to be <40%.
C2: Second column confirmation was performed. The relative percent difference value between the results on the two columns was evaluated and determined to be >40%.
-: A value was not provided.
*: The values are listed as the LOEL.
3: Gamma-BHC was compared to BHC
4: Alpha-chlordane was compared to chlordane.

Table 8A: Organochlorine Pesticides and PCBs - Sediment

Analyte	Sample ID	OAKB- HA-01	OAKB- HA-02	OAKB- HA-03	OAKB- HA-04	OAKB- HA-05	DEQ SLV	DEQ Soil Cleanup Level	DMEF Screening Level	NOAA TEL
		ug/kg								
Pesticides	4,4-DDD	12.4 ^{C1}	16.8 ^{C1}	6.83 ^{C1}	6.09 ^{C1}	7.39 ^{C1}	4	3,000	-	3.54
	4,4-DDE	13.4 ^{C1}	23.2 ^{C1}	12.3 ^{C1}	26 ^{C1}	65.9 ^{C1}	1.5	2,000	-	1.42
	4,4-DDT	11.6 ^{C1}	61.8 ^{C1}	8.37 ^{C1}	18.7 ^{C1}	126 ^{C1E}	4	2,000	6.9 (total)	-
	Dieldrin	<1.05	1.9 ^{JC2}	<0.937	<1.13	<1.12	3	40	10	2.85
	Heptachlor Alpha- Chlordane	<0.526	0.744 ^{JC2}	<0.468	<0.566	<0.56	10	400	10	-
	Gamma- Chlordane	<0.526	<0.553	0.518 ^{JC2}	<0.566	<0.56	4.5 ⁴	500 ⁴	10	4.5 ⁴
PCBs	Aroclor 1242	0.0335 ^{C1}	<0.019	<0.0106	<0.00611	<0.00632	-	-	-	-
	Aroclor 1260	0.0103 ^{JC2}	<0.019	<0.0106	0.00896 ^{JC1}	0.0227 ^{C1}	34 (total)	80 (total)	130 (total)	34.1 (total)

Qualifier Codes:
C1: Second column confirmation was performed. The relative percent difference value between the results on the two columns was evaluated and determined to be <40%.
C2: Second column confirmation was performed. The relative percent difference value between the results on the two columns was evaluated and determined to be >40%.
E: The concentration of this analyte exceeded the instrument calibration range and should be considered an estimated quantity.
J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
-: A value was not provided.
4: Alpha-chlordane was compared to chlordane.
5: Gamma-chlordane was compared to chlordane.

Table 9A: Diesel Range Organics - Water

Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60004	CMC/CCC	Acute/Chronic
		ug/L				
#2 Diesel		0.704 ^{X1}	0.14 ^J	0.316 ^{X2}	-	-
Motor Oil		0.465 ^{JX1}	<0.241	0.42 ^{JX2}	-	-
Qualifier Codes: J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity. X1: Contamination does not appear to be a typical product. Chromatogram suggests this might be fuel oil or similar product. X2: Contamination does not appear to be a typical product. Notes: 1. Sample 3WLR60003 was received broken at the laboratory and was, therefore, not analyzed for DRO. 2. Hydrocarbons were not identified above the laboratory method detection limits in any of the five sediment samples collected from Oaks Bottom and are, therefore, not depicted in a tabular format. -: A value was not provided.						



Table 10A: Metals - Water

Analyte	Sample ID	3WLR60001	3WLR60002	3WLR60003	3WLR60004	3WLR60005	3WLR60006	DEQ SLV	DEQ Acute /Chronic	EPA CMC/ CCC	NOAA CMC/ CCC
		ug/L									
As		<0.00125	0.00241^J	<0.00125	0.00433	<0.00125	0.00196^J	150	-	340/150	340/150
Sb		0.00167^J	<0.00125	<0.00125	<0.00125	<0.00125	<0.00125	1,600	9,000/1,600*	-	88p/30p
Cu		0.0113	0.00663	0.00387	0.018	0.00176^J	0.00895	9	18+/12+	13/9.0	13/9.0
Pb		0.0189	0.00817	0.00342	0.0108	0.00132^J	0.00681	2.5	82+/3.2+	65/2.5	65/2.5
Ni		0.00888	0.00429	0.00262	0.00473	0.00173^J	0.00541	52	1,400+/160+	470/52	470/52
Zn		0.0846	0.0239	0.0113	0.0284	0.00378	0.0241	120	120+/110+	120/120	120/120

Qualifier Codes:
 J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
 -: A value was not provided.
 *: The values are listed as the LOEL.
 +: Hardness dependent criteria (100 mg/L used)
 p: Proposed

Table 11A: Metals - Sediment

Analyte	Sample ID	OAKB- HA-01	OAKB- HA-02	OAKB- HA-03	OAKB- HA-04	OAKB- HA-05	DEQ SLV	DEQ Soil Cleanup Level	DMEF Screening Level	NOAA TEL
		ug/kg								
As		2.97	4.1	3.18	4.23	4.03	6,000	400	5.7x10 ⁴	5,900
Cu		26.2	38.5	33.9	35.9	37.7	3.6 x10 ⁴	10 ⁶	3.9x10 ⁵	3.57 x10 ⁴
Pb		15.3	38.6	22.5	26.5	32.6	3.5 x10 ⁴	2x 10 ⁵	4.5 x10 ⁵	3.5 x10 ⁴
Ni		19	27.6	21.7	23.4	22.8	1.8 x10 ⁴	5x10 ⁶	1.4 x10 ⁵	1.8 x10 ⁴
Zn		81.4	84.1	85.9	85.7	98.4	1.23 x10 ⁵	-	4.1 x10 ⁵	1.23 x10 ⁵
Hg		0.0375	0.0756	0.051	0.0749	0.0706	200	8x10 ⁴	410	174
Qualifier Codes: J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity. -: A value was not provided.										

Appendix 3: Site Photographs

