FINAL
QUALITY ASSURANCE PROJECT PLAN (SHORT FORM)
EXPANDED SITE INSPECTION

GRENADA MANUFACTURING ESI
(also known as Rockwell International Wheel & Trim)
GRENADA, GRENADA COUNTY, MISSISSIPPI
MSD007037278

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 4
Atlanta, GA 30303

Contract No.	:	EP-S4-14-03
TDD No.	:	TT-05-020
Date Prepared	:	March 30, 2016
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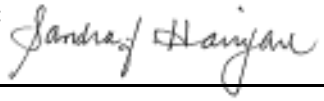
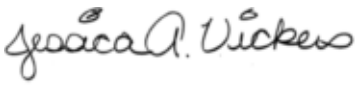
QUALITY ASSURANCE PROJECT PLAN (SHORT FORM)

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 4 & TETRA TECH, INC.

SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM CONTRACT NO. EP-S4-14-03

Site Name:	Grenada Manufacturing ESI	**City, County:** Grenada, Grenada	**State:** Mississippi
Prepared By:	Tetra Tech, Inc. (Tetra Tech)	**Date:** March 30, 2016	
Approved By: Sandra Harrigan **Date:** 3/30/16 **Title:** Tetra Tech Task Order Manager		**Signature:** 	
Approved By: Jessica Vickers **Date:** 3/30/16 **Title:** Tetra Tech Quality Assurance (QA) Manager		**Signature:** 	
Approved By: Andrew Johnson **Date:** 3/30/16 **Title:** Tetra Tech Superfund Technical Assessment and Response Team (START IV) Program Manager		**Signature:** 	
Approved By: Cathy Amoroso **Date:** 04/08/2016 **Title:** U.S. Environmental Protection Agency (EPA) Remedial Project Manager (RPM) and EPA Region 4 QA Manager's Designated Approving Official		**Signature:**  Cathy Amoroso	

1.0 PROJECT INFORMATION

1.1 Distribution List

EPA Region 4:

Cathy Amoroso, EPA RPM
Katrina Jones, EPA Project Officer

Tetra Tech:

Angel Reed, Tetra Tech Document Control Coordinator

1.2 Project/Task Organization

Cathy Amoroso will serve as the EPA RPM for the activities described in this Quality Assurance Project Plan (QAPP). Quinn Kelley will serve as the Tetra Tech project manager and is responsible for maintaining an approved version of this QAPP. Jessica Vickers will serve as the Tetra Tech QA manager and is responsible for providing approval of this QAPP. The EPA RPM has the authority to issue a Stop Work order. Specific Tetra Tech field personnel will be selected before mobilization as defined under the Superfund Technical Assessment and Response Team (START) IV Contract No. EP-S4-14-03 and organized in accordance with the organizational chart found in Figure 1-1 of Section 1.1 in the START Program Level QAPP.

1.3 Problem Definition/Background

The former Rockwell International Wheel & Trim facility (now known as Grenada Manufacturing) is located in Grenada, Grenada County, Mississippi. The Grenada Manufacturing site includes the approximately 40-acre main facility, as well as an approximately 4-acre disposal area (Rockwell Moose Lodge Road Disposal Area Site [Moose Lodge]), located directly east of the main facility along Moose Lodge Road. The site is bordered to the north by residential properties and vacant land, to the east by vacant land, to the south by vacant land, and to the west by Riverdale Creek and agricultural land beyond. The current features of the Grenada Manufacturing property include an equalization lagoon, former sludge lagoon, and former on-site disposal area (referred to now as the former on-site landfill), among others.

From 1966 to 2008, the site was operated as a wheel cover manufacturing and chrome plating facility. In 2008, portions of the plant property were leased to ICE Industries, Inc. (ICE). ICE has converted the facility to a stamping plant, which manufactures stamp-formed parts for various industries. The 40-acre Grenada Manufacturing main facility is owned in part by Grenada Manufacturing and in part by Grenada County and City. The approximately 4-acre Moose Lodge Road disposal area is owned by Sustainable Forests, LLC. During wheel cover manufacturing and chrome plating operations, the facility contained a plant building, warehouse, drum storage area, two lagoons (equalization and sludge), wastewater treatment plant, a waste oil tank, a chromium reduction tank, a flash mix tank, a clarifier tank, sumps, chromic acid plating baths, and an on-site disposal area, referred to as a landfill, among others. Historical wastes generated at the facility included paint waste, toluene, spent solvents, chromic acid sludge, trichloroethylene (TCE) still bottoms, buffing compounds, paint sludge, wastewater treatment plant clarifier sludge, waste oil, metal shavings, corrosive alkaline wash waters, and hexavalent chromium electroplating wastewater, among others.

A remedial investigation (RI) under state oversight was conducted at the facility between 1991 and 1993. In addition to the former on-site disposal area (landfill) and equalization lagoon, the RI identified several source areas for contaminants of concern (COC) including the following: former sludge lagoon, chromium reduction unit, raw waste station/wet well, process sewers, outfall ditch, former toluene storage area, former TCE storage area, and former burn area. Soil and ground water samples collected during the RI contained toluene, chromium, and TCE and its degradation products. EPA assumed authority for the project oversight in 1995 and determined that the investigation and cleanup of the site needed to proceed as a Resource Conservation and Recovery Act (RCRA) corrective action under the terms of the RCRA permit issued to the facility. In 1996 and 1997, EPA performed a RCRA facility assessment (RFA) as part of the Federal Hazardous Waste Amendments (HSWA) permit process. Twenty-six solid waste management units (SWMU) and three areas of concern (AOC) were identified during the RFA. Of the 26 SWMUs, 18 were investigated and determined to have no evidence of a release and required no further action.

Three potential source areas at the Grenada Manufacturing site will be investigated during this Expanded Site Inspection (ESI). The source areas include the equalization lagoon (SWMU 2), former on-site disposal area referred to as a landfill (SWMU 3), and the former sludge lagoon (SWMU 4). The equalization lagoon, located in the north-central portion of the site, northwest of the main plant building, is approximately 75,000 square feet (ft^2) and received roll forming department wastewater, boiler blow down, boil-off, butler wash, buff wash, and alkaline rinse and cooling waters from 1961 to 1991. Additionally, the unit received electroplating wastewaters that contained hexavalent chromium (F006 [wastewater treatment sludge from electroplating operations] and D007 [chromium]) until 1990. The former on-site disposal area (landfill) is located in the northwestern portion of the site and is approximately 57,000 ft^2 in size. The disposal area received waste including buffing compounds, still bottoms from TCE recovery operations, and paint sludges. The former sludge lagoon, located in the northwestern portion of the site, just east of the former on-site disposal area, is approximately 33,000 ft^2. The clay-lined lagoon was in operation from 1976 to 1982 and received sludge generated in the wastewater treatment plant clarifier, hazardous waste code F006. Samples collected from these source areas contained chlorinated VOCs and metals, including hexavalent chromium.

Overland flow at the Grenada Manufacturing site is directed towards a connected series of drainage ditches. A flow divide exists in the northern-most ditch, located immediately east of the equalization lagoon. Water in the ditch west of this divide discharges directly to Riverdale Creek and is called the outfall ditch. Water in the ditches east of the divide combine and discharge to a swamp located south of the eastern portion of the site. The outfall ditch received discharge from the wastewater treatment plant, portions of several drainage ditches, and effluent from the equalization lagoon. According to the U.S. National Wetlands Inventory (NWI), Hazard Ranking System (HRS)-eligible palustrine forested wetlands are located on the western portion of the Grenada Manufacturing site, as well as south of the manufacturing area. Specifically, the former on-site disposal area (landfill) is located directly on these HRS-eligible wetlands. Samples collected from these wetlands and Riverdale Creek contained VOCs and metals.

1.4 Project/Task Description

Tetra Tech is tasked with conducting an ESI at the Grenada Manufacturing site, and preparing draft and final reports detailing the findings of the ESI. The goal of the ESI is to address data gaps identified in the preliminary scoring strategy and to determine the presence or absence of site-related contamination in Riverdale Creek and surrounding wetlands. The sampling event is scheduled for the week of April 11, 2016.

Source Sampling:

- Tetra Tech will collect 4 sediment samples at a depth of 0 to 1 foot below the lagoon bed from the equalization lagoon. Tetra Tech will use a boat to access the sampling locations in the lagoon and the sediment samples will be collected with a ponar dredge.
- Tetra Tech will collect 8 soil or sludge samples from four locations around the perimeter of the former sludge lagoon (outside of the capped area). Grab soil or sludge samples will be collected from two depth intervals: 1 to 3 feet below ground surface (bgs) and 3 to 5 feet bgs.
- Tetra Tech will collect 4 soil or sludge samples from two locations on the former on-site disposal area. Grab soil or sludge samples will be collected from two depth intervals: 1 to 3 feet bgs and 3 to 5 feet bgs.
- Tetra Tech will collect 9 soil or sludge samples at a depth of 0 to 1 foot bgs from wetlands on the former on-site disposal area. Samples will be screened for VOCs with a photoionization detector (PID).
- Tetra Tech will collect 6 wetland samples at a depth of 0 to 1 foot bgs from the HRS-eligible wetlands located south of the main facility.
- Source sampling locations will be logged to provide a description of the soil and waste encountered in each sample.
- Source samples will be screened in the field for VOCs with a photoionization detector (PID) and for metals with an X-ray fluorescence (XRF) instrument to help guide sampling locations in some source areas.
- Source samples will be collected using stainless steel spoons, hand augers, or ponar dredges, and aluminum pans.
- Source samples will be submitted to an EPA Contract Laboratory Program (CLP) laboratory for analysis.
- Source samples will be analyzed for EPA Target Compound List (TCL) VOCs, EPA Target Analyte List (TAL) metals (including mercury), and hexavalent chromium.
- Source sampling locations are depicted on Figure 3 in Appendix A and described in Table B-1 in Appendix B.

Surface Water and Sediment Sampling:

- Tetra Tech will collect 3 collocated sediment and surface water samples (if present) from the outfall ditch. Sediment samples will be collected from 0 to 6 inches below the ditch bed.
- Tetra Tech will collect 4 sediment samples from drainage ditches that direct water to the wetlands south of the site. Sediment samples will be collected from 0 to 6 inches below the ditch bed.
- Tetra Tech will collect 1 sediment sample from the point at which the outfall ditch enters Riverdale Creek (the probable point of entry [PPE]).
- Tetra Tech will collect 8 sediment samples from 0 to 6 inches below the stream bed along Riverdale Creek, downstream of the PPE.
- Background sediment samples from 0 to 6 inches below the stream bed will be collected from 4 locations along Riverdale Creek upstream of the PPE.
- One sediment sample will be collected from a similar wetland off-site for comparison to on-site wetland samples.
- Sediment samples will be collected using stainless steel spoons and aluminum pans.
- The surface water and sediment samples will be analyzed for EPA TCL VOCs, EPA TAL metals (including mercury), and hexavalent chromium.
- Surface water and sediment sampling locations are depicted on Figure 4 in Appendix A and described in Table B-2 in Appendix B.

1.5 Quality Objectives and Criteria for Measurement Data

Identification of the seven steps of the data quality objectives (DQO) process: DQOs were established for the Grenada Manufacturing site to define the quantity and quality of the data to be collected to support the objectives of the sampling event. DQOs were developed using the seven-step process outlined in the following guidance documents: "EPA Requirements for Quality Assurance Project Plans," EPA QA/R-5, March 2001; "Guidance for Quality Assurance Project Plans," EPA QA/G-5, December 2002; and "Guidance on Systematic Planning Using the Data Quality Objectives Process," EPA QA/G-4, February 2006.

Step 1: State the Problem	**Stakeholders:** EPA, MDEQ, and the local community. **Site History/Conceptual Site Model:** From 1961 to 2008, Grenada Manufacturing operated a wheel cover manufacturing and chrome plating facility. In 2008, portions of the plant property were leased to ICE. ICE has converted the facility to a stamping plant, which manufactures stamp-formed parts for various industries. VOCs and metals are the primary contaminants of concern. For additional information, see Section 1.3 of this QAPP. **Statement of Problem:** Sampling and laboratory analysis will be required to determine the presence or absence of contaminants in the on-site sources (equalization lagoon, former on-site disposal area, and the former sludge lagoon) and whether hazardous substances contained in the sources have migrated downstream into perennial Riverdale Creek and wetland areas. Sampling will be conducted to evaluate the source areas under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
Step 2: Identify the Goals of the Study	**Study Question:** Are hazardous substances present in on-site sources and Riverdale Creek and wetland areas? **Decision Statements:** Evaluate analytical data for samples collected throughout the property, including potentially contaminated sediment in the equalization lagoon, soil or sludge in the former on-site former disposal area and soil or sludge in the former sludge lagoon, as well as surface water and sediment from the on-site outfall ditch and downstream Riverdale Creek and wetlands to determine the presence or absence of hazardous substances. Tetra Tech will evaluate the analytical results to determine whether contaminant concentrations exceed comparison criteria listed in Step 5 of this QAPP.
Step 3: Identify Information Inputs	**Inputs:** Site history contained in Section 1.3 of this QAPP, analytical results generated from this sampling event, EPA Regional Screening Levels, EPA Region 4 Surface Water Screening Values (SWSV) and Sediment Screening Values (SSV), and MDEQ Water Quality Criteria
Step 4: Define Study Boundaries	**Spatial Boundary:** The Grenada Manufacturing main facility covers about 40 acres in area. There is also an approximately 4-acre landfill east of the main facility. The spatial boundary of the Grenada Manufacturing facility also includes the Riverdale Creek, wetlands, and potential fisheries in the downstream reach of Riverdale Creek and the Yalobusha River that might be impacted by past operational activities at Grenada Manufacturing (see Figures 3 and 4 in Appendix A). **Temporal Boundaries:** ESI sampling activities are anticipated to be conducted during the week of April 11, 2016. Additional sampling activities will be conducted the week of May 2, 2016. A QAPP for this event will be submitted under separate cover.

Step 5: Develop the Analytical Approach	**Analytical Methods:** Source, surface water, and sediment samples will be analyzed for parameters using the analytical methods indicated below: • TCL VOCs using CLP Statement of Work (SOW) for Organic Superfund Methods, Multi-Media, Multi-Concentration, SOM01.2, April 2007. • TAL metals (including mercury) using EPA Region 4 SESD, Analytical Support Branch (ASB) Laboratory Operations and Quality Assurance Manual (LOQAM), April 2015. • Hexavalent chromium using EPA Region 4 SESD, ASB LOQAM, April 2015. All samples will be submitted to the CLP laboratory (or laboratories) selected by EPA or the EPA SESD Region 4 laboratory. **Comparison Criteria:** Analytical data results will be compared with background, as well as with the comparison criteria listed below. • For source samples: EPA Regional Screening Levels, November 2015: http://www.epa.gov/risk/risk-based-screening-table-generic-tables • For surface water and sediment samples: EPA Supplemental Guidance to ERAGS: Region 4 Bulletins, Ecological Risk Assessment, 2015: http://www.epa.gov/risk/region-4-ecological-risk-assessment-supplemental-guidance • For surface water samples: MDEQ Water Quality Criteria, 2007: https://deq.state.ms.us/mdeq.nsf/0/E12C3B35E44CBFBC862574670051589E/$file/WQS_std_adpt_aug07.pdf?OpenElement **Decision Rules:** Analytical results will be compared to the criteria listed above (see Attachments 1 through 3). Constituent concentrations in samples that are greater than or equal to three times the background concentration or that are greater than or equal to the sample-specific and analyte-specific minimum reporting limit in the background sample are considered elevated. Decisions made regarding the results will be determined by EPA.
Step 6: Specify Performance or Acceptance Criteria	Analytical results (for source, surface water, and sediment samples) for initial acceptance will be assessed during validation performed by EPA Region 4 SESD, Office of Quality Assurance that evaluates the usability of the data. Any rejected data and the reasons for rejection will be summarized in the narrative summary of the analytical data packages. In addition, Tetra Tech will review quality control (QC) samples against field samples to determine if additional qualifications are warranted (see Table B-3 in Appendix B).
Step 7: Develop the Plan for Obtaining Data	**Optimized Design:** Up to 33 source (equalization lagoon, sludge lagoon, on-site disposal area, and wetlands), 4 surface water (outfall ditch), and 21 sediment (outfall ditch, southern drainage ditches, and Riverdale Creek) samples (including duplicate and background samples), as well as up to 6 QC samples are proposed to be collected at the site and in Riverdale Creek to evaluate the presence or absence of hazardous substances on site and in downstream surface water bodies. Sample nomenclature, locations, analytical parameters, and sampling rationales are described in Tables B-1 and B-2 of Appendix B. Appendix B, Table B-3 presents the collection frequencies of various field QC samples. See Appendix A, Figures 3 and 4 for sampling locations.

1.6 Special Training/Certification Requirements

☒ OSHA 29 CFR 1910.120 ☒ Special Equipment/Instrument Operator (describe below): ☐ Other (describe below):

Special Requirements: Only field team members trained on the proper use of the Trimble global positioning system (GPS) unit, PID, XRF and any additional field monitoring equipment used on site will operate the instruments.

1.7 Documentation and Records

The most current version of this QAPP will be distributed to the entire distribution list presented in Section 1.1. The Tetra Tech project manager will be responsible for maintaining the most current revision of this QAPP and for distributing it to all personnel and parties involved in the field effort. Field records that may be generated include the following:

- ☒ Chains-of-Custody Forms
- ☒ Field Instrument Calibration Logs
- ☒ Field Monitoring and Screening Results
- ☒ Tailgate Sign-In Sheet
- ☒ Health and Safety Plan (HASP)
- ☒ Photographic log
- ☒ Site Logbook
- ☒ Site Maps and Drawings

Field documentation and records will be generated and maintained in accordance with the requirements presented in the EPA Region 4 SESD Field Branches Quality System and Technical Procedures (FBQSTP) guidance document for *Logbooks* (SESDPROC-010-R5), May 2013. This document can be found at the following web address: http://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches. All field-generated data will also be maintained in the project file and included, as appropriate, in project deliverables in final form after all reviews and applicable corrective actions.

The formal deliverables for EPA associated with this project are specified in the EPA technical direction document. Draft and final reports will be prepared to summarize field activities and findings and present laboratory analytical results. All project records, including electronic and hard copies of field, laboratory, and project deliverables, under Tetra Tech's control will be maintained and retained in accordance with the requirements of EPA START IV Contract No. EP-S4-14-03 and Section 5.0, page 15 of the Tetra Tech START Quality Management Plan (QMP), January 2013.

2.0 DATA GENERATION AND ACQUISITION

2.1 Sampling Process Design

Tables B-1 through B-5 in Appendix B present details on the types (source, surface water, sediment, and QC) and numbers of samples to be collected, sample locations, analytical parameters, sampling rationales, sample containers, laboratory analytical methods, preservation methods, analytical holding times, and performance and acceptance criteria. The rationale for this sampling process design is based on the DQO process discussed in Section 1.5 of this QAPP. Source, surface water, and sediment samples will be submitted to the EPA-selected CLP laboratory(ies) and will be analyzed for the following: TCL VOCs, TAL metals (including mercury), and hexavalent chromium. See Table B-4 in Appendix B for the analytical methods.

2.2 Sample Methods Requirements

Matrix	Sampling Method	EPA and Tetra Tech Standard Operating Procedures and Guidance
Soil, sediment, and surface water	Refer to Tables B-1 through B-4 for more details, including requested analytical parameters and methods.	Refer to the CLP SOW for Organic Superfund Methods, Multi-Media, Multi-Concentration, SOM01.2, April 2007; the CLP SOW for Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM01.2, January 2010 (as modified by ISM01.3); the SESD FBQSTP for *Sediment Sampling* (SESDPROC-200-R3), August 2014; the SESD FBQSTP for *Soil Sampling* (SESDPROC-300-R3), August 2014; the SESD FBQSTP for *Surface Water Sampling* (SESDPROC-201-R3); and the SESD FBQSTP for *Waste Sampling* (SESDPROC-302-R23), January 2013. Also refer to Section 2.2, page 19 of the Tetra Tech START Program Level QAPP, May 2012. A list of applicable Safe Work Practices is included in the HASP, which will be available on site.

Other Sample Method Requirements: The Tetra Tech project manager, in coordination with the EPA RPM, will be responsible for identifying failures in sampling and field measurement systems, overseeing any corrective actions, ensuring that the corrective actions are documented in site logbooks and other appropriate records, and assessing the effectiveness of corrective actions. Global positioning system data collected in the field will be conducted in accordance with the EPA Region 4 SESD FBQSTP *Global Positioning System* (SESDPROC-110-R4), June 2015. XRF Screening will be conducted in accordance with the EPA Region 4, SESD FBQSTP for *Field XRF Measurement* (SESDPROC-107-R2), December 2011. Field decontamination will be conducted in accordance with the procedures provided in the EPA Region 4, SESD FBQSTP *Field Equipment Cleaning and Decontamination* (SESDPROC-205-R3), December 2015. All EPA Region 4 SESD FBQSTP procedures are available at the following web address http://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches.

Equipment required for this sampling event includes sample containers; sample packaging materials, such as coolers and suitable packing material; stainless steel spoons; aluminum pans; Trimble GPS unit; PID, boat, freezers, and personal protective equipment (PPE) identified in the HASP (including disposable nitrile gloves and boot covers). Also see Table B-6 in Appendix B of this QAPP for a list of field equipment and supplies.

2.3 Sample Handling and Custody Requirements

Sample handling and chain-of-custody record keeping will be conducted in accordance with EPA Region 4, SESD FBQSTP *Packing, Marking, Labeling, and Shipping of Environmental and Waste Samples* (SESDPROC-209-R3), February 2015; and *Sample and Evidence Management* (SESDPROC-005-R2), January 2013; both are available at the following web address: http://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches.
Once collected, metals samples will be placed on ice and kept in custody-sealed coolers in a secure location. VOC samples will be placed in a freezer at 4 °C or lower in a secure location. The Tetra Tech project manager will ensure that custody of samples is maintained until they are shipped to the laboratory. Chain-of-custody records will be used to document the samples collected and their delivery to the laboratory. Also refer to Section 2.3, page 27 of the Tetra Tech START Program Level QAPP, May 2012.

2.4 Analytical Method Requirements

The analytical parameters and associated laboratory analytical methods that will be used for this project are listed in Appendix B, Table B-4 of this QAPP.

Data validation of the analytical data packages will be conducted by the EPA Region 4 SESD, Office of Quality Assurance. Data validation will be conducted in accordance with the CLP SOW for Organic Superfund Methods, Multi-Media, Multi-Concentration, SOM01.2, April 2007; the CLP SOW for Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM01.2 January 2010 (as modified by ISM01.2); the EPA Region 4 Data Validation Standard Operating Procedures for Organic Analysis, August 2008; the EPA Region 4 Data Validation Standard Operating Procedures for CLP Inorganic Data by Inductively Coupled Plasma (ICP)-Atomic Emission Spectrometry (AES) and ICP-Mass Spectrometry (MS), September 2011; and Section 4.2.2, page 51 of the Tetra Tech START Program Level QAPP, May 2012. Laboratory instruments required for sample analyses are contained in the associated methods. Modifications to data validation criteria will be provided by EPA. The individuals responsible for ensuring the success of the analyses is Jeff Hendel, EPA SESD, Chief of the Inorganic Chemistry Section, and Floyd Wellborn, EPA SESD, Chief of the Organic Chemistry Section.

A 42-day turnaround time will be requested for the SESD, Office of Quality Assurance to submit final results to Tetra Tech and the EPA RPM. Within 14 days after the validated package is received, Tetra Tech will conduct a review of the field QC results and a cursory review of the data packages against the chain-of-custody records to ensure that results for all samples are received and if any additional qualifications are warranted. The data packages will also be reviewed to determine whether any data are rejected and whether any data qualifiers assigned during the validation process affects the usability of the data as defined in Section 1.5 of this QAPP.

2.5 Quality Control Requirements

GPS data, using a Trimble Geo-series GPS receiver, and XRF screening data will be collected during this investigation. Quality control (QC) requirements for GPS data collection are provided in the manufacturer's instruction manual and the EPA Region 4, SESD FBQSTP *Global Positioning System* (SESDPROC-110-R4), June 2015. QC requirements for XRF data collection are provided in the manufacturer's instruction manual and the EPA Region 4, SESD FBQSTP for *Field XRF Measurement* (SESDPROC-107-R2). Also refer to Section 2.5.1, page 33 of the Tetra Tech START Program Level QAPP, May 2012.

QC requirements for analytical methods are presented in the CLP SOW for Organic Superfund Methods, Multi-Media, Multi-Concentration, SOM01.2, April 2007; the CLP SOW for Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM01.2, January 2010 (as modified by ISM01.3); the EPA Region 4 SESD, ASB LOQAM, April 2015; and Section 2.5.2, page 34 of the Tetra Tech START Program Level QAPP, May 2012.

Laboratory QC samples will include the collection of matrix spike and matrix spike duplicate (MS/MSD) sample sets at a frequency of one MS/MSD set for every 20 samples per medium collected. Field QC samples will include field duplicate samples at a frequency of one field duplicate sample for every 20 samples per medium collected; one aqueous field blank and one equipment rinsate blank per type of sampling equipment used during each week of sampling; and one trip blank per shipment of samples for VOC analysis. Water to be used for the preparation of laboratory blanks will be certified ASTM Type 2+ Ultra-Pure blank water. QC samples will be submitted for analyses listed in Table B-3 of Appendix B.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

For instrument testing, inspection, and maintenance requirements for field monitoring, refer to EPA SESD FBQSTP *Equipment Inventory and Management* (SESDPROC-108-R5), August 2015; SESD FBQSTP *Global Positioning System* (SESDPROC-110-R4), June 2015; SESD FBQSTP for *Field XRF Measurement* (SESDPROC-107-R2); and SESD FBQSTP *Field Equipment Cleaning and Decontamination* (SESDPROC-205-R2), December 2011. All are available at the following web address: http://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches. Also refer to the equipment manufacturer's operating manual for further instructions on field instrument testing, inspection, and maintenance, as well as to Section 2.6.2, page 40 of the Tetra Tech START Program Level QAPP, May 2012. Table B-6 in Appendix B of this QAPP contains a list of field equipment that will be used during this sampling event. The project manager or designee will be responsible for ensuring the correct operation of all field equipment.

Laboratory instrument testing, inspection, and maintenance requirements are contained in the CLP SOW for Organic Superfund Methods, Multi-Media, Multi-Concentration, SOM01.2, April 2007; the CLP SOW for Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM01.2, January 2010 (as modified by ISM01.3); the EPA Region 4 SESD, ASB LOQAM, April 2015; the instrument and equipment manufacturer's operating manuals associated with the analytical methods; the laboratory quality assurance manual; and Section 2.6.3, page 40 of the Tetra Tech START Program Level QAPP, May 2012.

2.7 Instrument Calibration and Frequency

For instrument calibration and frequency requirements for field monitoring, refer to EPA SESD FBQSTP *Equipment Inventory and Management* (SESDPROC-108-R5), August 2015; SESD FBQSTP for *Field XRF Measurement* (SESDPROC-107-R2); and EPA SESD FBQSTP *Global Positioning System* (SESDPROC-110-R4), June 2015. All are available at the following web address: http://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches. Also refer to the equipment manufacturer's operating manuals for further instructions on calibration, as well as to Section 2.7.1, page 41 of the Tetra Tech START Program Level QAPP, May 2012.

Instrument calibration and frequency requirements for analytical methods are specified in the CLP SOW for Organic Superfund Methods, Multi-Media, Multi-Concentration, SOM01.2, April 2007; the CLP SOW for Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM01.2, January 2010 (as modified by ISM01.3); the EPA Region 4 SESD, ASB LOQAM, April 2015; the instrument and equipment manufacturer's operating manuals associated with the analytical methods; the laboratory quality assurance manual; and in Section 2.7.2, page 41 of the Tetra Tech START Program Level QAPP, May 2012.

2.8 Inspection/Acceptance Requirements for Supplies and Consumables

Supplies and consumables required for this sampling event will be inspected and accepted by the Tetra Tech project manager or designated field team member, and include sample jars, sampling implements, sample packaging materials, field measurement instruments (GPS Trimble unit), and PPE identified in the HASP. All sample containers will be pre-cleaned certified and meet the required detection limits established by EPA in the Office of Solid Waste and Emergency Response Directive 9240.0.05A *Specifications and Guidance for Contaminant-Free Sample Containers*. Sampling implements will be either disposable, one-time use devices or sealed, decontaminated equipment with a chain-of-custody seal. An equipment rinsate blank will be collected to assess any impacts that disposable and reusable sampling equipment might have on the sampling results. Sampling equipment and packaging materials will meet the requirements of EPA Region 4 SESD FBQSTP *Packing, Marking, Labeling and Shipping of Environmental and Waste Samples*, (SESDPROC-209-R3), February 2015. See Section 2.8, page 43 of the Tetra Tech START Program Level QAPP, May 2012. See Table B-6 in Appendix B for a complete list of supplies and consumables.

2.9 Non-Direct Measurement Requirements

Information pertaining to the site (including photographs, maps, and so forth) has been compiled from file information obtained from EPA and MDEQ. The extent to which these data and information, if any, are used to achieve the objectives of this project will be determined by Tetra Tech in cooperation with the EPA RPM. Any justifications and qualifications required for the use of these data and information will be provided in the reports generated for this project. Refer to Section 2.9, page 43 of the Tetra Tech START Program Level QAPP, May 2012.

2.10 Data Management

All reference materials generated during this investigation and included in the final reports will be submitted to the EPA RPM in portable document format (PDF) on CD, and a Scribe database will be created for the analytical data results. The Scribe database will be submitted to EPA with the transmittal. In addition, Tetra Tech will submit sample location information to EPA Region 4 for inclusion in the data acquisition and retrieval (DART) system. All field-generated data will be managed as part of the permanent field record for the project. All laboratory analytical data will be managed in accordance with the requirements of the associated analytical methods; as well as the EPA Region 4 policy and applicable federal regulations. Finally, all field-generated data, laboratory data, and other records (electronic and hard copy) generated or obtained during this project will be managed and retained according to the requirements of the EPA START IV Contract No. EP-S4-14-03, as well as to Section 2.10, page 44 of the Tetra Tech START Program Level QAPP, May 2012; and Section 5.0, page 15 of the Tetra Tech START QMP.

3.0 ASSESSMENT AND OVERSIGHT

3.1 Assessment and Response Actions

Field and laboratory audits will not be conducted for this project. All deliverables to which Tetra Tech contributes in whole or in part, including the draft and final reports, will be subject to a corporate two- or three-tiered review process, which includes a technical review, a QC review, and (for the three-tiered review only) an editorial review. Each reviewer will sign off on a QC review sheet recording any issues or revisions and how they have been addressed. These reviews will be performed by qualified individuals in accordance with the requirements of EPA START IV Contract No. EP-S4-14-03 and with Section 3.1, page 45 of the Tetra Tech START Program Level QAPP, May 2012.

3.2 Corrective Action

The Tetra Tech project manager, in coordination with the EPA RPM, will be responsible for identifying failures in sampling and field measurement systems (GPS coordinates), overseeing any corrective actions, ensuring that the corrective actions are documented in site logbooks and other appropriate records, and assessing the effectiveness of corrective actions. Corrective action requirements for analytical methods are presented in the CLP SOW for Organic Superfund Methods, Multi-Media, Multi-Concentration, SOM01.2, April 2007; the CLP SOW for Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM01.2, January 2010 (as modified by ISM01.3); the EPA Region 4 SESD, ASB LOQAM, April 2015; the EPA Region 4 Data Validation Standard Operating Procedures for Organic Analysis, August 2008; the EPA Region 4 Data Validation Standard Operating Procedures for CLP Inorganic Data by ICP- AES and ICP- MS, September 2011; and Section 3.1.2, page 47 of the Tetra Tech START Program Level QAPP, May 2012.

3.3 Reports to Management

Tetra Tech is responsible for notifying the EPA RPM if any circumstances arise during the field investigation that may impair the quality of the data collected. All formal deliverables to EPA associated with this project will be prepared, reviewed, and distributed in accordance with the requirements of the EPA START IV Contract No. EP-S4-14-03, Section 3.2, page 49 of the Tetra Tech START Program Level QAPP, May 2012, and under the supervision of the Tetra Tech QA manager, Jessica Vickers or appropriate designee.

4.0 DATA VALIDATION AND USABILITY

4.1 Data Review, Verification, and Validation Requirements

All field-generated data and records (such as GPS coordinates of sample locations, field logbook notes, and field sample collection sheets) will be reviewed for completeness and accuracy by the Tetra Tech project manager and appropriate designees. Field data and records will be reviewed at the end of each day so that corrective actions, if necessary, can be made prior to demobilizing from the site. After field work is completed, GPS data generated in the field will be downloaded and reviewed by the project manager to ensure that it is accurate. Any errors will be discussed with a Tetra Tech geographic information system (GIS) analyst and project manager, corrected, and noted in the logbook.

Data validation of the analytical data packages will be conducted by the EPA Region 4 SESD, Office of Quality Assurance. Data validation will be conducted in accordance with the CLP SOW for Organic Superfund Methods, Multi-Media, Multi-Concentration, SOM01.2, April 2007; the CLP SOW for Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM01.2, January 2010 (as modified by ISM01.3); the EPA Region 4 SESD, ASB LOQAM, April 2015; the EPA Region 4 Data Validation Standard Operating Procedures for Organic Analysis, August 2008; the EPA Region 4 Data Validation Standard Operating Procedures for CLP Inorganic Data by ICP- AES and ICP-MS, September 2011; and Section 4.2.2, page 51 of the Tetra Tech START Program Level QAPP, May 2012. Laboratory instruments required for sample analyses are contained in the associated methods.

Modifications to data validation criteria will be provided by EPA. The individuals responsible for ensuring the success of the analyses is Jeff Hendel, EPA SESD, Chief of the Inorganic Chemistry Section, and Floyd Wellborn, EPA SESD, Chief of the Organic Chemistry Section.

Tetra Tech will conduct a review of the field QC results against the field samples and a cursory review of the data packages against the chain-of-custody records to ensure that results for all samples are received. The data packages will also be reviewed to determine whether any data are rejected and whether any data qualifiers assigned during the validation process affects the usability of the data as defined in Section 1.5 of this QAPP.

4.2 Verification and Validation Methods

All field-generated data will be maintained in the project file and included (as appropriate) in project deliverables in final form after all reviews and associated corrective actions. The laboratory analytical data will be validated as discussed in Section 4.1 above. The final data packages will contain a summary of all data qualifier flags and their explanations. Also see Section 4.2, page 51 of the Tetra Tech START Program Level QAPP, May 2012.

4.3 Reconciliation of the Data to the Project-Specific DQOs:

The Tetra Tech project manager, in cooperation with the EPA RPM and Tetra Tech QA Manager, will be responsible for reconciling the data and other project results with the requirements specified in this QAPP and by the data users and decision makers. Ultimate acceptance of the data is at the discretion of the EPA RPM. Depending on how specific data quality indicators do not meet the project's requirements, the data may be discarded, and resampling and reanalysis of the subject samples may be required. Resampling, reanalysis, or other out-of-scope actions identified to address data quality deficiencies and data gaps will require approval by the EPA RPM, EPA Project Officer, and EPA Contracting Officer.

Limitations of the data and data rejection and qualification will be identified during the data review process conducted by EPA Region 4 SESD, Office of Quality Assurance and Tetra Tech. To assess the data relative to the objectives of the project, the data will be reviewed to determine whether any data are rejected and whether any data qualifiers or limitations assigned during the data review process affect the usability of the data as defined in Section 1.5 of this QAPP. All final laboratory data packages will be reviewed to evaluate whether the site-specific DQOs, as defined in Section 1.5 of this QAPP, are met. The data will be reconciled with the project-specific DQOs also in accordance with EPA guidance documents, including "Guidance on Systematic Planning Using the Data Quality Objectives Process," EPA QA/G-4, February 2006. Also see Section 4.3, page 53 of the Tetra Tech START Program Level QAPP, May 2012.

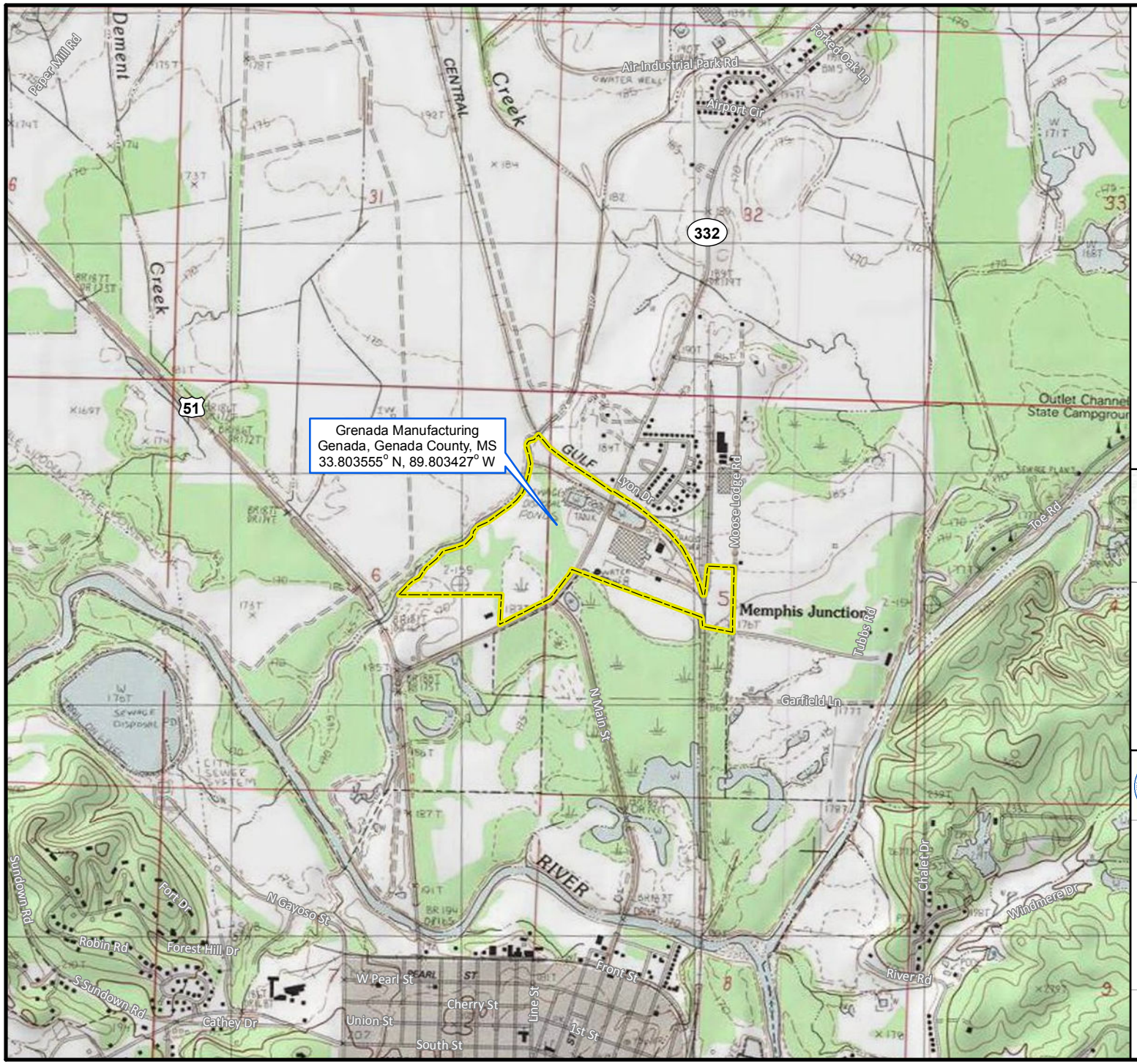
APPENDIX A

FIGURES

(Four Pages)

Figure

1 SITE LOCATION
2 SITE LAYOUT
3 SAMPLING LOCATIONS
4 RIVERDALE CREEK SAMPLING LOCATIONS



Legend

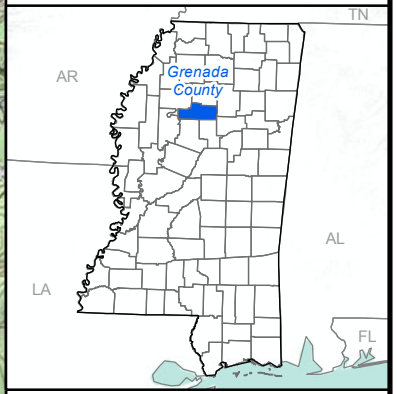
Approximate Site Boundary

N
W E
S

0 1,000 2,000

Feet

Map Sources:
USGS 7.5 Minute Topographic Quadrangle Map: Grenada, MS 1983.



United States Environmental Protection Agency Region 4

FIGURE 1

Site Location

TDD Name: Grenada Manufacturing ESI

TDD No.: TT-05-020

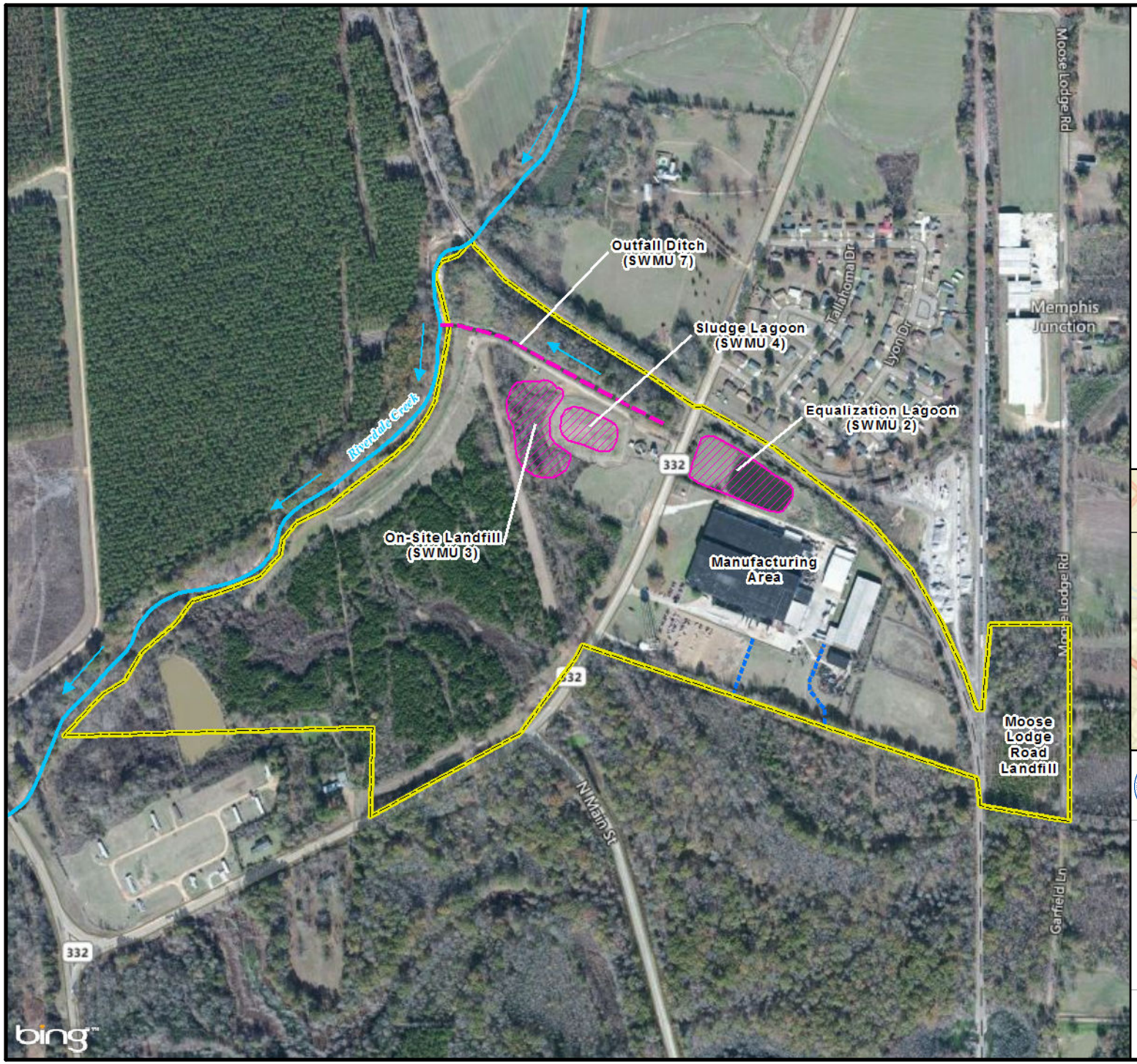
City:	County:	State:
Grenada	Grenada	Mississippi

TETRA TECH

Date: 3/22/2016

Analyst: dale.vonbusch

File: L:\TT-05-020_Grenada_Manufacturing_ESI\mxd\Site_Location.mxd



Legend

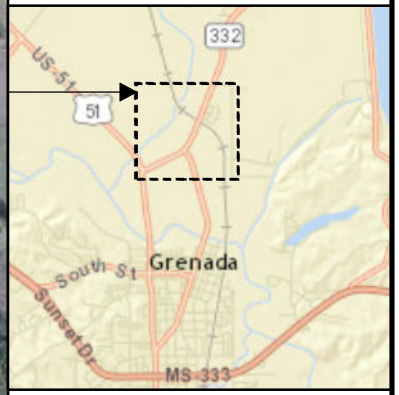
- SWMU Line *(ditch)*
- Surface Water
- Direction of Flow
- Drainage Ditch
- SWMU Area
- Approximate Site Boundary

N
W E
S

0 400 800
Feet

Note:
SWMU - Solid Waste Management Unit

Map Source:
Bing Maps Aerial Imagery, 2012.



United States Environmental Protection Agency
Region 4

FIGURE 2

Site Layout

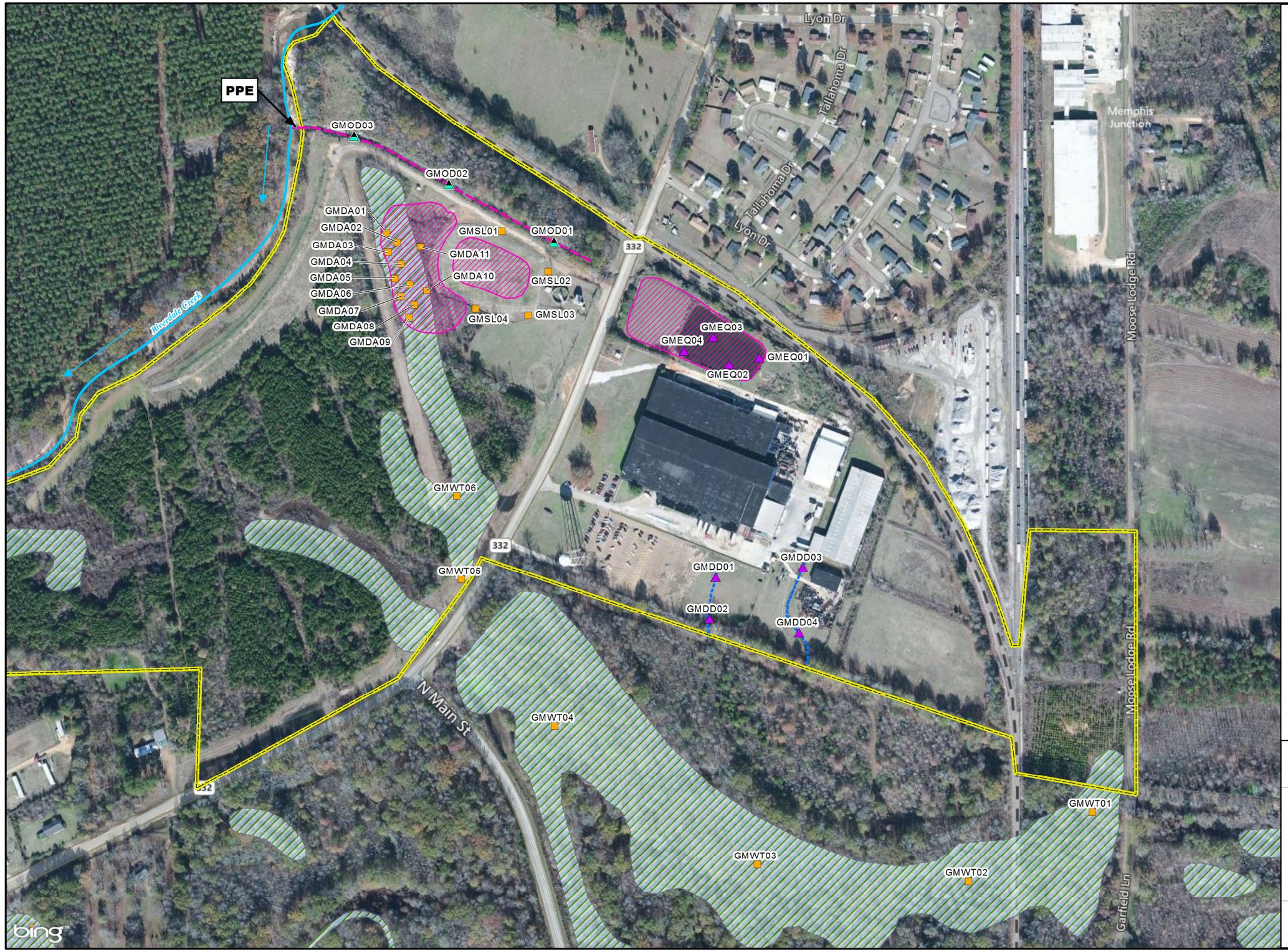
TDD Name: Grenada Manufacturing ESI
TDD No.: TT-05-020

City:	County:	State:
Grenada	Grenada	Mississippi

TETRA TECH

Date: 3/23/2016
Analyst: dale.vonbusch

File: C:\TT-05-020_Grenada_Manufacturing_ESI\mxd\Site_Layout.mxd



Legend

- Soil or Sludge Sample
- Sediment Sample
- Surface Water and Sediment Sample
- Surface Water
- Direction of Flow
- Drainage Ditch
- SWMU Line *(ditch)*
- SWMU Area
- Approximate Site Boundary *(partially shown)*
- Palustrine Forested Wetland Area

N
W E
S

0 200 400
Feet

Note:
DA - Disposal area
DD - Drainage ditch
EQ - Equalization lagoon
GM - Grenada Manufacturing
OD - Outfall ditch
PPE - Probable Point of Entry
SL - Sludge Lagoon
SWMU - Solid Waste Management Unit
WT - Wetland

Map Source:
Bing Maps Aerial Imagery, 2012.

United States Environmental Protection Agency Region 4

FIGURE 3

Sampling Locations

TDD Name: Grenada Manufacturing ESI

TDD No.: TT-05-020

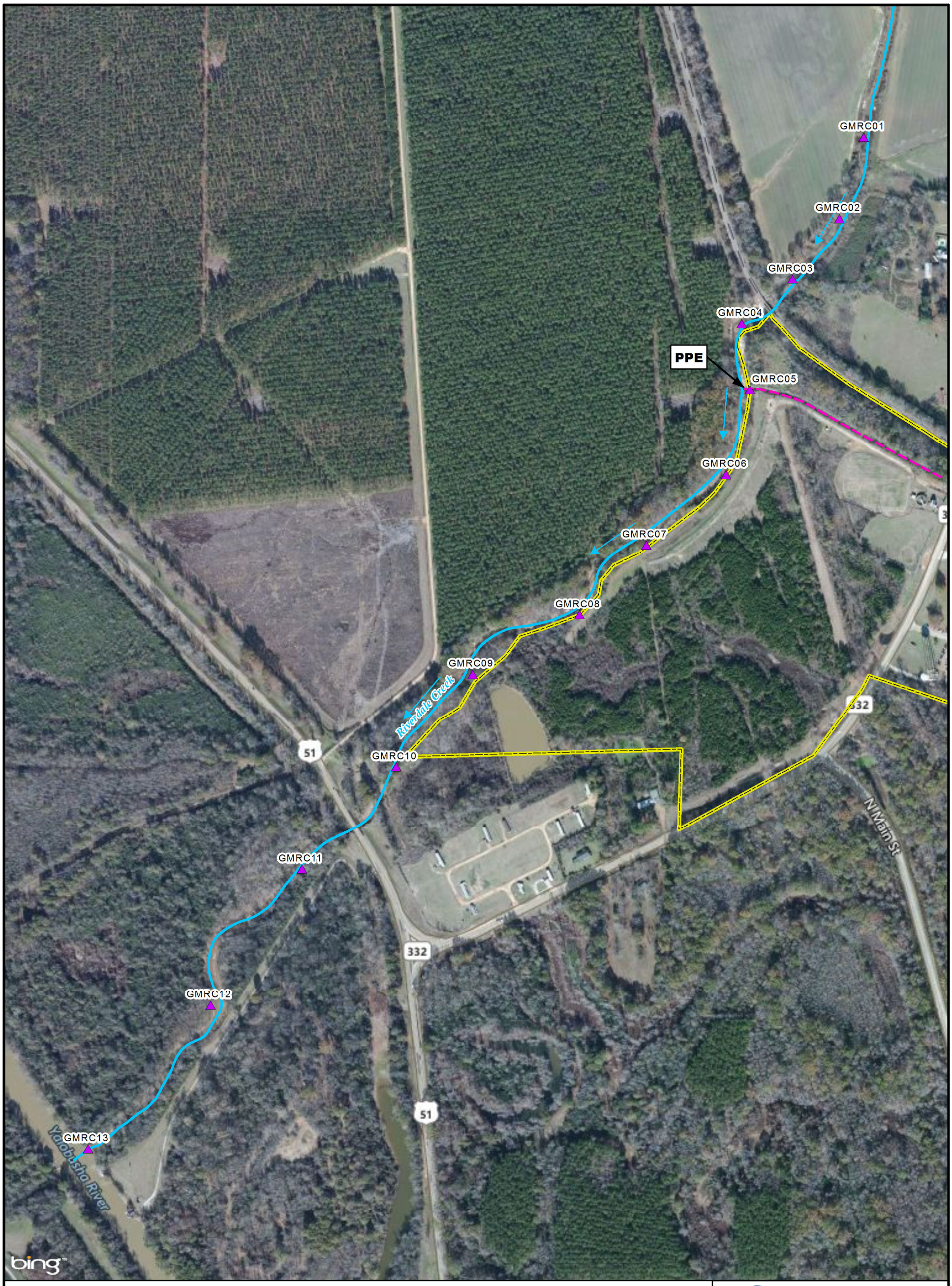
City:	**County:**	**State:**
Grenada	Grenada	Mississippi

TETRA TECH

Date: 3/24/2016

Analyst: dale.vonbusch

File: C:\TT-05-020_Grenada_Manufacturing_ESI\mxd\sampling_locations_11x17.mxd



Legend

- Sediment Sample
- Surface Water
- Direction of Flow
- SWMU_lines *SWMU Line (ditch)*
- Approximate Site Boundary

Notes:
GM - Grenada Manufacturing
PPE - Probable Point of Entry
RC - Riverdale Creek

Map Source:
Bing Maps Aerial Imagery, 2012.

N
W E
S
0 300 600
Feet

United States
Environmental Protection Agency
Region 4

FIGURE 4

Riverdale Creek
Sampling Locations

TDD Name: Grenada Manufacturing ESI

TDD No.: TT-05-020

City:	**County:**	**State:**
Grenada	Grenada	Mississippi

TETRA TECH

Date: 3/24/2016

Analyst: dale.vonbusch

File: C:\TT-05-020_Grenada_Manufacturing_ESI\mxd\creek_sampling_locations_11x17.mxd

APPENDIX B

TABLES

(10 Pages)

Table

TABLE B-1
GRENADA MANUFACTURING ESI
SOURCE SAMPLING TYPE, DEPTH, ANALYSIS, LOCATIONS, AND RATIONALE

Station ID	Sample ID	Depth (bgs)	Sample Type	Analysis	Location	Rationale
Equalization Lagoon (SWMU 2) Sediment Samples						
GMEQ01	GM-EQ-01	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Northeast corner of lagoon	Determine the presence or absence of contamination.
GMEQ02	GM-EQ-02	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Center of lagoon	Determine the presence or absence of contamination.
GMEQ03	GM-EQ-03	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Center of lagoon	Determine the presence or absence of contamination.
GMEQ04	GM-EQ-04	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Southewest corner of lagoon	Determine the presence or absence of contamination.
Sludge Lagoon (SWMU 4) Soil Samples						
GMSL01	GM-SL-01A	1 to 3 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Perimeter of sludge lagoon	Determine the presence or absence of contamination.
	GM-SL-01B	3 to 5 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI		
GMSL02	GM-SL-02A	1 to 3 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Perimeter of sludge lagoon	Determine the presence or absence of contamination.
	GM-SL-02B	3 to 5 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI		
GMSL03	GM-SL-03A	1 to 3 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Perimeter of sludge lagoon	Determine the presence or absence of contamination.
	GM-SL-03B	3 to 5 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI		
GMSL04	GM-SL-04A	1 to 3 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Perimeter of sludge lagoon	Determine the presence or absence of contamination.
	GM-SL-04B	3 to 5 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI		
On-Site Landfill (SWMU 3) Soil Samples						
GMDA01	GM-DA-01	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Wetlands	Determine the presence or absence of contamination.
GMDA02	GM-DA-02	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Wetlands	Determine the presence or absence of contamination.

TABLE B-1
GRENADA MANUFACTURING ESI
SOURCE SAMPLING TYPE, DEPTH, ANALYSIS, LOCATIONS, AND RATIONALE

Station ID	Sample ID	Depth (bgs)	Sample Type	Analysis	Location	Rationale
GMDA03	GM-DA-03	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Wetlands	Determine the presence or absence of contamination.
GMDA04	GM-DA-04	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Wetlands	Determine the presence or absence of contamination.
GMDA05	GM-DA-05	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Wetlands	Determine the presence or absence of contamination.
GMDA06	GM-DA-06	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Wetlands	Determine the presence or absence of contamination.
GMDA07	GM-DA-07	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Wetlands	Determine the presence or absence of contamination.
GMDA08	GM-DA-08	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Wetlands	Determine the presence or absence of contamination.
GMDA09	GM-DA-09	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Wetlands	Determine the presence or absence of contamination.
GMDA10	GM-DA-10A	1 to 3 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Disposal area	Determine the presence or absence of contamination.
	GM-DA-10B	3 to 5 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI		
GMDA11	GM-DA-11A	1 to 3 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Disposal area	Determine the presence or absence of contamination.
	GM-DA-11B	3 to 5 feet	Grab	TCL VOCs TAL Metals + Hg Chromium VI		
Wetland Samples South of the Site						
GMWT01	GM-WT-01	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Southeastern corner of the Moose Lodge Rd landfill	Determine the presence or absence of contamination.
GMWT02	GM-WT-02	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Southeast of manufacturing area	Determine the presence or absence of contamination.
GMWT03	GM-WT-03	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	South of manufacturing area	Determine the presence or absence of contamination.
GMWT04	GM-WT-04	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	South of manufacturing area	Determine the presence or absence of contamination.

TABLE B-1
GRENADA MANUFACTURING ESI
SOURCE SAMPLING TYPE, DEPTH, ANALYSIS, LOCATIONS, AND RATIONALE

Station ID	Sample ID	Depth (bgs)	Sample Type	Analysis	Location	Rationale
GMWT05	GM-WT-05	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Southwest of manufacturing area	Determine the presence or absence of contamination.
GMWT06	GM-WT-06	0 to 1 foot	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Southwest of manufacturing area	Determine the presence or absence of contamination.

Notes:

A	First depth interval
B	Second depth interval
bgs	Below ground surface
DA	Disposal area
EQ	Equalization lagoon
GM	Grenada Manufacturing
Hg	Mercury
ID	Identification
SL	Sludge lagoon
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCL	Target Compound List
VOCs	Volatile organic compounds
WT	Wetland

TABLE B-2
GRENADA MANUFACTURING ESI
SURFACE WATER AND SEDIMENT
SAMPLING TYPE, DEPTH, ANALYSIS, LOCATIONS, AND RATIONALE

Station ID	Sample ID	Depth (in. bgs)	Sample Type	Analysis	Location	Rationale
Outfall Ditch (SWMU 7) Surface Water and Sediment Samples						
GMOD01	GM-OD-01-SD	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	North of on-site landfill	Determine the presence or absence of hazardous substances
	GM-OD-01-SW	NA	Grab	TCL VOCs TAL Metals + Hg Chromium VI		
GMOD02	GM-OD-02-SD	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Northwest of on-site landfill	Determine the presence or absence of hazardous substances
	GM-OD-02-SW	NA	Grab	TCL VOCs TAL Metals + Hg Chromium VI		
GMOD03	GM-OD-03-SD	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	North of confluence with Riverdale Creek	Determine the presence or absence of hazardous substances
	GM-OD-03-SW	NA	Grab	TCL VOCs TAL Metals + Hg Chromium VI		
Southern Drainage Ditches Sediment Samples						
GMDD01	GM-DD-01	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Drainage ditch south of the main facility	Determine the presence or absence of hazardous substances
GMDD02	GM-DD-02	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Drainage ditch south of the main facility	Determine the presence or absence of hazardous substances
GMDD03	GM-DD-03	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Drainage ditch south of the main facility	Determine the presence or absence of hazardous substances
GMDD04	GM-DD-04	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	Drainage ditch south of the main facility	Determine the presence or absence of hazardous substances
Riverdale Creek Sediment Samples						
GMRC01	GM-RC-01	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 0.3 mile north of PPE	Background sample for comparison to downstream samples
GMRC02	GM-RC-02	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 0.22 mile north of PPE	Background sample for comparison to downstream samples
GMRC03	GM-RC-03	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 0.15 mile north of PPE	Background sample for comparison to downstream samples
GMRC04	GM-RC-04	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 350 feet north of PPE	Background sample for comparison to downstream samples

TABLE B-2
GRENADA MANUFACTURING ESI
SURFACE WATER AND SEDIMENT
SAMPLING TYPE, DEPTH, ANALYSIS, LOCATIONS, AND RATIONALE

Station ID	Sample ID	Depth (in. bgs)	Sample Type	Analysis	Location	Rationale
GMRC05	GM-RC-05	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	At PPE	Determine the presence or absence of hazardous substances
GMRC06	GM-RC-06	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 475 feet south of PPE	Determine the presence or absence of hazardous substances
GMRC07	GM-RC-07	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 0.20 mile south of PPE	Determine the presence or absence of hazardous substances
GMRC08	GM-RC-08	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 0.30 mile south of PPE	Determine the presence or absence of hazardous substances
GMRC09	GM-RC-09	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 0.42 mile south of PPE	Determine the presence or absence of hazardous substances
GMRC10	GM-RC-10	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 0.55 mile south of PPE	Determine the presence or absence of hazardous substances
GMRC11	GM-RC-11	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 0.70 mile south of PPE	Determine the presence or absence of hazardous substances
GMRC12	GM-RC-12	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 0.85 mile south of PPE	Determine the presence or absence of hazardous substances
GMRC13	GM-RC-13	0 to 6	Grab	TCL VOCs TAL Metals + Hg Chromium VI	About 1.05 miles south of PPE	Determine the presence or absence of hazardous substances

Notes:

bgs	Below ground surface
DD	Drainage ditch
GM	Grenada Manufacturing
Hg	Mercury
ID	Identification
in.	Inches
NA	Not applicable
OD	Outfall ditch
PPE	Probable point of entry
RC	Riverdale Creek
SD	Sediment
SW	Surface water
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCL	Target Compound List
VOCs	Volatile organic compounds

The depth of the sediment samples are measured below the sediment-surface water interface.

TABLE B-3
GRENADA MANUFACTURING ESI
QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Sample ID	Sample Type	Analysis	Rationale
GM-TB-01	Trip Blank (aqueous)	TCL VOCs	Determine if unknown site conditions or sample handling procedures are influencing analytical results. One trip blank will be submitted with each sample shipment for VOC analysis only.
GM-TB-02	Trip Blank (soil)	TCL VOCs	Determine if unknown site conditions or sample handling procedures are influencing analytical results. One trip blank will be submitted with each sample shipment for VOC analysis only.
GM-EB-01	Equipment Rinsate Blank (aqueous)	TCL VOCs TAL Metals + Hg Chromium VI	Evaluate whether decontamination procedures adequately clean sampling equipment. One equipment rinsate blank will be submitted for the sampling equipment used.
GM-FB-01	Field Blank (aqueous)	TCL VOCs TAL Metals + Hg Chromium VI	Evaluate the potential for contamination of a sample from sources not associated with sample collection (ambient conditions). One field blank will be submitted for each lot of high-purity water used.
(Original sample ID)	MS/MSD	TBD	Provide information about the effect of each sample matrix on the sample preparation procedures and measurement methodology. One MS/MSD sample will be designated for every 20 samples collected per matrix.
(Original sample ID)-DUP	Field Duplicate	TBD	Measure both field and laboratory precision. One duplicate sample will be collected for every 20 samples collected per matrix.

Notes: Also refer to Section 2.5 of this QAPP.

DUP Field duplicate
EB Equipment rinsate blank
FB Field blank
GM Grenada Manufacturing
Hg Mercury
ID Identification
MS/MSD Matrix spike/matrix spike duplicate
TAL Target Analyte List
TB Trip blank
TBD To be determined
TCL Target Compound List
VOCs Volatile organic compounds

TABLE B-4
GRENADA MANUFACTURING ESI
ANALYTICAL PARAMETERS AND METHODS, REQUIRED SAMPLE CONTAINERS, PRESERVATION METHODS, AND HOLDING TIMES

ANALYTICAL PARAMETER	PARAMETER TO BE NOTED ON CHAIN-OF-CUSTODY RECORDS	MATRIX	ANALYTICAL METHOD[1]	NUMBER[2] AND TYPE OF SAMPLE CONTAINER	PRESERVATION METHOD	SAMPLE HOLDING TIME
SOIL AND SEDIMENT SAMPLES						
Target Compound List (TCL) volatile organic compounds (VOC)	VOCs	Soil, soil trip blanks, and sediment samples	SOM01.2	One Terracore kit consisting of three 40-mL glass vials with Teflon-lined septum lids and one 2-ounce glass jar with Teflon-lined lid	Deionized water (two of the vials); methanol (one of the vials); cool to 4 °C	48 hours to preparation; 14 days for analysis; if frozen, 14 days to preparation and analysis
Target Analyte List (TAL) Metals	TM + Hg		ISM01.2	One 4-ounce glass jar with Teflon-lined lid	Cool to 4 °C	28 days for mercury and 6 months for all other metals
Hexavalent Chromium	Cr(VI)		SM 3500 Cr B[3]	One 4-ounce glass jar with Teflon®-lined lid	Cool to 4 °C	1 month to extraction; 4 days for analysis
AQUEOUS[4] SAMPLES						
Trace TCL VOCs	TVOCs	Surface water and QC samples (trip blanks, equipment rinsate blanks, and field blanks)	SOM02.1	Three 40-mL glass vials with Teflon-lined septum lids	Hydrochloric acid (HCL) to pH<2; cool to 4 °C	14 days
TAL Metals + Hg	TM + Hg		ISM01.2	One 1-liter polyethylene bottle	Nitric acid (HNO_3) to pH<2; cool to 4 °C	28 days for mercury and 6 months for all other metals
Hexavalent Chromium	Cr(VI)		SM 3500 Cr B[3]	One 1-liter polyethylene bottle	Ammonium sulfate; cool to 4 °C	28 days

TABLE B-4
GRENADA MANUFACTURING ESI
ANALYTICAL PARAMETERS AND METHODS, REQUIRED SAMPLE CONTAINERS, PRESERVATION METHODS, AND HOLDING TIMES

Notes:

[1] Target Compound List (TCL) VOCs using Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Superfund Methods, Multi-Media, Multi-Concentration, SOM01.2, April 2007, located at http://www.epa.gov/superfund/programs/clp/som1.htm.
Target Analyte List (TAL) metals using CLP SOW for Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM01.2, January 2010, as modified by ISM01.3, located at http://www.epa.gov/superfund/programs/clp/ism1.htm.
The following metals will be analyzed using Indcutively Coupled Plasma-Mass Spectrometry: antimony, arsenic, cadmium, chromium, copper, lead, selenium, and thallium.
All other metals will be analyzed using Inductively Coupled Plasma-Atomic Emission Spectrometry.

[2] For samples designated for MS/MSD analysis, triple sample volume is required for soil and water VOCs; and no additional volume is required for metals soil and water.

[3] Available at the following web address: http://www.epa.gov/superfund/programs/clp/target.htm.

[4] Aquesous samples include surface water and and quality control samples inlcuding field and equipment rinsae blanks.

°C Degrees Celsius
< Less than
Cr Chromium
Cr(VI) Hexavalent chromium
Hg Mercury
QC Quality control
SM Standard Methods
TM Total metals

TABLE B-5
GRENADA MANUFACTURING ESI
PERFORMANCE OR ACCEPTANCE CRITERIA

SOURCE, SURFACE WATER, SEDIMENT, AND FIELD QUALITY CONTROL SAMPLES	
Analytical Parameter	**Analytical Method**
TCL Volatile Organic Compounds	SOM01.2
TAL Metals (including mercury)	ISM01.2
Hexavalent Chromium	SM 3500 Cr B
DATA QUALITY MEASUREMENTS	
Accuracy	Refer to EPA Region 4, SESD FBQSTPs for *Soil Sampling* (SESDPROC-300-R3), August 2014; *Sediment Sampling* (SESDPROC-200-R3), August 2014; *Surface Water Sampling* (SESDPROC-201-R3), February 2013; *Field Equipment Cleaning and Decontamination* (SESDPROC-205-R2), December 2011; *Global Positioning System* (SESDPROC-110-R3), April 2011; the analytical methods listed above; and the data validation guidance documents discussed in Sections 4.1 and 4.2 of this QAPP.
Precision	Refer to EPA Region 4, SESD FBQSTPs for *Soil Sampling* (SESDPROC-300-R3), August 2014; *Sediment Sampling* (SESDPROC-200-R3), August 2014; *Surface Water Sampling* (SESDPROC-201-R3), February 2013; *Field Equipment Cleaning and Decontamination* (SESDPROC-205-R2), December 2011; *Global Positioning System* (SESDPROC-110-R3), April 2011; the analytical methods listed above; and the data validation guidance documents discussed in Sections 4.1 and 4.2 of this QAPP.
Representativeness	Refer to EPA Region 4, SESD FBQSTPs for *Soil Sampling* (SESDPROC-300-R3), August 2014; *Sediment Sampling* (SESDPROC-200-R3), August 2014; *Surface Water Sampling* (SESDPROC-201-R3), February 2013; *Field Equipment Cleaning and Decontamination* (SESDPROC-205-R2), December 2011; *Global Positioning System* (SESDPROC-110-R3), April 2011; the analytical methods listed above; and the data validation guidance documents discussed in Sections 4.1 and 4.2 of this QAPP.
Completeness	Based on a review of the available file information, including discussions with the EPA RPM, sediment samples are proposed for collection. The EPA RPM is responsible for determining if the field and laboratory data collected during this project achieve the level of completeness required to meet the objectives of the project.
Comparability	Sample and data comparability is expected to be achieved by conducting all field and laboratory work using the same, well-documented, uniform procedures.

Notes:

EPA	Environmental Protection Agency
FBQSTP	Field Branches Quality System and Technical Procedures, available at the following web address: https://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches
QAPP	Quality Assurance Project Plan
RPM	Remedial Project Manager
SESD	Science and Ecosystem Support Division
TAL	Target Analyte List
TCL	Target Compound List

TABLE B-6
GRENADA MANUFACTURING ESI
EQUIPMENT AND SUPPLIES

FIELD INSTRUMENTS/ EQUIPMENT	SAMPLE CONTAINERS	SAMPLING EQUIPMENT AND SUPPLIES	SAMPLE PROCESSING SUPPLIES	DECONTAMINATION SUPPLIES	MISCELLANEOUS SUPPLIES
Trimble GPS unit	4-oz glass jars	stainless steel spoons, augers, and ponar dredges	Zip-loc plastic bags	buckets	digital camera
Boat	40 mL glass vials with HCl	aluminum pans	coolers	Luminox	permanent markers
MultiRAE PID	1-L poly with HNO_3	nitrile gloves	custody seals	brushes	logbooks
XRF analyzer	1-L poly with (NH4)2SO4	ultra-pure water	labels	aluminum foil	garbage bags
	Terra Core kits	2 freezers	laptop	ultra-pure water	first aid kit
			printer		eyewash
			paper		
			FedEx labels		
			duct tape, strapping tape		
			paper towels		

Notes:

GPS	Global positioning system	(NH4)2SO4	Ammonium sulfate
HCl	Hydrochloric acid	oz	Ounce
HNO_3	Nitric acid	PID	Photoionization detector
L	Liter	Poly	Polyethylene bottle
mL	Milliliter	XRF	X-ray fluorescence

ATTACHMENT 1

EPA REGIONAL SCREENING LEVELS, NOVEMBER 2015
(13 Sheets)

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
8.7E-03	I			4.0E-03	I					1	0.1		Acephate	30560-19-1	6.2E+01	c**	2.6E+02	c*					8.9E+00	c**		2.0E-03	c**	
		2.2E-06	I			9.0E-03	I	V		1		1.1E+05	Acetaldehyde	75-07-0	1.1E+01	c**	4.9E+01	c**	1.3E+00	c**	5.6E+00	c**	2.6E+00	c**		5.2E-04	c**	
				2.0E-02	I					1	0.1		Acetochlor	34256-82-1	1.3E+03	n	1.6E+04	n					3.5E+02	n		2.8E-01	n	
				9.0E-01	I	3.1E+01	A	V		1		1.1E+05	Acetone	67-64-1	6.1E+04	n	6.7E+05	nms	3.2E+04	n	1.4E+05	n	1.4E+04	n		2.9E+00	n	
						2.0E-03	X			1	0.1		Acetone Cyanohydrin	75-86-5	2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n						
						6.0E-02	I	V		1		1.3E+05	Acetonitrile	75-05-8	8.1E+02	n	3.4E+03	n	6.3E+01	n	2.6E+02	n	1.3E+02	n		2.6E-02	n	
				1.0E-01	I			V		1		2.5E+03	Acetophenone	98-86-2	7.8E+03	ns	1.2E+05	nms					1.9E+03	n		5.8E-01	n	
3.8E+00	C	1.3E-03	C							1	0.1		Acetylaminofluorene, 2-	53-96-3	1.4E-01	c	6.0E-01	c	2.2E-03	c	9.4E-03	c	1.6E-02	c		7.2E-05	c	
				5.0E-04	I	2.0E-05	I	V		1		2.3E+04	Acrolein	107-02-8	1.4E-01	n	6.0E-01	n	2.1E-02	n	8.8E-02	n	4.2E-02	n		8.4E-06	n	
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I		M	1	0.1		Acrylamide	79-06-1	2.4E-01	c	4.6E+00	c	1.0E-02	c	1.2E-01	c	5.0E-02	c		1.1E-05	c	
				5.0E-01	I	1.0E-03	I	V		1		1.1E+05	Acrylic Acid	79-10-7	9.9E+01	n	4.2E+02	n	1.0E+00	n	4.4E+00	n	2.1E+00	n		4.2E-04	n	
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V		1		1.1E+04	Acrylonitrile	107-13-1	2.5E-01	c*	1.1E+00	c*	4.1E-02	c*	1.8E-01	c*	5.2E-02	c*		1.1E-05	c*	
						6.0E-03	P			1	0.1		Adiponitrile	111-69-3	8.5E+06	nm	3.6E+07	nm	6.3E+00	n	2.6E+01	n						
5.6E-02	C			1.0E-02	I					1	0.1		Alachlor	15972-60-8	9.7E+00	c*	4.1E+01	c					1.1E+00	c	2.0E+00	8.7E-04	c	1.6E-03
				1.0E-03	I					1	0.1		Aldicarb	116-06-3	6.3E+01	n	8.2E+02	n					2.0E+01	n	3.0E+00	4.9E-03	n	7.5E-04
				1.0E-03	I					1	0.1		Aldicarb Sulfone	1646-88-4	6.3E+01	n	8.2E+02	n					2.0E+01	n	2.0E+00	4.4E-03	n	4.4E-04
										1	0.1		Aldicarb sulfoxide	1646-87-3											4.0E+00			8.8E-04
1.7E+01	I	4.9E-03	I	3.0E-05	I			V		1			Aldrin	309-00-2	3.9E-02	c*	1.8E-01	c	5.7E-04	c	2.5E-03	c	9.2E-04	c		1.5E-04	c	
				5.0E-03	I	1.0E-04	X	V		1		1.1E+05	Allyl Alcohol	107-18-6	3.5E+00	n	1.5E+01	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		4.2E-05	n	
2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1		1.4E+03	Allyl Chloride	107-05-1	7.2E-01	c**	3.2E+00	c**	4.7E-01	c**	2.0E+00	c**	7.3E-01	c**		2.3E-04	c**	
				1.0E+00	P	5.0E-03	P			1			Aluminum	7429-90-5	7.7E+04	n	1.1E+06	nm	5.2E+00	n	2.2E+01	n	2.0E+04	n		3.0E+04	n	
				4.0E-04	I					1			Aluminum Phosphide	20859-73-8	3.1E+01	n	4.7E+02	n					8.0E+00	n			n	
				9.0E-03	I					1	0.1		Ametryn	834-12-8	5.7E+02	n	7.4E+03	n					1.5E+02	n		1.6E-01	n	
2.1E+01	C	6.0E-03	C							1	0.1		Aminobiphenyl, 4-	92-67-1	2.6E-02	c	1.1E-01	c	4.7E-04	c	2.0E-03	c	3.0E-03	c		1.5E-05	c	
				8.0E-02	P					1	0.1		Aminophenol, m-	591-27-5	5.1E+03	n	6.6E+04	n					1.6E+03	n		6.1E-01	n	
				2.0E-02	P					1	0.1		Aminophenol, p-	123-30-8	1.3E+03	n	1.6E+04	n					4.0E+02	n		1.5E-01	n	
				2.5E-03	I					1	0.1		Amitraz	33089-61-1	1.6E+02	n	2.1E+03	n					8.2E+00	n		4.2E+00	n	
						1.0E-01	I	V		1			Ammonia	7664-41-7					1.0E+02	n	4.4E+02	n						
				2.0E-01	I					1			Ammonium Sulfamate	7773-06-0	1.6E+04	n	2.3E+05	nm					4.0E+03	n			n	
						3.0E-03	X	V		1		1.4E+04	Amyl Alcohol, tert-	75-85-4	8.2E+01	n	3.4E+02	n	3.1E+00	n	1.3E+01	n	6.3E+00	n		1.3E-03	n	
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I			1	0.1		Aniline	62-53-3	9.5E+01	c**	4.0E+02	c*	1.0E+00	n	4.4E+00	n	1.3E+01	c*		4.6E-03	c*	
4.0E-02	P			2.0E-03	X					1	0.1		Anthraquinone, 9,10-	84-65-1	1.4E+01	c**	5.7E+01	c*					1.4E+00	c*		1.4E-02	c*	
				4.0E-04	I					0.15			Antimony (metallic)	7440-36-0	3.1E+01	n	4.7E+02	n					7.8E+00	n	6.0E+00	3.5E-01	n	2.7E-01
				5.0E-04	H					0.15			Antimony Pentoxide	1314-60-9	3.9E+01	n	5.8E+02	n					9.7E+00	n			n	
				4.0E-04	H					0.15			Antimony Tetroxide	1332-81-6	3.1E+01	n	4.7E+02	n					7.8E+00	n			n	
						2.0E-04	I			0.15			Antimony Trioxide	1309-64-4	2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n						
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	0.03		Arsenic, Inorganic	7440-38-2	6.8E-01	c*R	3.0E+00	cR	6.5E-04	c*	2.9E-03	c*	5.2E-02	c	1.0E+01	1.5E-03	c	2.9E-01
				3.5E-06	C	5.0E-05	I			1			Arsine	7784-42-1	2.7E-01	n	4.1E+00	n	5.2E-02	n	2.2E-01	n	7.0E-02	n			n	
				5.0E-02	I					1	0.1		Asulam	3337-71-1	3.2E+03	n	4.1E+04	n					1.0E+03	n		2.6E-01	n	
2.3E-01	C			3.5E-02	I					1	0.1		Atrazine	1912-24-9	2.4E+00	c	1.0E+01	c					3.0E-01	c	3.0E+00	2.0E-04	c	1.9E-03
8.8E-01	C	2.5E-04	C							1	0.1		Auramine	492-80-8	6.2E-01	c	2.6E+00	c	1.1E-02	c	4.9E-02	c	6.7E-02	c		6.1E-04	c	
				4.0E-04	I					1	0.1		Avermectin B1	65195-55-3	2.5E+01	n	3.3E+02	n					8.0E+00	n		1.4E+01	n	
				3.0E-03	A	1.0E-02	A			1	0.1		Azinphos-methyl	86-50-0	1.9E+02	n	2.5E+03	n	1.0E+01	n	4.4E+01	n	5.6E+01	n		1.7E-02	n	
1.1E-01	I	3.1E-05	I					V		1			Azobenzene	103-33-3	5.6E+00	c	2.6E+01	c	9.1E-02	c	4.0E-01	c	1.2E-01	c		9.3E-04	c	
				1.0E+00	P	7.0E-06	P			1	0.1		Azodicarbonamide	123-77-3	8.6E+03	n	4.0E+04	n	7.3E-03	n	3.1E-02	n	2.0E+04	n		6.8E+00	n	
				2.0E-01	I	5.0E-04	H			0.07			Barium	7440-39-3	1.5E+04	n	2.2E+05	nm	5.2E-01	n	2.2E+00	n	3.8E+03	n	2.0E+03	1.6E+02	n	8.2E+01
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Barium Chromate	10294-40-3	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
				3.0E-01	I			V		1			Benfluralin	1861-40-1	2.3E+04	n	3.5E+05	nm					1.7E+03	n		5.6E+01	n	
				5.0E-02	I					1	0.1		Benomyl	17804-35-2	3.2E+03	n	4.1E+04	n					9.7E+02	n		8.5E-01	n	
				2.0E-01	I					1	0.1		Bensulfuron-methyl	83055-99-6	1.3E+04	n	1.6E+05	nm					3.9E+03	n		1.0E+00	n	
				3.0E-02	I					1	0.1		Bentazon	25057-89-0	1.9E+03	n	2.5E+04	n					5.7E+02	n		1.2E-01	n	
				1.0E-01	I			V		1		1.2E+03	Benzaldehyde	100-52-7	7.8E+03	ns	1.2E+05	nms					1.9E+03	n		4.3E-01	n	
5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V		1		1.8E+03	Benzene	71-43-2	1.2E+00	c*	5.1E+00	c*	3.6E-01	c*	1.6E+00	c*	4.6E-01	c*	5.0E+00	2.3E-04	c*	2.6E-03
1.0E-01	X			3.0E-04	X					1	0.1		Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	5.4E+00	c**	2.3E+01	c*					7.8E-01	c**		2.2E-04	c**	
				1.0E-03	P			V		1		1.3E+03	Benzenethiol	108-98-5	7.8E+01	n	1.2E+03	n					1.7E+01	n		1.1E-02	n	
2.3E+02	I	6.7E-02	I	3.0E-03	I				M	1	0.1		Benzidine	92-87-5	5.3E-04	c	1.0E-02	c	1.5E-05	c	1.8E-04	c	1.1E-04	c		2.8E-07	c	
				4.0E+00	I					1	0.1		Benzoic Acid	65-85-0	2.5E+05	nm	3.3E+06	nm					7.5E+04	n		1.8E+01	n	
1.3E+01	I							V		1		3.2E+02	Benzotrichloride	98-07-7	5.3E-02	c	2.5E-01	c					3.0E-03	c		6.6E-06	c	
				1.0E-01	P					1	0.1		Benzyl Alcohol	100-51-6	6.3E+03	n	8.2E+04	n					2.0E+03	n		4.8E-01	n	
1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V		1		1.5E+03	Benzyl Chloride	100-44-7	1.1E+00	c*	4.8E+00	c*	5.7E-02	c*	2.5E-01	c*	8.9E-02	c*		9.8E-05	c*	
		2.4E-03	I	2.0E-03	I	2.0E-05	I			0.007			Beryllium and compounds	7440-41-7	1.6E+02	n	2.3E+03	n	1.2E-03	c*	5.1E-03	c*	2.5E+01	n	4.0E+00	1.9E+01	n	3.2E+00
				9.0E-03	P					1	0.1		Bifenox	42576-02-3	5.7E+02	n	7.4E+03	n					1.0E+02	n		7.6E-01	n	
				1.5E-02	I					1	0.1		Biphenthrin	82657-04-3	9.5E+02	n	1.2E+04	n					3.0E+02	n		1.4E+03	n	
8.0E-03	I			5.0E-01	I	4.0E-04	X	V		1			Biphenyl, 1,1'-	92-52-4	4.7E+01	n	2.0E+02	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		8.7E-03	n	
				4.0E-02	I			V		1		1.0E+03	Bis(2-chloro-1-methylethyl) ether	108-60-1	3.1E+03	ns	4.7E+04	ns					7.1E+02	n		2.6E-01	n	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information														Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				3.0E-03	P					1	0.1		Bis(2-chloroethoxy)methane	111-91-1	1.9E+02	n	2.5E+03	n					5.9E+01	n		1.3E-02	n		
1.1E+00	I	3.3E-04	I					V		1		5.1E+03	Bis(2-chloroethyl)ether	111-44-4	2.3E-01	c	1.0E+00	c	8.5E-03	c	3.7E-02	c	1.4E-02	c		3.6E-06	c		
2.2E+02	I	6.2E-02	I					V		1		4.2E+03	Bis(chloromethyl)ether	542-88-1	8.3E-05	c	3.6E-04	c	4.5E-05	c	2.0E-04	c	7.2E-05	c		1.7E-08	c		
				5.0E-02	I					1	0.1		Bisphenol A	80-05-7	3.2E+03	n	4.1E+04	n					7.7E+02	n		5.8E+01	n		
				2.0E-01	I	2.0E-02	H			1			Boron And Borates Only	7440-42-8	1.6E+04	n	2.3E+05	nm	2.1E+01	n	8.8E+01	n	4.0E+03	n		1.3E+01	n		
				2.0E+00	P	2.0E-02	P	V		1			Boron Trichloride	10294-34-5	1.6E+05	nm	2.3E+06	nm	2.1E+01	n	8.8E+01	n	4.2E+01	n			n		
				4.0E-02	C	1.3E-02	C	V		1			Boron Trifluoride	7637-07-2	3.1E+03	n	4.7E+04	n	1.4E+01	n	5.7E+01	n	2.6E+01	n			n		
7.0E-01	I			4.0E-03	I					1			Bromate	15541-45-4	9.9E-01	c	4.7E+00	c					1.1E-01	c	1.0E+01	8.5E-04	c	7.7E-02	
2.0E+00	X	6.0E-04	X					V		1		2.4E+03	Bromo-2-chloroethane, 1-	107-04-0	2.6E-02	c	1.1E-01	c	4.7E-03	c	2.0E-02	c	7.4E-03	c		2.1E-06	c		
				8.0E-03	I	6.0E-02	I	V		1		6.8E+02	Bromobenzene	108-86-1	2.9E+02	n	1.8E+03	ns	6.3E+01	n	2.6E+02	n	6.2E+01	n		4.2E-02	n		
						4.0E-02	X	V		1		4.0E+03	Bromochloromethane	74-97-5	1.5E+02	n	6.3E+02	n	4.2E+01	n	1.8E+02	n	8.3E+01	n		2.1E-02	n		
6.2E-02	I	3.7E-05	C	2.0E-02	I			V		1		9.3E+02	Bromodichloromethane	75-27-4	2.9E-01	c	1.3E+00	c	7.6E-02	c	3.3E-01	c	1.3E-01	c	8.0E+01(F)	3.6E-05	c	2.2E-02	
7.9E-03	I	1.1E-06	I	2.0E-02	I			V		1		9.2E+02	Bromoform	75-25-2	1.9E+01	c*	8.6E+01	c	2.6E+00	c	1.1E+01	c	3.3E+00	c	8.0E+01(F)	8.7E-04	c	2.1E-02	
				1.4E-03	I	5.0E-03	I	V		1		3.6E+03	Bromomethane	74-83-9	6.8E+00	n	3.0E+01	n	5.2E+00	n	2.2E+01	n	7.5E+00	n		1.9E-03	n		
				5.0E-03	H			V		1			Bromophos	2104-96-3	3.9E+02	n	5.8E+03	n					3.5E+01	n		1.5E-01	n		
				2.0E-02	I					1	0.1		Bromoxynil	1689-84-5	1.3E+03	n	1.6E+04	n					3.3E+02	n		2.8E-01	n		
				2.0E-02	I			V		1			Bromoxynil Octanoate	1689-99-2	1.6E+03	n	2.3E+04	n					1.4E+02	n		1.2E+00	n		
3.4E+00	C	3.0E-05	I			2.0E-03	I	V		1		6.7E+02	Butadiene, 1,3-	106-99-0	5.8E-02	c*	2.6E-01	c*	9.4E-02	c*	4.1E-01	c*	1.8E-02	c		9.9E-06	c		
				1.0E-01	I			V		1		7.6E+03	Butanol, N-	71-36-3	7.8E+03	ns	1.2E+05	nms					2.0E+03	n		4.1E-01	n		
1.9E-03	P			2.0E-01	I					1	0.1		Butyl Benzyl Phthalate	85-68-7	2.9E+02	c*	1.2E+03	c					1.6E+01	c		2.4E-01	c		
				2.0E+00	P	3.0E+01	P	V		1		2.1E+04	Butyl alcohol, sec-	78-92-2	1.3E+05	nms	1.5E+06	nms	3.1E+04	n	1.3E+05	n	2.4E+04	n		5.0E+00	n		
				5.0E-02	I			V		1			Butylate	2008-41-5	3.9E+03	n	5.8E+04	n					4.6E+02	n		4.5E-01	n		
2.0E-04	C	5.7E-08	C							1	0.1		Butylated hydroxyanisole	25013-16-5	2.7E+03	c	1.1E+04	c	4.9E+01	c	2.2E+02	c	1.5E+02	c		2.9E-01	c		
3.6E-03	P			3.0E-01	P					1	0.1		Butylated hydroxytoluene	128-37-0	1.5E+02	c	6.4E+02	c					3.4E+00	c		1.0E-01	c		
				5.0E-02	P			V		1		1.1E+02	Butylbenzene, n-	104-51-8	3.9E+03	ns	5.8E+04	ns					1.0E+03	n		3.2E+00	n		
				1.0E-01	X			V		1		1.5E+02	Butylbenzene, sec-	135-98-8	7.8E+03	ns	1.2E+05	nms					2.0E+03	n		5.9E+00	n		
				1.0E-01	X			V		1		1.8E+02	Butylbenzene, tert-	98-06-6	7.8E+03	ns	1.2E+05	nms					6.9E+02	n		1.6E+00	n		
				2.0E-02	A					1	0.1		Cacodylic Acid	75-60-5	1.3E+03	n	1.6E+04	n					4.0E+02	n		1.1E-01	n		
		1.8E-03	I	1.0E-03	I	1.0E-05	A			0.025	0.001		Cadmium (Diet)	7440-43-9	7.1E+01	n	9.8E+02	n											
		1.8E-03	I	5.0E-04	I	1.0E-05	A			0.05	0.001		Cadmium (Water)	7440-43-9					1.6E-03	c**	6.8E-03	c**	9.2E+00	n	5.0E+00	6.9E-01	n	3.8E-01	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Calcium Chromate	13765-19-0	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c		
				5.0E-01	I	2.2E-03	C			1	0.1		Caprolactam	105-60-2	3.1E+04	n	4.0E+05	nm	2.3E+00	n	9.6E+00	n	9.9E+03	n		2.5E+00	n		
1.5E-01	C	4.3E-05	C	2.0E-03	I					1	0.1		Captafol	2425-06-1	3.6E+00	c*	1.5E+01	c	6.5E-02	c	2.9E-01	c	4.0E-01	c*		7.1E-04	c*		
2.3E-03	C	6.6E-07	C	1.3E-01	I					1	0.1		Captan	133-06-2	2.4E+02	c*	1.0E+03	c	4.3E+00	c	1.9E+01	c	3.1E+01	c*		2.2E-02	c*		
				1.0E-01	I					1	0.1		Carbaryl	63-25-2	6.3E+03	n	8.2E+04	n					1.8E+03	n		1.7E+00	n		
				5.0E-03	I					1	0.1		Carbofuran	1563-66-2	3.2E+02	n	4.1E+03	n					9.4E+01	n	4.0E+01	3.7E-02	n	1.6E-02	
				1.0E-01	I	7.0E-01	I	V		1		7.4E+02	Carbon Disulfide	75-15-0	7.7E+02	ns	3.5E+03	ns	7.3E+02	n	3.1E+03	n	8.1E+02	n		2.4E-01	n		
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V		1		4.6E+02	Carbon Tetrachloride	56-23-5	6.5E-01	c	2.9E+00	c	4.7E-01	c	2.0E+00	c	4.6E-01	c	5.0E+00	1.8E-04	c	1.9E-03	
						1.0E-01	P	V		1		5.9E+03	Carbonyl Sulfide	463-58-1	6.7E+01	n	2.8E+02	n	1.0E+02	n	4.4E+02	n	2.1E+02	n		5.1E-01	n		
				1.0E-02	I					1	0.1		Carbosulfan	55285-14-8	6.3E+02	n	8.2E+03	n					5.1E+01	n		1.2E+00	n		
				1.0E-01	I					1	0.1		Carboxin	5234-68-4	6.3E+03	n	8.2E+04	n					1.9E+03	n		1.0E+00	n		
						9.0E-04	I			1			Ceric oxide	1306-38-3	1.3E+06	nm	5.4E+06	nm	9.4E-01	n	3.9E+00	n							
				1.0E-01	I			V		1			Chloral Hydrate	302-17-0	7.8E+03	n	1.2E+05	nm					2.0E+03	n		4.0E-01	n		
				1.5E-02	I					1	0.1		Chloramben	133-90-4	9.5E+02	n	1.2E+04	n					2.9E+02	n		7.0E-02	n		
4.0E-01	H									1	0.1		Chloranil	118-75-2	1.3E+00	c	5.7E+00	c					1.8E-01	c		1.5E-04	c		
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I	V		1	0.04		Chlordane	12789-03-6	1.7E+00	c*	7.5E+00	c*	2.8E-02	c*	1.2E-01	c*	4.5E-02	c*	2.0E+00	3.0E-03	c*	1.4E-01	
1.0E+01	I	4.6E-03	C	3.0E-04	I					1	0.1		Chlordecone (Kepone)	143-50-0	5.4E-02	c	2.3E-01	c	6.1E-04	c	2.7E-03	c	3.5E-03	c		1.2E-04	c		
				7.0E-04	A					1	0.1		Chlorfenvinphos	470-90-6	4.4E+01	n	5.7E+02	n					1.1E+01	n		3.1E-02	n		
				2.0E-02	I					1	0.1		Chlorimuron, Ethyl-	90982-32-4	1.3E+03	n	1.6E+04	n					3.9E+02	n		1.3E-01	n		
				1.0E-01	I	1.5E-04	A	V		1		2.8E+03	Chlorine	7782-50-5	1.8E-01	n	7.8E-01	n	1.5E-01	n	6.4E-01	n	3.0E-01	n		1.4E-04	n		
				3.0E-02	I	2.0E-04	I	V		1			Chlorine Dioxide	10049-04-4	2.3E+03	n	3.4E+04	n	2.1E-01	n	8.8E-01	n	4.2E-01	n			n		
				3.0E-02	I					1			Chlorite (Sodium Salt)	7758-19-2	2.3E+03	n	3.5E+04	n					6.0E+02	n	1.0E+03		n		
						5.0E+01	I	V		1		1.2E+03	Chloro-1,1-difluoroethane, 1-	75-68-3	5.4E+04	ns	2.3E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		5.2E+01	n		
		3.0E-04	I	2.0E-02	H	2.0E-02	I	V		1		7.9E+02	Chloro-1,3-butadiene, 2-	126-99-8	1.0E-02	c	4.4E-02	c	9.4E-03	c	4.1E-02	c	1.9E-02	c		9.8E-06	c		
4.6E-01	H									1	0.1		Chloro-2-methylaniline HCl, 4-	3165-93-3	1.2E+00	c	5.0E+00	c					1.7E-01	c		1.5E-04	c		
1.0E-01	P	7.7E-05	C	3.0E-03	X					1	0.1		Chloro-2-methylaniline, 4-	95-69-2	5.4E+00	c*	2.3E+01	c	3.6E-02	c	1.6E-01	c	7.0E-01	c*		4.0E-04	c*		
2.7E-01	X							V		1		1.2E+04	Chloroacetaldehyde, 2-	107-20-0	2.6E+00	c	1.2E+01	c					2.9E-01	c		5.8E-05	c		
										1	0.1		Chloroacetic Acid	79-11-8											6.0E+01			1.2E-02	
						3.0E-05	I			1	0.1		Chloroacetophenone, 2-	532-27-4	4.3E+04	n	1.8E+05	nm	3.1E-02	n	1.3E-01	n							
2.0E-01	P			4.0E-03	I					1	0.1		Chloroaniline, p-	106-47-8	2.7E+00	c*	1.1E+01	c					3.7E-01	c		1.6E-04	c		
				2.0E-02	I	5.0E-02	P	V		1		7.6E+02	Chlorobenzene	108-90-7	2.8E+02	n	1.3E+03	ns	5.2E+01	n	2.2E+02	n	7.8E+01	n	1.0E+02	5.3E-02	n	6.8E-02	
1.1E-01	C	3.1E-05	C	2.0E-02	I					1	0.1		Chlorobenzilate	510-15-6	4.9E+00	c	2.1E+01	c	9.1E-02	c	4.0E-01	c	3.1E-01	c		1.0E-03	c		
				3.0E-02	X					1	0.1		Chlorobenzoic Acid, p-	74-11-3	1.9E+03	n	2.5E+04	n					5.1E+02	n		1.3E-01	n		
				3.0E-03	P	3.0E-01	P	V		1		2.9E+02	Chlorobenzotrifluoride, 4-	98-56-6	2.1E+02	n	2.5E+03	ns	3.1E+02	n	1.3E+03	n	3.5E+01	n		1.2E-01	n		
				4.0E-02	P			V		1		7.3E+02	Chlorobutane, 1-	109-69-3	3.1E+03	ns	4.7E+04	ns					6.4E+02	n		2.6E-01	n		

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Toxicity and Chemical-specific Information														Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
						5.0E+01	I	V		1		1.7E+03	Chlorodifluoromethane	75-45-6	4.9E+04	ns	2.1E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		4.3E+01	n		
				2.0E-02	P			V		1		1.1E+05	Chloroethanol, 2-	107-07-3	1.6E+03	n	2.3E+04	n					4.0E+02	n		8.1E-02	n		
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1		2.5E+03	Chloroform	67-66-3	3.2E-01	c	1.4E+00	c	1.2E-01	c	5.3E-01	c	2.2E-01	c	8.0E+01(F)	6.1E-05	c	2.2E-02	
						9.0E-02	I	V		1		1.3E+03	Chloromethane	74-87-3	1.1E+02	n	4.6E+02	n	9.4E+01	n	3.9E+02	n	1.9E+02	n		4.9E-02	n		
2.4E+00	C	6.9E-04	C					V		1		9.3E+03	Chloromethyl Methyl Ether	107-30-2	2.0E-02	c	8.9E-02	c	4.1E-03	c	1.8E-02	c	6.5E-03	c		1.4E-06	c		
3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1		Chloronitrobenzene, o-	88-73-3	1.8E+00	c	7.7E+00	c	1.0E-02	n	4.4E-02	n	2.4E-01	c		2.2E-04	c		
6.3E-03	P			1.0E-03	P	6.0E-04	P			1	0.1		Chloronitrobenzene, p-	100-00-5	6.3E+01	n	3.6E+02	c**	6.3E-01	n	2.6E+00	n	1.1E+01	c**		1.0E-02	c**		
				5.0E-03	I			V		1		2.2E+04	Chlorophenol, 2-	95-57-8	3.9E+02	n	5.8E+03	n					9.1E+01	n		7.4E-02	n		
						4.0E-04	C	V		1		6.2E+02	Chloropicrin	76-06-2	2.0E+00	n	8.2E+00	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		2.5E-04	n		
3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1		Chlorothalonil	1897-45-6	1.8E+02	c**	7.4E+02	c*	3.2E+00	c	1.4E+01	c	2.2E+01	c*		5.0E-02	c*		
				2.0E-02	I			V		1		9.1E+02	Chlorotoluene, o-	95-49-8	1.6E+03	ns	2.3E+04	ns					2.4E+02	n		2.3E-01	n		
				2.0E-02	X			V		1		2.5E+02	Chlorotoluene, p-	106-43-4	1.6E+03	ns	2.3E+04	ns					2.5E+02	n		2.4E-01	n		
2.4E+02	C	6.9E-02	C							1	0.1		Chlorozotocin	54749-90-5	2.3E-03	c	9.6E-03	c	4.1E-05	c	1.8E-04	c	3.2E-04	c		7.1E-08	c		
				2.0E-01	I					1	0.1		Chlorpropham	101-21-3	1.3E+04	n	1.6E+05	nm					2.8E+03	n		2.6E+00	n		
				1.0E-03	A					1	0.1		Chlorpyrifos	2921-88-2	6.3E+01	n	8.2E+02	n					8.4E+00	n		1.2E-01	n		
				1.0E-02	H					1	0.1		Chlorpyrifos Methyl	5598-13-0	6.3E+02	n	8.2E+03	n					1.2E+02	n		5.4E-01	n		
				5.0E-02	I					1	0.1		Chlorsulfuron	64902-72-3	3.2E+03	n	4.1E+04	n					9.9E+02	n		8.3E-01	n		
				1.0E-02	I					1	0.1		Chlorthal-dimethyl	1861-32-1	6.3E+02	n	8.2E+03	n					1.2E+02	n		1.5E-01	n		
				8.0E-04	H					1	0.1		Chlorthiophos	60238-56-4	5.1E+01	n	6.6E+02	n					2.8E+00	n		7.3E-02	n		
				1.5E+00	I					0.013			Chromium(III), Insoluble Salts	16065-83-1	1.2E+05	nm	1.8E+06	nm					2.2E+04	n		4.0E+07	n		
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I		M	0.025			Chromium(VI)	18540-29-9	3.0E-01	c	6.3E+00	c	1.2E-05	c	1.5E-04	c	3.5E-02	c		6.7E-04	c		
										0.013			Chromium, Total	7440-47-3											1.0E+02			1.8E+05	
				1.3E-02	I					1	0.1		Clofentezine	74115-24-5	8.2E+02	n	1.1E+04	n					2.3E+02	n		1.4E+01	n		
		9.0E-03	P	3.0E-04	P	6.0E-06	P			1			Cobalt	7440-48-4	2.3E+01	n	3.5E+02	n	3.1E-04	c*	1.4E-03	c*	6.0E+00	n		2.7E-01	n		
		6.2E-04	I					V	M	1			Coke Oven Emissions	8007-45-2					1.6E-03	c	2.0E-02	c							
				4.0E-02	H					1			Copper	7440-50-8	3.1E+03	n	4.7E+04	n					8.0E+02	n	1.3E+03	2.8E+01	n	4.6E+01	
				5.0E-02	I	6.0E-01	C			1	0.1		Cresol, m-	108-39-4	3.2E+03	n	4.1E+04	n	6.3E+02	n	2.6E+03	n	9.3E+02	n		7.4E-01	n		
		5.0E-02	I	6.0E-01	C					1	0.1		Cresol, o-	95-48-7	3.2E+03	n	4.1E+04	n	6.3E+02	n	2.6E+03	n	9.3E+02	n		7.5E-01	n		
		1.0E-01	A	6.0E-01	C					1	0.1		Cresol, p-	106-44-5	6.3E+03	n	8.2E+04	n	6.3E+02	n	2.6E+03	n	1.9E+03	n		1.5E+00	n		
		1.0E-01	A							1	0.1		Cresol, p-chloro-m-	59-50-7	6.3E+03	n	8.2E+04	n					1.4E+03	n		1.7E+00	n		
		1.0E-01	A	6.0E-01	C					1	0.1		Cresols	1319-77-3	6.3E+03	n	8.2E+04	n	6.3E+02	n	2.6E+03	n	1.5E+03	n		1.3E+00	n		
1.9E+00	H			1.0E-03	P			V		1		1.7E+04	Crotonaldehyde, trans-	123-73-9	3.7E-01	c	1.7E+00	c					4.0E-02	c		8.2E-06	c		
				1.0E-01	I	4.0E-01	I	V		1		2.7E+02	Cumene	98-82-8	1.9E+03	ns	9.9E+03	ns	4.2E+02	n	1.8E+03	n	4.5E+02	n		7.4E-01	n		
2.2E-01	C	6.3E-05	C							1	0.1		Cupferron	135-20-6	2.5E+00	c	1.0E+01	c	4.5E-02	c	1.9E-01	c	3.5E-01	c		6.1E-04	c		
8.4E-01	H			2.0E-03	H					1	0.1		Cyanazine	21725-46-2	6.5E-01	c	2.7E+00	c					8.8E-02	c		4.1E-05	c		
													Cyanides																	
				1.0E-03	I					1			~Calcium Cyanide	592-01-8	7.8E+01	n	1.2E+03	n					2.0E+01	n			n		
				5.0E-03	I					1			~Copper Cyanide	544-92-3	3.9E+02	n	5.8E+03	n					1.0E+02	n			n		
				6.0E-04	I	8.0E-04	S	V		1		9.7E+05	~Cyanide (CN-)	57-12-5	2.7E+00	n	1.2E+01	n	8.3E-01	n	3.5E+00	n	1.5E+00	n	2.0E+02	1.5E-02	n	2.0E+00	
				1.0E-03	I			V		1			~Cyanogen	460-19-5	7.8E+01	n	1.2E+03	n					2.0E+01	n			n		
				9.0E-02	I			V		1			~Cyanogen Bromide	506-68-3	7.0E+03	n	1.1E+05	nm					1.8E+03	n			n		
				5.0E-02	I			V		1			~Cyanogen Chloride	506-77-4	3.9E+03	n	5.8E+04	n					1.0E+03	n			n		
				6.0E-04	I	8.0E-04	I	V		1		1.0E+07	~Hydrogen Cyanide	74-90-8	2.3E+01	n	1.5E+02	n	8.3E-01	n	3.5E+00	n	1.5E+00	n		1.5E-02	n		
				2.0E-03	I					1			~Potassium Cyanide	151-50-8	1.6E+02	n	2.3E+03	n					4.0E+01	n			n		
				5.0E-03	I					0.04			~Potassium Silver Cyanide	506-61-6	3.9E+02	n	5.8E+03	n					8.2E+01	n			n		
				1.0E-01	I					0.04			~Silver Cyanide	506-64-9	7.8E+03	n	1.2E+05	nm					1.8E+03	n			n		
				1.0E-03	I					1			~Sodium Cyanide	143-33-9	7.8E+01	n	1.2E+03	n					2.0E+01	n	2.0E+02		n		
				2.0E-04	P					1			~Thiocyanates	NA	1.6E+01	n	2.3E+02	n					4.0E+00	n			n		
				2.0E-04	X			V		1			~Thiocyanic Acid	463-56-9	1.6E+01	n	2.3E+02	n					4.0E+00	n			n		
				5.0E-02	I					1			~Zinc Cyanide	557-21-1	3.9E+03	n	5.8E+04	n					1.0E+03	n			n		
						6.0E+00	I	V		1		1.2E+02	Cyclohexane	110-82-7	6.5E+03	ns	2.7E+04	ns	6.3E+03	n	2.6E+04	n	1.3E+04	n		1.3E+01	n		
2.3E-02	H									1	0.1		Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	2.4E+01	c	1.0E+02	c					2.4E+00	c		1.4E-02	c		
				5.0E+00	I	7.0E-01	P	V		1		5.1E+03	Cyclohexanone	108-94-1	2.8E+04	ns	1.3E+05	nms	7.3E+02	n	3.1E+03	n	1.4E+03	n		3.4E-01	n		
				5.0E-03	P	1.0E+00	X	V		1		2.8E+02	Cyclohexene	110-83-8	3.1E+02	ns	3.1E+03	ns	1.0E+03	n	4.4E+03	n	7.0E+01	n		4.6E-02	n		
		2.0E-01	I					V		1		2.9E+05	Cyclohexylamine	108-91-8	1.6E+04	n	2.3E+05	nm					3.8E+03	n		1.0E+00	n		
		2.5E-02	I							1	0.1		Cyfluthrin	68359-37-5	1.6E+03	n	2.1E+04	n					1.2E+02	n		3.1E+01	n		
				5.0E-03	I					1	0.1		Cyhalothrin	68085-85-8	3.2E+02	n	4.1E+03	n					1.0E+02	n		6.8E+01	n		
				1.0E-02	I					1	0.1		Cypermethrin	52315-07-8	6.3E+02	n	8.2E+03	n					2.0E+02	n		3.2E+01	n		
				7.5E-03	I					1	0.1		Cyromazine	66215-27-8	4.7E+02	n	6.2E+03	n					1.5E+02	n		3.8E-02	n		
2.4E-01	I	6.9E-05	C							1	0.1		DDD	72-54-8	2.3E+00	c	9.6E+00	c	4.1E-02	c	1.8E-01	c	3.2E-02	c		7.5E-03	c		
3.4E-01	I	9.7E-05	C					V		1			DDE, p,p'-	72-55-9	2.0E+00	c	9.3E+00	c	2.9E-02	c	1.3E-01	c	4.6E-02	c		1.1E-02	c		
3.4E-01	I	9.7E-05	I	5.0E-04	I					1	0.03		DDT	50-29-3	1.9E+00	c*	8.5E+00	c*	2.9E-02	c	1.3E-01	c	2.3E-01	c*		7.7E-02	c*		
				3.0E-02	I					1	0.1		Dalapon	75-99-0	1.9E+03	n	2.5E+04	n					6.0E+02	n	2.0E+02	1.2E-01	n	4.1E-02	
1.8E-02	C	5.1E-06	C	1.5E-01	I					1	0.1		Daminozide	1596-84-5	3.0E+01	c	1.3E+02	c	5.5E-01	c	2.4E+00	c	4.3E+00	c		9.5E-04	c		
7.0E-04	I			7.0E-03	I					1	0.1		Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	4.4E+02	n	3.3E+03	c**					1.1E+02	c**		6.2E+01	c**		

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information														Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				4.0E-05	I					1	0.1		Demeton	8065-48-3	2.5E+00	n	3.3E+01	n					4.2E-01	n			n	
1.2E-03	I			6.0E-01	I					1	0.1		Di(2-ethylhexyl)adipate	103-23-1	4.5E+02	c*	1.9E+03	c					6.5E+01	c	4.0E+02	4.7E+00	c	2.9E+01
6.1E-02	H									1	0.1		Diallate	2303-16-4	8.9E+00	c	3.8E+01	c					5.4E-01	c		8.0E-04	c	
				7.0E-04	A					1	0.1		Diazinon	333-41-5	4.4E+01	n	5.7E+02	n					1.0E+01	n		6.5E-02	n	
				1.0E-02	X			V		1			Dibenzothiophene	132-65-0	7.8E+02	n	1.2E+04	n					6.5E+01	n		1.2E+00	n	
8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	1		9.8E+02	Dibromo-3-chloropropane, 1,2-	96-12-8	5.3E-03	c	6.4E-02	c	1.7E-04	c	2.0E-03	c	3.3E-04	c	2.0E-01	1.4E-07	c	8.6E-05
				4.0E-04	X			V		1		1.6E+02	Dibromobenzene, 1,3-	108-36-1	3.1E+01	n	4.7E+02	ns					5.3E+00	n		5.1E-03	n	
				1.0E-02	I			V		1			Dibromobenzene, 1,4-	106-37-6	7.8E+02	n	1.2E+04	n					1.3E+02	n		1.2E-01	n	
8.4E-02	I			2.0E-02	I			V		1		8.0E+02	Dibromochloromethane	124-48-1	8.3E+00	c	3.9E+01	c					8.7E-01	c	8.0E+01(F)	2.3E-04	c	2.1E-02
2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1		1.3E+03	Dibromoethane, 1,2-	106-93-4	3.6E-02	c	1.6E-01	c	4.7E-03	c	2.0E-02	c	7.5E-03	c	5.0E-02	2.1E-06	c	1.4E-05
						4.0E-03	X	V		1		2.8E+03	Dibromomethane (Methylene Bromide)	74-95-3	2.4E+01	n	9.9E+01	n	4.2E+00	n	1.8E+01	n	8.3E+00	n		2.1E-03	n	
				3.0E-04	P					1	0.1		Dibutyltin Compounds	NA	1.9E+01	n	2.5E+02	n					6.0E+00	n			n	
				3.0E-02	I					1	0.1		Dicamba	1918-00-9	1.9E+03	n	2.5E+04	n					5.7E+02	n		1.5E-01	n	
		4.2E-03	P					V		1		5.5E+02	Dichloro-2-butene, 1,4-	764-41-0	2.1E-03	c	9.4E-03	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.6E-07	c	
		4.2E-03	P					V		1		5.2E+02	Dichloro-2-butene, cis-1,4-	1476-11-5	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c	
		4.2E-03	P					V		1		7.6E+02	Dichloro-2-butene, trans-1,4-	110-57-6	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c	
5.0E-02	I			4.0E-03	I					1	0.1		Dichloroacetic Acid	79-43-6	1.1E+01	c*	4.6E+01	c*					1.5E+00	c*	6.0E+01	3.1E-04	c*	1.2E-02
				9.0E-02	I	2.0E-01	H	V		1		3.8E+02	Dichlorobenzene, 1,2-	95-50-1	1.8E+03	ns	9.3E+03	ns	2.1E+02	n	8.8E+02	n	3.0E+02	n	6.0E+02	3.0E-01	n	5.8E-01
5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V		1			Dichlorobenzene, 1,4-	106-46-7	2.6E+00	c	1.1E+01	c	2.6E-01	c	1.1E+00	c	4.8E-01	c	7.5E+01	4.6E-04	c	7.2E-02
4.5E-01	I	3.4E-04	C							1	0.1		Dichlorobenzidine, 3,3'-	91-94-1	1.2E+00	c	5.1E+00	c	8.3E-03	c	3.6E-02	c	1.3E-01	c		8.2E-04	c	
				9.0E-03	X					1	0.1		Dichlorobenzophenone, 4,4'-	90-98-2	5.7E+02	n	7.4E+03	n					7.8E+01	n		4.7E-01	n	
				2.0E-01	I	1.0E-01	X	V		1		8.5E+02	Dichlorodifluoromethane	75-71-8	8.7E+01	n	3.7E+02	n	1.0E+02	n	4.4E+02	n	2.0E+02	n		3.0E-01	n	
5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1		1.7E+03	Dichloroethane, 1,1-	75-34-3	3.6E+00	c	1.6E+01	c	1.8E+00	c	7.7E+00	c	2.8E+00	c		7.8E-04	c	
9.1E-02	I	2.6E-05	I	6.0E-03	X	7.0E-03	P	V		1		3.0E+03	Dichloroethane, 1,2-	107-06-2	4.6E-01	c*	2.0E+00	c*	1.1E-01	c*	4.7E-01	c*	1.7E-01	c*	5.0E+00	4.8E-05	c*	1.4E-03
				5.0E-02	I	2.0E-01	I	V		1		1.2E+03	Dichloroethylene, 1,1-	75-35-4	2.3E+02	n	1.0E+03	n	2.1E+02	n	8.8E+02	n	2.8E+02	n	7.0E+00	1.0E-01	n	2.5E-03
				2.0E-03	I			V		1		2.4E+03	Dichloroethylene, 1,2-cis-	156-59-2	1.6E+02	n	2.3E+03	n					3.6E+01	n	7.0E+01	1.1E-02	n	2.1E-02
				2.0E-02	I			V		1		1.9E+03	Dichloroethylene, 1,2-trans-	156-60-5	1.6E+03	n	2.3E+04	ns					3.6E+02	n	1.0E+02	1.1E-01	n	3.1E-02
				3.0E-03	I					1	0.1		Dichlorophenol, 2,4-	120-83-2	1.9E+02	n	2.5E+03	n					4.6E+01	n		5.4E-02	n	
				1.0E-02	I					1	0.05		Dichlorophenoxy Acetic Acid, 2,4-	94-75-7	7.0E+02	n	9.6E+03	n					1.7E+02	n	7.0E+01	4.5E-02	n	1.8E-02
				8.0E-03	I					1	0.1		Dichlorophenoxybutyric Acid, 4-(2,4-	94-82-6	5.1E+02	n	6.6E+03	n					1.2E+02	n		1.1E-01	n	
3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	V		1		1.4E+03	Dichloropropane, 1,2-	78-87-5	1.0E+00	c*	4.4E+00	c*	2.8E-01	c*	1.2E+00	c*	4.4E-01	c*	5.0E+00	1.5E-04	c*	1.7E-03
				2.0E-02	P			V		1		1.5E+03	Dichloropropane, 1,3-	142-28-9	1.6E+03	ns	2.3E+04	ns					3.7E+02	n		1.3E-01	n	
				3.0E-03	I					1	0.1		Dichloropropanol, 2,3-	616-23-9	1.9E+02	n	2.5E+03	n					5.9E+01	n		1.3E-02	n	
1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1		1.6E+03	Dichloropropene, 1,3-	542-75-6	1.8E+00	c*	8.2E+00	c*	7.0E-01	c*	3.1E+00	c*	4.7E-01	c*		1.7E-04	c*	
2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I			1	0.1		Dichlorvos	62-73-7	1.9E+00	c*	7.9E+00	c*	3.4E-02	c*	1.5E-01	c*	2.6E-01	c*		8.1E-05	c*	
				1.0E-04	I					1	0.1		Dicrotophos	141-66-2	6.3E+00	n	8.2E+01	n					2.0E+00	n		4.7E-04	n	
				8.0E-02	P	3.0E-04	X	V		1		2.6E+02	Dicyclopentadiene	77-73-6	1.3E+00	n	5.4E+00	n	3.1E-01	n	1.3E+00	n	6.3E-01	n		2.2E-03	n	
1.6E+01	I	4.6E-03	I	5.0E-05	I					1	0.1		Dieldrin	60-57-1	3.4E-02	c*	1.4E-01	c	6.1E-04	c	2.7E-03	c	1.8E-03	c		7.1E-05	c	
		3.0E-04	C			5.0E-03	I			1	0.1		Diesel Engine Exhaust	NA					9.4E-03	c	4.1E-02	c						
				2.0E-03	P	2.0E-04	P			1	0.1		Diethanolamine	111-42-2	1.3E+02	n	1.6E+03	n	2.1E-01	n	8.8E-01	n	4.0E+01	n		8.1E-03	n	
				3.0E-02	P	1.0E-04	P			1	0.1		Diethylene Glycol Monobutyl Ether	112-34-5	1.9E+03	n	2.4E+04	n	1.0E-01	n	4.4E-01	n	6.0E+02	n		1.3E-01	n	
				6.0E-02	P	3.0E-04	P			1	0.1		Diethylene Glycol Monoethyl Ether	111-90-0	3.8E+03	n	4.8E+04	n	3.1E-01	n	1.3E+00	n	1.2E+03	n		2.4E-01	n	
				1.0E-03	P			V		1		1.1E+05	Diethylformamide	617-84-5	7.8E+01	n	1.2E+03	n					2.0E+01	n		4.1E-03	n	
3.5E+02	C	1.0E-01	C							1	0.1		Diethylstilbestrol	56-53-1	1.6E-03	c	6.6E-03	c	2.8E-05	c	1.2E-04	c	5.1E-05	c		2.8E-05	c	
				8.0E-02	I					1	0.1		Difenzoquat	43222-48-6	5.1E+03	n	6.6E+04	n					1.6E+03	n			n	
				2.0E-02	I					1	0.1		Diflubenzuron	35367-38-5	1.3E+03	n	1.6E+04	n					2.9E+02	n		3.3E-01	n	
						4.0E+01	I	V		1		1.4E+03	Difluoroethane, 1,1-	75-37-6	4.8E+04	ns	2.0E+05	nms	4.2E+04	n	1.8E+05	n	8.3E+04	n		2.8E+01	n	
4.4E-02	C	1.3E-05	C					V		1			Dihydrosafrole	94-58-6	9.9E+00	c	4.5E+01	c	2.2E-01	c	9.4E-01	c	3.0E-01	c		1.9E-04	c	
						7.0E-01	P	V		1		2.3E+03	Diisopropyl Ether	108-20-3	2.2E+03	n	9.4E+03	ns	7.3E+02	n	3.1E+03	n	1.5E+03	n		3.7E-01	n	
				8.0E-02	I			V		1		5.3E+02	Diisopropyl Methylphosphonate	1445-75-6	6.3E+03	ns	9.3E+04	ns					1.6E+03	n		4.5E-01	n	
				2.0E-02	I					1	0.1		Dimethipin	55290-64-7	1.3E+03	n	1.6E+04	n					4.0E+02	n		8.8E-02	n	
				2.0E-04	I					1	0.1		Dimethoate	60-51-5	1.3E+01	n	1.6E+02	n					4.0E+00	n		9.0E-04	n	
1.6E+00	P									1	0.1		Dimethoxybenzidine, 3,3'-	119-90-4	3.4E-01	c	1.4E+00	c					4.7E-02	c		5.8E-05	c	
1.7E-03	P			6.0E-02	P					1	0.1		Dimethyl methylphosphonate	756-79-6	3.2E+02	c*	1.4E+03	c*					4.6E+01	c*		9.6E-03	c*	
4.6E+00	C	1.3E-03	C							1	0.1		Dimethylamino azobenzene [p-]	60-11-7	1.2E-01	c	5.0E-01	c	2.2E-03	c	9.4E-03	c	5.0E-03	c		2.1E-05	c	
5.8E-01	H									1	0.1		Dimethylaniline HCl, 2,4-	21436-96-4	9.4E-01	c	4.0E+00	c					1.3E-01	c		1.2E-04	c	
2.0E-01	P			2.0E-03	X					1	0.1		Dimethylaniline, 2,4-	95-68-1	2.7E+00	c*	1.1E+01	c					3.7E-01	c		2.1E-04	c	
				2.0E-03	I			V		1		8.3E+02	Dimethylaniline, N,N-	121-69-7	1.6E+02	n	2.3E+03	ns					3.5E+01	n		1.3E-02	n	
1.1E+01	P									1	0.1		Dimethylbenzidine, 3,3'-	119-93-7	4.9E-02	c	2.1E-01	c					6.5E-03	c		4.3E-05	c	
				1.0E-01	P	3.0E-02	I	V		1		1.1E+05	Dimethylformamide	68-12-2	2.6E+03	n	1.5E+04	n	3.1E+01	n	1.3E+02	n	6.1E+01	n		1.2E-02	n	
				1.0E-04	X	2.0E-06	X	V		1		1.7E+05	Dimethylhydrazine, 1,1-	57-14-7	5.7E-02	n	2.4E-01	n	2.1E-03	n	8.8E-03	n	4.2E-03	n		9.3E-07	n	
5.5E+02	C	1.6E-01	C					V		1		1.9E+05	Dimethylhydrazine, 1,2-	540-73-8	8.8E-04	c	4.1E-03	c	1.8E-05	c	7.7E-05	c	2.8E-05	c		6.5E-09	c	
				2.0E-02	I					1	0.1		Dimethylphenol, 2,4-	105-67-9	1.3E+03	n	1.6E+04	n					3.6E+02	n		4.2E-01	n	
				6.0E-04	I					1	0.1		Dimethylphenol, 2,6-	576-26-1	3.8E+01	n	4.9E+02	n					1.1E+01	n		1.3E-02	n	
				1.0E-03	I					1	0.1		Dimethylphenol, 3,4-	95-65-8	6.3E+01	n	8.2E+02	n					1.8E+01	n		2.1E-02	n	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information														Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
4.5E-02	C	1.3E-05	C					V		1		1.3E+03	Dimethylvinylchloride	513-37-1	2.0E-01	c	8.9E-01	c	2.2E-01	c	9.4E-01	c	3.3E-01	c		2.4E-04	c	
				8.0E-05	X					1	0.1		Dinitro-o-cresol, 4,6-	534-52-1	5.1E+00	n	6.6E+01	n					1.5E+00	n		2.6E-03	n	
				2.0E-03	I					1	0.1		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5	1.3E+02	n	1.6E+03	n					2.3E+01	n		7.7E-01	n	
				1.0E-04	P					1	0.1		Dinitrobenzene, 1,2-	528-29-0	6.3E+00	n	8.2E+01	n					1.9E+00	n		1.8E-03	n	
				1.0E-04	I					1	0.1		Dinitrobenzene, 1,3-	99-65-0	6.3E+00	n	8.2E+01	n					2.0E+00	n		1.8E-03	n	
				1.0E-04	P					1	0.1		Dinitrobenzene, 1,4-	100-25-4	6.3E+00	n	8.2E+01	n					2.0E+00	n		1.8E-03	n	
				2.0E-03	I					1	0.1		Dinitrophenol, 2,4-	51-28-5	1.3E+02	n	1.6E+03	n					3.9E+01	n		4.4E-02	n	
6.8E-01	I									1	0.1		Dinitrotoluene Mixture, 2,4/2,6-	NA	8.0E-01	c	3.4E+00	c					1.1E-01	c		1.5E-04	c	
3.1E-01	C	8.9E-05	C	2.0E-03	I					1	0.102		Dinitrotoluene, 2,4-	121-14-2	1.7E+00	c*	7.4E+00	c	3.2E-02	c	1.4E-01	c	2.4E-01	c		3.2E-04	c	
1.5E+00	P			3.0E-04	X					1	0.099		Dinitrotoluene, 2,6-	606-20-2	3.6E-01	c*	1.5E+00	c					4.9E-02	c		6.7E-05	c	
				2.0E-03	S					1	0.006		Dinitrotoluene, 2-Amino-4,6-	35572-78-2	1.5E+02	n	2.3E+03	n					3.9E+01	n		3.0E-02	n	
				2.0E-03	S					1	0.009		Dinitrotoluene, 4-Amino-2,6-	19406-51-0	1.5E+02	n	2.3E+03	n					3.9E+01	n		3.0E-02	n	
4.5E-01	X			9.0E-04	X					1	0.1		Dinitrotoluene, Technical grade	25321-14-6	1.2E+00	c*	5.1E+00	c					1.0E-01	c		1.4E-04	c	
				1.0E-03	I					1	0.1		Dinoseb	88-85-7	6.3E+01	n	8.2E+02	n					1.5E+01	n	7.0E+00	1.3E-01	n	6.2E-02
1.0E-01	I	5.0E-06	I	3.0E-02	I	3.0E-02	I	V		1		1.2E+05	Dioxane, 1,4-	123-91-1	5.3E+00	c	2.4E+01	c	5.6E-01	c*	2.5E+00	c*	4.6E-01	c		9.4E-05	c	
													Dioxins																
6.2E+03	I	1.3E+00	I							1	0.03		~Hexachlorodibenzo-p-dioxin, Mixture	NA	1.0E-04	c	4.7E-04	c	2.2E-06	c	9.4E-06	c	1.3E-05	c		1.7E-05	c	
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C	V		1	0.03		~TCDD, 2,3,7,8-	1746-01-6	4.8E-06	c*	2.2E-05	c*	7.4E-08	c	3.2E-07	c	1.2E-07	c	3.0E-05	5.9E-08	c	1.5E-05
				3.0E-02	I					1	0.1		Diphenamid	957-51-7	1.9E+03	n	2.5E+04	n					5.3E+02	n		5.2E+00	n	
				8.0E-04	X					1	0.1		Diphenyl Sulfone	127-63-9	5.1E+01	n	6.6E+02	n					1.5E+01	n		3.6E-02	n	
				2.5E-02	I					1	0.1		Diphenylamine	122-39-4	1.6E+03	n	2.1E+04	n					3.1E+02	n		5.8E-01	n	
8.0E-01	I	2.2E-04	I							1	0.1		Diphenylhydrazine, 1,2-	122-66-7	6.8E-01	c	2.9E+00	c	1.3E-02	c	5.6E-02	c	7.8E-02	c		2.5E-04	c	
				2.2E-03	I					1	0.1		Diquat	85-00-7	1.4E+02	n	1.8E+03	n					4.4E+01	n	2.0E+01	8.3E-01	n	3.7E-01
7.1E+00	C	1.4E-01	C							1	0.1		Direct Black 38	1937-37-7	7.6E-02	c	3.2E-01	c	2.0E-05	c	8.8E-05	c	1.1E-02	c		5.3E+00	c	
7.4E+00	C	1.4E-01	C							1	0.1		Direct Blue 6	2602-46-2	7.3E-02	c	3.1E-01	c	2.0E-05	c	8.8E-05	c	1.1E-02	c		1.7E+01	c	
6.7E+00	C	1.4E-01	C							1	0.1		Direct Brown 95	16071-86-6	8.1E-02	c	3.4E-01	c	2.0E-05	c	8.8E-05	c	1.2E-02	c			c	
				4.0E-05	I					1	0.1		Disulfoton	298-04-4	2.5E+00	n	3.3E+01	n					5.0E-01	n		9.4E-04	n	
				1.0E-02	I			V		1			Dithiane, 1,4-	505-29-3	7.8E+02	n	1.2E+04	n					2.0E+02	n		9.7E-02	n	
				2.0E-03	I					1	0.1		Diuron	330-54-1	1.3E+02	n	1.6E+03	n					3.6E+01	n		1.5E-02	n	
				4.0E-03	I					1	0.1		Dodine	2439-10-3	2.5E+02	n	3.3E+03	n					8.0E+01	n		4.1E-01	n	
				2.5E-02	I			V		1			EPTC	759-94-4	2.0E+03	n	2.9E+04	n					3.8E+02	n		2.0E-01	n	
				6.0E-03	I			V		1			Endosulfan	115-29-7	4.7E+02	n	7.0E+03	n					1.0E+02	n		1.4E+00	n	
				2.0E-02	I					1	0.1		Endothall	145-73-3	1.3E+03	n	1.6E+04	n					3.8E+02	n	1.0E+02	9.1E-02	n	2.4E-02
				3.0E-04	I					1	0.1		Endrin	72-20-8	1.9E+01	n	2.5E+02	n					2.3E+00	n	2.0E+00	9.2E-02	n	8.1E-02
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1		1.1E+04	Epichlorohydrin	106-89-8	1.9E+01	n	8.2E+01	n	1.0E+00	n	4.4E+00	n	2.0E+00	n		4.5E-04	n	
						2.0E-02	I	V		1		1.5E+04	Epoxybutane, 1,2-	106-88-7	1.6E+02	n	6.7E+02	n	2.1E+01	n	8.8E+01	n	4.2E+01	n		9.2E-03	n	
				4.0E-02	P					1	0.1		Ethanol, 2-(2-methoxyethoxy)-	111-77-3	2.5E+03	n	3.3E+04	n					8.0E+02	n		1.6E-01	n	
				5.0E-03	I					1	0.1		Ethephon	16672-87-0	3.2E+02	n	4.1E+03	n					1.0E+02	n		2.1E-02	n	
				5.0E-04	I					1	0.1		Ethion	563-12-2	3.2E+01	n	4.1E+02	n					4.3E+00	n		8.5E-03	n	
				1.0E-01	P	6.0E-02	P	V		1		2.4E+04	Ethoxyethanol Acetate, 2-	111-15-9	2.6E+03	n	1.4E+04	n	6.3E+01	n	2.6E+02	n	1.2E+02	n		2.5E-02	n	
				9.0E-02	P	2.0E-01	I	V		1		1.1E+05	Ethoxyethanol, 2-	110-80-5	5.2E+03	n	4.7E+04	n	2.1E+02	n	8.8E+02	n	3.4E+02	n		6.8E-02	n	
				9.0E-01	I	7.0E-02	P	V		1		1.1E+04	Ethyl Acetate	141-78-6	6.2E+02	n	2.6E+03	n	7.3E+01	n	3.1E+02	n	1.4E+02	n		3.1E-02	n	
				5.0E-03	P	8.0E-03	P	V		1		2.5E+03	Ethyl Acrylate	140-88-5	4.7E+01	n	2.1E+02	n	8.3E+00	n	3.5E+01	n	1.4E+01	n		3.2E-03	n	
						1.0E+01	I	V		1		2.1E+03	Ethyl Chloride (Chloroethane)	75-00-3	1.4E+04	ns	5.7E+04	ns	1.0E+04	n	4.4E+04	n	2.1E+04	n		5.9E+00	n	
				2.0E-01	I			V		1		1.0E+04	Ethyl Ether	60-29-7	1.6E+04	ns	2.3E+05	nms					3.9E+03	n		8.8E-01	n	
						3.0E-01	P	V		1		1.1E+03	Ethyl Methacrylate	97-63-2	1.8E+03	ns	7.6E+03	ns	3.1E+02	n	1.3E+03	n	6.3E+02	n		1.5E-01	n	
				1.0E-05	I					1	0.1		Ethyl-p-nitrophenyl Phosphonate	2104-64-5	6.3E-01	n	8.2E+00	n					8.9E-02	n		2.8E-03	n	
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		1		4.8E+02	Ethylbenzene	100-41-4	5.8E+00	c	2.5E+01	c	1.1E+00	c	4.9E+00	c	1.5E+00	c	7.0E+02	1.7E-03	c	7.8E-01
				7.0E-02	P					1	0.1		Ethylene Cyanohydrin	109-78-4	4.4E+03	n	5.7E+04	n					1.4E+03	n		2.8E-01	n	
				9.0E-02	P			V		1		1.9E+05	Ethylene Diamine	107-15-3	7.0E+03	n	1.1E+05	nm					1.8E+03	n		4.1E-01	n	
				2.0E+00	I	4.0E-01	C			1	0.1		Ethylene Glycol	107-21-1	1.3E+05	nm	1.6E+06	nm	4.2E+02	n	1.8E+03	n	4.0E+04	n		8.1E+00	n	
				1.0E-01	I	1.6E+00	I			1	0.1		Ethylene Glycol Monobutyl Ether	111-76-2	6.3E+03	n	8.2E+04	n	1.7E+03	n	7.0E+03	n	2.0E+03	n		4.1E-01	n	
3.1E-01	C	8.8E-05	C			3.0E-02	C	V		1		1.2E+05	Ethylene Oxide	75-21-8	1.8E-01	c	7.9E-01	c	3.2E-02	c	1.4E-01	c	5.1E-02	c		1.1E-05	c	
4.5E-02	C	1.3E-05	C	8.0E-05	I					1	0.1		Ethylene Thiourea	96-45-7	5.1E+00	n	5.1E+01	c**	2.2E-01	c	9.4E-01	c	1.6E+00	n		3.6E-04	n	
6.5E+01	C	1.9E-02	C					V		1		1.5E+05	Ethyleneimine	151-56-4	2.7E-03	c	1.2E-02	c	1.5E-04	c	6.5E-04	c	2.4E-04	c		5.2E-08	c	
				3.0E+00	I					1	0.1		Ethylphthalyl Ethyl Glycolate	84-72-0	1.9E+05	nm	2.5E+06	nm					5.8E+04	n		1.3E+02	n	
				2.5E-04	I					1	0.1		Fenamiphos	22224-92-6	1.6E+01	n	2.1E+02	n					4.4E+00	n		4.3E-03	n	
				2.5E-02	I					1	0.1		Fenpropathrin	39515-41-8	1.6E+03	n	2.1E+04	n					6.4E+01	n		2.9E+00	n	
				2.5E-02	I					1	0.1		Fenvalerate	51630-58-1	1.6E+03	n	2.1E+04	n					5.0E+02	n		3.2E+02	n	
				1.3E-02	I					1	0.1		Fluometuron	2164-17-2	8.2E+02	n	1.1E+04	n					2.4E+02	n		1.9E-01	n	
				4.0E-02	C	1.3E-02	C			1			Fluoride	16984-48-8	3.1E+03	n	4.7E+04	n	1.4E+01	n	5.7E+01	n	8.0E+02	n		1.2E+02	n	
				6.0E-02	I	1.3E-02	C			1			Fluorine (Soluble Fluoride)	7782-41-4	4.7E+03	n	7.0E+04	n	1.4E+01	n	5.7E+01	n	1.2E+03	n	4.0E+03	1.8E+02	n	6.0E+02
				8.0E-02	I					1	0.1		Fluridone	59756-60-4	5.1E+03	n	6.6E+04	n					1.4E+03	n		1.6E+02	n	
				2.0E-02	I					1	0.1		Flurprimidol	56425-91-3	1.3E+03	n	1.6E+04	n					3.4E+02	n		1.6E+00	n	
				7.0E-04	I					1	0.1		Flusilazole	85509-19-9	4.4E+01	n	5.7E+02	n					1.1E+01	n		1.8E+00	n	

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Toxicity and Chemical-specific Information																Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				6.0E-02	I					1	0.1		Flutolanil	66332-96-5	3.8E+03	n	4.9E+04	n					9.5E+02	n		5.0E+00	n	
				1.0E-02	I					1	0.1		Fluvalinate	69409-94-5	6.3E+02	n	8.2E+03	n					2.0E+02	n		2.9E+02	n	
3.5E-03	I			1.0E-01	I					1	0.1		Folpet	133-07-3	1.6E+02	c*	6.6E+02	c					2.0E+01	c*		4.7E-03	c*	
1.9E-01	I									1	0.1		Fomesafen	72178-02-0	2.9E+00	c	1.2E+01	c					3.9E-01	c		1.3E-03	c	
				2.0E-03	I					1	0.1		Fonofos	944-22-9	1.3E+02	n	1.6E+03	n					2.4E+01	n		4.7E-02	n	
		1.3E-05	I	2.0E-01	I	9.8E-03	A	V		1		4.2E+04	Formaldehyde	50-00-0	1.7E+01	c*	7.3E+01	c*	2.2E-01	c*	9.4E-01	c*	4.3E-01	c*		8.7E-05	c*	
				9.0E-01	P	3.0E-04	X	V		1		1.1E+05	Formic Acid	64-18-6	2.9E+01	n	1.2E+02	n	3.1E-01	n	1.3E+00	n	6.3E-01	n		1.3E-04	n	
				3.0E+00	I					1	0.1		Fosetyl-AL	39148-24-8	1.9E+05	nm	2.5E+06	nm					6.0E+04	n		7.9E+02	n	
													Furans																
				1.0E-03	X			V		1	0.03		~Dibenzofuran	132-64-9	7.3E+01	n	1.0E+03	n					7.9E+00	n		1.5E-01	n	
				1.0E-03	I			V		1	0.03	6.2E+03	~Furan	110-00-9	7.3E+01	n	1.0E+03	n					1.9E+01	n		7.3E-03	n	
				9.0E-01	I	2.0E+00	I	V		1	0.03	1.7E+05	~Tetrahydrofuran	109-99-9	1.8E+04	n	9.6E+04	n	2.1E+03	n	8.8E+03	n	3.4E+03	n		7.5E-01	n	
3.8E+00	H									1	0.1		Furazolidone	67-45-8	1.4E-01	c	6.0E-01	c					2.0E-02	c		3.9E-05	c	
				3.0E-03	I	5.0E-02	H	V		1		1.0E+04	Furfural	98-01-1	2.1E+02	n	2.6E+03	n	5.2E+01	n	2.2E+02	n	3.8E+01	n		8.1E-03	n	
1.5E+00	C	4.3E-04	C							1	0.1		Furium	531-82-8	3.6E-01	c	1.5E+00	c	6.5E-03	c	2.9E-02	c	5.1E-02	c		6.8E-05	c	
3.0E-02	I	8.6E-06	C							1	0.1		Furmecyclox	60568-05-0	1.8E+01	c	7.7E+01	c	3.3E-01	c	1.4E+00	c	1.1E+00	c		1.2E-03	c	
				4.0E-04	I					1	0.1		Glufosinate, Ammonium	77182-82-2	2.5E+01	n	3.3E+02	n					8.0E+00	n		1.8E-03	n	
						8.0E-05	C			1	0.1		Glutaraldehyde	111-30-8	1.1E+05	nm	4.8E+05	nm	8.3E-02	n	3.5E-01	n						
				4.0E-04	I	1.0E-03	H	V		1		1.1E+05	Glycidyl	765-34-4	2.3E+01	n	2.1E+02	n	1.0E+00	n	4.4E+00	n	1.7E+00	n		3.3E-04	n	
				1.0E-01	I					1	0.1		Glyphosate	1071-83-6	6.3E+03	n	8.2E+04	n					2.0E+03	n	7.0E+02	8.8E+00	n	3.1E+00
				1.0E-02	X			V		1			*Guanidine*	113-00-8	7.8E+02	n	1.2E+04	n					2.0E+02	n		4.5E-02	n	
				2.0E-02	P					1	0.1		Guanidine Chloride	50-01-1	1.3E+03	n	1.6E+04	n					4.0E+02	n			n	
				5.0E-05	I					1	0.1		Haloxyfop, Methyl	69806-40-2	3.2E+00	n	4.1E+01	n					7.6E-01	n		8.4E-03	n	
4.5E+00	I	1.3E-03	I	5.0E-04	I			V		1			Heptachlor	76-44-8	1.3E-01	c	6.3E-01	c	2.2E-03	c	9.4E-03	c	1.4E-03	c	4.0E-01	1.2E-04	c	3.3E-02
9.1E+00	I	2.6E-03	I	1.3E-05	I			V		1			Heptachlor Epoxide	1024-57-3	7.0E-02	c*	3.3E-01	c*	1.1E-03	c	4.7E-03	c	1.4E-03	c*	2.0E-01	2.8E-05	c*	4.1E-03
				2.0E-03	I			V		1			Hexabromobenzene	87-82-1	1.6E+02	n	2.3E+03	n					4.0E+01	n		2.3E-01	n	
				2.0E-04	I					1	0.1		Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2	1.3E+01	n	1.6E+02	n					4.0E+00	n			n	
1.6E+00	I	4.6E-04	I	8.0E-04	I			V		1			Hexachlorobenzene	118-74-1	2.1E-01	c	9.6E-01	c	6.1E-03	c	2.7E-02	c	9.8E-03	c	1.0E+00	1.2E-04	c	1.3E-02
7.8E-02	I	2.2E-05	I	1.0E-03	P			V		1		1.7E+01	Hexachlorobutadiene	87-68-3	1.2E+00	c*	5.3E+00	c	1.3E-01	c	5.6E-01	c	1.4E-01	c*		2.7E-04	c*	
6.3E+00	I	1.8E-03	I	8.0E-03	A					1	0.1		Hexachlorocyclohexane, Alpha-	319-84-6	8.6E-02	c	3.6E-01	c	1.6E-03	c	6.8E-03	c	7.2E-03	c		4.2E-05	c	
1.8E+00	I	5.3E-04	I							1	0.1		Hexachlorocyclohexane, Beta-	319-85-7	3.0E-01	c	1.3E+00	c	5.3E-03	c	2.3E-02	c	2.5E-02	c		1.5E-04	c	
1.1E+00	C	3.1E-04	C	3.0E-04	I					1	0.0		Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	5.7E-01	c*	2.5E+00	c	9.1E-03	c	4.0E-02	c	4.2E-02	c*	2.0E-01	2.4E-04	c*	1.2E-03
1.8E+00	I	5.1E-04	I							1	0.1		Hexachlorocyclohexane, Technical	608-73-1	3.0E-01	c	1.3E+00	c	5.5E-03	c	2.4E-02	c	2.5E-02	c		1.5E-04	c	
				6.0E-03	I	2.0E-04	I	V		1		1.6E+01	Hexachlorocyclopentadiene	77-47-4	1.8E+00	n	7.5E+00	n	2.1E-01	n	8.8E-01	n	4.1E-01	n	5.0E+01	1.3E-03	n	1.6E-01
4.0E-02	I	1.1E-05	C	7.0E-04	I	3.0E-02	I	V		1			Hexachloroethane	67-72-1	1.8E+00	c*	8.0E+00	c*	2.6E-01	c	1.1E+00	c	3.3E-01	c*		2.0E-04	c*	
				3.0E-04	I					1	0.1		Hexachlorophene	70-30-4	1.9E+01	n	2.5E+02	n					6.0E+00	n		8.0E+00	n	
1.1E-01	I			3.0E-03	I					1	0.01		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	6.1E+00	c*	2.8E+01	c					7.0E-01	c*		2.7E-04	c*	
						1.0E-05	I	V		1		3.4E+03	Hexamethylene Diisocyanate, 1,6-	822-06-0	3.1E+00	n	1.3E+01	n	1.0E-02	n	4.4E-02	n	2.1E-02	n		2.1E-04	n	
				4.0E-04	P					1	0.1		Hexamethylphosphoramide	680-31-9	2.5E+01	n	3.3E+02	n					8.0E+00	n		1.8E-03	n	
						7.0E-01	I	V		1		1.4E+02	Hexane, N-	110-54-3	6.1E+02	ns	2.5E+03	ns	7.3E+02	n	3.1E+03	n	1.5E+03	n		1.0E+01	n	
				2.0E+00	P					1	0.1		Hexanedioic Acid	124-04-9	1.3E+05	nm	1.6E+06	nm					4.0E+04	n		9.9E+00	n	
				5.0E-03	I	3.0E-02	I	V		1		3.3E+03	Hexanone, 2-	591-78-6	2.0E+02	n	1.3E+03	n	3.1E+01	n	1.3E+02	n	3.8E+01	n		8.8E-03	n	
				3.3E-02	I					1	0.1		Hexazinone	51235-04-2	2.1E+03	n	2.7E+04	n					6.4E+02	n		3.0E-01	n	
				2.5E-02	I					1	0.1		Hexythiazox	78587-05-0	1.6E+03	n	2.1E+04	n					1.1E+02	n		5.0E-01	n	
				3.0E-04	I					1	0.1		Hydramethylnon	67485-29-4	1.9E+01	n	2.5E+02	n					5.9E+00	n		2.1E+03	n	
3.0E+00	I	4.9E-03	I			3.0E-05	P	V		1			Hydrazine	302-01-2	2.3E-01	c	1.1E+00	c	5.7E-04	c*	2.5E-03	c*	1.1E-03	c*			c*	
3.0E+00	I	4.9E-03	I							1			Hydrazine Sulfate	10034-93-2	2.3E-01	c	1.1E+00	c	5.7E-04	c	2.5E-03	c	2.6E-02	c			c	
						2.0E-02	I	V		1			Hydrogen Chloride	7647-01-0	2.8E+07	nm	1.2E+08	nm	2.1E+01	n	8.8E+01	n	4.2E+01	n			n	
				4.0E-02	C	1.4E-02	C	V		1			Hydrogen Fluoride	7664-39-3	3.1E+03	n	4.7E+04	n	1.5E+01	n	6.1E+01	n	2.8E+01	n			n	
						2.0E-03	I	V		1			Hydrogen Sulfide	7783-06-4	2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n	4.2E+00	n			n	
6.0E-02	P			4.0E-02	P					1	0.1		Hydroquinone	123-31-9	9.0E+00	c	3.8E+01	c					1.3E+00	c		8.7E-04	c	
				1.3E-02	I					1	0.1		Imazalil	35554-44-0	8.2E+02	n	1.1E+04	n					1.9E+02	n		3.2E+00	n	
				2.5E-01	I					1	0.1		Imazaquin	81335-37-7	1.6E+04	n	2.1E+05	nm					4.9E+03	n		2.4E+01	n	
				2.5E-01	I					1	0.1		Imazethapyr	81335-77-5	1.6E+04	n	2.1E+05	nm					4.7E+03	n		4.1E+00	n	
				1.0E-02	A					1			Iodine	7553-56-2	7.8E+02	n	1.2E+04	n					2.0E+02	n		1.2E+01	n	
				4.0E-02	I					1	0.1		Iprodione	36734-19-7	2.5E+03	n	3.3E+04	n					7.4E+02	n		2.2E-01	n	
				7.0E-01	P					1			Iron	7439-89-6	5.5E+04	n	8.2E+05	nm					1.4E+04	n		3.5E+02	n	
				3.0E-01	I			V		1		1.0E+04	Isobutyl Alcohol	78-83-1	2.3E+04	ns	3.5E+05	nms					5.9E+03	n		1.2E+00	n	
9.5E-04	I			2.0E-01	I	2.0E+00	C			1	0.1		Isophorone	78-59-1	5.7E+02	c*	2.4E+03	c*	2.1E+03	n	8.8E+03	n	7.8E+01	c*		2.6E-02	c*	
				1.5E-02	I			V		1			Isopropalin	33820-53-0	1.2E+03	n	1.8E+04	n					4.0E+01	n		9.2E-01	n	
				2.0E+00	P	2.0E-01	P	V		1		1.1E+05	Isopropanol	67-63-0	5.6E+03	n	2.4E+04	n	2.1E+02	n	8.8E+02	n	4.1E+02	n		8.4E-02	n	
				1.0E-01	I					1	0.1		Isopropyl Methyl Phosphonic Acid	1832-54-8	6.3E+03	n	8.2E+04	n					2.0E+03	n		4.3E-01	n	
				5.0E-02	I					1	0.1		Isoxaben	82558-50-7	3.2E+03	n	4.1E+04	n					7.3E+02	n		2.0E+00	n	
						3.0E-01	A	V		1			JP-7	NA	4.3E+08	nm	1.8E+09	nm	3.1E+02	n	1.3E+03	n	6.3E+02	n			n	
				2.0E-03	I					1	0.1		Lactofen	77501-63-4	1.3E+02	n	1.6E+03	n					2.5E+01	n		1.2E+00	n	

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Toxicity and Chemical-specific Information												Contaminant		Screening Levels													Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
													Lead Compounds															
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			~Lead Chromate	7758-97-6	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
8.5E-03	C	1.2E-05	C							1			~Lead Phosphate	7446-27-7	8.2E+01	c	3.8E+02	c	2.3E-01	c	1.0E+00	c	9.1E+00	c			c	
2.8E-01	C	8.0E-05	C							1	0.1		~Lead acetate	301-04-2	1.9E+00	c	8.2E+00	c	3.5E-02	c	1.5E-01	c	2.8E-01	c			c	
										1			~Lead and Compounds	7439-92-1	4.0E+02	L	8.0E+02	L	1.5E-01	L			1.5E+01	L		1.5E+01	L	1.4E+01
8.5E-03	C	1.2E-05	C							1	0.1		~Lead subacetate	1335-32-6	6.4E+01	c	2.7E+02	c	2.3E-01	c	1.0E+00	c	9.2E+00	c			c	
				1.0E-07	I			V		1		2.4E+00	~Tetraethyl Lead	78-00-2	7.8E-03	n	1.2E-01	n					1.3E-03	n		4.7E-06	n	
				5.0E-06	P			V		1		3.8E+02	Lewisite	541-25-3	3.9E-01	n	5.8E+00	n					9.0E-02	n		3.8E-05	n	
				2.0E-03	I					1	0.1		Linuron	330-55-2	1.3E+02	n	1.6E+03	n					3.3E+01	n		2.9E-02	n	
				2.0E-03	P					1			Lithium	7439-93-2	1.6E+02	n	2.3E+03	n					4.0E+01	n		1.2E+01	n	
				5.0E-04	I					1	0.1		MCPA	94-74-6	3.2E+01	n	4.1E+02	n					7.5E+00	n		2.0E-03	n	
				1.0E-02	I					1	0.1		MCPB	94-81-5	6.3E+02	n	8.2E+03	n					1.5E+02	n		5.8E-02	n	
				1.0E-03	I					1	0.1		MCPP	93-65-2	6.3E+01	n	8.2E+02	n					1.6E+01	n		4.7E-03	n	
				2.0E-02	I					1	0.1		Malathion	121-75-5	1.3E+03	n	1.6E+04	n					3.9E+02	n		1.0E-01	n	
				1.0E-01	I	7.0E-04	C			1	0.1		Maleic Anhydride	108-31-6	6.3E+03	n	8.0E+04	n	7.3E-01	n	3.1E+00	n	1.9E+03	n		3.8E-01	n	
				5.0E-01	I					1	0.1		Maleic Hydrazide	123-33-1	3.2E+04	n	4.1E+05	nm					1.0E+04	n		2.1E+00	n	
				1.0E-04	P					1	0.1		Malononitrile	109-77-3	6.3E+00	n	8.2E+01	n					2.0E+00	n		4.1E-04	n	
				3.0E-02	H					1	0.1		Mancozeb	8018-01-7	1.9E+03	n	2.5E+04	n					5.4E+02	n		7.6E-01	n	
				5.0E-03	I					1	0.1		Maneb	12427-38-2	3.2E+02	n	4.1E+03	n					9.8E+01	n		1.4E-01	n	
				1.4E-01	I	5.0E-05	I			1			Manganese (Diet)	7439-96-5														
				2.4E-02	S	5.0E-05	I			0.04			Manganese (Non-diet)	7439-96-5	1.8E+03	n	2.6E+04	n	5.2E-02	n	2.2E-01	n	4.3E+02	n		2.8E+01	n	
				9.0E-05	H					1	0.1		Mephosfolan	950-10-7	5.7E+00	n	7.4E+01	n					1.8E+00	n		2.6E-03	n	
				3.0E-02	I					1	0.1		Mepiquat Chloride	24307-26-4	1.9E+03	n	2.5E+04	n					6.0E+02	n		2.0E-01	n	
													Mercury Compounds															
				3.0E-04	I	3.0E-04	S			0.07			~Mercuric Chloride (and other Mercury salts)	7487-94-7	2.3E+01	n	3.5E+02	n	3.1E-01	n	1.3E+00	n	5.7E+00	n	2.0E+00		n	
						3.0E-04	I	V		1		3.1E+00	~Mercury (elemental)	7439-97-6	1.1E+01	ns	4.6E+01	ns	3.1E-01	n	1.3E+00	n	6.3E-01	n	2.0E+00	3.3E-02	n	1.0E-01
				1.0E-04	I					1			~Methyl Mercury -	22967-92-6	7.8E+00	n	1.2E+02	n					2.0E+00	n				
				8.0E-05	I					1	0.1		~Phenylmercuric Acetate	62-38-4	5.1E+00	n	6.6E+01	n					1.6E+00	n		5.0E-04	n	
				3.0E-05	I			V		1			Merphos	150-50-5	2.3E+00	n	3.5E+01	n					6.0E-01	n		5.9E-02	n	
				3.0E-05	I					1	0.1		Merphos Oxide	78-48-8	1.9E+00	n	2.5E+01	n					8.5E-02	n		4.2E-04	n	
				6.0E-02	I					1	0.1		Metalaxyl	57837-19-1	3.8E+03	n	4.9E+04	n					1.2E+03	n		3.3E-01	n	
				1.0E-04	I	3.0E-02	P	V		1		4.6E+03	Methacrylonitrile	126-98-7	7.5E+00	n	1.0E+02	n	3.1E+01	n	1.3E+02	n	1.9E+00	n		4.3E-04	n	
				5.0E-05	I					1	0.1		Methamidophos	10265-92-6	3.2E+00	n	4.1E+01	n					1.0E+00	n		2.1E-04	n	
				2.0E+00	I	2.0E+01	I	V		1		1.1E+05	Methanol	67-56-1	1.2E+05	nms	1.2E+06	nms	2.1E+04	n	8.8E+04	n	2.0E+04	n		4.1E+00	n	
				1.0E-03	I					1	0.1		Methidathion	950-37-8	6.3E+01	n	8.2E+02	n					1.9E+01	n		4.7E-03	n	
				2.5E-02	I					1	0.1		Methomyl	16752-77-5	1.6E+03	n	2.1E+04	n					5.0E+02	n		1.1E-01	n	
4.9E-02	C	1.4E-05	C							1	0.1		Methoxy-5-nitroaniline, 2-	99-59-2	1.1E+01	c	4.7E+01	c	2.0E-01	c	8.8E-01	c	1.5E+00	c		5.3E-04	c	
				5.0E-03	I					1	0.1		Methoxychlor	72-43-5	3.2E+02	n	4.1E+03	n					3.7E+01	n	4.0E+01	2.0E+00	n	2.2E+00
				8.0E-03	P	1.0E-03	P	V		1		1.2E+05	Methoxyethanol Acetate, 2-	110-49-6	1.1E+02	n	5.1E+02	n	1.0E+00	n	4.4E+00	n	2.1E+00	n		4.2E-04	n	
				5.0E-03	P	2.0E-02	I	V		1		1.1E+05	Methoxyethanol, 2-	109-86-4	3.3E+02	n	3.5E+03	n	2.1E+01	n	8.8E+01	n	2.9E+01	n		5.9E-03	n	
				1.0E+00	X			V		1		2.9E+04	Methyl Acetate	79-20-9	7.8E+04	ns	1.2E+06	nms					2.0E+04	n		4.1E+00	n	
						2.0E-02	P	V		1		6.8E+03	Methyl Acrylate	96-33-3	1.5E+02	n	6.1E+02	n	2.1E+01	n	8.8E+01	n	4.2E+01	n		8.9E-03	n	
				6.0E-01	I	5.0E+00	I	V		1		2.8E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3	2.7E+04	n	1.9E+05	nms	5.2E+03	n	2.2E+04	n	5.6E+03	n		1.2E+00	n	
		1.0E-03	X	1.0E-03	P	2.0E-05	X	V		1		1.8E+05	Methyl Hydrazine	60-34-4	1.4E-01	c**	6.2E-01	c**	2.8E-03	c**	1.2E-02	c**	5.6E-03	c**		1.3E-06	c**	
						3.0E+00	I	V		1		3.4E+03	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	3.3E+04	ns	1.4E+05	nms	3.1E+03	n	1.3E+04	n	6.3E+03	n		1.4E+00	n	
						1.0E-03	C	V		1		1.0E+04	Methyl Isocyanate	624-83-9	4.6E+00	n	1.9E+01	n	1.0E+00	n	4.4E+00	n	2.1E+00	n		5.9E-04	n	
				1.4E+00	I	7.0E-01	I	V		1		2.4E+03	Methyl Methacrylate	80-62-6	4.4E+03	ns	1.9E+04	ns	7.3E+02	n	3.1E+03	n	1.4E+03	n		3.0E-01	n	
				2.5E-04	I					1	0.1		Methyl Parathion	298-00-0	1.6E+01	n	2.1E+02	n					4.5E+00	n		7.4E-03	n	
				6.0E-02	X					1	0.1		Methyl Phosphonic Acid	993-13-5	3.8E+03	n	4.9E+04	n					1.2E+03	n		2.4E-01	n	
				6.0E-03	H	4.0E-02	H	V		1		3.9E+02	Methyl Styrene (Mixed Isomers)	25013-15-4	3.2E+02	n	2.6E+03	ns	4.2E+01	n	1.8E+02	n	2.3E+01	n		3.8E-02	n	
9.9E-02	C	2.8E-05	C							1	0.1		Methyl methanesulfonate	66-27-3	5.5E+00	c	2.3E+01	c	1.0E-01	c	4.4E-01	c	7.9E-01	c		1.6E-04	c	
1.8E-03	C	2.6E-07	C			3.0E+00	I	V		1		8.9E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	4.7E+01	c	2.1E+02	c	1.1E+01	c	4.7E+01	c	1.4E+01	c		3.2E-03	c	
				3.0E-04	X					1	0.1		Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2	1.9E+01	n	2.5E+02	n					6.0E+00	n		3.6E-03	n	
9.0E-03	P			2.0E-02	X					1	0.1		Methyl-5-Nitroaniline, 2-	99-55-8	6.0E+01	c*	2.6E+02	c*					8.2E+00	c*		4.6E-03	c*	
8.3E+00	C	2.4E-03	C							1	0.1		Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	6.5E-02	c	2.8E-01	c	1.2E-03	c	5.1E-03	c	9.4E-03	c		3.2E-06	c	
1.3E-01	C	3.7E-05	C							1	0.1		Methylaniline Hydrochloride, 2-	636-21-5	4.2E+00	c	1.8E+01	c	7.6E-02	c	3.3E-01	c	6.0E-01	c		2.6E-04	c	
				1.0E-02	A					1	0.1		Methylarsonic acid	124-58-3	6.3E+02	n	8.2E+03	n					2.0E+02	n			n	
				2.0E-04	X					1	0.1		Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7	1.3E+01	n	1.6E+02	n					4.0E+00	n			n	
1.0E-01	X			3.0E-04	X					1	0.1		Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	5.4E+00	c**	2.3E+01	c*					7.8E-01	c**			c**	
2.2E+01	C	6.3E-03	C						M	1	0.1		Methylcholanthrene, 3-	56-49-5	5.5E-03	c	1.0E-01	c	1.6E-04	c	1.9E-03	c	1.1E-03	c		2.2E-03	c	
2.0E-03	I	1.0E-08	I	6.0E-03	I	6.0E-01	I	V	M	1		3.3E+03	Methylene Chloride	75-09-2	5.7E+01	c**	1.0E+03	c**	1.0E+02	c**	1.2E+03	c**	1.1E+01	c**	5.0E+00	2.9E-03	c**	1.3E-03
1.0E-01	P	4.3E-04	C	2.0E-03	P				M	1	0.1		Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.2E+00	c	2.3E+01	c*	2.4E-03	c	2.9E-02	c	1.6E-01	c		1.8E-03	c	
4.6E-02	I	1.3E-05	C							1	0.1		Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	1.2E+01	c	5.0E+01	c	2.2E-01	c	9.4E-01	c	4.8E-01	c		2.6E-03	c	
1.6E+00	C	4.6E-04	C			2.0E-02	C			1	0.1		Methylenebisbenzenamine, 4,4'-	101-77-9	3.4E-01	c	1.4E+00	c	6.1E-03	c	2.7E-02	c	4.7E-02	c		2.1E-04	c	
						6.0E-04	I			1	0.1		Methylenediphenyl Diisocyanate	101-68-8	8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n						

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information															Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				7.0E-02	H			V		1		5.0E+02	Methylstyrene, Alpha-	98-83-9	5.5E+03	ns	8.2E+04	ns					7.8E+02	n		1.2E+00	n		
				1.5E-01	I					1	0.1		Metolachlor	51218-45-2	9.5E+03	n	1.2E+05	nm					2.7E+03	n		3.2E+00	n		
				2.5E-02	I					1	0.1		Metribuzin	21087-64-9	1.6E+03	n	2.1E+04	n					4.9E+02	n		1.5E-01	n		
				2.5E-01	I					1	0.1		Metsulfuron-methyl	74223-64-6	1.6E+04	n	2.1E+05	nm					4.9E+03	n		1.9E+00	n		
				3.0E+00	P			V		1		3.4E-01	Mineral oils	8012-95-1	2.3E+05	nms	3.5E+06	nms					6.0E+04	n		2.4E+03	n		
1.8E+01	C	5.1E-03	C	2.0E-04	I			V		1			Mirex	2385-85-5	3.6E-02	c	1.7E-01	c	5.5E-04	c	2.4E-03	c	8.8E-04	c		6.3E-04	c		
				2.0E-03	I					1	0.1		Molinate	2212-67-1	1.3E+02	n	1.6E+03	n					3.0E+01	n		1.7E-02	n		
				5.0E-03	I					1			Molybdenum	7439-98-7	3.9E+02	n	5.8E+03	n					1.0E+02	n		2.0E+00	n		
				1.0E-01	I					1			Monochloramine	10599-90-3	7.8E+03	n	1.2E+05	nm					2.0E+03	n	4.0E+03		n		
				2.0E-03	P					1	0.1		Monomethylaniline	100-61-8	1.3E+02	n	1.6E+03	n					3.8E+01	n		1.4E-02	n		
				2.5E-02	I					1	0.1		Myclobutanil	88671-89-0	1.6E+03	n	2.1E+04	n					4.5E+02	n		5.6E+00	n		
				3.0E-04	X					1	0.1		N,N'-Diphenyl-1,4-benzenediamine	74-31-7	1.9E+01	n	2.5E+02	n					3.6E+00	n		3.7E-01	n		
				2.0E-03	I			V		1			Naled	300-76-5	1.6E+02	n	2.3E+03	n					4.0E+01	n		1.8E-02	n		
				3.0E-02	X	1.0E-01	P	V		1			Naphtha, High Flash Aromatic (HFAN)	64742-95-6	2.3E+03	n	3.5E+04	n	1.0E+02	n	4.4E+02	n	1.5E+02	n			n		
1.8E+00	C	0.0E+00	C							1	0.1		Naphthylamine, 2-	91-59-8	3.0E-01	c	1.3E+00	c					3.9E-02	c		2.0E-04	c		
				1.0E-01	I					1	0.1		Napropamide	15299-99-7	6.3E+03	n	8.2E+04	n					1.6E+03	n		1.1E+01	n		
		2.6E-04	C	1.1E-02	C	1.4E-05	C			1	0.1		Nickel Acetate	373-02-4	6.7E+02	n	8.1E+03	n	1.1E-02	c**	4.7E-02	c**	2.2E+02	n			n		
		2.6E-04	C	1.1E-02	C	1.4E-05	C			1	0.1		Nickel Carbonate	3333-67-3	6.7E+02	n	8.1E+03	n	1.1E-02	c**	4.7E-02	c**	2.2E+02	n			n		
		2.6E-04	C	1.1E-02	C	1.4E-05	C	V		1			Nickel Carbonyl	13463-39-3	8.2E+02	n	1.1E+04	n	1.1E-02	c**	4.7E-02	c**	2.2E-02	c**			c**		
		2.6E-04	C	1.1E-02	C	1.4E-05	C			0.04			Nickel Hydroxide	12054-48-7	8.2E+02	n	1.1E+04	n	1.1E-02	c**	4.7E-02	c**	2.0E+02	n			n		
		2.6E-04	C	1.1E-02	C	2.0E-05	C			0.04			Nickel Oxide	1313-99-1	8.4E+02	n	1.2E+04	n	1.1E-02	c**	4.7E-02	c**	2.0E+02	n			n		
		2.4E-04	I	1.1E-02	C	1.4E-05	C			0.04			Nickel Refinery Dust	NA	8.2E+02	n	1.1E+04	n	1.2E-02	c**	5.1E-02	c**	2.2E+02	n		3.2E+01	n		
		2.6E-04	C	2.0E-02	I	9.0E-05	A			0.04			Nickel Soluble Salts	7440-02-0	1.5E+03	n	2.2E+04	n	1.1E-02	c**	4.7E-02	c**	3.9E+02	n		2.6E+01	n		
1.7E+00	C	4.8E-04	I	1.1E-02	C	1.4E-05	C			0.04			Nickel Subsulfide	12035-72-2	4.1E-01	c	1.9E+00	c	5.8E-03	c**	2.6E-02	c**	4.5E-02	c			c		
		2.6E-04	C	1.1E-02	C	1.4E-05	C			1	0.1		Nickelocene	1271-28-9	6.7E+02	n	8.1E+03	n	1.1E-02	c**	4.7E-02	c**	2.2E+02	n			n		
				1.6E+00	I					1			Nitrate	14797-55-8	1.3E+05	nm	1.9E+06	nm					3.2E+04	n	1.0E+04		n		
										1			Nitrate + Nitrite (as N)	NA											1.0E+04				
				1.0E-01	I					1			Nitrite	14797-65-0	7.8E+03	n	1.2E+05	nm					2.0E+03	n	1.0E+03		n		
				1.0E-02	X	5.0E-05	X			1	0.1		Nitroaniline, 2-	88-74-4	6.3E+02	n	8.0E+03	n	5.2E-02	n	2.2E-01	n	1.9E+02	n		8.0E-02	n		
2.0E-02	P			4.0E-03	P	6.0E-03	P			1	0.1		Nitroaniline, 4-	100-01-6	2.7E+01	c**	1.1E+02	c*	6.3E+00	n	2.6E+01	n	3.8E+00	c*		1.6E-03	c*		
		4.0E-05	I	2.0E-03	I	9.0E-03	I	V		1		3.1E+03	Nitrobenzene	98-95-3	5.1E+00	c*	2.2E+01	c*	7.0E-02	c	3.1E-01	c	1.4E-01	c*		9.2E-05	c*		
				3.0E+03	P					1	0.1		Nitrocellulose	9004-70-0	1.9E+08	nm	2.5E+09	nm					6.0E+07	n		1.3E+04	n		
				7.0E-02	H					1	0.1		Nitrofurantoin	67-20-9	4.4E+03	n	5.7E+04	n					1.4E+03	n		6.1E-01	n		
1.3E+00	C	3.7E-04	C							1	0.1		Nitrofurazone	59-87-0	4.2E-01	c	1.8E+00	c	7.6E-03	c	3.3E-02	c	6.0E-02	c		5.4E-05	c		
1.7E-02	P			1.0E-04	P					1	0.1		Nitroglycerin	55-63-0	6.3E+00	n	8.2E+01	n					2.0E+00	n		8.5E-04	n		
				1.0E-01	I					1	0.1		Nitroguanidine	556-88-7	6.3E+03	n	8.2E+04	n					2.0E+03	n		4.8E-01	n		
		8.8E-06	P			5.0E-03	P	V		1		1.8E+04	Nitromethane	75-52-5	5.4E+00	c*	2.4E+01	c*	3.2E-01	c*	1.4E+00	c*	6.4E-01	c*		1.4E-04	c*		
		2.7E-03	H			2.0E-02	I	V		1		4.9E+03	Nitropropane, 2-	79-46-9	1.4E-02	c	6.0E-02	c	1.0E-03	c	4.5E-03	c	2.1E-03	c		5.4E-07	c		
2.7E+01	C	7.7E-03	C						M	1	0.1		Nitroso-N-ethylurea, N-	759-73-9	4.5E-03	c	8.5E-02	c	1.3E-04	c	1.6E-03	c	9.2E-04	c		2.2E-07	c		
1.2E+02	C	3.4E-02	C						M	1	0.1		Nitroso-N-methylurea, N-	684-93-5	1.0E-03	c	1.9E-02	c	3.0E-05	c	3.6E-04	c	2.1E-04	c		4.6E-08	c		
5.4E+00	I	1.6E-03	I					V		1			Nitroso-di-N-butylamine, N-	924-16-3	9.9E-02	c	4.6E-01	c	1.8E-03	c	7.7E-03	c	2.7E-03	c		5.5E-06	c		
7.0E+00	I	2.0E-03	C							1	0.1		Nitroso-di-N-propylamine, N-	621-64-7	7.8E-02	c	3.3E-01	c	1.4E-03	c	6.1E-03	c	1.1E-02	c		8.1E-06	c		
2.8E+00	I	8.0E-04	C							1	0.1		Nitrosodiethanolamine, N-	1116-54-7	1.9E-01	c	8.2E-01	c	3.5E-03	c	1.5E-02	c	2.8E-02	c		5.6E-06	c		
1.5E+02	I	4.3E-02	I						M	1	0.1		Nitrosodiethylamine, N-	55-18-5	8.1E-04	c	1.5E-02	c	2.4E-05	c	2.9E-04	c	1.7E-04	c		6.1E-08	c		
5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X	V	M	1		2.4E+05	Nitrosodimethylamine, N-	62-75-9	2.0E-03	c	3.4E-02	c	7.2E-05	c	8.8E-04	c	1.1E-04	c		2.7E-08	c		
4.9E-03	I	2.6E-06	C							1	0.1		Nitrosodiphenylamine, N-	86-30-6	1.1E+02	c	4.7E+02	c	1.1E+00	c	4.7E+00	c	1.2E+01	c		6.7E-02	c		
2.2E+01	I	6.3E-03	C					V		1		1.1E+05	Nitrosomethylethylamine, N-	10595-95-6	2.0E-02	c	9.1E-02	c	4.5E-04	c	1.9E-03	c	7.1E-04	c		2.0E-07	c		
6.7E+00	C	1.9E-03	C							1	0.1		Nitrosomorpholine [N-]	59-89-2	8.1E-02	c	3.4E-01	c	1.5E-03	c	6.5E-03	c	1.2E-02	c		2.8E-06	c		
9.4E+00	C	2.7E-03	C							1	0.1		Nitrosopiperidine [N-]	100-75-4	5.8E-02	c	2.4E-01	c	1.0E-03	c	4.5E-03	c	8.2E-03	c		4.4E-06	c		
2.1E+00	I	6.1E-04	I							1	0.1		Nitrosopyrrolidine, N-	930-55-2	2.6E-01	c	1.1E+00	c	4.6E-03	c	2.0E-02	c	3.7E-02	c		1.4E-05	c		
				1.0E-04	X					1	0.1		Nitrotoluene, m-	99-08-1	6.3E+00	n	8.2E+01	n					1.7E+00	n		1.6E-03	n		
2.2E-01	P			9.0E-04	P			V		1		1.5E+03	Nitrotoluene, o-	88-72-2	3.2E+00	c*	1.5E+01	c*					3.1E-01	c*		3.0E-04	c*		
1.6E-02	P			4.0E-03	P					1	0.1		Nitrotoluene, p-	99-99-0	3.4E+01	c**	1.4E+02	c*					4.3E+00	c*		4.0E-03	c*		
				3.0E-04	X	2.0E-02	P	V		1		6.9E+00	Nonane, n-	111-84-2	1.1E+01	ns	7.2E+01	ns	2.1E+01	n	8.8E+01	n	5.3E+00	n		7.5E-02	n		
				4.0E-02	I					1	0.1		Norflurazon	27314-13-2	2.5E+03	n	3.3E+04	n					7.7E+02	n		5.0E+00	n		
				3.0E-03	I					1	0.1		Octabromodiphenyl Ether	32536-52-0	1.9E+02	n	2.5E+03	n					6.0E+01	n		1.2E+01	n		
				5.0E-02	I					1	0.006		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	3.9E+03	n	5.7E+04	n					1.0E+03	n		1.3E+00	n		
				2.0E-03	H					1	0.1		Octamethylpyrophosphoramide	152-16-9	1.3E+02	n	1.6E+03	n					4.0E+01	n		9.6E-03	n		
				5.0E-02	I					1	0.1		Oryzalin	19044-88-3	3.2E+03	n	4.1E+04	n					8.1E+02	n		1.5E+00	n		
				5.0E-03	I					1	0.1		Oxadiazon	19666-30-9	3.2E+02	n	4.1E+03	n					4.7E+01	n		4.8E-01	n		
				2.5E-02	I					1	0.1		Oxamyl	23135-22-0	1.6E+03	n	2.1E+04	n					5.0E+02	n	2.0E+02	1.1E-01	n	4.4E-02	
				3.0E-03	I					1	0.1		Oxyfluorfen	42874-03-3	1.9E+02	n	2.5E+03	n					3.2E+01	n		2.5E+00	n		
				1.3E-02	I					1	0.1		Paclobutrazol	76738-62-0	8.2E+02	n	1.1E+04	n					2.3E+02	n		4.6E-01	n		
				4.5E-03	I					1	0.1		Paraquat Dichloride	1910-42-5	2.8E+02	n	3.7E+03	n					9.0E+01	n		1.2E+00	n		
				6.0E-03	H					1	0.1		Parathion	56-38-2	3.8E+02	n	4.9E+03	n					8.6E+01	n		4.3E-01	n		

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information															Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				5.0E-02	H			V		1			Pebulate	1114-71-2	3.9E+03	n	5.8E+04	n					5.6E+02	n		4.5E-01	n		
				4.0E-02	I					1	0.1		Pendimethalin	40487-42-1	2.5E+03	n	3.3E+04	n					1.8E+02	n		2.1E+00	n		
				2.0E-03	I			V		1		3.1E-01	Pentabromodiphenyl Ether	32534-81-9	1.6E+02	ns	2.3E+03	ns					4.0E+01	n		1.7E+00	n		
				1.0E-04	I					1	0.1		Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9	6.3E+00	n	8.2E+01	n					2.0E+00	n		8.7E-02	n		
				8.0E-04	I			V		1			Pentachlorobenzene	608-93-5	6.3E+01	n	9.3E+02	n					3.2E+00	n		2.4E-02	n		
9.0E-02	P							V		1		4.6E+02	Pentachloroethane	76-01-7	7.7E+00	c	3.6E+01	c					6.5E-01	c		3.1E-04	c		
2.6E-01	H			3.0E-03	I			V		1			Pentachloronitrobenzene	82-68-8	2.7E+00	c*	1.3E+01	c					1.2E-01	c		1.5E-03	c		
4.0E-01	I	5.1E-06	C	5.0E-03	I					1	0.25		Pentachlorophenol	87-86-5	1.0E+00	c	4.0E+00	c	5.5E-01	c	2.4E+00	c	4.1E-02	c	1.0E+00	4.2E-04	c	1.0E-02	
4.0E-03	X			2.0E-03	P					1	0.1		Pentaerythritol tetranitrate (PETN)	78-11-5	1.3E+02	n	5.7E+02	c**					1.9E+01	c**		2.8E-02	c**		
						1.0E+00	P	V		1		3.9E+02	Pentane, n-	109-66-0	8.1E+02	ns	3.4E+03	ns	1.0E+03	n	4.4E+03	n	2.1E+03	n		1.0E+01	n		
													Perchlorates																	
				7.0E-04	I					1			~Ammonium Perchlorate	7790-98-9	5.5E+01	n	8.2E+02	n					1.4E+01	n			n		
				7.0E-04	I					1			~Lithium Perchlorate	7791-03-9	5.5E+01	n	8.2E+02	n					1.4E+01	n			n		
				7.0E-04	I					1			~Perchlorate and Perchlorate Salts	14797-73-0	5.5E+01	n	8.2E+02	n					1.4E+01	n	1.5E+01(F)		n		
				7.0E-04	I					1			~Potassium Perchlorate	7778-74-7	5.5E+01	n	8.2E+02	n					1.4E+01	n			n		
				7.0E-04	I					1			~Sodium Perchlorate	7601-89-0	5.5E+01	n	8.2E+02	n					1.4E+01	n			n		
				2.0E-02	P			V		1			Perfluorobutane Sulfonate	375-73-5	1.6E+03	n	2.3E+04	n					3.8E+02	n		2.1E-01	n		
				5.0E-02	I					1	0.1		Permethrin	52645-53-1	3.2E+03	n	4.1E+04	n					1.0E+03	n		2.4E+02	n		
2.2E-03	C	6.3E-07	C							1	0.1		Phenacetin	62-44-2	2.5E+02	c	1.0E+03	c	4.5E+00	c	1.9E+01	c	3.4E+01	c		9.7E-03	c		
				2.5E-01	I					1	0.1		Phenmedipham	13684-63-4	1.6E+04	n	2.1E+05	nm					4.0E+03	n		2.1E+01	n		
				3.0E-01	I	2.0E-01	C			1	0.1		Phenol	108-95-2	1.9E+04	n	2.5E+05	nm	2.1E+02	n	8.8E+02	n	5.8E+03	n		3.3E+00	n		
				5.0E-04	X					1	0.1		Phenothiazine	92-84-2	3.2E+01	n	4.1E+02	n					4.3E+00	n		1.4E-02	n		
				6.0E-03	I					1	0.1		Phenylenediamine, m-	108-45-2	3.8E+02	n	4.9E+03	n					1.2E+02	n		3.2E-02	n		
4.7E-02	H									1	0.1		Phenylenediamine, o-	95-54-5	1.2E+01	c	4.9E+01	c					1.6E+00	c		4.4E-04	c		
				1.9E-01	H					1	0.1		Phenylenediamine, p-	106-50-3	1.2E+04	n	1.6E+05	nm					3.8E+03	n		1.0E+00	n		
1.9E-03	H									1	0.1		Phenylphenol, 2-	90-43-7	2.8E+02	c	1.2E+03	c					3.0E+01	c		4.1E-01	c		
				2.0E-04	H					1	0.1		Phorate	298-02-2	1.3E+01	n	1.6E+02	n					3.0E+00	n		3.4E-03	n		
						3.0E-04	I	V		1		1.6E+03	Phosgene	75-44-5	3.1E-01	n	1.3E+00	n	3.1E-01	n	1.3E+00	n							
				2.0E-02	I					1	0.1		Phosmet	732-11-6	1.3E+03	n	1.6E+04	n					3.7E+02	n		8.2E-02	n		
													Phosphates, Inorganic																	
				4.9E+01	P					1			~Aluminum metaphosphate	13776-88-0	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Ammonium polyphosphate	68333-79-9	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Calcium pyrophosphate	7790-76-3	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Diammonium phosphate	7783-28-0	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Dicalcium phosphate	7757-93-9	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Dimagnesium phosphate	7782-75-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Dipotassium phosphate	7758-11-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Disodium phosphate	7558-79-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Monoaluminum phosphate	13530-50-2	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Monoammonium phosphate	7722-76-1	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Monocalcium phosphate	7758-23-8	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Monomagnesium phosphate	7757-86-0	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Monopotassium phosphate	7778-77-0	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Monosodium phosphate	7558-80-7	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Polyphosphoric acid	8017-16-1	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Potassium tripolyphosphate	13845-36-8	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Sodium acid pyrophosphate	7758-16-9	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Sodium aluminum phosphate (acidic)	7785-88-8	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Sodium aluminum phosphate (anhydrous)	10279-59-1	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Sodium aluminum phosphate (tetrahydrate)	10305-76-7	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Sodium hexametaphosphate	10124-56-8	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Sodium polyphosphate	68915-31-1	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Sodium trimetaphosphate	7785-84-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Sodium tripolyphosphate	7758-29-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Tetrapotassium phosphate	7320-34-5	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Tetrasodium pyrophosphate	7722-88-5	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Tricalcium phosphate	7758-87-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Trimagnesium phosphate	7757-87-1	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Tripotassium phosphate	7778-53-2	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				4.9E+01	P					1			~Trisodium phosphate	7601-54-9	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n		
				3.0E-04	I	3.0E-04	I	V		1			Phosphine	7803-51-2	2.3E+01	n	3.5E+02	n	3.1E-01	n	1.3E+00	n	5.7E-01	n			n		
				4.9E+01	P	1.0E-02	I			1			Phosphoric Acid	7664-38-2	3.0E+06	nm	2.9E+07	nm	1.0E+01	n	4.4E+01	n	9.7E+05	n			n		
				2.0E-05	I			V		1			Phosphorus, White	7723-14-0	1.6E+00	n	2.3E+01	n					4.0E-01	n		1.5E-03	n		
													Phthalates																	

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Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
1.4E-02	I	2.4E-06	C	2.0E-02	I					1	0.1		~Bis(2-ethylhexyl)phthalate	117-81-7	3.9E+01	c*	1.6E+02	c	1.2E+00	c	5.1E+00	c	5.6E+00	c*	6.0E+00	1.3E+00	c*	1.4E+00
				1.0E+00	I					1	0.1		~Butylphthalyl Butylglycolate	85-70-1	6.3E+04	n	8.2E+05	nm					1.3E+04	n		3.1E+02	n	
				1.0E-01	I					1	0.1		~Dibutyl Phthalate	84-74-2	6.3E+03	n	8.2E+04	n					9.0E+02	n		2.3E+00	n	
				8.0E-01	I					1	0.1		~Diethyl Phthalate	84-66-2	5.1E+04	n	6.6E+05	nm					1.5E+04	n		6.1E+00	n	
				1.0E-01	I			V		1			~Dimethylterephthalate	120-61-6	7.8E+03	n	1.2E+05	nm					1.9E+03	n		4.9E-01	n	
				1.0E-02	P					1	0.1		~Octyl Phthalate, di-N-	117-84-0	6.3E+02	n	8.2E+03	n					2.0E+02	n		5.7E+01	n	
				1.0E+00	H					1	0.1		~Phthalic Acid, P-	100-21-0	6.3E+04	n	8.2E+05	nm					1.9E+04	n		6.8E+00	n	
				2.0E+00	I	2.0E-02	C			1	0.1		~Phthalic Anhydride	85-44-9	1.3E+05	nm	1.6E+06	nm	2.1E+01	n	8.8E+01	n	3.9E+04	n		8.5E+00	n	
				7.0E-02	I					1	0.1		Picloram	1918-02-1	4.4E+03	n	5.7E+04	n					1.4E+03	n	5.0E+02	3.8E-01	n	1.4E-01
				1.0E-04	X					1	0.1		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3	6.3E+00	n	8.2E+01	n					2.0E+00	n		1.3E-03	n	
				9.0E-04	X					1	0.1		Picric Acid (2,4,6-Trinitrophenol)	88-89-1	5.7E+01	n	7.4E+02	n					1.8E+01	n		8.4E-02	n	
				1.0E-02	I					1	0.1		Pirimiphos, Methyl	29232-93-7	6.3E+02	n	8.2E+03	n					1.2E+02	n		1.2E-01	n	
3.0E+01	C	8.6E-03	C	7.0E-06	H					1	0.1		Polybrominated Biphenyls	59536-65-1	1.8E-02	c*	7.7E-02	c*	3.3E-04	c	1.4E-03	c	2.6E-03	c*			c*	
													Polychlorinated Biphenyls (PCBs)																
7.0E-02	S	2.0E-05	S	7.0E-05	I			V		1	0.14		~Aroclor 1016	12674-11-2	4.1E+00	n	2.7E+01	c**	1.4E-01	c	6.1E-01	c	2.2E-01	c**		2.1E-02	c**	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1221	11104-28-2	2.0E-01	c	8.3E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1232	11141-16-5	1.7E-01	c	7.2E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1242	53469-21-9	2.3E-01	c	9.5E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1248	12672-29-6	2.3E-01	c	9.5E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c	
2.0E+00	S	5.7E-04	S	2.0E-05	I			V		1	0.14		~Aroclor 1254	11097-69-1	2.4E-01	c**	9.7E-01	c*	4.9E-03	c	2.1E-02	c	7.8E-03	c*		2.0E-03	c*	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1260	11096-82-5	2.4E-01	c	9.9E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		5.5E-03	c	
				6.0E-04	X			V		1	0.14		~Aroclor 5460	11126-42-4	3.5E+01	n	4.4E+02	n					1.2E+01	n		2.0E+00	n	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.3E-01	c*	5.2E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		2.8E-03	c	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.2E-01	c*	5.2E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.7E-03	c	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	1.2E-01	c*	5.1E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.7E-03	c	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	1.2E-01	c*	5.1E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.7E-03	c	
3.9E+03	E	1.1E+00	E	2.3E-08	E	1.3E-06	E	V		1	0.14		~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.2E-04	c*	5.2E-04	c*	2.5E-06	c	1.1E-05	c	4.0E-06	c		1.7E-06	c	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.2E-01	c*	5.0E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.2E-01	c*	5.0E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.2E-01	c*	5.0E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.2E-01	c*	5.1E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c	
1.3E+04	E	3.8E+00	E	7.0E-09	E	4.0E-07	E	V		1	0.14		~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	3.7E-05	c*	1.5E-04	c*	7.4E-07	c	3.2E-06	c	1.2E-06	c		3.0E-07	c	
2.0E+00	I	5.7E-04	I					V		1	0.14		~Polychlorinated Biphenyls (high risk)	1336-36-3	2.3E-01	c	9.4E-01	c	4.9E-03	c	2.1E-02	c						
4.0E-01	I	1.0E-04	I					V		1	0.14		~Polychlorinated Biphenyls (low risk)	1336-36-3					2.8E-02	c	1.2E-01	c	4.4E-02	c	5.0E-01	6.8E-03	c	7.8E-02
7.0E-02	I	2.0E-05	I					V		1	0.14		~Polychlorinated Biphenyls (lowest risk)	1336-36-3					1.4E-01	c	6.1E-01	c						
1.3E+01	E	3.8E-03	E	7.0E-06	E	4.0E-04	E			1	0.14		~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	3.8E-02	c*	1.6E-01	c*	7.4E-04	c	3.2E-03	c	6.0E-03	c*		9.4E-04	c*	
3.9E+01	E	1.1E-02	E	2.3E-06	E	1.3E-04	E	V		1	0.14		~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.2E-02	c*	4.9E-02	c*	2.5E-04	c	1.1E-03	c	4.0E-04	c		6.2E-05	c	
						6.0E-04	I			1	0.1		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9	8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n						
													Polynuclear Aromatic Hydrocarbons (PAHs)																
				6.0E-02	I			V		1	0.13		~Acenaphthene	83-32-9	3.6E+03	n	4.5E+04	n					5.3E+02	n		5.5E+00	n	
				3.0E-01	I			V		1	0.13		~Anthracene	120-12-7	1.8E+04	n	2.3E+05	nm					1.8E+03	n		5.8E+01	n	
7.3E-01	E	1.1E-04	C					V	M	1	0.13		~Benz[a]anthracene	56-55-3	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	1.2E-02	c		4.2E-03	c	
1.2E+00	C	1.1E-04	C							1	0.13		~Benzo[j]fluoranthene	205-82-3	4.2E-01	c	1.8E+00	c	2.6E-02	c	1.1E-01	c	6.5E-02	c		7.8E-02	c	
7.3E+00	I	1.1E-03	C						M	1	0.13		~Benzo[a]pyrene	50-32-8	1.6E-02	c	2.9E-01	c	9.2E-04	c	1.1E-02	c	3.4E-03	c	2.0E-01	4.0E-03	c	2.4E-01
7.3E-01	E	1.1E-04	C						M	1	0.13		~Benzo[b]fluoranthene	205-99-2	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	3.4E-02	c		4.1E-02	c	
7.3E-02	E	1.1E-04	C						M	1	0.13		~Benzo[k]fluoranthene	207-08-9	1.6E+00	c	2.9E+01	c	9.2E-03	c	1.1E-01	c	3.4E-01	c		4.0E-01	c	
				8.0E-02	I			V		1	0.13		~Chloronaphthalene, Beta-	91-58-7	4.8E+03	n	6.0E+04	n					7.5E+02	n		3.9E+00	n	
7.3E-03	E	1.1E-05	C						M	1	0.13		~Chrysene	218-01-9	1.6E+01	c	2.9E+02	c	9.2E-02	c	1.1E+00	c	3.4E+00	c		1.2E+00	c	
7.3E+00	E	1.2E-03	C						M	1	0.13		~Dibenz[a,h]anthracene	53-70-3	1.6E-02	c	2.9E-01	c	8.4E-04	c	1.0E-02	c	3.4E-03	c		1.3E-02	c	
1.2E+01	C	1.1E-03	C							1	0.13		~Dibenzo(a,e)pyrene	192-65-4	4.2E-02	c	1.8E-01	c	2.6E-03	c	1.1E-02	c	6.5E-03	c		8.4E-02	c	
2.5E+02	C	7.1E-02	C						M	1	0.13		~Dimethylbenz(a)anthracene, 7,12-	57-97-6	4.6E-04	c	8.4E-03	c	1.4E-05	c	1.7E-04	c	1.0E-04	c		9.9E-05	c	
				4.0E-02	I					1	0.13		~Fluoranthene	206-44-0	2.4E+03	n	3.0E+04	n					8.0E+02	n		8.9E+01	n	
				4.0E-02	I			V		1	0.13		~Fluorene	86-73-7	2.4E+03	n	3.0E+04	n					2.9E+02	n		5.4E+00	n	
7.3E-01	E	1.1E-04	C						M	1	0.13		~Indeno[1,2,3-cd]pyrene	193-39-5	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	3.4E-02	c		1.3E-01	c	
2.9E-02	P			7.0E-02	A			V		1	0.13	3.9E+02	~Methylnaphthalene, 1-	90-12-0	1.8E+01	c	7.3E+01	c					1.1E+00	c		6.0E-03	c	
				4.0E-03	I			V		1	0.13		~Methylnaphthalene, 2-	91-57-6	2.4E+02	n	3.0E+03	n					3.6E+01	n		1.9E-01	n	
		3.4E-05	C	2.0E-02	I	3.0E-03	I	V		1	0.13		~Naphthalene	91-20-3	3.8E+00	c*	1.7E+01	c*	8.3E-02	c*	3.6E-01	c*	1.7E-01	c*		5.4E-04	c*	
1.2E+00	C	1.1E-04	C							1	0.13		~Nitropyrene, 4-	57835-92-4	4.2E-01	c	1.8E+00	c	2.6E-02	c	1.1E-01	c	1.9E-02	c		3.3E-03	c	
				3.0E-02	I			V		1	0.13		~Pyrene	129-00-0	1.8E+03	n	2.3E+04	n					1.2E+02	n		1.3E+01	n	
				2.0E-02	P					1	0.1		Potassium Perfluorobutane Sulfonate	29420-49-3	1.3E+03	n	1.6E+04	n					4.0E+02	n			n	
1.5E-01	I			9.0E-03	I					1	0.1		Prochloraz	67747-09-5	3.6E+00	c	1.5E+01	c					3.8E-01	c		1.9E-03	c	
				6.0E-03	H			V		1			Profluralin	26399-36-0	4.7E+02	n	7.0E+03	n					2.6E+01	n		1.6E+00	n	
				1.5E-02	I					1	0.1		Prometon	1610-18-0	9.5E+02	n	1.2E+04	n					2.5E+02	n		1.2E-01	n	
				4.0E-03	I					1	0.1		Prometryn	7287-19-6	2.5E+02	n	3.3E+03	n					6.0E+01	n		9.0E-02	n	
				1.3E-02	I					1	0.1		Propachlor	1918-16-7	8.2E+02	n	1.1E+04	n					2.5E+02	n		1.5E-01	n	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information																	Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				4.0E-03	I					1	0.1		Propanediol, 1,2-	114-26-1	2.5E+02	n	3.3E+03	n					7.8E+01	n		2.5E-02	n	
				5.0E-03	I					1	0.1		Propanil	709-98-8	3.2E+02	n	4.1E+03	n					8.2E+01	n		4.5E-02	n	
				2.0E-02	I					1	0.1		Propargite	2312-35-8	1.3E+03	n	1.6E+04	n					1.6E+02	n		1.2E+01	n	
				2.0E-03	I			V		1		1.1E+05	Propargyl Alcohol	107-19-7	1.6E+02	n	2.3E+03	n					4.0E+01	n		8.1E-03	n	
				2.0E-02	I					1	0.1		Propazine	139-40-2	1.3E+03	n	1.6E+04	n					3.4E+02	n		3.0E-01	n	
				2.0E-02	I					1	0.1		Propham	122-42-9	1.3E+03	n	1.6E+04	n					3.5E+02	n		2.2E-01	n	
				1.3E-02	I					1	0.1		Propiconazole	60207-90-1	8.2E+02	n	1.1E+04	n					2.1E+02	n		6.9E-01	n	
						8.0E-03	I	V		1		3.3E+04	Propionaldehyde	123-38-6	7.5E+01	n	3.1E+02	n	8.3E+00	n	3.5E+01	n	1.7E+01	n		3.4E-03	n	
				1.0E-01	X	1.0E+00	X	V		1		2.6E+02	Propyl benzene	103-65-1	3.8E+03	ns	2.4E+04	ns	1.0E+03	n	4.4E+03	n	6.6E+02	n		1.2E+00	n	
						3.0E+00	C	V		1		3.5E+02	Propylene	115-07-1	2.2E+03	ns	9.3E+03	ns	3.1E+03	n	1.3E+04	n	6.3E+03	n		6.0E+00	n	
				2.0E+01	P					1	0.1		Propylene Glycol	57-55-6	1.3E+06	nm	1.6E+07	nm					4.0E+05	n		8.1E+01	n	
						2.7E-04	A			1	0.1		Propylene Glycol Dinitrate	6423-43-4	3.9E+05	nm	1.6E+06	nm	2.8E-01	n	1.2E+00	n						
				7.0E-01	H	2.0E+00	I	V		1		1.1E+05	Propylene Glycol Monomethyl Ether	107-98-2	4.1E+04	n	3.7E+05	nms	2.1E+03	n	8.8E+03	n	3.2E+03	n		6.5E-01	n	
2.4E-01	I	3.7E-06	I			3.0E-02	I	V		1		7.8E+04	Propylene Oxide	75-56-9	2.1E+00	c	9.7E+00	c	7.6E-01	c*	3.3E+00	c*	2.7E-01	c		5.6E-05	c	
				7.5E-02	I					1	0.1		Propyzamide	23950-58-5	4.7E+03	n	6.2E+04	n					1.2E+03	n		1.2E+00	n	
				1.0E-03	I			V		1		5.3E+05	Pyridine	110-86-1	7.8E+01	n	1.2E+03	n					2.0E+01	n		6.8E-03	n	
				5.0E-04	I					1	0.1		Quinalphos	13593-03-8	3.2E+01	n	4.1E+02	n					5.1E+00	n		4.3E-02	n	
3.0E+00	I									1	0.1		Quinoline	91-22-5	1.8E-01	c	7.7E-01	c					2.4E-02	c		7.8E-05	c	
				9.0E-03	I					1	0.1		Quizalofop-ethyl	76578-14-8	5.7E+02	n	7.4E+03	n					1.2E+02	n		1.9E+00	n	
						3.0E-02	A			1			Refractory Ceramic Fibers	NA	4.3E+07	nm	1.8E+08	nm	3.1E+01	n	1.3E+02	n						
				3.0E-02	I					1	0.1		Resmethrin	10453-86-8	1.9E+03	n	2.5E+04	n					6.7E+01	n		4.2E+01	n	
				5.0E-02	H			V		1			Rogor	299-84-3	3.9E+03	n	5.8E+04	n					4.1E+02	n		3.7E+00	n	
				4.0E-03	I					1	0.1		Rotenone	83-79-4	2.5E+02	n	3.3E+03	n					6.1E+01	n		3.2E+01	n	
2.2E-01	C	6.3E-05	C						M	1	0.1		Safrole	94-59-7	5.5E-01	c	1.0E+01	c	1.6E-02	c	1.9E-01	c	9.6E-02	c		5.9E-05	c	
				5.0E-03	I					1			Selenious Acid	7783-00-8	3.9E+02	n	5.8E+03	n					1.0E+02	n			n	
				5.0E-03	I	2.0E-02	C			1			Selenium	7782-49-2	3.9E+02	n	5.8E+03	n	2.1E+01	n	8.8E+01	n	1.0E+02	n	5.0E+01	5.2E-01	n	2.6E-01
				5.0E-03	C	2.0E-02	C			1			Selenium Sulfide	7446-34-6	3.9E+02	n	5.8E+03	n	2.1E+01	n	8.8E+01	n	1.0E+02	n			n	
				9.0E-02	I					1	0.1		Sethoxydim	74051-80-2	5.7E+03	n	7.4E+04	n					1.0E+03	n		9.3E+00	n	
						3.0E-03	C			1			Silica (crystalline, respirable)	7631-86-9	4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n						
				5.0E-03	I					0.04			Silver	7440-22-4	3.9E+02	n	5.8E+03	n					9.4E+01	n		8.0E-01	n	
1.2E-01	H			5.0E-03	I					1	0.1		Simazine	122-34-9	4.5E+00	c*	1.9E+01	c					6.1E-01	c	4.0E+00	3.0E-04	c	2.0E-03
				1.3E-02	I					1	0.1		Sodium Acifluorfen	62476-59-9	8.2E+02	n	1.1E+04	n					2.6E+02	n		2.1E+00	n	
				4.0E-03	I					1			Sodium Azide	26628-22-8	3.1E+02	n	4.7E+03	n					8.0E+01	n			n	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Sodium Dichromate	10588-01-9	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
2.7E-01	H			3.0E-02	I					1	0.1		Sodium Diethyldithiocarbamate	148-18-5	2.0E+00	c	8.5E+00	c					2.9E-01	c			c	
				5.0E-02	A	1.3E-02	C			1			Sodium Fluoride	7681-49-4	3.9E+03	n	5.8E+04	n	1.4E+01	n	5.7E+01	n	1.0E+03	n			n	
				2.0E-05	I					1	0.1		Sodium Fluoroacetate	62-74-8	1.3E+00	n	1.6E+01	n					4.0E-01	n		8.1E-05	n	
				1.0E-03	H					1			Sodium Metavanadate	13718-26-8	7.8E+01	n	1.2E+03	n					2.0E+01	n			n	
				8.0E-04	P					1			Sodium Tungstate	13472-45-2	6.3E+01	n	9.3E+02	n					1.6E+01	n			n	
				8.0E-04	P					1			Sodium Tungstate Dihydrate	10213-10-2	6.3E+01	n	9.3E+02	n					1.6E+01	n			n	
2.4E-02	H			3.0E-02	I					1	0.1		Stirofos (Tetrachlorovinphos)	961-11-5	2.3E+01	c*	9.6E+01	c					2.8E+00	c		8.2E-03	c	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Strontium Chromate	7789-06-2	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
				6.0E-01	I					1			Strontium, Stable	7440-24-6	4.7E+04	n	7.0E+05	nm					1.2E+04	n		4.2E+02	n	
				3.0E-04	I					1	0.1		Strychnine	57-24-9	1.9E+01	n	2.5E+02	n					5.9E+00	n		6.5E-02	n	
				2.0E-01	I	1.0E+00	I	V		1		8.7E+02	Styrene	100-42-5	6.0E+03	ns	3.5E+04	ns	1.0E+03	n	4.4E+03	n	1.2E+03	n	1.0E+02	1.3E+00	n	1.1E-01
				3.0E-03	P					1	0.1		Styrene-Acrylonitrile (SAN) Trimer	NA	1.9E+02	n	2.5E+03	n					4.8E+01	n			n	
				1.0E-03	P	2.0E-03	X			1	0.1		Sulfolane	126-33-0	6.3E+01	n	8.2E+02	n	2.1E+00	n	8.8E+00	n	2.0E+01	n		4.4E-03	n	
				8.0E-04	P					1	0.1		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9	5.1E+01	n	6.6E+02	n					1.1E+01	n		6.5E-02	n	
						1.0E-03	C	V		1			Sulfur Trioxide	7446-11-9	1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n	2.1E+00	n			n	
						1.0E-03	C			1			Sulfuric Acid	7664-93-9	1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n						
2.5E-02	I	7.1E-06	I	5.0E-02	H					1	0.1		Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8	2.2E+01	c	9.2E+01	c	4.0E-01	c	1.7E+00	c	1.3E+00	c		1.5E-02	c	
				3.0E-02	H					1	0.1		TCMTB	21564-17-0	1.9E+03	n	2.5E+04	n					4.8E+02	n		3.3E+00	n	
				7.0E-02	I					1	0.1		Tebuthiuron	34014-18-1	4.4E+03	n	5.7E+04	n					1.4E+03	n		3.9E-01	n	
				2.0E-02	H					1	0.1		Temephos	3383-96-8	1.3E+03	n	1.6E+04	n					4.0E+02	n		7.6E+01	n	
				1.3E-02	I					1	0.1		Terbacil	5902-51-2	8.2E+02	n	1.1E+04	n					2.5E+02	n		7.5E-02	n	
				2.5E-05	H			V		1		3.1E+01	Terbufos	13071-79-9	2.0E+00	n	2.9E+01	n					2.4E-01	n		5.2E-04	n	
				1.0E-03	I					1	0.1		Terbutryn	886-50-0	6.3E+01	n	8.2E+02	n					1.3E+01	n		1.9E-02	n	
				1.0E-04	I					1	0.1		Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1	6.3E+00	n	8.2E+01	n					2.0E+00	n		5.3E-02	n	
				3.0E-04	I			V		1			Tetrachlorobenzene, 1,2,4,5-	95-94-3	2.3E+01	n	3.5E+02	n					1.7E+00	n		7.9E-03	n	
2.6E-02	I	7.4E-06	I	3.0E-02	I			V		1		6.8E+02	Tetrachloroethane, 1,1,1,2-	630-20-6	2.0E+00	c	8.8E+00	c	3.8E-01	c	1.7E+00	c	5.7E-01	c		2.2E-04	c	
2.0E-01	I	5.8E-05	C	2.0E-02	I			V		1		1.9E+03	Tetrachloroethane, 1,1,2,2-	79-34-5	6.0E-01	c	2.7E+00	c	4.8E-02	c	2.1E-01	c	7.6E-02	c		3.0E-05	c	
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V		1		1.7E+02	Tetrachloroethylene	127-18-4	2.4E+01	c**	1.0E+02	c**	1.1E+01	c**	4.7E+01	c**	1.1E+01	c**	5.0E+00	5.1E-03	c**	2.3E-03
				3.0E-02	I					1	0.1		Tetrachlorophenol, 2,3,4,6-	58-90-2	1.9E+03	n	2.5E+04	n					2.4E+02	n		1.5E+00	n	
2.0E+01	H							V		1			Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	3.5E-02	c	1.6E-01	c					1.3E-03	c		4.5E-06	c	
				5.0E-04	I					1	0.1		Tetraethyl Dithiopyrophosphate	3689-24-5	3.2E+01	n	4.1E+02	n					7.1E+00	n		5.2E-03	n	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information														Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
						8.0E+01	I	V		1		2.1E+03	Tetrafluoroethane, 1,1,1,2-	811-97-2	1.0E+05	nms	4.3E+05	nms	8.3E+04	n	3.5E+05	n	1.7E+05	n		9.3E+01	n	
				2.0E-03	P					1	0.0007		Tetryl (Trinitrophenylmethylnitramine)	479-45-8	1.6E+02	n	2.3E+03	n					3.9E+01	n		3.7E-01	n	
				7.0E-06	X					1			Thallium (I) Nitrate	10102-45-1	5.5E-01	n	8.2E+00	n					1.4E-01	n			n	
				1.0E-05	X					1			Thallium (Soluble Salts)	7440-28-0	7.8E-01	n	1.2E+01	n					2.0E-01	n	2.0E+00	1.4E-02	n	1.4E-01
				6.0E-06	X			V		1			Thallium Acetate	563-68-8	4.7E-01	n	7.0E+00	n					1.2E-01	n			n	
				2.0E-05	X			V		1			Thallium Carbonate	6533-73-9	1.6E+00	n	2.3E+01	n					4.0E-01	n			n	
				6.0E-06	X					1			Thallium Chloride	7791-12-0	4.7E-01	n	7.0E+00	n					1.2E-01	n			n	
				2.0E-05	X					1			Thallium Sulfate	7446-18-6	1.6E+00	n	2.3E+01	n					4.0E-01	n			n	
				1.3E-02	I					1	0.1		Thifensulfuron-methyl	79277-27-3	8.2E+02	n	1.1E+04	n					2.6E+02	n		7.8E-02	n	
				1.0E-02	I					1	0.1		Thiobencarb	28249-77-6	6.3E+02	n	8.2E+03	n					1.6E+02	n		5.5E-01	n	
				7.0E-02	X					1	0.0075		Thiodiglycol	111-48-8	5.4E+03	n	7.9E+04	n					1.4E+03	n		2.8E-01	n	
				3.0E-04	H					1	0.1		Thiofanox	39196-18-4	1.9E+01	n	2.5E+02	n					5.3E+00	n		1.8E-03	n	
				8.0E-02	I					1	0.1		Thiophanate, Methyl	23564-05-8	5.1E+03	n	6.6E+04	n					1.6E+03	n		1.4E+00	n	
				5.0E-03	I					1	0.1		Thiram	137-26-8	3.2E+02	n	4.1E+03	n					9.8E+01	n		1.4E-01	n	
				6.0E-01	H					1			Tin	7440-31-5	4.7E+04	n	7.0E+05	nm					1.2E+04	n		3.0E+03	n	
						1.0E-04	A	V		1			Titanium Tetrachloride	7550-45-0	1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n	2.1E-01	n			n	
				8.0E-02	I	5.0E+00	I	V		1		8.2E+02	Toluene	108-88-3	4.9E+03	ns	4.7E+04	ns	5.2E+03	n	2.2E+04	n	1.1E+03	n	1.0E+03	7.6E-01	n	6.9E-01
1.8E-01	X			2.0E-04	X					1	0.1		Toluene-2,5-diamine	95-70-5	3.0E+00	c**	1.3E+01	c*					4.3E-01	c**		1.3E-04	c**	
3.0E-02	P			4.0E-03	X					1	0.1		Toluidine, p-	106-49-0	1.8E+01	c*	7.7E+01	c*					2.5E+00	c*		1.1E-03	c*	
				3.0E+00	P			V		1		3.4E-01	Total Petroleum Hydrocarbons (Aliphatic High)	NA	2.3E+05	nms	3.5E+06	nms					6.0E+04	n		2.4E+03	n	
						6.0E-01	P	V		1		1.4E+02	Total Petroleum Hydrocarbons (Aliphatic Low)	NA	5.2E+02	ns	2.2E+03	ns	6.3E+02	n	2.6E+03	n	1.3E+03	n		8.8E+00	n	
				1.0E-02	X	1.0E-01	P	V		1		6.9E+00	Total Petroleum Hydrocarbons (Aliphatic Medium)	NA	9.6E+01	ns	4.4E+02	ns	1.0E+02	n	4.4E+02	n	1.0E+02	n		1.5E+00	n	
				4.0E-02	P					1	0.1		Total Petroleum Hydrocarbons (Aromatic High)	NA	2.5E+03	n	3.3E+04	n					8.0E+02	n		8.9E+01	n	
				4.0E-03	P	3.0E-02	P	V		1		1.8E+03	Total Petroleum Hydrocarbons (Aromatic Low)	NA	8.2E+01	n	4.2E+02	n	3.1E+01	n	1.3E+02	n	3.3E+01	n		1.7E-02	n	
				4.0E-03	P	3.0E-03	P	V		1			Total Petroleum Hydrocarbons (Aromatic Medium)	NA	1.1E+02	n	6.0E+02	n	3.1E+00	n	1.3E+01	n	5.5E+00	n		2.3E-02	n	
1.1E+00	I	3.2E-04	I							1	0.1		Toxaphene	8001-35-2	4.9E-01	c	2.1E+00	c	8.8E-03	c	3.8E-02	c	7.1E-02	c	3.0E+00	1.1E-02	c	4.6E-01
				7.5E-03	I					1	0.1		Tralomethrin	66841-25-6	4.7E+02	n	6.2E+03	n					1.5E+02	n		5.8E+01	n	
				3.0E-04	A			V		1			Tri-n-butyltin	688-73-3	2.3E+01	n	3.5E+02	n					3.7E+00	n		8.2E-02	n	
				8.0E+01	X					1	0.1		Triacetin	102-76-1	5.1E+06	nm	6.6E+07	nm					1.6E+06	n		4.5E+02	n	
				3.0E-02	I					1	0.1		Triadimefon	43121-43-3	1.9E+03	n	2.5E+04	n					5.5E+02	n		4.4E-01	n	
				1.3E-02	I			V		1			Triallate	2303-17-5	1.0E+03	n	1.5E+04	n					1.2E+02	n		2.6E-01	n	
				1.0E-02	I					1	0.1		Triasulfuron	82097-50-5	6.3E+02	n	8.2E+03	n					2.0E+02	n		2.1E-01	n	
				8.0E-03	I					1	0.1		Tribenuron-methyl	101200-48-0	5.1E+02	n	6.6E+03	n					1.6E+02	n		6.1E-02	n	
				5.0E-03	I			V		1			Tribromobenzene, 1,2,4-	615-54-3	3.9E+02	n	5.8E+03	n					4.5E+01	n		6.4E-02	n	
9.0E-03	P			1.0E-02	P					1	0.1		Tributyl Phosphate	126-73-8	6.0E+01	c*	2.6E+02	c*					5.2E+00	c*		2.5E-02	c*	
				3.0E-04	P					1	0.1		Tributyltin Compounds	NA	1.9E+01	n	2.5E+02	n					6.0E+00	n			n	
				3.0E-04	I					1	0.1		Tributyltin Oxide	56-35-9	1.9E+01	n	2.5E+02	n					5.7E+00	n		2.9E+02	n	
				3.0E+01	I	3.0E+01	H	V		1		9.1E+02	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1	4.0E+04	ns	1.7E+05	nms	3.1E+04	n	1.3E+05	n	5.5E+04	n		1.4E+02	n	
7.0E-02	I			2.0E-02	I					1	0.1		Trichloroacetic Acid	76-03-9	7.8E+00	c	3.3E+01	c					1.1E+00	c	6.0E+01	2.2E-04	c	1.2E-02
2.9E-02	H									1	0.1		Trichloroaniline HCl, 2,4,6-	33663-50-2	1.9E+01	c	7.9E+01	c					2.7E+00	c		7.4E-03	c	
7.0E-03	X			3.0E-05	X					1	0.1		Trichloroaniline, 2,4,6-	634-93-5	1.9E+00	n	2.5E+01	n					4.0E-01	n		3.6E-03	n	
				8.0E-04	X			V		1			Trichlorobenzene, 1,2,3-	87-61-6	6.3E+01	n	9.3E+02	n					7.0E+00	n		2.1E-02	n	
2.9E-02	P			1.0E-02	I	2.0E-03	P	V		1		4.0E+02	Trichlorobenzene, 1,2,4-	120-82-1	2.4E+01	c**	1.1E+02	c**	2.1E+00	n	8.8E+00	n	1.2E+00	c**	7.0E+01	3.4E-03	c**	2.0E-01
				2.0E+00	I	5.0E+00	I	V		1		6.4E+02	Trichloroethane, 1,1,1-	71-55-6	8.1E+03	ns	3.6E+04	ns	5.2E+03	n	2.2E+04	n	8.0E+03	n	2.0E+02	2.8E+00	n	7.0E-02
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V		1		2.2E+03	Trichloroethane, 1,1,2-	79-00-5	1.1E+00	c**	5.0E+00	c**	1.8E-01	c**	7.7E-01	c**	2.8E-01	c**	5.0E+00	8.9E-05	c**	1.6E-03
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	M	1		6.9E+02	Trichloroethylene	79-01-6	9.4E-01	c**	6.0E+00	c**	4.8E-01	c**	3.0E+00	c**	4.9E-01	c**	5.0E+00	1.8E-04	c**	1.8E-03
				3.0E-01	I			V		1		1.2E+03	Trichlorofluoromethane	75-69-4	2.3E+04	ns	3.5E+05	nms					5.2E+03	n		3.3E+00	n	
				1.0E-01	I					1	0.1		Trichlorophenol, 2,4,5-	95-95-4	6.3E+03	n	8.2E+04	n					1.2E+03	n		4.4E+00	n	
1.1E-02	I	3.1E-06	I	1.0E-03	P					1	0.1		Trichlorophenol, 2,4,6-	88-06-2	4.9E+01	c**	2.1E+02	c**	9.1E-01	c	4.0E+00	c	4.1E+00	c**		1.5E-02	c**	
				1.0E-02	I					1	0.1		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5	6.3E+02	n	8.2E+03	n					1.6E+02	n		6.8E-02	n	
				8.0E-03	I					1	0.1		Trichlorophenoxypropionic acid, -2,4,5	93-72-1	5.1E+02	n	6.6E+03	n					1.1E+02	n	5.0E+01	6.1E-02	n	2.8E-02
				5.0E-03	I			V		1		1.3E+03	Trichloropropane, 1,1,2-	598-77-6	3.9E+02	n	5.8E+03	ns					8.8E+01	n		3.5E-02	n	
3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1		1.4E+03	Trichloropropane, 1,2,3-	96-18-4	5.1E-03	c	1.1E-01	c	3.1E-01	n	1.3E+00	n	7.5E-04	c		3.2E-07	c	
				3.0E-03	X	3.0E-04	P	V		1		3.1E+02	Trichloropropene, 1,2,3-	96-19-5	7.3E-01	n	3.1E+00	n	3.1E-01	n	1.3E+00	n	6.2E-01	n		3.1E-04	n	
				2.0E-02	A					1	0.1		Tricresyl Phosphate (TCP)	1330-78-5	1.3E+03	n	1.6E+04	n					1.6E+02	n		1.5E+01	n	
				3.0E-03	I					1	0.1		Tridiphane	58138-08-2	1.9E+02	n	2.5E+03	n					1.8E+01	n		1.3E-01	n	
						7.0E-03	I	V		1		2.8E+04	Triethylamine	121-44-8	1.2E+02	n	4.8E+02	n	7.3E+00	n	3.1E+01	n	1.5E+01	n		4.4E-03	n	
				2.0E+00	P					1	0.1		Triethylene Glycol	112-27-6	1.3E+05	nm	1.6E+06	nm					4.0E+04	n		8.8E+00	n	
						2.0E+01	P	V		1		4.8E+03	Trifluoroethane, 1,1,1-	420-46-2	1.5E+04	ns	6.2E+04	ns	2.1E+04	n	8.8E+04	n	4.2E+04	n		1.3E+02	n	
7.7E-03	I			7.5E-03	I			V		1			Trifluralin	1582-09-8	9.0E+01	c**	4.2E+02	c*					2.6E+00	c*		8.4E-02	c*	
2.0E-02	P			1.0E-02	P					1	0.1		Trimethyl Phosphate	512-56-1	2.7E+01	c*	1.1E+02	c*					3.9E+00	c*		8.6E-04	c*	
						5.0E-03	P	V		1		2.9E+02	Trimethylbenzene, 1,2,3-	526-73-8	4.9E+01	n	2.1E+02	n	5.2E+00	n	2.2E+01	n	1.0E+01	n		1.5E-02	n	
						7.0E-03	P	V		1		2.2E+02	Trimethylbenzene, 1,2,4-	95-63-6	5.8E+01	n	2.4E+02	ns	7.3E+00	n	3.1E+01	n	1.5E+01	n		2.1E-02	n	
				1.0E-02	X			V		1		1.8E+02	Trimethylbenzene, 1,3,5-	108-67-8	7.8E+02	ns	1.2E+04	ns					1.2E+02	n		1.7E-01	n	
				1.0E-02	X			V		1		3.0E+01	Trimethylpentene, 2,4,4-	25167-70-8	7.8E+02	ns	1.2E+04	ns					6.5E+01	n		2.2E-01	n	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels													Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				3.0E-02	I					1	0.019		Trinitrobenzene, 1,3,5-	99-35-4	2.2E+03	n	3.2E+04	n					5.9E+02	n		2.1E+00	n	
3.0E-02	I			5.0E-04	I					1	0.032		Trinitrotoluene, 2,4,6-	118-96-7	2.1E+01	c**	9.6E+01	c**					2.5E+00	c**		1.5E-02	c**	
				2.0E-02	P					1	0.1		Triphenylphosphine Oxide	791-28-6	1.3E+03	n	1.6E+04	n					3.6E+02	n		1.5E+00	n	
				2.0E-02	A					1	0.1		Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8	1.3E+03	n	1.6E+04	n					3.6E+02	n		8.0E+00	n	
				1.0E-02	X					1	0.1		Tris(1-chloro-2-propyl)phosphate	13674-84-5	6.3E+02	n	8.2E+03	n					1.9E+02	n		6.5E-01	n	
2.3E+00	C	6.6E-04	C					V		1		4.7E+02	Tris(2,3-dibromopropyl)phosphate	126-72-7	2.8E-01	c	1.3E+00	c	4.3E-03	c	1.9E-02	c	6.8E-03	c		1.3E-04	c	
2.0E-02	P			7.0E-03	P					1	0.1		Tris(2-chloroethyl)phosphate	115-96-8	2.7E+01	c*	1.1E+02	c*					3.8E+00	c*		3.8E-03	c*	
3.2E-03	P			1.0E-01	P					1	0.1		Tris(2-ethylhexyl)phosphate	78-42-2	1.7E+02	c*	7.2E+02	c					2.4E+01	c*		1.2E+02	c*	
				8.0E-04	P					1			Tungsten	7440-33-7	6.3E+01	n	9.3E+02	n					1.6E+01	n		2.4E+00	n	
				3.0E-03	I	4.0E-05	A			1			Uranium (Soluble Salts)	NA	2.3E+02	n	3.5E+03	n	4.2E-02	n	1.8E-01	n	6.0E+01	n	3.0E+01	2.7E+01	n	1.4E+01
1.0E+00	C	2.9E-04	C						M	1	0.1		Urethane	51-79-6	1.2E-01	c	2.3E+00	c	3.5E-03	c	4.2E-02	c	2.5E-02	c		5.6E-06	c	
		8.3E-03	P	9.0E-03	I	7.0E-06	P			0.026			Vanadium Pentoxide	1314-62-1	4.6E+02	c**	2.0E+03	c**	3.4E-04	c*	1.5E-03	c*	1.5E+02	n			n	
				5.0E-03	S	1.0E-04	A			0.026			Vanadium and Compounds	7440-62-2	3.9E+02	n	5.8E+03	n	1.0E-01	n	4.4E-01	n	8.6E+01	n		8.6E+01	n	
				1.0E-03	I			V		1			Vernolate	1929-77-7	7.8E+01	n	1.2E+03	n					1.1E+01	n		8.9E-03	n	
				2.5E-02	I					1	0.1		Vinclozolin	50471-44-8	1.6E+03	n	2.1E+04	n					4.4E+02	n		3.4E-01	n	
				1.0E+00	H	2.0E-01	I	V		1		2.8E+03	Vinyl Acetate	108-05-4	9.1E+02	n	3.8E+03	ns	2.1E+02	n	8.8E+02	n	4.1E+02	n		8.7E-02	n	
		3.2E-05	H			3.0E-03	I	V		1		2.5E+03	Vinyl Bromide	593-60-2	1.2E-01	c*	5.2E-01	c*	8.8E-02	c*	3.8E-01	c*	1.8E-01	c*		5.1E-05	c*	
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1		3.9E+03	Vinyl Chloride	75-01-4	5.9E-02	c	1.7E+00	c	1.7E-01	c	2.8E+00	c	1.9E-02	c	2.0E+00	6.5E-06	c	6.9E-04
				3.0E-04	I					1	0.1		Warfarin	81-81-2	1.9E+01	n	2.5E+02	n					5.6E+00	n		5.9E-03	n	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, P-	106-42-3	5.6E+02	ns	2.4E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	n	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, m-	108-38-3	5.5E+02	ns	2.4E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	n	
				2.0E-01	S	1.0E-01	S	V		1		4.3E+02	Xylene, o-	95-47-6	6.5E+02	ns	2.8E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	n	
				2.0E-01	I	1.0E-01	I	V		1		2.6E+02	Xylenes	1330-20-7	5.8E+02	ns	2.5E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n	1.0E+04	1.9E-01	n	9.9E+00
				3.0E-04	I					1			Zinc Phosphide	1314-84-7	2.3E+01	n	3.5E+02	n					6.0E+00	n			n	
				3.0E-01	I					1			Zinc and Compounds	7440-66-6	2.3E+04	n	3.5E+05	nm					6.0E+03	n		3.7E+02	n	
				5.0E-02	I					1	0.1		Zineb	12122-67-7	3.2E+03	n	4.1E+04	n					9.9E+02	n		2.9E+00	n	
				8.0E-05	X					1			Zirconium	7440-67-7	6.3E+00	n	9.3E+01	n					1.6E+00	n		4.8E+00	n	

ATTACHMENT 2

EPA REGION 4 ECOLOGICAL RISK ASSESSMENT BULLETINS – SUPPLEMENT TO RAGS, 2015

(80 Sheets)

EPA
United States
Environmental Protection
Agency

Scientific Support Section
Superfund Division
EPA Region 4

Region 4 Ecological Risk Assessment Supplemental Guidance Interim Draft

EPA 2015.
Supplemental Guidance to ERAGS: Region 4, Ecological Risk Assessment.
Originally published November 1995

Contents

Contents (continued)

Tables

Acronyms and Abbreviations

ΣTU	Sum Toxic Unit
ACR	acute to chronic ratio
ARAR	applicable or relevant and appropriate requirement
BAF	bioaccumulation factor
BERA	baseline ecological risk assessment
BLM	Biotic Ligand Model
BSV	background screening value
$CaCO_3$	calcium carbonate
CCC	Criteria Continuous Concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	conversion factor
CLP	Contract Laboratory Program
cm^3	cubic centimeter
CMC	Criteria Maximum Concentration
COPCs	chemicals of potential concern
COPEC	chemicals of potential ecological concern
CS	Confirmation Sampling
CSM	conceptual site model
CTLBB	critical lipid body burden
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethylene
DoD	Department of Defense
DOI	U.S. Department of Interior
DQO	Data Quality Objective
dw	dry weight
EBS	Environmental Baseline Survey
EcoSSL	Ecological Soil Screening Value
ECOSAR	Ecological Structure Activity Relationships
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EPI	Estimation Program Interface
EqP	equilibrium partitioning

Acronyms and Abbreviations (continued)

ERA	Ecological Risk Assessment
ERAGS	Ecological Risk Assessment Guidance for Superfund
ER-L	effects range-low
ER-M	effects range-median
ESI	Expanded Site Investigation
ESV	ecological screening value
ETAG	Region 4 Ecological and Technical Advisory Group
FDEP	Florida Department of Environmental Protection
FWS	Fish and Wildlife Service
g/cm^3	grams per cubic centimeter
GERA	Guidelines for Ecological Risk Assessment
GLI	Great Lakes Initiative
HMW-PAH	high molecular weight polycyclic aromatic hydrocarbon
HQ	hazard quotient
Kow	partition coefficient
LANL	Los Alamos National Laboratory
LMW-PAH	low molecular weight polycyclic aromatic hydrocarbon
LOAEL	Lowest Observed Adverse Effect Level
L/kg	liters per kilogram
mg/kg	milligrams per kilogram
mg/kg/day	milligrams per kilogram per day
mg/L	milligrams per liter
mmol/L	millimoles per liter
µmol/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effect Level
NPL	National Priorities List
NWQC	National Water Quality Criteria
OC	organic carbon
ORNL	Oak Ridge National Laboratory
OSWER	Office of Solid Waste and Emergency Response

Acronyms and Abbreviations (continued)

PA/SI	Preliminary Assessment/Site Inspection
PBT	persistent, bioaccumulative and toxic
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCOPC	preliminary chemical of potential concern
PEC	probable effect concentration
PEL	probable effect level
pH	hydrogen ion concentration
PRGs	preliminary remedial goals
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act of 1976
RFA	Resource Conservation and Recovery Act Facility Assessment
RFI	Resource Conservation and Recovery Act facility investigation
RI	remedial investigation
RPM	remedial project manager
ROD	Record of Decision
RSV	refinement screening value
SAP	Sampling and Analysis Plan
SI	site investigation
SLERA	Screening-Level Ecological Risk Assessment
SMDP	scientific/management decision point
SSS	Scientific Support Section
SVOC	semi-volatile organic compound
TEC	threshold effect concentration
TEL	threshold effect level
TLM	target lipid model
TRV	toxicity reference value
UCL	upper confidence limit
VOC	volatile organic compound
WQB	water quality benchmark

1.0 Overview

1.1 Introduction and Purpose

The role of an Ecological Risk Assessment (ERA) is to: (1) determine whether unacceptable risks are posed to ecological receptors from chemical stressors, (2) derive chemical levels that would not pose unacceptable risks, and (3) provide the information necessary to make a risk management decision concerning the practical need and extent of remedial action.

The purpose of this supplemental guidance is to provide regional direction for implementation of the U.S. Environmental Protection Agency (EPA) *Ecological Risk Assessment Guidance for Superfund* (ERAGS; EPA, 1997). This guidance is appropriate for Superfund sites under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and regulated by the Office of Solid Waste and Emergency Response (OSWER). The Guidelines for Ecological Risk Assessment (GERA; EPA, 1998) published by the Risk Assessment Forum provide agency-wide guidance. This supplemental guidance clarifies the National ERAGS guidance as appropriate at both Resource Conservation and Recovery Act (RCRA) and Superfund sites.

The ERA process as outlined in ERAGS consists of eight steps and five scientific/management decision points (SMDPs). These steps are:

1) Screening-level Problem Formulation and Ecological Effects Evaluation,
2) Screening-level Exposure Estimate and Risk Calculation
3) Baseline Problem Formulation,
4) Study Design and Data Quality Objectives (DQO) Process,
5) Field Verification of Sampling Design,
6) Site Investigation and Data Analysis,
7) Risk Characterization, and
8) Risk Management.

The decision points follow Steps 2 - 5, and 8. The decision points provide an opportunity to reach agreement between the risk manager for the site (e.g. the remedial project manager [RPM]), the risk assessment review team and any other stakeholders in the process. Exhibit I-2 from ERAGS provides a flow chart for the process.

ERAGS and this supplemental guidance provide a logical approach for evaluating ecological risks and documenting ecological concerns for remedial decision making. Project managers are guided in balancing the scope of the risk assessment against the hazards posed by the site conditions. Interaction among risk managers, risk assessors, and appropriate stakeholders is vital to all stages of the process. This guidance also promotes flexibility on a case-by-case basis regarding completion of an ERA with appropriate expenditure of effort and resources.

Additional resources may be found on the EPA's Waste and Cleanup Risk Assessment website, particularly in the ECO Update Bulletin Series issued by OSWER. This supplemental guidance contains a focused discussion of elements and topics related to CERCLA and RCRA ERAs. The guidance and direction contained in this supplemental guidance can be somewhat broad; therefore approval of specific ERA approaches that may depart from this guidance should be obtained from the EPA Region 4 Scientific Support Section (SSS).

The EPA Region 4 Supplemental Guidance is a dynamic document. Sections will be updated and new ones added as questions are posed and regional practices are developed. This guidance does not constitute rulemaking by the Agency, and may not be relied on to create a substantive or procedural right enforceable by any other person. Region 4 reserves the right to take action that is at variance with this guidance. The intent of this guidance is to aid in the development of high-quality, single draft risk assessments consistent with the criteria of the SSS in its oversight role.

1.2 Coordination with Stakeholders

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires the lead agency to seek to coordinate investigations with stakeholders. Stakeholders in the ERA process include state and federal regulatory and scientific personnel, and natural resource trustees. These stakeholders should be notified early in the ERA process if ecological concerns exist at a site. The public is also a stakeholder, and members of the public should be included in the decision process during those times normally arranged for public input, such as the public comment period of the CERCLA proposed plan or the RCRA statement of basis.

Natural resource trustees are representatives of federal agencies, state and/or tribes that share responsibility with the EPA in protecting the natural resources of the United States,

including “land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources.” Trustees may include representatives of other federal agencies such as the Department of Interior (DOI), Department of Defense (DoD), the National Oceanic and Atmospheric Administration (NOAA), state and/or tribal officials designated by the governor of the state, as well as private and non-profit conservation organizations. Federal and state trustees in EPA Region 4are listed under Contacts in Section 1.3.

The failure of an identified trustee or stakeholder to participate should not delay completion of these steps. Any questions regarding the stakeholder involvement should be directed to the Region 4 SSS.

1.3 Contacts

The following table lists the NOAA coastal resource coordinators assigned to Region 4, Fish and Wildlife Service (FWS) environmental contaminants specialists for Region 4 states, and their coordinator within DOI. The table also includes contact information for the Region 4 Ecological and Technical Advisory group (ETAG) coordinator.

ADD TABLE from Glenn

2.0 Screening Level Ecological Risk Assessment

The Screening-level Ecological Risk Assessment (SLERA) represents the first two steps in the ERAGS process and is intended to allow a rapid determination by the risk assessment team and risk managers whether a waste site poses no or negligible ecological risk, or to identify which contaminants and exposure pathways require further evaluation.

SLERA activities can commence as soon as ecological concerns are identified and appropriate chemical analytical data are available for a given site. Often, limited environmental chemical data are available. Data from Preliminary Assessment/Site Inspection (PA/SI) reports in the CERCLA process, or a RCRA Facility Assessment (RFA) or Confirmation Sampling (CS) in the RCRA process or data from an Environmental Baseline Survey (EBS) can be used. The SLERA is recommended to begin upon completion of an Expanded Site Investigation (ESI) in the Superfund program or completion of a RFA in the RCRA program. If there are concerns about the potential for ecological risk at a site, ecological risk assessors can be consulted before these investigations have been performed, to obtain input that may be useful even for the initial investigations on a site.

Waiting until a remedial investigation (RI) or a RCRA Facility investigation (RFI) data are available to begin the SLERA may result in additional data collection that may be costly and potentially redundant. However, the SLERA can be iterated as new data become available. Details of how to handle phased projects should be worked out with the risk managers. Please direct any questions regarding the scope of a process and timing of an ERA or about technical issues in ERA to SSS.

2.1 Step 1: Screening-level Problem Formulation and Ecological Effects Evaluation

The screening-level problem formulation explains important environmental aspects in defining risk management decisions at the site and includes review of existing information on the following:

- Environmental setting and contaminants known or suspected at the site;
- Contaminant fate and transport mechanisms that may exist;

- The mechanisms of ecotoxicity associated with contaminants and likely affected receptors;
- Identification of complete exposure pathways;
- Selection of endpoints to screen for ecological risk; and
- A preliminary ecological effects evaluation that should include screening ecotoxicity values based on conservative thresholds such as chronic no-observed-adverse-effect-levels (NOAELs).

This information and a description of complete and potentially complete exposure pathways present at the site should be presented in a preliminary conceptual site model (CSM). Potentially complete exposure pathways refer to exposure pathways that are not currently complete but might become complete in the future. Potentially complete exposure pathways should be retained in Steps 1 and 2. Incomplete exposure pathways should also be identified and discussed.

The screening-level problem formulation can contain maps, figures, and color photographs of the site and surrounding area, if available. Completion of the Checklist for Ecological Assessment/Sampling (Appendix B – ERAGS) is highly recommended. Site visits by review personnel are strongly encouraged.

2.2 Step 2: Screening-level Preliminary Exposure Estimate and Risk Calculation

The screening-level exposure estimate and risk calculation provide a conservative risk estimate to ensure that sites with unacceptable risk will be recommended for further evaluation. The maximum concentrations of chemicals in each medium are compared to ecological screening values (ESVs) to determine preliminary chemicals of potential concern (PCOPCs). Ecological screening values are based on chemical concentrations associated with a low probability of unacceptable risks to ecological receptors. A detailed discussion of the ESV development for EPA Region 4 is provided in Section 6.

Tables 1a – 1c, 2a – 2b, and 3 list the chemical ESVs in surface water, sediment and soil, respectively. Since the ESVs are based on conservative endpoints and sensitive ecological effects data, they represent a preliminary screening of site chemical concentrations to determine if there is a need to conduct further investigations at the site. ESVs are not recommended as remediation levels.

Exceedance of the ESVs may indicate the need for further evaluation of the potential ecological risks posed by the site. To perform the screening level risk calculation, the maximum detected concentration (or if not detected, a surrogate concentration based on one-half the detection limit) of a given chemical in a medium is divided by the Region 4 ESV for that medium. The result is the Hazard Quotient (HQ). There are a minimum of four (4) categories of PCOPCs as defined by the following criteria:

1. HQ≥1. The maximum detected concentration was greater than or equal to the ESV.
2. The chemical was detected, but no ESV was available.
3. The chemical was not detected, but the surrogate concentration was greater than or equal to the ESV. (HQ≥1)
4. The chemical was not detected, and no ESV was available.

For Category 2 and Category 4 chemicals that have no available ESVs, it is possible that these chemicals could cause an adverse effect depending on the detected concentration or the adequacy of the analytical detection limit. These circumstances would be identified as uncertainties and these chemicals would be included as PCOPCs and carried forward to into Step 3a of the Baseline Problem Formulation. There should be very few PCOPCs in Categories 2 and 4 because ESVs can be generated for chemicals that are not on the screening tables, as described in Section 6 of this document.

With respect to surface water ESVs, it is recognized that States have water quality standards for aquatic life protection that may be lower than the ESVs in Table 1a. Therefore, it is highly recommended that the State standards be reviewed and incorporated into the site-specific screening tables if they are more conservative than the ESVs.

In this Step 2, local or regional background concentrations should not be used. For screening of polycyclic aromatic hydrocarbons (PAHs) in sediment (Table 2b) and soil (Table 3), the sum total of low molecular weight PAHs (LMW-PAHs) or high molecular weight PAHs (HMW-PAHs) screening values are to be used.

Tables summarizing the ecological screening for chemicals at the site should be constructed to aid project managers with decision making processes. The presence or absence of each chemical, for all media of concern, should be listed with descriptive data

such as the frequency of detection, range of detection, location(s) of maximum detection, screening criteria, and screening outcome. See the example table at the end of this subsection for screening chemicals in soil. In addition, the flowchart located at the end of this section provides an organization of the screening process used in Steps 1 through 3.

The Region 4 ESVs consider direct toxicity as well as bioaccumulative effects on organisms, and the lowest protective value is chosen as the ESV. The term "direct" toxicity refers to adverse effects associated with exposure to a chemical dissolved in or incorporated into an environmental medium through immediate contact with the medium. For screening, the exposure point concentration (EPC) for direct toxicity to sessile organisms is the maximum detected concentrations in the habitat where these organisms live or could potentially live.

In addition to direct toxicity, there are chemicals that substantially bioaccumulate into upper trophic level receptors and many of the ESVs are protective of these receptors. For example, some of the National Recommended Water Quality Criteria for pesticides such as dichlorodiphenyltrichloroethylene (DDT) and chlordane are based on bioaccumulation and wildlife exposures. DDT is based on protection of aquatic-dependent wildlife – namely the brown pelican. In addition, the more conservative mercury number of 0.012 micrograms per liter (µg/L) accounts for bioaccumulation in piscivorous birds. Other chemicals such as PAHs and polychlorinated biphenyls (PCBs) also have benchmarks protective of upper trophic receptors.

In the surface water and sediment screening tables, bioaccumulative chemicals are presented in red color. The determination of organic bioaccumulative chemicals was derived from the Persistent, Bioaccumulative, and Toxic (PBT) Profiles Estimated for Organic Chemicals http://www.pbtprofiler.net. The soil screening table includes those receptors that are protected by the benchmark value. In some cases, there are two screening values represented in Table 1a for bioaccumulative chemicals. Where this occurs, the maximum detected concentration is compared to the wildlife-based screening benchmark in addition to the direct contact benchmark.

Detected bioaccumulative chemicals that do not have a wildlife-based ESV should automatically be retained as PCOPCs in Step 2. A food-chain model can be used in Step 3a to further screen bioaccumulative chemicals using Region 4 default food-chain model assumptions and toxicity reference values (see Section 3.1.5). Non-detected

bioaccumulative chemicals that do not have a wildlife-based ESV are not retained as PCOPCs.

2.3 SLERA Uncertainties and Data Gaps

An important part of a SLERA is identifying data gaps and uncertainties. This is especially true at sites with limited data. Uncertainty may occur in the degree of site characterization or in the potential for complete exposure pathways. Identification of data gaps and questions will guide future assessment steps. It is important to distinguish what is unknown from conclusions drawn regarding screening-level risks.

2.4 SLERA Report

The format of the SLERA may depend on whether environmental monitoring data are collected in a single phase or as multiple phases. A SLERA performed as part of the site inspection can eliminate from consideration those portions of a site that pose no threat to the environment. In cases where potential threat to the environment cannot be eliminated, the SLERA becomes a part of the planning and scoping for Step 3 – Problem Formulation. While a baseline ecological risk assessment (BERA) would typically contain an extensive discussion of all of the risk elements, the degree of emphasis in the SLERA on particular elements is adjusted as necessary to support project-specific decision-making and planning. In general, the more detailed information that is presented in Step 1, the easier it will be to develop Step 3, if needed.

The SLERA should be submitted for review to the regulatory project manager as a technical memorandum or as part of a Site Investigation (SI) report or a similar level report. Review personnel may include both the EPA staff and the EPA contractors. SSS provides oversight.

Example Table Depicting Ecological Screening for Chemicals in Soils								
CHEMICAL	**Freq. of Detection**	**Range of Detection Limits**	**Range of Detected Conc.**	**Location of Maximum Detected Conc.**	**EPA Region 4 Screening Value**	**Max Hazard Quotient (HQ)**	**Freq. Exceeding ESV**	**PCOPC (Y/N) Basis**
Volatile Organic Compounds, µg/kg								
1,2-Dichlorobenzene	2/10	4.9 – 6.4	3.5 - 80	SS-06	100	0.8	0/10	No/A
1,2-Dichlrorethylene	10/10	4.8 - 9	10 - 209	SS-06	60	3.5	3/10	Yes/E
1,1,2-Trichloroethene	0/10	4.9 - 12	NA	NA	100	NA	0/10	No/C
Cyclohexane	0/10	4.9 - 12	NA	NA	NA	NA	0/10	No/B
Semi-volatile Organic Compounds, µg/kg								
2-Chlorophenol	0/10	5-20	NA	NA	10	NA	NA	Yes/D
3-Chlorophenol	0/10	5-20	NA	NA	10	NA	NA	Yes/D
Monochlorophenols (total)	0/10	5-20	NA	NA	50	NA	NA	No/C
Pentachlorobenzene	2/10	79-120	40-220	SS-03	50	4.4	1/10	Yes/E
Polycyclic Aromatic Hydrocarbons (PAHs), µg/kg								
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LMW-PAHs)								
Acenaphthene	2/10	220 - 360	24-54	SS-08	F	NA	NA	No/F
Fluorene	2/10	220 - 360	41-91	SS-08	F	NA	NA	No/F
Phenanthrene	3/10	220 - 350	23-120	SS-08	F	NA	NA	No/F
Naphthalene	1/10	220 - 360	ND-73	SS-08	F	NA	NA	No/F
Total LMW-PAHs[1]	4/10	220 - 350	70 - 265	SS-08	29,000	0.009	0/10	No/A
High Molecular Weight PAHs (HMW-PAHs), µg/kg								
Benzo(a)anthracene	4/10	220 - 360	19 - 640	SS-09	F	NA	NA	No/F
Benzo(a)pyrene	2/10	220 - 350	20 - 590	SS-09	F	NA	NA	No/F
Benzo(b)fluoranthene	2/10	220 - 360	28 - 120	SS-09	F	NA	NA	No/F
Chrysene	1/10	220 - 350	21 - 130	SS-09	F	NA	NA	No/F
Dibenz(a,h)anthracene	1/10	220 - 350	ND - 46	SS-09	F	NA	NA	No/F
Indeno(1,2,3-cd)pyrene	5/10	220 - 350	21 - 54	SS-09	F	NA	NA	No/F
Pyrene	3/10	220 - 350	26 - 300	SS-09	F	NA	NA	No/F

Example Table Depicting Ecological Screening for Chemicals in Soils								
CHEMICAL	**Freq. of Detection**	**Range of Detection Limits**	**Range of Detected Conc.**	**Location of Maximum Detected Conc.**	**EPA Region 4 Screening Value**	**Max Hazard Quotient (HQ)**	**Freq. Exceeding ESV**	**PCOPC (Y/N) Basis**
Total HMW-PAHs[2]	5/10	220 - 350	21 – 1,800	SS-09	1,100	1.6	1/10	Yes/E
Pesticides, µg/kg								
4,4'-DDD	7/10	4.9 – 5.2	2.8 - 25	SS-07	44	0.6	0/10	No/A
4,4'-DDE	6/10	4.9 – 5.2	2.4 - 49	SS-07	110	0.4	0/10	No/A
4,4'-DDT	6/10	4.9 – 5.2	2.5 - 110	SS-07	6.3	17.5	1/10	Yes/E
Total DDT	7/10	4.9 – 5.2	18.3 - 184	SS-07	21	8.8	5/10	Yes/E
Heptachlor	1/10	2.7 – 4.7	ND - 140	SS-07	59	2.4	2/10	Yes/E
Inorganic Compounds, mg/kg								
Copper	9/10	1 - 1.3	10.4 - 66	SS-07	28	2.4	3/10	Yes/E
Manganese	10/10	1 - 3	44 - 1,020	SS-06	220	4.6	6/10	Yes/E
Sodium	3/10	61.3 – 70.6	2,550	SS-06	NA	NA	NA	Yes/G
Vanadium	10/10	1 - 3	12.1 - 54	SS-07	7.8	6.9	10/10	Yes/E

Footnotes:

PCOPC = Preliminary Chemical of Potential Concern (yes/no)

1 = Total of low molecular weight PAHs includes acenaphthene, fluorene, phenanthrene, and naphthalene,

2 = Total of high molecular weight PAHs includes benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene

A = Maximum detected concentration is less than the screening value.

B = Chemical lacks a Region 4 screening value and was not detected in any sample.

C = Maximum detection limit is less than screening value for a chemical not detected in any sample.

D = Maximum detection limit exceeds screening value for a chemical not detected in any sample.

E = Maximum detected concentration exceeds screening value.

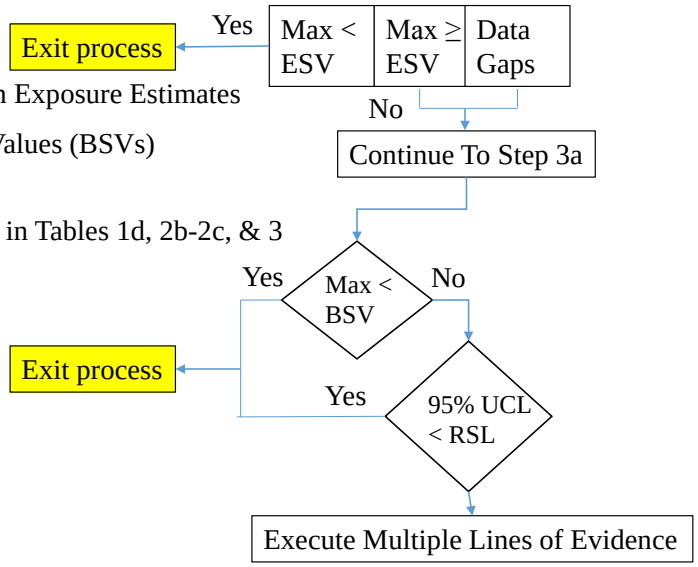
F = Chemical is a member of a class of compounds and the total concentration is screened against the screening value for the total compound in that class.

G = Chemical was detected and no Region 4 ESV was available.

Step 1: Screening-level Baseline Problem Formulation & Maximum Exposure Estimates

Step 2: Ecological Screening Values, Risk Calculation, & Scientific and Management Decision Point

- Ecological Screening Values (ESVs) in Tables 1a-1c, 2a, & 3
- Half Detection Limit for Non-detects



Step 3: Baseline Problem Formulation & Conservative Mean Exposure Estimates

- Site-specific Background Screening Values (BSVs)
- 95% UCLs
- Refinement Screening Values (RSVs) in Tables 1d, 2b-2c, & 3
- Fortify Data Gaps

Step 3a: Refinement of Preliminary Chemicals of Potential Concern & Scientific and Management Decision Point

- Multiple Lines of Evidence
  - Background Concentrations
  - Nutrients & Dietary Considerations
  - Frequency, Magnitude, & Pattern of Detection
  - Mode of Toxicity & Potential for Bioaccumulation
  - Multiple Contaminant Effect & Sum Toxic Units for Organic Chemicals in a Mixture
  - Exposure Considerations
- Step 3a Scientific & Management Decision Point
  - Chemicals of Potential Concern (COPCs)
  - Refined Exposure Pathways

Step 3b: Baseline Problem Formulation–Planning & Scoping of Risk Assessment

2.5 Scientific/Management Decision Point

Documentation of the activities in SLERA Steps 1 and 2 should be provided to all stakeholders prior to discussions associated with the SMDP.

The first SMDP occurs after Step 2. The purpose of this SMDP is to determine the best course of action for the site. There are three outcomes of the Step 2 SMDP.

1. There is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk.

   This first case covers the situation where one of three conditions are met: the site passed the screen, there are no complete or potentially complete exposure pathways to ecological receptors, or weight of evidence suggests ecological risks are relatively low and other risk management considerations apply, such as cleanup to protect human health will effectively address ecological risks. When the SLERA indicates that no potentially complete exposure pathways exist for a site and no further risk assessment is warranted, the site can exit the ERA at the end of Step 2. The results of the SLERA are described in Step 8 (Risk Management) and included for the final RI or RFI report. Documentation must be included regarding why each of the subsequent steps (Steps 3 through 7) of the ERA is not needed. Steps 1 & 2, while abbreviated, are a complete risk assessment.

2. The information is not adequate to make a decision at this point, and the ERA process will continue to Step 3.

   Generally, sites with Screening-Level HQs greater than 1 or with chemicals present that have no screening values are carried into Step 3 (Refinement of Preliminary COPCs and Baseline Problem Formulation).

3. The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

   Data collected during the SLERA can be used to identify and prioritize areas within a site for potential need of interim removal actions. The SLERA results may also be useful at this point when considering other early risk management options, such as focusing potential future investigations on key exposure pathways and receptors.

3.0 Baseline Problem Formulation

Baseline Problem Formulation, or Step 3 of the EPA's eight-step ERA process, is made up of three basic components:

1. Providing risk managers with sufficient information to determine which of the PCOPCs identified during the SLERA may need additional site-specific investigation and, which under more realistic exposure scenarios, may not require additional investigation;
2. Identifying all the potentially complete exposure pathways; and
3. Developing assessment endpoints that will be used to focus the remaining investigation to protect receptors of concern.

Baseline problem formulation is an opportunity to present additional information to help address any data gaps that may have been identified during the Step 2 SMDP and focus the remaining steps of the ERA process.

Step 3 refines the screening-level problem formulation and, with input from the trustees and other involved parties, expands on the ecological issues that may require additional work at a site. This process includes the following activities:

- Refining preliminary chemicals of potential concern;
- Further characterizing ecological effects of chemicals;
- Reviewing and refining information on chemical fate and transport, complete exposure pathways and ecosystems potentially at risk;
- Developing assessment endpoints;
- Developing a conceptual model with working hypotheses or questions that the site investigation will address; and
- Dividing the site into habitats for separate exposure groups, as appropriate.

When Baseline Problem Formulation is complete, a SMDP is required, resulting ideally in agreement on the basic components among the risk assessors, risk managers, and potentially other stakeholders.

3.1 Refinement of Preliminary Chemicals of Potential Concern (Step 3a)

The goal of PCOPC refinement is to review the conservative assumptions used in the SLERA and determine if any of the PCOPCs would pose negligible risk if more realistic conservative assumptions were used. This helps to focus the ERA on identifying a realistic list of chemicals of potential concern (COPCs) that are more likely to pose risk to ecological receptors.

The most important aspect of the refining process is the use of multiple lines of evidence to support a decision to drop a chemical from further investigation and providing adequate justification. Refinement screening values are screening values from other sources or are modifications to screening values to reflect site-specific conditions.

Consistent with the Eco Update entitled "The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments", the refinement process should address chemicals based on the following criteria:

- Background concentrations;
- Nutrients and dietary considerations;
- Frequency, magnitude, and pattern of detected chemicals;
- Mode of toxicity and potential for bioaccumulation;
- Multiple contaminant effects;
- Exposure considerations.

The COPC refinement should use more than one line of evidence to support decisions and should provide justification. The criteria listed above should be applied as a discussion rather than a simple pass-fail process. For example, if a contaminant is detected in less than 5 percent of samples, it still may need to be retained as a refined COPC if site characterization is inadequate. The pattern of detection is important because all of the samples with concentrations above the RSV might be located adjacent to each other. The size of the impacted area could also be an indication of potential unacceptable risk if it is greater than the home range of a local area receptor.

Refer to the flowchart in Section 2.2. Each of these criteria is discussed in detail in the following sections.

3.1.1 Background Concentrations

Chemicals exceeding the screening values in the SLERA but determined to be at concentrations equal to or below the background screening value (BSV) generally do not require additional data collection or evaluation in the BERA. Details are found in the OSWER Directive "Role of Background in the CERCLA Program" (EPA, 2002a). The default BSV is conservatively set to twice the average concentration in the reference stations and compared to the site-wide maximum detected concentration. The chemical can be eliminated as a COPC if it is less than 2 times the average background level. If a chemical is not detected in the background yet detected at the site, then it is considered to exceed background.

This process is a policy-based screening that recognizes that statistically-based background data sets may not be available. However, where background samples have been collected using a statistically valid approach, the Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (EPA, 2002b) can be applied on a site-specific basis.

Background evaluations should also incorporate lines of evidence as presented in Sections 3.1.2 through 3.1.7 as well as the chemicals expected to be present at the site based on the site history. If a chemical is detected above background and above the refinement screening value, it goes into the weight of evidence consideration that can include the magnitude above background.

3.1.2 Nutrients and Dietary Considerations

Chemicals that are (1) essential nutrients, (2) present at low concentrations (i.e., only slightly elevated above background concentrations), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact with the site) need not be considered further in the quantitative risk assessment. In general, only essential nutrients present at low concentrations (i.e., only slightly elevated above background) should be eliminated to help ensure that chemicals present at potentially toxic concentrations are evaluated in the quantitative risk assessment.

Essential nutrients include calcium, magnesium, sodium, and potassium. Iron should never be screened out purely on the basis of dietary considerations. Iron can be toxic at concentrations consistent with naturally occurring background concentrations under conditions of low hydrogen ion concentration (pH).

3.1.3 Conservative Mean Exposure Estimates and Refinement Screening Values

Chemicals that had site-wide maximum concentrations above the ESVs in Step 2 or those that lacked ESVs are carried into Step 3. At this point the maximum detected concentration should be replaced with the 95% upper confidence of the arithmetic mean (95% upper confidence limit [UCL]) as the EPC. Sites with multiple habitats can have more than one EPC for each chemical to reflect the averaging of samples from various exposure units within the site.

Refinement screening values (RSVs) will need to be developed for those chemicals that lacked tabulated ESVs in Step 2. The first column of Tables 1a, 2a, 2b and the recommended screening value from Table 3 is used as ESVs for screening in Step 2. These ESVs are based on chronic effect values for aquatic organisms or based primarily on NOAELs. The second column of Table 1a, 2a, 2b and Table 2c for PAHs and Table 3 for soils is used as RSVs in this Step 3a. These RSVs are based on less conservative values or lowest observed adverse effect level (LOAEL)-based effects.

Acute surface water screening values can be used as refinement values for surface water. However, if the values are based on the National Recommended Water Quality Criterion or are State water quality standards, then the exposure durations relevant to the numerical criteria or standard will apply. Chemical-specific applicable or relevant and appropriate requirement (ARARs) such as State standards automatically become preliminary remedial goals (PRGs). Therefore, chemicals that were detected at concentrations above the ARAR will automatically become COPCs and cannot screen out by less restrictive RSVs.

For soils, an RSV other than the recommended soil screening value (which is the most conservative value among all possible receptors) can be selected for other receptors that are present or likely to be exposed to the site.

Many of the RSVs for organic chemicals were based on equilibrium partitioning and that a Sum Toxic Unit (ΣTU) approach by mode of action for screening for direct toxicity to benthic marcroinvertebrates should be used as discussed in Section 3.1.6.

Refer to Section 6.1 for recommendations for using models to develop RSVs for chemicals lacking ESVs. Benchmarks from other sources can be provided for information but cannot be used to narrow the list of COPCs without an analysis of what the benchmark represents and whether it is appropriate.

3.1.4 Frequency, Magnitude, and Pattern of Detected Chemicals

Chemicals that are infrequently detected may be artifacts in the data due to sampling, analytical, or other problems, and therefore may not be related to site operations or disposal practices. However, chemicals detected at concentrations significantly above the RSVs in one or a small number of samples should not be screened out, but rather be identified as hotspot contamination for resolution by risk managers and scientists at the Step 3a SMDP. Chemicals present at high concentrations over a small area might be acting as a contaminant source.

Consider the chemical as a candidate for exclusion from the quantitative risk assessment if: (1) it is detected infrequently (i.e., < 5% of the samples) at low concentrations in one or perhaps two environmental media, (2) it is not detected in any other sampled medium or at high concentrations in any medium sampled, and (3) there is no reason to believe that the chemical should be present at the site.

3.1.5 Mode of Toxicity and Potential for Bioaccumulation

This refinement criterion evaluates the likelihood that chemicals could exert adverse effects on higher trophic level organisms. The assessment of chemicals that may bioaccumulate, bioconcentrate, or biomagnify will benefit from quantitative risk assessment using food-chain modeling. Chemicals retained from the SLERA that do not bioaccumulate still need to be screened for direct toxicity.

For those chemical PCOPCs retained from Step 2 whose effects may be expressed via uptake through the food web, especially bioaccumulative/biomagnifying chemicals, simple food chain models can be presented as evidence to eliminate a chemical as a potential contaminant to wildlife. As mentioned in Section 2.2, the PBT web-based program at http://www.pbtprofiler.net/ was used to identify organic bioaccumulative chemicals. The food chain models can be conducted for both aquatic and terrestrial pathways by selecting sensitive receptors (e.g., insectivorous mammals or avians) that are representative of the most sensitive endpoints such as reproductive effects. Since, at this stage in the 8-Step process, little is typically known about site-specific conditions, the food chain model selected to evaluate effects via dietary/bioaccumulation exposure should be generic and conservative. The Region 4 SSS has developed basic food chain model assumptions and toxicity reference values (TRVs) at (ADD WEB LINK) that can be used in the refinement screening. These models and TRVs may also be used as a starting point for evaluating bioaccumulation in the BERA.

The EPC for bioaccumulative chemicals and mobile organism exposure through contamination in their food supply is the 95% UCL on the arithmetic mean concentration within a defined spatial exposure unit. The 95% UCL concentration may be calculated by using ½ the sample quantitation limit for each sample where the chemical was not detected. For details and guidance on treating non-detected data see the ProUCL program website.

Note that there may be more than one exposure unit within a site. The refinement process can be a tool to narrow the list of COPCs to certain spatial areas of a site. For media screening in this stage, the 95% UCL for a bioaccumulative chemical is compared to the same wildlife-based screening benchmark in Step 2.

3.1.6 Multiple Contaminant Effects

Contamination at many sites involve various chemical mixtures such as PAHs that are typically found at sites that released petroleum-based compounds into the environment, or halogenated aliphatic compounds (e.g., trichloroethylene, tetrachloroethylene) released from former dry cleaning sites. PAHs and many aliphatic and aromatic compounds generally share the same mode of narcosis toxicity to aquatic organisms. A protective advantage of using the common narcosis endpoint for these types of chemical mixtures is that it allows for the direct summation of the effects from each of the narcotic compounds detected in the particular medium. The refinement screening for these chemical mixtures in water, sediment and soil should apply the ΣTU approach as discussed below.

To derive the narcosis ΣTU for a sample containing multiple narcotic chemicals (Table 2b), the concentration of each detected narcotic contaminant is divided by its individual ESV. Then the toxic units for each of the chemicals are added together to obtain the ΣTU. If the ΣTU is >1.0, then a potential for narcotic toxicity exists to the organisms. Similarly, Table 2a, lists those chemicals that share the same toxic mode of action (e.g., many chlorinated pesticides are classified as central nervous system seizure agents). For those detected chemicals that share the same toxic mode of action, the ΣTU approach should be used. See the example table below for screening of PAHs in sediment to protect benthic organisms and refer to Section 6.2.4. Note that none of the individual PAHs in the example table exceeded their final chronic values; however, when they are summed as contributing to narcosis, the PAHs collectively suggest a chronic risk to benthic organisms.

Example Table Depicting Refinement Screening of PAHs as Chemicals of Potential Concern in Sediment using Sum Toxic Unit Approach

CHEMICAL	Freq. of Detection	Maximum Conc. mg/kg dry wt.	Maximum Conc. mg/kg 1% OC	Final Chronic Value (mg/kg OC)	$ESBTU_{FCVi}$	COPC (Y/N)
Acenaphthene	6/10	0.18 J	18	491	0.037	See total
Acenaphthylene	2/10	0.19 J	19	452	0.042	See total
Anthracene	4/10	1.1	110	594	0.185	See total
Fluorene	6/10	0.22	22	538	0.041	See total
Naphthalene	2/10	0.13 J	13	385	0.034	See total
Phenanthrene	9/10	0.82	82	596	0.138	See total
Benzo(a)anthracene	4/10	1.12	112	841	0.133	See total
Benzo(a)pyrene	2/10	0.69	69	965	0.072	See total
Benzo(b)fluoranthene	2/10	0.21	21	979	0.021	See total
Benzo(k)fluoranthene	0/10	0.1 U	5	981	0.005	See total
Benzo(g,h,i)perylene	2/10	0.34	34	1,095	0.031	See total
Chrysene	8/10	1.47	147	844	0.174	See total
Dibenz(a,h)anthracene	0/10	0.1 U	5	1,123	0.004	See total
Indeno(1,2,3-cd)pyrene	0/10	0.1 U	5	1,115	0.004	See total
Pyrene	9/10	1.7	170	697	0.243	See total
Σ ESBTU $_{FCV, TOT}$					**1.164**	**YES**

$ESBTU_{FCVi}$ = Equilibrium partitioning sediment benchmark toxic unit final chronic value
= Maximum Conc. @ 1% Organic Carbon ÷ Final Chronic Value OC
See Section 6.2.4 for detailed discussion of PAH ΣTU.

Besides the narcosis mode of action, multiple contaminant mixtures may include metals, pesticides or PCBs that exhibit different toxic modes of action and these should be briefly discussed in Step 3a when there may be multiple contaminant effects.

3.1.7 Exposure Considerations

In addition to the above discussions on refinement of COPC, exposure evaluations may assist in determining if a chemical may pose a threat to receptors. If there is supportable rationale that receptors are unlikely to be exposed to risk-related concentrations of a chemicals of potential ecological concern (COPEC) due to physical inaccessibility, extremely unfavorable habitat conditions where the COPEC occurs, or some similar exposure consideration, then a COPEC could potentially be screened out based on this rationale.

3.1.8 COPC Refinement Table

COPC refinement provides the risk manager with additional information about the magnitude and distribution of chemicals on site and the likelihood of adverse effects to receptors. This is accomplished by providing a COPC refinement table for each affected media. An example refinement table is included below. In addition to providing a summary of the information included in the screening-level risk characterization table (such as the frequency of detection, range of detections, location of maximum detection, and frequency of exceeding ESV), the refinement of COPCs table should include the mean concentration, background screening value, refinement screening value, refinement screening value source, refinement HQ, frequency of exceeding the RSV, frequency of exceeding the BSV, and COPC category.

Chemicals that were previously screened out in the SLERA are not included in the refinement table. The following discussion briefly describes the content in each column of the refinement table.

Background Screening Value. This column should present the site-specific reference values, or background values, that are being used for the ERA.

Frequency Exceeding BSV. This column should indicate the number of sample locations whose concentration exceeds the reference concentration (background screening concentrations).

Refinement Screening Value (RSV). This column should indicate the single refinement screening value agreed to by the risk manager, the Region 4 SSS and the trustees involved in the risk management decisions for the site.

RSV Source. This column will most likely be for footnotes that will be included in detail at the bottom of each table to detail the source for each RSV included in the table.

Frequency Exceeding RSV. This column should indicate the number of sample locations that exceeded the RSV. These locations should be clearly identified and presented in a figure(s) that are included with the report.

Example Table Depicting Refinement Of Chemicals Of Potential Concern In Soil											
CHEMICAL	**Freq. of Detection**	**Maximum Detected Conc.**	**Background Screening Value (BSV)**	**Freq. Exceeding BSV**	**Refinement Screening Value (RSV)**	**Refinement Screening Value Source**	**Freq. Exceeding RSV**	**Refinement Hazard Quotient (HQ)**	**95% UCL Conc.**	**95% UCL HQ**	**COPC (Y/N) Basis**
Volatile Organic Compounds, µg/kg											
1,2-Dichlorobenzene	2/10	80	NA	NA	2,900	R4 inverts	0/10	0.03	20	0.007	No/B
1,2-Dichloroethylene	10/10	209	NA	NA	100	R4	3/10	2.1	75	0.75	No/A
Semi-volatile Organic Compounds, µg/kg											
Pentachlorobenzene	2/10	220	NA	NA	NA	NA	1/10	0.2	130	NA	Yes/Bioaccu.
Polycyclic Aromatic Hydrocarbons (PAHs) Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LMW-PAHs), µg/kg											
Acenaphthene	2/10	41	NA	NA	See total	NA	NA	NA	40	NA	See total
Fluorene	2/10	47	NA	NA	See total	NA	NA	NA	45	NA	See total
Phenanthrene	3/10	36	NA	NA	See total	NA	NA	NA	30	NA	See total
Naphthalene	1/10	40	NA	NA	See total	NA	NA	NA	39	NA	See total
Total LMW-PAHs	4/10	164	NA	NA	29,000	R4 inverts	0/10	0.006	140	0.005	No/A
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HMW-PAHs), µg/kg											
Benzo(a)anthracene	4/10	46	NA	NA	See total	NA	NA	NA	44	NA	See total
Benzo(a)pyrene	2/10	78	NA	NA	See total	NA	NA	NA	78	NA	See total
Benzo(b)fluoranthene	2/10	139	NA	NA	See total	NA	NA	NA	120	NA	See total
Chrysene	1/10	70	NA	NA	See total	NA	NA	NA	69	NA	See total
Dibenz(a,h)anthracene	1/10	135	NA	NA	See total	NA	NA	NA	125	NA	See total
Indeno(1,2,3-cd)pyrene	5/10	280	NA	NA	See total	NA	NA	NA	227	NA	See total
Pyrene	3/10	25	NA	NA	See total	NA	NA	NA	21	NA	See total
Total HMW-PAHs	5/10	773	NA	NA	1,100	R4	0/10	0.7	674	0.6	No/A

Example Table Depicting Refinement Of Chemicals Of Potential Concern In Soil											
CHEMICAL	**Freq. of Detection**	**Maximum Detected Conc.**	**Background Screening Value (BSV)**	**Freq. Exceeding BSV**	**Refinement Screening Value (RSV)**	**Refinement Screening Value Source**	**Freq. Exceeding RSV**	**Refinement Hazard Quotient (HQ)**	**95% UCL Conc.**	**95% UCL HQ**	**COPC (Y/N) Basis**
Pesticides, µg/kg											
4,4'-DDD	7/10	25	NA	NA	NA	NA	NA	NA	16	D	Yes/C
4,4'-DDE	6/10	49	NA	NA	NA	NA	NA	NA	25	D	Yes/C
4,4'-DDT	6/10	110	NA	NA	NA	NA	NA	NA	94	D	Yes/C
Total DDT	7/10	184	NA	NA	NA	NA	NA	NA	135	6.4	Yes/C
Heptachlor	1/10	140	NA	NA	NA	NA	NA	NA	67	NA	Yes/Bioaccu
Inorganic Compounds, mg/kg											
Copper	9/10	66	13	1/10	NA	NA	NA	NA	11.4	0.4	No/E
Manganese	10/10	1,020	1,579	0/10	NA	NA	NA	NA	275	1.4	No/F
Sodium	3/10	2,550	634	2/10	NA	NA	NA	NA	1,670	NA	No/G
Vanadium	10/10	81.3	59	3/10	NA	NA	NA	NA	38.1	4.9	Yes/H

Footnotes:
COPC = Chemical of Potential Concern (yes/no)
A = Chemical was infrequently detected above RSV and 95% UCL HQ is less than 1.
B = Chemical was not detected or infrequently detected and refinement HQ is less than 1.
C = Chemical was frequently detected and 95% UCL HQ was greater than 1.
D = Chemical is a member of a class of compounds. The total concentration is screened against the RSV for the total compound in that class.
E = 95% UCL hazard quotient was less than 1 and concentration was less than background screening value.
F = Chemical was detected below background screening value.
G = Chemical is an essential nutrient.
H = Chemical was frequently detected above background and mean hazard quotient was greater than 1.

Refinement HQ. This column should indicate the refinement HQ (maximum concentration / RSV).

95% UCL Concentration. This column should indicate the 95% UCL on the arithmetic mean concentration of each screening COPC.

95% UCL HQ. This column should indicate the 95% UCL concentration divided by the RSV from Step 3a.

Refinement COPC Category. This column should indicate which category each chemical falls into based on the example description found at the bottom of the COPC Refinement table.

Upon completion of the refinement table, the final list of Step 3a COPCs should be identified. The table and supporting text should give the risk managers a clearer picture of the chemicals and exposure pathways that require additional investigation or those chemicals and pathways that do not warrant further investigation. Any chemicals detected above the RSVs that screened out because they were below BSVs should be mentioned. In addition, figures should be presented in the Baseline Problem Formulation showing areas of concern so that risk managers will have a better idea of the spatial area of contaminated medium potentially causing adverse effects.

3.1.9 Uncertainties in the Refinement Screening Process

Multiple aspects of uncertainty may occur in Step 3a. These can include what is unknown about non-detected chemicals, adequacy of site characterization, chemicals lacking screening values, extent of exposure to the site by ecological receptors (e.g., multiple exposure units based on habitat types), presence of sensitive ecological receptors, and data quality issues.

Any data gaps that will be important to decide whether the site poses unacceptable risk or to refine preliminary remedial goals should be identified. Some sites, in early investigation phases, may not be characterized sufficiently to delineate the extent of contamination or may lack basic information that precludes reaching a decision about certain exposure pathways or COPCs. These types of uncertainties should also be documented.

3.1.10 Step 3a – Scientific/Management Decision Point

An SMDP meeting between the risk managers, risk assessors and stakeholders is needed to discuss the outcome of the Step 3a process for finalizing which contaminants and likely exposure pathways will be carried forward into Step 3b. A summary of the refinement screening process for the site should be presented that includes the refinement screening table.

Some judgments will be required for chemicals, slightly over background, having low hazard quotients or detected in limited areas of the site. It is important that a weight of evidence approach is used based on multiple lines of evidence and that the basis for decisions is documented along with any major sources of uncertainty. A summary table that presents the multiple lines of evidence for each chemical in each environmental medium is desired. Figures of maps showing the distribution of the concentrations of COPCs are recommended to present the data.
The possible decisions to be made by risk managers at the end of Step 3a are:

- There is adequate information to conclude that ecological risks are negligible;
- The available information is not adequate to conclude that ecological risks are negligible; or
- The available information indicates a potential for adverse ecological effects.

If the SMDP team decides that ecological risk is negligible, the site can exit the process at Step 3a. Typically this occurs when all chemicals screen out, when a habitat survey indicates that the site does not provide habitat to ecological receptors, or when it is concluded that there are no completed exposure pathways at the site. Sites that do not exit the process at Step 3a can combine the Step 3a SMDP with the SMDP for Step 3b in Section 3.2.5.

3.2 Baseline Problem Formulation Step 3b – Planning and Scoping of the Risk Assessment

Sites reaching this point in the ERA process are here because critical information was lacking to decide whether the site posed unacceptable ecological risk or because the site potentially posed unacceptable ecological risk and requires a BERA to further evaluate the potential for ecological risk and/or develop PRGs.

Step 3b is an important part of the planning process for the BERA. At this point, the

preliminary remedial goals for COPCs are the RSVs. In cases where Step 3a evaluations included food-chain modeling, the PRGs derived used conservative assumptions for contaminant bioavailability, conservative toxicity reference values, and assumed 100% site use.

A limited amount of site-specific information is typically available at this stage of the assessment. The planning process of data collection that occurs during Step 3b is primarily focused on necessary steps to refine the PRGs. The Baseline Problem Formulation summarizes what is known about the exposure profile and potential effects of COPCs. Thus, the Step 3b effort compiles and presents information in a manner that helps frame the risk evaluation in Step 4 and reduce the number of exposure pathways that need to be evaluated for each chemical. The sections below summarize the information that should be presented to help risk managers make these decisions.

3.2.1 Known Ecological Effects of COPCs

A narrative description of the known ecological effects for the main chemical groups of COPCs, and those specific COPCs that are expected to be major risk drivers, should be presented. The descriptions can be relatively concise at this point in the problem formulation stage. Details of specific toxicity endpoints and/or toxicological reference values for the COPCs will be developed in Section 4.1.

3.2.2 Contaminant Fate and Transport, Ecosystems Potentially at Risk, and Complete Exposure Pathways

Contaminant Fate and Transport. This section of the report should summarize the primary ways that site chemicals can be transported or transformed in the environment physically, chemically, and biologically. This information is used to identify the exposure pathways that might lead to significant ecological effects. Although most of this information was presented in the SLERA; there may be a need for additional evaluation of certain chemical fate and transport mechanisms based on the list of the final COPCs for a site. For example, site-specific information on potential bioavailability of COPCs would be helpful if it is available. The discussion in this section would build on the chemical fate and transport mechanisms identified during the SLERA and the known ecological effects identified for each COPC. This effort may involve compiling additional information on:

- The potential bioavailability of the COPCs to various ecological receptors;

- The habitat types and potential receptors along the exposure pathways; and
- The magnitude and extent of contamination, including its spatial and temporal variability relative to the receptors potentially exposed.

Ecosystems Potentially at Risk. It is important for the risk assessor to identify the ecosystems (or habitats) potentially at risk based on the information provided in the site ecological checklist completed during the SLERA. Additional site setting information is not typically necessary to complete this portion of baseline problem formulation; however, all ecosystems should be identified in this section of the report. After each ecosystem has been identified, they can typically be focused during this stage of the risk assessment based on the known ecological effects of the COPCs. The refinement conducted during this stage of the process involves attempting to identify the habitats that are at greatest risk of exposure based on the chemical fate and transport mechanisms present at a site. This may involve identifying species that are highly sensitive to particular COPCs or species that have greater potential for exposure based on the habitats they utilize. In addition, there may be areas with minimal habitat quality or wildlife usage such as drainage ditches, lawns and maintained fields that should be discussed.

Complete Exposure Pathways. While the SLERA should have presented every complete and potentially complete exposure pathway present, they should be refined by this point in the Baseline Problem Formulation process. This may result in adding exposure pathways identified through additional information gathered at the site, but the primary goal of this section is to focus any remaining investigation on the exposure pathways present at the site where the greatest potential for unacceptable risks is present. It should be noted that this exercise may not focus solely on areas of ideal habitat, but rather in areas where exposure to COPCs is likely. At many sites this includes areas that may not be considered adequate habitat to support a community of ecological receptors (i.e. drainage ditches, maintained grassy areas); however, the potential for exposure is present in these areas and justification with documentation should be provided to support a conclusion of minimal ecological exposure in these habitat types, especially when exposure occurs via trophic transfer through the food chain.

3.2.3 Assessment Endpoints

As defined in national EPA guidance (EPA, 1997), an assessment endpoint is "an explicit expression of the environmental value that is to be protected." Since it is not practical to directly evaluate all the individual components of an ecosystem, assessment endpoints

should focus the BERA on the components of the ecosystem that could most likely be adversely affected by the COPCs at a site. The assessment endpoint is an expression of an ecological entity and the value of that entity to be protected. Assessment endpoints are site-specific and will depend on the habitats present.

The process of selecting assessment endpoints for a site should be based on the following information as previously evaluated above:

- Refined list of COPCs for the site;
- Toxic mechanisms of the COPCs;
- Relevant receptor groups that are potentially sensitive and/or highly exposed to the COPCs; and
- Complete exposure pathways present at the site.

Input from applicable trustees/stakeholders for a site is crucial during the development of the assessment endpoints to help ensure that the risk managers have all the potentially pertinent information available for making risk management decisions.

3.2.4 Conceptual Model and Risk Questions

In addition to providing the final list of refined COPCs, Step 3b of the ERA includes a refinement of the screening-level CSM. This refinement of the CSM typically relies on a literature search on known ecological effects, a description of chemical fate and transport, and refinement of the complete and potentially complete exposure pathways identified in Step 2.

The refinement to the CSM is the most important outcome of Step 3. The CSM is a tool or concept that describes the relationships between target populations and exposure routes/areas in such a manner as to facilitate predictions about nature, extent, risk, and risk reduction strategies. An accurate CSM will delineate populations of chemicals, receptors, exposure pathways, sources, and bioavailability, for which the decisions or outcomes will differ across the site. The CSM is a simplified construct of complexities at the site to aid in correct decision making.

Scope, boundaries, and scale are important considerations in the CSM. The scope and boundaries of the CSM should reflect the scope and boundaries of the decision. Target populations and boundaries are explained in the EPA's Guidance on Systematic Planning

Using the Data Quality Objectives Process. In addition to the exposure pathways and chemical populations of interest, the CSM should present the geographic scales of risk management decisions and time frames for critical exposures, if applicable. The spatial pattern of contaminant distribution provides evidence of how the chemical may be related to chemical releases, migration pathways, or degradation. Distribution may also indicate which exposure pathways will require additional evaluation.

The risk evaluation can only support correct decisions at appropriate spatial scales. The EPA prefers to target cleanup decisions to source areas and to specific migration pathways. The subdivision of a larger site into operable units, solid waste management units, or exposure units should support decisions targeted to specific sources or pathways.

The CSM may be simplified to focus on the most important chemicals. A smaller set of signature chemicals may be identified that appear to explain the behavior of many of the site-related chemicals and the majority of the risk. This does not mean that other COPCs would not be evaluated further. Their uncertainty might be addressed by an alternate method rather than designing a field study specifically for minor risk-contributing chemicals. Often a field study targeted toward one chemical will gather information that can serve to assess several other chemicals, because chemicals often co-occur in site media.

The risk questions included in baseline problem formulation should be linked to risk management objectives. The purpose of the risk questions is to outline the basis of the study design (Step 4) and the methods to be used to evaluate the results of any site-specific investigations that may be recommended for the site. Risk questions should be based on the relationship of the assessment endpoints and the predicted response when exposed to the chemicals present at a site. It is helpful if a single chemical or class of chemicals can be identified in the risk questions; however, at some Superfund sites this is not possible. The risk questions asked should lead toward developing a range of measurement endpoints for each assessment endpoint. This is typically done by including a comparison in the risk question of site conditions to (1) concentrations of a chemical that, based on literature searches are known to be toxic to receptors associated with the assessment endpoint; and/or (2) comparing areas of contamination with reference sites.

3.2.5 Scientific/Management Decision Point

The conclusion of Step 3b of the BERA has a SMDP that consists of agreement on:

- The COPCs;
- Habitats and environmental media of potential concern;
- Receptors of concern;
- Exposure pathways;
- Assessment endpoints; and
- Risk questions.

Each of these components should be summarized in the refined conceptual site model and on other figures or charts. Agreement by risk assessors and risk managers on these key aspects of the conceptual site model will facilitate development of the site study design (Step 4).

4.0 Study Design

The study design (Step 4 of the ERA) is part of the DQO process. Therefore, many of the same components of the DQO process apply in this step. Details of the DQO process are found in the EPA's Guidance on Systematic Planning Using the Data Quality Objectives Process.

4.1 Establishing Measurement Endpoints

At the end of Step 3 of the ERA process, the assessment endpoints as described in Section 3.2.3 have been selected for a site. A measurement endpoint is defined as a measurable characteristic related to the value to be protected of the entity described by the assessment endpoint. Measurement endpoints can include measurements of exposure and effects. For example, concentrations in sediment samples as well as measures of effects (direct toxicity testing to benthic organisms) provide ways to evaluate potential risks. Measurement endpoints are site-specific and reflect the ecological functions provided by the habitats in question. The relationship of the measurement endpoints to the assessment endpoint should be clearly presented.

Following assessment and measurement endpoint selection and development of the CSM and risk questions, a study plan is designed to ensure that adequate data are collected to support the ecological component of the BERA. There are a limited number of fundamental approaches for conducting site specific investigations on ecological impacts of hazardous substances. Further soil/water/sediment sampling, tissue residue studies, population or community evaluations and toxicity testing are the four methodologies most commonly used. The appropriate methodology will depend on the assessment and measurement endpoints selected in the previous steps.

Food-chain models and toxicity reference values. Measurement endpoints involving prediction of the risk to wildlife receptors typically rely on food-chain models of the daily intake of chemicals in dietary items consumed by wildlife for estimation of a daily dose. When planning to use food-chain models in the BERA, the EPA Region 4 requests that Step 4 provide tables including all of the assumptions that will be made for the food-chain model calculations. These assumptions include items such as the intake rates and body weights of model receptors and the toxicity reference values that will be used to characterize the risk. It is recommended that the EPA Region 4 web site ADD LINK be

consulted for exposure assumption and TRVs. This link has values that can be used in most food chain models.

If studies other than the recommended values are used or there are no recommended values on the EPA website, then a justification should be provided that contains a review of the pertinent toxicity information for the chemical. This should include 1) a summary of potential effects from chemicals when present in aquatic and terrestrial environments, and 2) a summary of the NOAEL and LOAEL chosen for each chemical as reported in the literature. These data should also present the literature citation and a brief description of the study conducted so that an evaluation can be made as to how applicable the study results are to hazardous waste sites. The description should include the setting of the study (laboratory or field), length of exposure, type of exposure, effects measured, the date of the study, and the results of the study.

If receptors other than the ones provided on the EPA table of recommended exposure assumptions are used, the baseline problem formulation report should include a section describing the characteristics of the receptors and how the parameters were obtained. Alternate TRVs may be used; however the preference is to use EPA Region 4 values when they are available. If the EPA Region 4 values are used, then the original citations and the information requested above is not necessary to include.

Toxicity tests. Toxicity testing is most commonly employed to determine potential risk via direct contact with contaminated surface water, soil or sediment. Toxicity testing must be carefully designed to ensure that the proper test species are used for the environmental medium being evaluated. For example, a benthic macroinvertebrate such as *Hyalella* should be used as a test subject in freshwater sediment toxicity tests rather than free-swimming organisms such as *Ceriodaphnia*.

Community assessments. Community or population evaluations involve floral or faunal field surveys and the computation of species diversity and richness indices as measurement endpoints. These types of studies should be used with caution in a BERA because the various diversity and richness indices were not developed to measure ecological impacts of hazardous materials in the environment. Natural variability in population and community structure (e.g., seasonal effects), lack of sensitivity of some species to certain chemicals and impacts to population/community structure from non-chemical stressors make the interpretation of these studies difficult in the context of

distinguishing between these effects and those from hazardous substances. Therefore, it is important to have an understanding of the various potential stressors and ecotoxicology to design an appropriate field survey. Any such surveys should include an evaluation of potential differences between contaminated areas and reference areas. Presentation of survey results should also be accompanied by a detailed uncertainty discussion.

Other considerations. If there are multiple habitats at the site the Study Design should discuss the data groupings and the boundaries of the habitat areas. If there are bioaccumulative chemicals among the COPCs, the summary of available data should include any biological tissue data available for estimating site-specific bioaccumulation. The pairing of tissue data with abiotic data for estimation of bioaccumulation factors (BAFs) can also be discussed.

For complex sites, the work plan should present the manner in which the BAFs are derived from the site-specific tissue data collection prior to the initiation of the risk assessment.

4.2 Scientific/Management Decision Point

At the end of Step 4, the ecological risk assessor and the ecological risk manager should come to agreement on the contents of the Work Plan and the Sampling Analysis Plan (SAP). The Step 4 SMDP should summarize the existing categories of data available to support the BERA. The SMDP should summarize what is known about the site, the conceptual site model, available data, the need to collect site-specific information to refine risk assessment assumptions and to close data gaps.

Specifically, this SMDP should result in agreement between the ecological risk assessor and the risk manager on the following:

- Site measurement endpoints selected as lines of evidence to evaluate the assessment endpoints;
- Exposure assumptions and toxicity reference values;
- Field investigations, specific DQOs, and laboratory methods to be conducted; and
- Selection of data reduction and interpretation techniques.

This SMDP is essentially an agreement by the project team on the elements of the BERA and the parameter assumptions in the equations that will be used to estimate the risk.

5.0 Additional Steps in the Ecological Risk Assessment Process

Following Step 4 (study design), there are four more steps to complete the ERA process. These steps are described in detail in ERAGS and are described briefly here for reference, although no specific EPA Region 4 guidance is offered on these steps.

Step 5 – Field Verification of Sampling Plan. This is an optional step to visit the site prior to a field sampling event to verify the feasibility of the sampling plan. Step 5 is recommended for sites where complex field studies are planned. Complex sites that require a field visit to select reference stations or to conduct field reconnaissance to determine what species of biota are available to collect may require another step to finalize the work plan. Sites that skip the field verification step do not require a Step 5 SMDP.

Step 6 – Site Investigation and Analysis Phase. Step 6 is straightforward in that in involves implementation of the site investigation and study design according to plans. Ecological exposures and effects are evaluated based on the information gathered in the previous steps including any site-specific information obtained during the site investigation.

A data summary report can be prepared to present the results. Sites with complex data may require an intermediate step to evaluate laboratory data before the data can be incorporated into the BERA. Many sites provide a RI report to present the data and its interpretation. It is possible, in the case of extensive ecological investigations that data with interpretations for the BERA may need to be prepared as separate reports. For example, benthic community analyses interpretations, toxicity testing data may need to be fit to dose-response models to estimate PRGs for the BERA, and development of BAFs from biological tissue data should be provided as appendices in support of the BERA.

Step 7 – Risk Characterization. As explained in ERAGS, Step 7 is the final step in the ERA process. It includes risk estimation and risk description. The ERA should conclude with a statement of whether there was a risk or not to the receptors for each exposure pathway evaluated. In addition, information should be presented on the nature and

likelihood of risk. The uncertainty analysis, a critical element in this step, should clarify what is known and unknown about the risks for the benefit of risk managers.

PRGs are also developed in Step 7. PRGs for protection of wildlife are compiled from the food-chain models that should be back calculated to obtain the media concentrations representing a HQ of 1 for the NOAEL and LOAEL toxicity reference values for the chemicals posing unacceptable risk. From Step 6, site-specific toxicity thresholds are compiled for direct toxicity to plants and soil invertebrates (in the case of soils) or toxicity to the benthic macroinvertebrate community (in the case of sediment). These thresholds are assembled into a table for each environmental medium from which a range of PRGs is selected in the SMDP to inform Step 8, risk management.

Step 8 – Risk Management. The risk management decision is finalized in the Record of Decision (ROD) for a CERCLA site or in the Statement of Basis for a RCRA site. The user is recommended to consult ERAGS and guidance documents for waste and cleanup risk assessment on the OSWER web site.

6.0 Ecological Screening Values

ESVs are based on chemical concentrations associated with a low probability of unacceptable risks to ecological receptors. The SSS has developed the attached tables for use at Region 4 hazardous waste sites. Since these numbers are based on conservative endpoints and sensitive ecological effects data, they represent a preliminary screening of site chemical concentrations to determine the need to conduct further investigations at the site. ESVs are not recommended for use as remediation levels.

Preliminary screening values for chemicals which lack Region 4 ESVs can be proposed and submitted to the SSS for approval. If at all possible these ESVs should be based on ecotoxicological information from the scientific literature, computer databases, and other sources. As information is submitted to the SSS for review or as new information becomes available, these Region 4 ESVs may be modified or additional screening values added. Users are encouraged to consult Region 4 ecological risk assessors or the website for further information and updates.

6.1 Surface Water Screening Levels

The surface water screening-level hierarchy for freshwater is as follows:

- National Recommended Surface Water Criteria
- Tier 2 values or equivalent
  - Great Lakes Initiative Tier 2 Values (freshwater)
  - State Surface Water Standards for freshwater
  - Suter and Tsao (1996) Tier 2 Values
- Canadian Water Quality Values
- Minimum value from either the Target Lipid Model or ECOSAR (Ecological Structure Activity Relationships) model.
- Office of Pesticide Programs Aquatic Life Benchmarks.

The hierarchy for saltwater values is the same except that State surface water standards for marine are used. The following sections provide details for the screening values derived for each hierarchy level.

6.1.1 Water Quality Criteria and Great Lakes Initiative Tier 2 Values

The surface water screening-level hierarchy for freshwater and saltwater starts with the Current Recommended National Water Quality Criteria (NWQC). For the NWQC, The chronic ambient water quality criteria value for the protection of aquatic life, (i.e., the

Criterion 2 Continuous Concentration [CCC]), is used as the screening value for surface water. The Criteria Maximum Concentration (CMC) is an estimate of the highest concentration of a chemical in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The CCC is an estimate of the highest concentration of a chemical in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. In some cases, dissolved (filtered samples) have been collected to assess exposures particularly for metals. In these cases, the dissolved concentrations may also be used in the screening process (see also Table 1b for certain metals).

The Great Lakes Initiative (GLI) Clearinghouse database was used when a nationally recommended water quality criterion was unavailable. For many chemicals in the GLI database, there are several Tier 2 value from the Great Lakes states. In general, the most conservative and/or most recent value was selected as the ESV.

6.1.2 State Surface Water Standards, Other Tier 2 Values and Canadian Water Quality Guidelines

Each state has developed water quality standards or criteria that may be lower than those in Table 1a which show the National Recommended Water Quality Criteria as the first tier in the hierarchy for generality. However, if a state standard for a particular state in Region 4 is available, it becomes the first tier and should be used as the ESV.

For those chemicals in Table 1a that did not have a GLI value, then other state standards were used, especially for marine ESVs. If a chemical had more than one standard, then the most conservative state standard was selected as the ESV.

The surface water Tier 2 benchmarks in Suter and Tsao (1996) were then used in the hierarchy followed by the Canadian water quality guidelines.

6.1.3 Other Considerations for Surface Water Screening

Screening values such as the ambient surface water quality criteria are intended to protect 95% of the species, 95% of the time. If there is reason to believe that a more sensitive species is present at the site, such that surface water chemical concentrations below the chronic ambient water quality values may pose unacceptable risks, more protective site-specific surface water screening values may be developed.

The surface water screening values listed in Table 1a assume a hardness of 50 milligrams per liter (mg/L) as calcium carbonate ($CaCO_3$) for those metals whose freshwater criteria depend on hardness, such as cadmium, chromium III, copper, lead, nickel, silver, and zinc. Table 1a includes supporting Tables 1b and 1c. Table 1b provides the conversion factors (CFs) and hardness-dependent equations. The CFs are used to calculate surface water criteria for dissolved metals and can be used to convert criteria for dissolved metals into total metals criteria. CFs were applied to freshwater and saltwater National recommended criteria, which apply to dissolved metals, to obtain the screening values in Table 1a for total metals. Hardness-specific freshwater screening values (for total metals) are provided in Table 1c for hardness concentrations of 25, 50, 100, and 200 mg/L as $CaCO_3$. A recent change to the national recommended water quality criteria no longer requires that if the site-specific surface water hardness is less than 25 mg/L $CaCO_3$ that one should fix the hardness at 25 mg/L as $CaCO_3$. Therefore, where site-specific hardness information is available, surface water ESVs for hardness-dependent metals should be adjusted accordingly.

Typically, copper is screened against the federal or state standard. The Biotic Ligand Model (BLM) for copper can be used to fine tune the ESV provided site-specific data is sufficient to run the BLM to estimate a chronic value. This can be done in the SLERA or as a part of the refinement screen in Step 3a.

6.1.4 Equilibrium Partitioning and Target Lipid Modeling to Derive Surface Water ESVs

For organic chemicals that do not have any available water quality benchmarks (WQBs), the surface water ESV can be calculated using two methods:

1) The combined equilibrium partitioning and target lipid model (TLM) approach. The TLM developed by Di Toro, et al. (2000) and Di Toro and McGrath (2000) is used and is applied to both freshwater and saltwater ESVs for nonpolar organic chemicals with narcotic toxicity.
2) The ECOSAR model within the EPA's Estimation Program Interface (EPI) suite. ECOSAR predicts acute and chronic effect concentrations to several organisms (e.g., fish, daphnids, algae) and the lowest predicted chronic value is selected as the ESV. ECOSAR is different from the TLM in that it has algorithms for various classes of chemicals and thus can be more versatile. However, the ECOSAR values are for typical species and do not account for sensitive species.

Since both models predict chronic and acute effects, the most conservative or lowest predicted effect from the two models is used as the ESV.

For many nonpolar organic compounds, the octanol-water partition coefficient (Kow) is a useful surrogate of how nonpolar organic compounds will accumulate in lipids of animal tissue. The Kow is the ratio that describes the partitioning of a compound between water and octanol. Kows are available for many common organic compounds although values may be somewhat different between reference sources. The Kows used in this document were obtained from the EPI Suite program. The TLM is used for nonionic (neutral) organic compounds and is based on the assumption that the aqueous concentration for an acute toxic endpoint can be predicted from the critical target lipid body burden (CTLBB) in an organism. The CTLBB is the chemical concentration in the organism lipid needed to cause 50% mortality. The following TLM equation from Di Toro et al. (2000) predicts the critical acute aqueous concentration:

$$\log(C^*_{w\ acute}) - \log(2) = m \times \log(K_{ow}) + \log(C^*_L) + \Delta c \qquad (1)$$

Where: C^*_w = Critical aqueous concentration (millimoles per liter [mmol/L])

K_{ow} = Octanol-water partitioning coefficient (liters per kilogram [L/kg])

C^*_L = Critical target lipid body burden (micromoles per gram [µmol/g] octanol)

m = universal slope (-0.936) from McGrath and Di Toro (2009)

Δc = chemical class correction factors (e.g., ranging from 0 for alkanes and alcohols, -0.109 for monoaromatic hydrocarbons and -0.352 for PAHs) from McGrath and Di Toro (2009).

To be conservative, the 5th percentile CTLBB (C^*_L) of 28.94 µmol/g octanol was derived from the data in McGrath and Di Toro (2009). Consistent with the derivation of the methodology for deriving the criterion maximum concentration (EPA 1985), the estimated final acute value is divided by a factor of 2.

For chronic toxicity, the TLM uses an acute to chronic ratio (ACR) methodology which simply is the acute effect concentration divided by the chronic effect concentration. The chronic effect concentrations are those that cause an adverse effect on long-term endpoints such as growth and reproduction. Therefore, the equation for chronic effects is similar to Equation 1:

$$\log(C^*_{w\ chronic}) = m \times \log(K_{ow}) + \log(C^*_L/ACR) + \Delta c \qquad (2)$$

The ACR for nonpolar organic chemicals was determined to be 3.83 (McGrath and Di Toro [2009] and Redman et al [2014]) based on the geometric mean of 29 paired data sets for aliphatic hydrocarbons. To convert the critical aqueous concentration (mmol/L) to mg/L one has to take the antilog of the equation answer and multiply by the molecular weight.

The following represents an example calculation for a chronic value for 1,2,4,5-tetrachlorobenzene:

$$\begin{aligned}\log(\text{C*w chronic}) &= -0.936 \times 4.571 + \log(28.94/3.83) - 0.448\\ &= -4.278 + 0.878 - 0.448\\ &= -3.848\end{aligned}$$

Taking the antilog of –3.848 and multiplying by the molecular weight of 1,2,4,5-tetrachlorobenzene (215.89 g/mol) yields 0.031 mg/L as the chronic WQB. This value is higher than the ESV (0.0083 mg/L) listed in Table 1a that is based on a GLI value.

The GLI methodology requires several studies of chronic toxicity for the same chemical, without which a conservative default ACR is mandated. The TLM, on the other hand, uses an average ACR for all narcotic chemicals. Differences in Kow values used in the equations also contribute to variability in the calculations.

As described in Section 3.1.6, when assessing potential toxicity to aquatic organisms from mixtures of chemicals with a similar mode of action, the ΣTU Approach should be used.

To generate screening values that are not on Table 1a, the ECOSAR model may be used. ECOSAR uses chemical class-specific algorithms to estimate toxicity to representative freshwater and saltwater species from the Kow. The lowest predicted ECOSAR chronic value among the species is selected as the ESV. For acute values, the lowest ECOSAR predicted acute concentration from the species is selected and then divided by 2. As previously noted, the values from ECOSAR are for typical species and do not account for sensitive species. Also, caution that ECOSAR should not be used for chemicals that are not a member of a chemical class for which an ECOSAR model was developed.

6.2 Sediment Screening Values

Numerous efforts to develop suitable sediment quality benchmarks for classifying sediment as toxic or non-toxic have been published in the scientific literature. In order to best protect aquatic resources, many of the Region 4 sediment ESVs (Tables 2a and 2b) are derived from statistical interpretation of effects databases obtained from the literature, as reported in publications from states such as Florida and Washington, and from other agencies. These benchmarks are generally based on observations of direct toxicity to benthic organisms.

The following represents the Step 2 ESV hierarchy for both freshwater and marine sediments:

- Threshold effect levels (TELs) or threshold effect concentrations (TECs) such as those provided in MacDonald et al., (2003) for other than PAHs;
- Modeled equilibrium partitioning values for organic chemicals from surface water benchmarks;
- Other effect ranges such as effects range-low values and Washington State sediment quality objectives.

Each of the sediment screening tables (Tables 2a, 2b, and 2c) contain different chemicals. Table 2a includes metals, phenols, energetic compounds, and pesticides/herbicides and other polar (ionic) chemicals. The chemicals in Table 2b are predominantly nonpolar chemicals that are considered to have a narcotic mode of toxic action. Table 2c pertains only to PAHs and their narcotic toxicity.

Step 2 sediment data should be screened against the first column in Table 2a. If the chemical is not found on Table 2a, then screen against the first column in Table 2b. The ΣTU from the values in the first column will also be conservative as an added layer of protection for multiple chemicals sharing the same mode of toxic action.

In Step 3a for refinement of sediment screening values, the value in the second column of Table 2a or 2b can be used as the RSV. If there is no RSV, then an ECOSAR derived value for 1% organic carbon (OC) may be derived for Table 2a. A RSV for Table 2b can be derived by using the more conservative WQB from the McGrath and Di Toro (2009) methodology (Equation 2 below) or from ECOSAR. The RSVs could also be used for the ΣTU approach as part of refinement. For sites with many organic chemicals, it is

possible that the ΣTU approach in the refinement could be more conservative than the single compound screening in Step 2. The refinement for PAHs would use the ΣTU approach from the values in Table 2c. Specific discussion of the methods used to develop the sediment ESVs and for deriving sediment RSVs are provided in the subsections below.

6.2.1 Sediment ESVs based on Effect Ranges

Sediment ESVs for most of the inorganic chemicals, butyl tins and bulk petroleum hydrocarbons presented in Table 2a are based on a range of effect levels and measured in milligrams per kilogram (mg/kg) dry weight. Several organic chemical ESVs are also listed on a dry weight basis as indicated by the gray shaded cells in Tables 2a and 2b. The effects range-low (ER-L) is the concentration of a chemical in sediment at the low end of the range at which adverse biological effects on aquatic organisms were observed (Long and Morgan, 1991). The ER-L is the lower 10^{th} percentile in the distribution of biological effects data from matching biological and chemical laboratory data or field surveys. The effects range-median (ER-M) is the approximate midway in the range of concentrations where adverse biological effects were observed. The ER-M is the median of the distribution of effects values. The TEL is the threshold effects level below which adverse biological effects on aquatic organisms are unlikely. It is calculated as the geometric mean of the 15^{th} percentile of the effects data set and the 50^{th} percentile of the no effects data set. If the chemical concentration in sediment is below the TEL adverse effects are expected to occur infrequently. The probable effect level (PEL) represents a second threshold value, above which adverse effects are frequently observed. The PEL is the lower limit of the probable effects range. It is calculated as the geometric mean of the 50^{th} percentile of the effects data set and the 85^{th} percentile of the no effects data set.

When sediment concentrations fall between the TEL and the PEL, adverse biological effects may be possible; but the severity and magnitude of potential effects can be difficult to gauge. A weight of evidence approach is used in cases where the concentrations at the site fall between the TEL and PEL, as described in Section 3. The TEC is a consensus value which identifies COPC concentrations below which harmful effects on sediment-dwelling organisms are unlikely to be observed. The TECs were developed by the Florida Department of Environmental Protection (FDEP) by taking the geometric mean of ER-L and TEL values from various sources (MacDonald et al., 2003). The probable effect concentration (PEC) is a consensus value formed by taking the geometric mean of ER-M and PEL values from various sources. When concentrations of

COPCs are between the TEC and the PEC, adverse biological effects on sediment-dwelling organisms are possible. The TEC and PEC values in MacDonald et al. (2003) are nearly identical to the values found in MacDonald et al. (2000). The TEL, TEC, or ER-L is used for screening in the SLERA.

For the Step 2 Screening, the PAH ESVs are based on the sum total of low molecular weight PAHs (LMW-PAHs) and high molecular weight PAHs (HMW-PAHs) from MacDonald (1994) and total PAHs from MacDonald et al. (2003). These ESVs for PAHs (shown in Table 2b) are measured in micrograms per kilogram (µg/kg) dry weight (dw). If PAHs exceed the ESV, then Step 3 refinement will be necessary as discussed in Section 6.2.4.

6.2.2 Sediment ESVs Based on Equilibrium Partitioning

The equilibrium partitioning (EqP) methodology is well-documented in the scientific literature (Di Toro et al., 2000; U.S. EPA, 2003; U.S. EPA, 2008; McGrath and Di Toro, 2009; Burgess et al., 2013; Redman et al., 2014). The EPA (2002) reported that adverse biological effects from the concentration of nonionic organic contaminants (such as PAHs, PCBs, certain organochlorine and organophosphate insecticides, etc.) in sediment are not correlated with bulk concentration of the contaminants in sediment; however, they can be correlated with the concentration of the contaminant in interstitial pore water. This suggests that the toxicity of many organic chemicals to sediment-dwelling organisms is proportional to their concentration that is dissolved in the interstitial water of the sediment.

The EqP theory is based on the principle that organic contaminants (primarily non-ionic compounds) in sediment will partition between the OC fraction in sediment and the sediment interstitial water in a relatively constant ratio. This ratio can be used to predict the fraction of a contaminant that is freely dissolved in interstitial pore water from the concentration in sediment. The ratio is referred to as the OC partitioning coefficient, or Koc. A chemical may have different Kocs depending on the OC in the sediment and for different types of OC such as humic and fulvic acids, soot or black carbon. In general, the higher the Koc of an organic compound, the stronger the contaminant will adsorb to the OC content in the sediment. When more OC is present in sediment, the concentration of an organic contaminant freely dissolved in the interstitial water will be smaller, and therefore, the sediment contamination will exhibit proportionally less toxicity to aquatic organisms.

The Koc values used in this document were derived from the KOCWIN™ model in the EPA Estimation Program Interface (EPI) suite. In most cases, the KOCWIN™ model estimates Koc two different ways using either an estimate from log Kow or from a molecular connectivity index model. To be conservative, the lower of the two Koc estimates is used to develop the sediment ESV.

An EqP-based sediment ESV for an organic contaminant is derived by multiplying a WQB by its Koc:

$$ESV_{Sed} = WQB \times [Koc \times foc + (\Theta m/pw)] \qquad (3)$$

Where: ESV_{Sed} = normalized to 1% organic carbon (µg/kg 1% OC)
WQB = water quality benchmark (µg/L)
Koc = organic carbon partitioning coefficient (L/kg)
foc = fraction of organic carbon (0.01 for 1% OC)
Θm = 0.3 (assumed 30% moisture of sediment by mass)
pw = 0.9982 density of water at 20˚C.

The WQB for this model is obtained from the values in Table 1a. If there were no Table 1a values, then the lowest WQB from the following three models was used:

1. ECOSAR;
2. EPA (2008) model;
3. McGrath and Di Torro (2009);

As mentioned in Section 6.1.4, the ECOSAR program predicts a final chronic value and is used for non-neutral organic chemicals. For neutral organics, either the EPA (2008) sediment benchmark or the McGrath and Di Toro (2009) model was used (Equation 2 in Section 6.1.4).

Since most measurements of organic chemicals are in µg/kg, the modeled values have been converted to µg/kg at 1% OC in Table 2a. In addition, because measurements of total organic carbon (TOC) are typically not available for screening purposes in the SLERA, a default TOC of 1 percent (1%) is used and is reflected in Equation 3 and in Table 2a. Region 4 highly recommends collecting TOC measurements in sediment and soil concurrent with analyses of volatile organic compounds (VOCs) and semi-volatile

organic compounds (SVOCs) including PAHs. This will provide for more accuracy in the screening process.

Table 2a also lists chemicals that share the same toxic mode of action, based on the work of Russom, et al., (1997). For those detected chemicals that share the same toxic mode of action, the ΣTU approach should be used. For example, a number of pesticides listed in Table 2a share the same toxic mode of action as central nervous system seizure agents, as identified by the symbol "C". Detected concentrations of these pesticides should be evaluated using the ΣTU approach.

Except where noted on Table 2a as "wildlife based", the sediment ESVs provide protection to benthic organisms from direct toxicity. The wildlife based ESV should be used in the Step 2 screening and if the site concentration exceeds the wildlife based ESV, then a food chain model will be needed in Step 3a. See also Sections 2.1 and 3.1.5 for discussion of bioaccumulative chemicals.

It is important to determine if there are any State regulatory sediment benchmarks. If so, then the State sediment regulatory values are used if they are more conservative than the equilibrium partitioning values derived from surface water benchmarks.

The screening values do not consider the antagonistic, additive or synergistic effects of other sediment contaminants in combination with other mixtures or the potential for bioaccumulation and trophic transfer to aquatic life or wildlife. Such potential effects of identified COPCs would likely be discussed in the BERA.

6.2.3 Sediment ESVs based on Narcotic Mode of Toxicity

The predominant mode of toxicity for each of the chemicals in Table 2b is narcosis. Most of the ESVs in Table 2b are based on EqP of neutral (nonionic) organic chemicals. With the exception of PAHs and a few other chemicals that are measured on a dry weight basis (highlighted in gray color on Table 2b) the concentrations are expressed in µg/kg at 1% OC.

The ΣTU approach should be used in the screening process to identify COPCs that may collectively contribute narcotic effects to sediment-dwelling organisms. The same methodology described in the previous section (Equation 3) was used for deriving the ESVs, except for PAHs which are discussed below.

6.2.4 PAH Mixtures – Refinement Screening Values

The EqP methodology presented in this section provides a means to estimate the ΣTU concentrations for PAHs that may be present in sediment for protection of benthic organisms from adverse effects.

The refinement screening values for PAHs are derived from the methodology developed in the EPA (2003) guidance document and incorporate the ΣTU approach for narcosis as discussed in Section 3.1.6. The methodology and equations are similar to the EqP discussion in Section 6.2.2. Based on this EPA (2003) approach and terminology, the quotient for a specific OC normalized PAH concentration ($C_{OC,PAHi}$) and the sediment OC normalized PAH final chronic value ($C_{OC,PAHi,FCVi}$) in sediments is termed the equilibrium partitioning sediment benchmark toxic unit ($ESBTU_{FCVi}$). Thus, the EqP sediment benchmark (ESB) for the mixture of PAHs is the sum of the $ESBTU_{FCVi}$ for all of the PAHs in the particular sediment as reflected below:

$$\Sigma ESBTU_{FCV} = \sum_i C_{OC,PAHi,} / C_{OC,PAHi,FCVi} \qquad (4)$$

Table 2c provides the sediment $C_{OC,PAHi,FCVi}$ for various PAHs. The 34 PAHs are bolded in the Table. Other individual PAH benchmark values may be found in Table 3.4 of the EPA (2003) guidance document. Note that these values are expressed as µg/kg OC (direct from the guidance) and have not been normalized to 1% OC.

This approach specifies that the sum of 34 individual PAHs be used for protection of benthic organisms. If the $\Sigma ESBTU_{FCV}$ is <1.0 for the 34 PAHs, then sensitive benthic organisms are considered not to be adversely affected.

It is recognized that most analytical methods do not measure the suggested 34 PAHs. In general, EPA's Contract Laboratory Program (CLP) does not provide such analyses and many other laboratories do not have the capability. Typically, non-alkylated PAHs are identified through the semi-volatile analysis methods (e.g., EPA SW-846 Method 8270C), that usually provide results for approximately 16 individual PAHs. For screening purposes, if there are less than 34 PAHs, then the EPA 2003 guidance document should be consulted to determine an appropriate multiplying factor to account for the potential contribution of the alkylated PAHs to benthic organism toxicity.

The EPA (2003) guidance document states that the FCVs and resulting sediment benchmarks are acceptable for saltwater sediments. Consequently, the freshwater sediment RSVs for PAHs are the same for marine sediment. These RSVs also do not consider the antagonistic, additive or synergistic effects of other sediment contaminants in combination with PAH mixtures or the potential for bioaccumulation and trophic transfer of PAH mixtures to aquatic life or wildlife.

At sites with PAH contamination, certain chemicals that are not technically PAHs are often present, such as dibenzofuran, carbazole, benzaldehyde, and 1,1-biphenyl. These chemicals should be considered for inclusion in the ΣTU for PAHs.

6.3 Soil Screening Values

The hierarchy for soil benchmarks for protection of plants, soil invertebrates, mammals and avians is as follows:

- EPA Ecological Soil Screening levels (EcoSSLs);
- Department of Energy Laboratories i.e., Los Alamos National Laboratory (LANL) and Oak Ridge National laboratory (ORNL).
- EqP modeled values for organic chemicals.

The Region 4 soil screening values (Table 3) include the EPA Ecological Soil Screening Values (EcoSSLs). Table 3 indicates the ecological entity that the soil screening value is intended to protect. Soil screening values that protect plants, soils invertebrates, avian wildlife or mammalian wildlife are reported from various sources. The Region 4 soil screening values typically address toxicity through direct exposure (e.g., toxicity to soil invertebrates such as earthworms and plants). For those chemicals that biomagnify, screening values may be back-calculated to derive screening values for avian or mammalian wildlife by considering trophic transfers from the abiotic medium to prey items. The EcoSSLs provide screening values for avian and mammalian wildlife by this method.

Where there are no EcoSSLs, the LANL or ORNL benchmarks are used. The Region 4 SSS is currently in the process of reviewing their benchmarks in the hierarchy. For organic compounds that don't have conventional screening benchmarks, Table 3 also includes screening benchmarks for invertebrates based on EqP theory similar to the sediment model. The following equation is used:

$$ESV_{Soil\ Inverts} = WQB \times [foc \times Koc + \theta_w/\rho_b + (\theta_a/\rho_b)*H'] \quad (6)$$

Where: $ESV_{Soil\ Inverts}$ = screening value (mg/kg)
WQB = water quality benchmark from ECOSAR (mg/L)
foc = fraction of OC assumed to be 1% (dimensionless)
Koc = OC partitioning coefficient (L/kg)
θw = volumetric water content of soil (0.198 cubic centimeter [cm^3]/cm^3)
θa = aeration porosity of soil (0.284 cm^3/cm^3)
ρb = soil bulk density (1.37 grams per cubic centimeter [g/cm^3])
H' = Henry's Law constant (dimensionless)

Although the θw, θa, and ρb parameters depend on soil texture, for screening purposes, the default values for each of these are based on the silty clay loam texture classification consistent with the Johnson and Ettinger (1991) Vapor Intrusion Model. Therefore, Equation 6 can be simplified to:

$$ESV_{Soil\ Inverts} = WQB \times [Koc + 0.145 + (0.207 * H')] \quad (7)$$

This model assumes that the WQBs protective of aquatic invertebrates in interstitial pore water are also protective of terrestrial invertebrates in soil. Recent research by Redman et al. (2014) suggests that a target lipid model for soil organisms may also be combined with the EqP model. Research to test their combined model is needed and will likely be forthcoming in the near future.

Although there are no refinement values (RSVs) for soils, the risk assessor may use the other benchmark values on Table 3 as RSVs, depending on the receptors exposed.

6.4 Wildlife Screening Values

Currently there is limited information concerning tissue chemical screening levels which would pose minimal or no toxic effects to predatory ecological receptors. Consequently, no screening-level tissue residue values have been proposed at this time for use in the SLERA. As mentioned in Section 3.2, dietary and bioaccumulation modeling is not recommended in the SLERA and should be reserved for Step 3a and beyond. There are TRVs for various wildlife that serve to indicate if a dietary contaminant dose may pose potential risk to a predatory ecological receptor. The chemical exposure is generally

expressed as a daily dietary exposure with the units in mg/kg body weight of the receptor per day (mg/kg-BW/day). Site-specific wildlife screening values that are based on ecotoxicological information from sources such as the scientific literature, computer databases, etc., may be submitted during the Step 3a Refinement Screen or later in the BERA. The EPA Region 4 SSS have TRVs and wildlife exposure parameters that are preferred for use in ecological risk assessments conducted in Region 4. Please contact the SSS ADD LINK for their latest updated values.

6.5 Groundwater Screening Values

If the initial CSM suggests the potential for impacts of contaminated groundwater on ecological receptors, either directly (e.g., cave-dwelling ecological receptors if present) or indirectly through existing or potential discharge to sediments, seeps, and surface water, then these pathways should be considered in the SLERA. The maximum groundwater chemical concentrations should be compared to the surface water screening values as a conservative scenario (e.g., no attenuation, dilution, etc.). The ΣTU approach for PAHs and other potentially narcotic chemicals in groundwater should be used as described in Section 3.1.5.

7.0 References

Burgess, R.M., Berry, W.J., Mount, D.R., and D.M. Di Toro. 2013. Mechanistic sediment quality guidelines based on contaminant bioavailability: Equilibrium partitioning sediment benchmarks. *Environ. Toxicol. Chem.* 32:102-114.

Di Toro, D.M., McGrath, J.A., and D.J. Hansen. 2000. Technical basis for narcotic chemicals and polycyclic aromatic hydrocarbon criteria. I. Water and Tissue. *Environ. Toxicol. Chem.* 19:1951-1970.

Johnson, P.C, and R.A. Ettinger. 1991. Heuristic model for predicting the intrusion rate of contaminant vapors in buildings. *Environ. Sci. Technol.* 25: 1445-1452.

Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52. National Oceanic and Atmospheric Administration.

MacDonald, D.D., Ingersoll, C.G, Smorong, D.E., Lindskoog, R.A., Sloane, G., and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Prepared for Florida Department of Environmental Protection, Tallahassee, Florida.
http://www.dep.state.fl.us/water/monitoring/docs/seds/SQAGs_for_Florida_Inland_Waters_01_03.PDF

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. *Arch. Environ. Contam. Toxicol.* 39:20-31.

McGrath, J.A. and D.M. Di Toro. 2009. Validation of the target lipid model for toxicity assessment of residual petroleum constituents: Monocyclic and polycyclic aromatic hydrocarbons. *Environ. Toxicol. Chem.* 28:1130-1148.

Redman, A.D., Parkerton, T.F., Paumen, M.L., and J.A. McGrath. 2014. Extension and validation of the target lipid model for deriving predicted no-effect concentrations for soils and sediments. *Environ. Toxicol. Chem.* 33:2679-2687.

Suter, G.W. II, and Tsao, C.L. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 Revision. U.S. Department of Energy, Oak Ridge, Tennessee. ES/ER/TM-96/R2.
http://www.esd.ornl.gov/programs/ecorisk/documents/tm96r2.pdf,

Swartjes, F.A., Rutgers, M., Lijzen, J.P.A., Janssen, P.J.C.M., Otte, P.F., Wintersen, A., Brand, E., and L. Posthuma. 2012. State of the art of contaminated site management in The Netherlands: Policy framework and risk assessment tools. *Sci. Tot. Environ.* 427-428: 1-10.

United States Environmental Protection Agency (U.S. EPA). 2008. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics. EPA-600-R-02-016. Office of Research and Development, Washington, D.C.
http://www.epa.gov/nheerl/download_files/publications/ESB_Compendium_v14_final.pdf

U.S. EPA. 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4. Office of Environmental Information, Washington, D.C. EPA/240/B-06/001. February 2006.
http://www.epa.gov/quality/qs-docs/g4-final.pdf

U.S. EPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. Office of Research and Development, Washington, D.C.
http://www.epa.gov/nheerl/download_files/publications/PAHESB.pdf

U.S. EPA. 2002a. Role of Background in the CERCLA Cleanup Program. Office of Solid Waste and Emergency Response, Washington, D.C., OSWER 9285.6-07P. April 2002.
http://www.epa.gov/oswer/riskassessment/pdf/bkgpol_jan01.pdf

U.S. EPA. 2002b. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites. Office of Emergency and Remedial Responses, Washington, D.C. EPA 540-R-01-003. September 2002.
http://www.epa.gov/oswer/riskassessment/pdf/background.pdf

U.S. EPA. 2001. Eco Update. The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments. Office of Solid Waste and Emergency Response, Washington, D.C. Publication 9345.0-14. EPA 540/F-01/014. June 2001.
http://www.epa.gov/oswer/riskassessment/ecoup/pdf/slera0601.pdf

U.S. EPA. 1998. Guidelines for Ecological Risk Assessment. Risk Assessment Forum, Washington, DC, EPA/630/R095/002F, 1998.
http://www.epa.gov/raf/publications/guidelines-ecological-risk-assessment.htm

U.S. EPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments - Interim Final. OSWER Directive 9285.7-25 EPA/540/R-97/006.
http://www.epa.gov/oswer/riskassessment/ecorisk/ecorisk.htm

U.S. EPA. 1995. Final Water Quality Guidance for the Great Lakes System. 60 *Federal Register:* 15365 (March 23, 1995). Table 6.
http://www.epa.gov/owow/tmdl/glsprohibit.pdf

U.S. EPA. 1993. Wildlife Exposure Factors Handbook, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R-93/187a,b. December 1993.
http://cfpub.epa.gov/ncea/cfm/wefh.cfm?ActType=default

U.S. EPA. 1992. Framework for Ecological Risk Assessment. Risk Assessment Forum, Washington, D.C. EPA/630/R-92/011. February 1992.
http://www.epa.gov/raf/publications/pdfs/FRMWRK_ERA.PDF

U.S. EPA. 1985. Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and their Uses. Office of Research and Development, Environmental Research Laboratories. PB85-227049.
http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/85guidelines.pdf

Table 1a
Region 4 Surface Water Screening Values for Hazardous Waste Sites

Chemical	CAS	Freshwater Screening Values (µg/L)			Saltwater Screening Values (µg/L)		
		Chronic	Acute	Source	Chronic	Acute	Source
Inorganic Compounds							
Metals							
Aluminum (pH 6.5 -9.0)	7429-90-5	87	750	a	1,900	3,288	c
Antimony	7440-36-0	190	900	b	30	180	c
Arsenic (unfiltered) ^	7440-38-2	150	340	a	36	69	a
Arsenic III (unfiltered) ^	22541-54-4	148	340	b	36	69	f
Barium	7440-39-3	220	2,000	b			
Beryllium	7440-41-7	11	93	b	0.66	35	c
Boron	7440-42-8	7,200	34,000	b	1,000		l
Cadmium (unfiltered) ^ *	7740-43-9	0.25	2	a	8.8	40	a
Calcium	7440-70-2	116,000	-	c	116,000		c
Chromium III (unfiltered) ^ *	16065-83-1	74	570	a	20		e
Chromium VI (unfiltered) ^	18540-29-9	11	16	a	50	1,100	a
Cobalt	7440-48-4	19	120	b	23	1,500	c
Copper (unfiltered) ^ *	7740-50-8	9	13	a	3.1	4.8	a
Iron	7439-89-6	1,000		a			
Lead (unfiltered) ^ *	7439-92-1	2.5	65	a	8.1	210	a
Lithium	7439-93-2	440	910	b	14	260	c
Magnesium	7439-95-4	82,000		c	82,000		c
Manganese	7439-96-5	93	1,680	b	120	2,300	d, c
Mercury (unfiltered) ^ (aquatic)	7439-97-6	0.77	1.4	a	0.94	1.8	a
Mercury (wildlife based)	7439-97-6	0.0013	0.012	b, a	0.00053	0.025	a
Methylmercury (aquatic life)	22967-92-6	0.0028	0.099	c	0.0028	0.099	c
Molybdenum	7439-98-7	800	7,200	b	370	16,000	c
Nickel (unfiltered) ^ *	7440-02-0	52	470	a	8.2	74	a
Phosphorus (elemental)	7723-14-0	1,000		m	100		d
Potassium	7440-09-7	53,000		c	53,000		c
Selenium (unfiltered) ^ (aquatic)	7782-49-2	5	20	a	71	290	a
Silver (unfiltered) ^ *	7740-22-4	0.06	3.2	b	0.1	1.9	e, a
Sodium	7440-23-5	680,000		c	680,000		c
Strontium	7440-24-6	5,300	48,000	b	1,500	15,000	c
Thallium	7740-28-0	6	54	b	12	110	c
Tin	7440-31-5	180	1,600	b	73	2,700	c
Uranium	7440-61-1	2.6	46	c	2.6	46	c
Vanadium	7440-62-2	27	79	b	20	280	c
Zinc (unfiltered) ^ *	7740-66-6	120	120	a	81	90	a
Zirconium	7440-67-7	17	310	c	17	310	c
Other Inorganics							
Chloride	16887-00-6	230,000	860,000	a			
Chlorine	7782-50-5	11	19	a	7.5	13	a
Cyanide (free)	57-12-5	5.2	22	a	1	1	a
Fluorides	16984-48-8	2,700	9,800	b	5,000		d
Hydrogen sulfide (S^{2-}, HS^-)	7783-06-4	2	3.2	a	2		a
Sulfite	14265-45-3	200		b			
Volatile Organic Compounds (VOCs)							
Chlorinated alkanes							
1,1,1,2-Tetrachloroethane	630-20-6	85	770	b	10.8		d
1,1,2,2-Tetrachloroethane	79-34-5	200	910	b	610	2,100	c
1,1,1-Trichloroethane	71-55-6	76	690	b	11	200	c
1,1,2-Trichloroethane	79-00-5	730	3,200	b	1,200	5,200	c
1,1-Dichloroethane	75-34-3	410	3,700	b	47	830	c
1,2-Dichloroethane	107-06-2	2,000	8,200	b	910	8,800	c
1,2-Dichloropropane	78-87-5	520	3,300	b		3,400	g
Dichloromethane (Methylene chloride)	75-09-2	1,500	8,500	b	2,200	26,000	c
Trichloromethane (Chloroform)	67-66-3	140	1,300	b	28	490	c
Tetrachloromethane (Carbon tetrachloride)	56-23-5	77	690	b	9.8	180	c

Table 1a
Region 4 Surface Water Screening Values for Hazardous Waste Sites

Chemical	CAS	Freshwater Screening Values (µg/L)			Saltwater Screening Values (µg/L)		
		Chronic	Acute	Source	Chronic	Acute	Source
Volatile Organic Compounds (VOCs)							
Chlorinated alkenes							
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	130	1,200	b	25	450	c
1,2-Dichloroethene (1,2-Dichloroethylene)	540-59-0	970	8,800	b	590	1,100	c
1,2-cis-Dichloroethyene	156-59-2	620	5,500	b			
1,2-trans-Dichloroethylene	156-60-5	558	10,046	b			
1,3-Dichloropropene (cis and trans)	542-75-6	1.7	15	b	0.06	0.99	c
1,1,2,2-Tetrachloroethylene (PCE)	127-18-4	53	430	b	98	830	c
1,1,2-Trichloroethylene (TCE)	79-01-6	200	2,000	b	47	440	c
Chloroethene (Vill chloride)	75-01-4	930	8,400	b			
Chlorobenzenes							
Chlorobenzene	108-90-7	25	220	b	64	1,100	c
1,2-Dichlorobenzene	95-50-1	23	130	b	14	260	c
1,3-Dichlorobenzene	541-73-1	22	79	b	71	630	c
1,4-Dichlorobenzene	106-46-7	9.4	57	b	15	180	c
1,2,3-Trichlorobenzene	87-61-6	5	195	l, i	5		l
1,2,4-Trichlorobenzene	120-82-1	130	420	b	110	700	c
1,3,5-Trichlorobenzene	108-70-3	5	195	l, i	5		l
Trichlorobenzene (mixed isomers)	12002-48-1	5	555	b, i	5		l
Monoaromatic hydrocarbons							
1,2,4-Trimethylbenzene	95-63-6	15	140	b			
1,3,5-Trimethylbenzene	108-67-8	26	230	b			
Benzene	71-43-2	160	700	b	71.3		d
Cymene, p- (4-Isopropyltoluene)	99-87-6	16	150	b			
Ethylbenzene	100-41-4	61	550	b	7.3	130	c
Isopropylbenzene (Cumene)	98-82-8	4.8	43	b			
Styrene (vinyl benzene)	100-42-5	32	290	b			
Toluene	108-88-3	62	560	b	9.8	120	c
Xylenes (total)	1330-20-7	27	240	b	13	230	c
Energetic VOAs							
Acetonitrile	75-05-8	12,000	100,000	b			
Acrylonitrile	107-13-1	78	650	b			
1,2-Diphenylhydrazine	122-66-7	1.1	9.6	b			
Hydrazine	302-01-2	2	16	b			
Ketones							
2-Butanone (methyl ethyl ketone)	78-93-3	22,000	200,000	b	14,000	240,000	c
2-Hexanone (methyl butyl ketone)	591-78-6	99	1,800	c	99	1,800	c
2-Octanone (methyl hexyl ketone)	111-13-7	8.3	150	c	8.3	150	c
4-Methyl-2-pentanone (MIBK)	108-10-1	170	2,200	c	170	2,200	c
Acetone	67-64-1	1,700	15,000	b	1,500	28,000	c
Other VOCs							
1-Pentanol	71-41-0	110	2,000	c	110	2,000	c
2-Propanol	67-63-0	7.5	130	c	7.5	130	c
Acetaldehyde	75-07-0	130	1,200	b	1.4		e
Acrolein	107-02-8	3	3	a			
Bromoform (tribromomethane)	75-25-2	230	1,100	b	320	2,300	c
Bromomethane (methyl bromide)	74-83-9	16	38	b			
Carbon disulfide	75-15-0	15	130	b	0.92	17	c
Cyclohexane	110-82-7	230		e	120		e
Dibromochloromethane	124-48-1	320	2,900	b	34		d
Dichlorobromomethane	75-27-4	340	3,100	b			
Ethylene glycol	107-21-1	140,000	1,300,000	b			
Hexane	110-54-3	0.58	10	c	0.58	10	c
Hexachloroethane	67-72-1	12	210	c	12	210	c
Methanol	67-56-1	330	3,000	b			
Methylamine	74-89-5	860	7,700	b			

Table 1a
Region 4 Surface Water Screening Values for Hazardous Waste Sites

Chemical	CAS	Freshwater Screening Values (µg/L)			Saltwater Screening Values (µg/L)		
		Chronic	Acute	Source	Chronic	Acute	Source
Volatile Organic Compounds (VOCs)							
Other VOCs							
Methyl tert-butyl ether (MTBE)	1634-04-4	730	6,500	b	18,000	53,000	m
Propylene glycol	57-55-6	71	640	b			
Tetrahydrofuran	109-99-9	11,000	74,000	b			
Vinyl acetate	108-05-4	16	280	c	16	280	c
Semivolatile Organic Compounds							
Chloroanilines							
4-Chloroaniline	106-47-8	19	459	j			
2,4-Dichloroaniline	554-00-7	15	575	j			
Pentachloroaniline	527-20-8	5	429	j			
Chlorobenzenes							
1,2,3,4-Tetrachlorobenzene	634-66-2	3.4	18	n			
1,2,4,5-Tetrachlorobenzene	95-94-3	8.3	75	b			
Chlorobenzene	108-90-7	25	220	b	64	1,100	c
Hexachlorobenzene (wildlife based)	118-74-1	0.0003		n			
Pentachlorobenzene (aquatic only)	608-93-5	3.1	16	b	0.47	8.4	c
Pentachlorobenzene (wildlife based)	608-93-5	0.019		n			
Chlorophenols							
2-Chlorophenol	95-57-8	32	290	b	400		d
2,4-Dichlorophenol	120-83-2	11	110	b	790		d
2,4,5-Trichlorophenol	95-95-4	1.9	17	b	12	259	o
2,4,6-Trichlorophenol	88-06-2	4.9	39	b	6.5		d
2,3,4,6-Tetrachlorophenol	58-90-2	1.2	11	n			
3-Methyl-4-Chlorophenol	59-50-7	7.4	67	n			
Other Phenols							
2-Methylphenol (Cresol, o-)	95-48-7	67	600	b	13	230	c
3-Methylphenol (Cresol, m-)	108-39-4	62	560	b			
4-Methylphenol (Cresol, p-)	106-44-5	53	480	b			
2,3-Dimethylphenol	526-75-0	120	1,100	n			
2,4-Dimethylphenol	105-67-9	15	140	b			
2-Nitrophenol	88-75-5	73	650	b			
4-Nitrophenol	100-02-7	58	530	b	300	1,200	c
2,4-Dinitrophenol	51-28-5	71	379	b	14.3		d
2,4,6-Tribromophenol	118-79-6	5.6	50	b			
Nonylphenol	84852-15-3	6.6	28	o	1.7	7	o
Pentachlorophenol # (aquatic)	87-86-5	15	19	a	7.9	13	a
Phenol	108-95-2	160	4,700	b	58	300	p
Semivolatile Organic Compounds							
Energetic SVOAs							
2-Amino-4,6-dinitrotoluene	35572-78-2	18	160	b	20	180	k
4-Amino-2,6-dinitrotoluene	19406-51-0	11	98	b			
1,3-Dinitrobenzene (DNB)	99-65-0	22	100	b	20	110	k
2,3-Dinitrotoluene	602-01-7	2.3	21	b			
2,4-Dinitrotoluene	121-14-2	44	390	b	9.1	200	d, g
2,5-Dinitrotoluene	619-15-8	5.6	50	b			
2,6-Dinitrotoluene	606-20-2	81	730	b		200	g
3,5-Dinitrotoluene	618-85-9	95	860	b			
3,5-Dinitroanaline (DNA)	618-87-1	60	230	k	60	230	k
HMX (Octahydro-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	220	1,200	b	330	1,880	k
Nitroglycerine	55-63-0	18	160	b			
2-Nitrotoluene	88-72-2	71	640	b			
3-Nitrotoluene	99-08-1	42	380	b			
4-Nitrotoluene	99-99-0	46	410	b			
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	79	520	b	190	700	k
1,3,5-Trinitrobenzene (TNB)	99-35-4	11	27	b	10	30	k
2,4,6-Trinitrotoluene (TNT)	118-96-7	13	120	b	90	570	k

Table 1a
Region 4 Surface Water Screening Values for Hazardous Waste Sites

Chemical	CAS	Freshwater Screening Values (µg/L)			Saltwater Screening Values (µg/L)		
		Chronic	Acute	Source	Chronic	Acute	Source
Semivolatile Organic Compounds							
Phthalates							
bis(2-Ethylhexyl) Phthalate	117-81-7	3	27	c	3	27	c
Butylbenzyl Phthalate	85-68-7	23	130	b	19		c
Diethyl Phthalate	84-66-2	220	980	b	210	1,800	c
Dimethyl Phthalate	131-11-3	1,100	3,200	b	2,900		e
Di-n-Butyl Phthalate	84-74-2	19	34	b	35	190	c
Polycyclic Aromatic Hydrocarbons (PAHs)							
1-Methylnaphthalene	90-12-0	2.1	37	c	2.1	37	c
2-Methylnaphthalene	91-57-6	4.7	42	b	72	86, i	q
Acenaphthene	83-32-9	15	19	b	20	86, i	l
Acenaphthylene	208-96-8	13	120	b	307	582, i	q
Anthracene	120-12-7	0.02	0.18	b	0.73	13	c
Benz(a)anthracene	56-55-3	4.7	42	b	0.027	0.49	c
Benzo(a)pyrene	50-32-8	0.060	0.54	b	0.3	2, i	c
Benzo(b)fluoranthene	205-99-2	2.6	23	b	0.68	2, i	q
Benzo(g,h,i)perylene	191-24-2	0.44	6	q, j	0.44	0.5, i	q
Benzo(k)fluoranthene	207-08-9	0.64	2	q, i	0.64	2, i	q
Chrysene	218-01-9	4.7	42	b	2	6.5, i	q
Dibenz(a,h)anthracene	53-70-3	0.28	6	q, j	0.28	1.2 i	q
Fluoranthene	206-44-0	0.8	3.7	b	7.1	21, i	q
Fluorene	86-73-7	19	110	b	3.9	70	c
Indeno(1,2,3-cd)pyrene	193-39-5	0.28	6	q, j	0.28	0.5, i	q
Naphthalene	91-20-3	21	170	b	12	190	c
Phenanthrene	85-01-8	2.3	31	b	4.6	7.7	o
Pyrene	129-00-0	4.6	42	b	10	21, i	q
Other SVOCs							
1,1-Biphenyl	92-52-4	6.5	26	b	14		c
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	20	50	b			
3,3'-Dichlorobenzidine	91-94-1	4.5	41	n			
4-Bromophenyl Phenyl Ether	101-55-3	1.5	0	c	1.5		c
Aniline	62-53-3	4.1	30	b			
Benzaldehyde	100-52-7	57	547	j			
Benzidine	92-87-5	1.5	14	b	3.9	70	c
Benzoic Acid	65-85-0	42	740	c	42	740	c
Benzyl alcohol	100-51-6	8.6	150	c	8.6	150	c
Decane	124-18-5	49	880	c	49	880	c
Dibenzofuran	132-64-9	4	36	b	3.7	66	c
Hexachlorobutadiene (Aquatic Life)	87-68-3	1	10	b	0.3	3	l
Hexachlorobutadiene (Wildlife Based)	87-68-3	0.053		n			
Hexachlorocyclopentadiene	77-47-4	0.45	4.5	b	0.07	0.7	l
Hydroquinone	123-31-9	2.2	4.4	b			
Isodecyl diphenyl phosphate	29761-21-5	1.73	22	b			
Isophorone	78-59-1	920	7,500	b		4,300	g
N-Nitrosodiphenylamine	86-30-6	25	220	b	210	3,800	c
Nitrobenzene	98-95-3	380	2,000	b		2,000	g
Propylene glycol	57-55-6	71	640	b			
Quinoline	91-22-5	3.4		h			
Triphenyl phosphate	115-86-6	4	40	b			
Pesticides, Herbicides, Fungicides							
2,4-D	94-75-7	79.2	130	r	70		d
4,4'-DDT (Aquatic Life Only)	50-29-3	0.0032	1.1	a	0.001	0.13	a
4,4'-DDE	72-55-9	0.41	7	j			
4,4'-DDD	72-54-8	0.011	0.19	c	0.011	0.19	c
Acephate	30560-19-1	150	550	r			
Aldrin	309-00-2	0.035	3.0	b	0.00014	1.3	d
Atrazine	1912-24-9	12	330	b			
Azinphos-methyl (Guthion)	86-50-0	0.01	0.08	a, r	0.01		a

Table 1a
Region 4 Surface Water Screening Values for Hazardous Waste Sites

Chemical	CAS	Freshwater Screening Values (µg/L)			Saltwater Screening Values (µg/L)		
		Chronic	Acute	Source	Chronic	Acute	Source
Pesticides, Herbicides, Fungicides							
BHC (beta)	319-84-6	0.046		d	0.046		d
BHC-gamma (Lindane) (Aquatic Life)	58-89-9	0.11	0.95	b, a	0.063	0.16	d, a
BHC-gamma (Lindane) (Wildlife Based)	58-89-9	0.026		n			
Carbaryl	63-25-2	0.5	0.85	r		1.6	a
Carbofuran	1563-66-2	0.75	1.12	r			
Captan	133-06-2		13.1	r			
Chlordane	57-74-9	0.0043	2.4	a	0.00059	0.004	d
Chlorothalonil	1897-45-6	0.6	1.8	r			
Chloropyrifos	2921-88-2	0.041	0.05	a, r	0.0056	0.011	a
Cyanazine	21725-46-2	270	2420	b			
Demeton	8065-48-3	0.1	-	b, a	0.1		a
Diazinon	333-41-5	0.17	0.17	a	0.82	0.82	a
Dicamba	1918-00-9	3,898	216	b			
Dieldrin	60-57-1	0.056	0.24	a	0.0019	0.71	a
Dimethoate	60-51-5	0.5	21.5	r			
Dinoseb	88-85-7	0.48	9.5	n			
Diquat	2764-72-9	6	54	b			
Endosulfan-alpha	959-98-8	0.01	0.11	r	0.0087	0.034	a
Endosulfan-beta	33213-65-9	0.01	0.11	r	0.0087	0.034	a
Endosulfan Sulfate	1031-07-8	0.056	0.22	p	0.0087	0.034	p
Endrin	72-20-8	0.036	0.086	a	0.0023	0.037	a
Heptachlor	76-44-8	0.0038	0.52	a	0.0036	0.053	a
Heptachlor Epoxide	1024-57-3	0.0038	0.52	a	0.0036	0.053	a
Malathion	121-75-5	0.035	0.295	r	0.1		a
MCPA (2-methyl-4-chlorophenoxyacetic acid)	94-74-6	2.6		h	4.2		h
Pesticides, Herbicides, Fungicides							
Methoxychlor	72-43-5	0.03	0.7	a	0.019		c
Metolachlor	51218-45-2	15	110	n			
Mirex (Aquatic Life)	2385-85-5	0.001	0.001	a	0.001	0.001	a
Mirex (Wildlife Based)	2385-85-5	0.000016	-	n			
Parathion	56-38-2	0.013	0.065	a	0.04		d
Silvex (2,4,5-TP)	93-72-1	30	270	n	50		f
Simazine	122-34-9	9	80	b			
Toxaphene	8001-35-2	0.0002	0.73	a	0.0002	0.21	a
Trifluralin	1582-09-8	1.14	20.5	r			
Polychlorinated Biphenyls (PCBs) and Dioxin/Furans							
2,3,7,8-TCDD (Dioxin)	1746-01-6	3.10E-09		b			
Dioxins (TEQ)			0.003	g			
Total PCBs (Wildlife Based)	1336-36-3	0.000074	0.014	b	0.000072	0.03	m
Other							
Alkalinity	-	20,000		a			
Ammonia ^^	7664-41-7	Varies	Varies	a	0.024	0.094	m
Formaldehyde	50-00-0	74	660	b			
Nitrite (warm water)	14797-65-0	20	100	b			
pH	-	6.5 - 9.0		a	6.5 - 8.5		a
Selenate	14124-68-6	9.5	12.5	b			
Selenite	14124-67-5	27.6	186	b			
Tributyltin	688-73-3	0.072	0.46	a	0.0074	0.42	a
Urea	57-13-6	17,000	150,000	b			

Table 1a
Region 4 Surface Water Screening Values for Hazardous Waste Sites

Chemical	CAS	Freshwater Screening Values (µg/L)			Saltwater Screening Values (µg/L)		
		Chronic	Acute	Source	Chronic	Acute	Source

Table 1a Notes:

Red font indicates a bioaccumulative chemical.

- Chemical that should be evaluated with the SUM Toxic Unit Approach as discussed in Text Section 3.1.5.

^ - Screening value is for total metals. A conversion factor (CF) was used to convert the screening value for total metals in surface water to a screening value for dissolved metals in surface water. CMC (dissolved) = CMC (total) × CF. See Table 1b for screening values for dissolved metals.

* - The freshwater screening value is hardness dependent. The screening value shown in Table 1a is for total metals assuming a hardness of 50 mg/L as $CaCO_3$. A correction for site-specific hardness was based on equations listed in Tables 1b and 1c. If hardness data are unavailable hardness may be estimated as: H = 2.497 × Ca (mg/L) + 4.118 × Mg (mg/L).

- Freshwater criteria for pentachlorophenol are pH Dependent. Values displayed are for a pH of 7.8.

^^ - Criteria for ammonia are pH, temperature, and lifestage dependent.

Table 1a Sources:

a - National Recommended Water Quality Criteria http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm

b - Great Lakes Initiative (GLI) Clearinghouse resources Tier II criteria revised 2013 http://www.epa.gov/gliclearinghouse/

c - Suter, G.W. II, and Tsao, C.L. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 Revision. ES/ER/TM-96/R2. http://www.esd.ornl.gov/programs/ecorisk/documents/tm96r2.pdf

d - Florida State Criteria for Surface Water Quality Classifications http://www.dep.state.fl.us/legal/Rules/shared/62-302/302-Table.pdf

e - North Carolina Department of Natural Resources (NCDNR) Surface Water Standards http://portal.ncdenr.org/web/wq/ps/csu/swstandards

f - Georgia Department of Natural Resources (GADNR) Water Use Classifications and Water Quality Standards http://rules.sos.state.ga.us/docs/391/3/6/03.pdf

g - Hawaii Department of Health (HDOH) Environmental Action Levels, Chronic and Acute Surface Water (Aquatic Habitat) Standards http://eha-web.doh.hawaii.gov/eha-cma/Leaders/HEER/environmental-hazard-evaluation-and-environmental-action-levels

h - CCME (Canadian Council of Ministers of the Environment). 2003. Canadian Environmental Quality Guidelines: Summary Table December 2003. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. Available at: http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/index.html

i - Region 4 Surface Water Model - See text Section 6.1.4 Equation 1.

j - ECOSAR program predicted lowest chronic or acute value. See Section 6.1.4 in text.

k - Talmadge et al. (1999)

l - New York Ambient Water Quality Criteria and Guidance Values: http://www.dec.ny.gov/docs/water_pdf/togs111.pdf

m - New Jersey Department of Environmental Protection (NJDEP) Ecological Screening Criteria http://www.nj.gov/dep/srp/guidance/ecoscreening/esc_table.pdf

n - Michican Water Quality Values - Rule 57: http://www.michigan.gov/deq/0,4561,7-135-3313_3686_3728-11383--,00.html

o - Texas Surface Water Quality Standards: https://www.tceq.texas.gov/waterquality/standards/2014standards.html

p - Mississippi Water Quality Standards: http://www.deq.state.ms.us/mdeq.nsf/page/WQSB_Water_Quality_Standards

q - EPA. 2003. Equilibrium Partitioning Sediment Benchmarks for Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. http://www.epa.gov/nheerl/download_files/publications/PAHESB.pdf

r - Office of Pesticide Programs (OPP) Aquatic Life Benchmarks: http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm

Table 1b
Conversion Factors (CF) and Hardness-Dependent Equations

Chemical	Freshwater						Saltwater	
	Chronic Values			Acute values			Conversion Factors	
	m_A	b_A	*CF*	m_A	b_A	*CF*	*CF - Chronic*	*CF - Acute*
Beryllium *	1.609	-5.017		1.609	-2.874			
Cadmium	0.7409	-4.719	1.101672-0.041838(lnH)	1.0166	-3.924	1.136672-0.041838 (lnH)	0.994	0.994
Chromium III	0.819	0.6848	0.86	0.819	3.7256	0.316	NA	NA
Chromium VI			0.962			0.982	0.993	0.993
Copper	0.8545	-1.702	0.96	0.9422	-1.7	0.96	0.83	0.83
Lead	1.273	-4.705	1.46203-0.145712(lnH)	1.273	-1.46	1.46203-0.145712 (lnH)	0.951	0.951
Mercury			0.85			0.85	0.85	0.85
Nickel	0.846	0.0584	0.997	0.846	2.255	0.998	0.99	0.99
Selenium							0.998	0.998
Silver				1.72	-6.59	0.85	NA	0.85
Zinc	0.8473	0.884	0.986	0.8473	0.884	0.978	0.986	0.978

Notes:

* - beryllium hardness-based Great Lakes Tier 2 equation

CF - Conversion Factor

InH - natural log of Hardness

Filtered Chronic Screening Value = $\exp\{m_A[\ln(H)]+b_A\}$ [CF]

Table 1c
Example Freshwater Screening Values for Varying Degrees of Water Hardness

CHEMICAL	Unfiltered Samples							
	Chronic Values (µg/L)				Acute Values (µg/L)			
	Hardness (mg/kg $CaCO_3$)				Hardness (mg/kg $CaCO_3$)			
	25	50	100	200	25	50	100	200
Beryllium	1.2	3.5	11	33	10	30	93	285
Cadmium	0.10	0.16	0.27	0.45	0.52	1.1	2.1	4.3
Chromium III	23.8	39	86	152	183	1,000	1,800	3,200
Copper	2.74	4.9	8.9	16	3.6	7.3	14	27
Lead	0.54	1.3	3.2	7.69	13.9	34	82	197
Nickel	16.1	29	52	94	145	261	469	843
Silver	--	--	--	--	0.30	1.1	3.8	12
Zinc	36	67	120	216	36	67	120	216

Notes:

$CaCO_3$ - calcium carbonate

µg/L - micrograms per liter

mg/kg- milligrams per kilogram

Table 2a
Region 4 Sediment Screening Values for Hazardous Waste Sites
Non-Narcotic Modes of Action

Chemical		CAS	Freshwater Sediment Screening Value		Source	Marine/Estuarine Sediment Screening Value		Source
			ESV	RSV		ESV	RSV	
Inorganic Compounds mg/kg dry weight								
Metals mg/kg dw								
Aluminum		7429-90-5	25,000	58,000	i			
Antimony		7440-36-0	2	25	a	2	25	a
Arsenic		7440-38-2	9.8	33	b	7.24	41.6	c
Barium		7440-39-3	20	60	b	-	-	-
Cadmium		7440-43-9	1	5	b	0.68	4.21	c
Chromium (Total)		7440-47-3	43.4	111	b	52.3	160	c
Cobalt		7440-48-4	50		g			
Copper		7440-50-8	31.6	149	b	18.7	108	c
Iron		7439-89-6	20,000	40,000	g			
Lead		7439-92-1	35.8	128	b	30.2	112	c
Manganese		7439-96-5	460	1,100	h			
Mercury		7439-97-6	0.18	1.1	b	0.13	0.7	c
Nickel		7440-02-0	22.7	48.6	b	15.9	42.8	c
Selenium		7782-49-2	11	20	h			
Silver		7440-22-4	1	2.2	b	0.73	1.77	c
Uranium		7440-61-1	100	1,000	i			
Zinc		7440-66-6	121	459	b	124	271	c
Other Inorganics mg/kg								
Ammonia		7664-41-7	230	300	h			
Sulfides (Total)		18946-25-8	39	61	h			
Volatile Organic Compounds (VOCs) µg/kg @1% OC								
Acetaldehyde	R	75-07-0	1.6	12	d	342		e
Acrylonitrile	R	107-13-1	6.9	55	d			
1,2-Diphenylhydrazine	R	122-66-7	3.8	31	d			
Methylamine	R	74-89-5	34	298	d			
Vinyl acetate	N3	108-05-4	1.2	16	d	1.2	16	d
Semivolatile Organic Compounds (SVOCs)								
Phenols µg/kg @1% OC unles denoted by shading								
2-Chlorophenol	N2	95-57-8	61		d	764		d
2-Methylphenol (o-cresol)	N2	95-48-7	100		d	19	63	d, h
2,3-Dimethylphenol	N2	526-75-0	349		d			
2,4-Dimethylphenol	N2	105-67-9	35		c	29	29	h
3-Methylphenol (Cresol, m-)	N2	108-39-4	93		d			
4-Methylphenol (p-Cresol)	N2	106-44-5	78	260	d, h	670	670	h
2-Nitrophenol	N2	88-75-5	146		d			
4-Nitrophenol	N2	100-02-7	135		d	699		d
2,4-Dinitrophenol	U	51-28-5	202		d	41		d
2-Methyl-4,6-Dinitrophenol	U	534-52-1	2,477		e			
2,4,5-Trichlorophenol	N2	95-95-4	34		d	213		d
2,4,6-Trichlorophenol	N2	88-06-2	87		d	116		d
3-Methyl-4-Chlorophenol	N2	59-50-7	37		d			
Pentachlorophenol	U	87-86-5	744	1,200	d, h	360	690	h
Phenol	N2	108-95-2	120	120	h	420	1,200	h
Energetic SVOAs µg/kg @ 1% OC								
2-Amino-4,6-dinitrotoluene	U	35572-78-2	41		d			
4-Amino-2,6-dinitrotoluene	U	19406-51-0	25		d			
1,3-Dinitrobenzene	U	99-65-0	34		d	795		e
2,3-Dinitrotoluene	R	602-01-7	8.8		d	1,168		e
2,4-Dinitrotoluene	R	121-14-2	127		d	26		d
2,5-Dinitrotoluene	R	619-15-8	21		d	1,168		e
2,6-Dinitrotoluene	R	606-20-2	271		d	1,084		e
3,5-Dinitrotoluene	R	618-85-9	353		d	1,168		e
HMX (Octahydro-tetranitro-1,3,5…)	C	2691-41-0	42		d			
Nitroglycerine	R	55-63-0	4.9		d			
RDX (Hexahydro-1,3,5-trinitro-1,3,5...)	R	121-82-4	41		d			
1,3,5-Trinitrobenzene	R	99-35-4	12		d	782		e
2,4,6-Trinitrotoluene (TNT)	R	118-96-7	23		d	888		e

Table 2a
Region 4 Sediment Screening Values for Hazardous Waste Sites
Non-Narcotic Modes of Action

Chemical		CAS	Freshwater Sediment Screening Value		Source	Marine/Estuarine Sediment Screening Value		Source
			ESV	RSV		ESV	RSV	
Semivolatile Organic Compounds (SVOCs)								
Other SVOCs µg/kg @ 1% OC								
4-Chloroaniline	N2	106-47-8	316		d			
2,4-Dichloroaniline	N2	554-00-7	328		d			
Pentachloroaniline	U	527-20-8	920		d			
2,2-Dibromo-3-nitrilopropionamide	R	10222-01-2	1.4		d	304		e
3,3'-Dichlorobenzidine	N2	91-94-1	30		d			
Aniline	N2	62-53-3	1.3		d			
Benzaldehyde	R	100-52-7	462		e			
Benzidine	N2	92-87-5	0.9		d	1.6		d
bis(2-Chloroethyl) Ether	R	111-44-4	4,761		e			
Decane	N2	124-18-5	491		e	308		d
Hexachlorobutadiene (aquatic life)	R	87-68-3	8.8		d	2.5		d
Hexachlorobutadiene (wildlife-based)	R	87-68-3	0.7		d			
Hexachlorocyclopentadiene	R	77-47-4	6.6		d	1.0		d
Hydroquinone	R	123-31-9	1.1		d			
Pesticides µg/kg @ 1% OC unless denoted by shading								
2,4-D	H	94-75-7	24		d			
4,4'-DDD	C	72-54-8	1.22	7.81	c	1.22	7.81	c
Total DDD	C	-	4.88	28	b	2	20	a
4,4'-DDE	C	72-55-9	2.07	3.74	c	2.07	3.74	c
Total DDE	C	-	3.16	31.3	b	2	15	a
4,4'-DDT (aquatic life)	C	50-29-3	5.7		d	1.7		d
4,4'-DDT (wildlife-based)	C	50-29-3	0.32		d	0.01		d
4,4'-DDT	C	50-29-3	1.19	4.77	c	1.19	4.77	c
Total DDT	C	-	4.16	62.9	b	3.89	51.7	c
DDT/DDE/DDD (total)	C	-	5.28	572	b			
Acephate	A	30560-19-1	5.7		d	300		d
Acrolein	R	107-02-8	0.33		d			
Aldrin	C	309-00-2	29		d	0.11		d
Atrazine	H	1912-24-9	18		d	1,289		e
BHC (alpha)	C	319-84-6	1.6		d	1.3		d
BHC (beta)	C	319-85-7	6,665		f			
BHC-gamma (Lindane)	C	58-89-9	2.37	4.99	b	0.32	0.99	c
BHC-gamma (Lindane) (aquatic life)	C	58-89-9	3.4		d			
BHC-gamma (Lindane) (wildlife-based)	C	58-89-9	1.0		d			
Carbaryl	A	63-25-2	1.0		d			
Carbofuran	A	1563-66-2	1.0		d			
Captan	F	133-06-2	346		d			
Chlordane	C	57-74-9	3.24	17.6	b	2.26	4.79	c
Chlorothalonil	R	1897-45-6	6.5		d	301		f
Chloropyrifos	A	2921-88-2	3.3		d	0.41		d
Cyanazine	H	21725-46-2	362		d	2,790		e
Demeton	A	126-75-0	0.44		d	300		e
Diazinon	A	333-41-5	4.0		d	18		d
Dicamba	H	1918-00-9	1,060		d			
Dieldrin	C	60-57-1	1.9	9.3	b, h	0.715	4.3	c
Dieldrin (aquatic life)	C	60-57-1	3.2		d	0.1		d
Dieldrin (wildlife-based)	C	60-57-1	0.3		d			
Dimethoate	A	60-51-5	0.36		d			
Dinoseb	H	88-85-7	15		d			
Diquat	H	2764-72-9	23		d			
Endosulfan-alpha	C	959-98-8	0.46		d	0.14		d
Endosulfan-beta	C	33213-65-9	0.46		d	0.14		d
Endosulfan Sulfate	C	1031-07-8	1.0		d	0.11		d
Endrin	C	72-20-8	2.22	207	b	2.67	62	j
Guthion	A	86-50-0	0.31		d	0.005		d
Heptachlor	C	76-44-8	1.9		d	1.5		d
Heptachlor epoxide	C	1024-57-3	2.47	16	b	0.6	2.7	j
Malathion	A	121-75-5	0.31		d	0.03		d

Table 2a
Region 4 Sediment Screening Values for Hazardous Waste Sites
Non-Narcotic Modes of Action

Chemical		CAS	Freshwater Sediment Screening Value		Source	Marine/Estuarine Sediment Screening Value		Source
			ESV	RSV		ESV	RSV	
Pesticides µg/kg @ 1% OC								
MCPA (2-methyl-4-chlorophenoxyacetic acid)	H	94-74-6	1,000		f	1,000		f
Methoxychlor	C	72-43-5	2.4		d	1.34		d
Metolachlor	H	51218-45-2	37		d	3,840		f
Mirex (aquatic life)	C	2385-85-5	3.9		d	3.6		d
Mirex (wildlife-based)	C	2385-85-5	0.36		d			
Parathion	A	56-38-2	0.5		d	0.6		d
Silvex (2,4,5-TP)	H	93-72-1	53		d	88		d
Simazine	H	122-34-9	7.8		d			
Toxaphene	C	8001-35-2	0.45		d	0.15		d
Trifluralin	H	1582-09-8	187		d			
Polychlorinated Biphenyls (PCBs) and Dioxins/Furans		**µg/kg @ 1% OC unless denoted by shading**						
Total PCBs	E	1336-36-3	59.8	676	b	21.6	12	c, h
Total PCBs (wildlife-based)	E	1336-36-3	0.33		d	0.025		d
Dioxins/Furans	E	1746-01-6	0.0025	0.025	k	0.0025	0.025	k
2,3,7,8-TCDD (Dioxin) (wildlife-based)	E	1746-01-6	0.3		d			
Other mg/kg dw								
Butyl tins mg/kg dw								
Monobutyltin		78763-54 -9	0.54	4.8	h			
Dibutyltin		818-08-6	0.91	130	h			
Tributyltin		688-73-3	0.047	0.32	h			
Tetrabutyltin		1461-25-2	0.097	0.097	h			
Bulk Petroleum Hydrocarbons mg/kg dw								
Total Petroleum Hydrocarbons - Diesel		68334-30-5	340	510	h			
Total Petroleum Hydrocarbons - Residual		68476-53-9	3,600	4,400	h			

Table 2 Notes:
Red font indicates a bioaccumulative chemical.
Shaded gray cells indicate units in µg/kg dry weight.
CAS = chemical abstract service registry number
ESV - Ecological Screening Value for Step 2
RSV - Refinement Screening Value for Step 3a
R - Reactive electrophiles/proelectrophiles
N2 - Polar Narcosis
N3 - Diesters
U - Oxidative phosphorylation uncouplers
H - Herbicides
C - Central nervous system seizure agents
A - Acetylcholinesterase inhibitors
F - Fungicide
E - Endocrine disrupters or reproductive and developmental toxicants

Table 2a Sources:

a - Long, Edward R., and Lee G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52. Used effects range low (ER-L) for chronic and effects range medium (ER-M) for acute.

b - MacDonald, D.D.; Ingersoll, C.G.; Smorong, D.E.; Lindskoog, R.A.; Sloane, G; and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Florida Department of Environmental Protection, Tallahassee, FL. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Used threshold effect concentration (TEC) for the ESV and probable effect concentration (PEC) for the RSV.

c - MacDonald, D.D. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Florida Department of Environmental Protection. 1994 Florida Sediment Quality Assessment Guidelines for Florida Coastal Waters.

d - Region 4 Sediment Model based on highest ranked surface water quality ESV from Table 1a. See Equation 3 in text Section 6.2.2.

e - Region 4 Sediment Model based on: (ECOSAR minimum chronic value). See text.

f - Region 4 Sediment Model based on: (lowest predicted surface water value from McGrath & Di Toro (2009). See text.

g - Persaud, D., R. Jaagumagi and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. Ontario Ministry of the Environment. Queen's Printer of Ontario.

h - Washington State Sediment Management Standards, Cleanup Objectives. http://www.ecy.wa.gov/programs/tcp/smu/sed_standards.htm

i - Los Alamos National Laboratory ECORISK Database. http://www.lanl.gov/community-environment/environmental-stewardship/protection/eco-risk-assessment.php

j - CCME (Canadian Council of Ministers of the Environment). 2003. Canadian Environmental Quality Guidelines: Summary Table December 2003. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. Available at http://www.ccme.ca/publications/ceqg_rcqe.html

k - USEPA. 1993. Interim Report on Data and Methods for Assessment of 2,3,7,8 - Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife. EPA/600/R-93/055. Available from the National Service Center for Environmental Publications (NSCEP) Document Number 600R93055. http://www.epa.gov/nscep/

Table 2b
Region 4 Sediment Screening Values for Hazardous Waste Sites
for Narcotic Mode of Action

Chemical	CAS	Freshwater Sediment Screening Value (µg/kg 1% OC)		Source	Marine/Estuarine Sediment Screening Value (µg/kg 1% OC)		Source
		ESV	RSV		ESV	RSV	
Volatile Organic Compounds (VOCs) - µg/kg @ 1% OC							
Chlorinated alkanes							
1,1,1,2-Tetrachloroethane	630-20-6	73		a	9.6		a
1,1,2,2-Tetrachloroethane	79-34-5	190		a	579		a
1,1,1-Trichloroethane	71-55-6	34		a	5.1		a
1,1,2-Trichloroethane	79-00-5	319		a	524		a
1,1-Dichloroethane	75-34-3	131		a	15		a
1,2-Dichloroethane	107-06-2	385		a	175		a
1,2-Dichloropropane	78-87-5	272		a	1,900		b
Dichloromethane (methylene chloride)	75-09-2	183		a	268		a
Trichloromethane (Chloroform)	67-66-3	45		a	9.2		a
Tetrachloromethane (Carbon tetrachloride)	56-23-5	34		a	4.6		a
Chlorinated alkenes							
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	41		a	8.3		a
1,2-Dichloroethene (1,2-Dichloroethylene)	540-59-0	338		a	234		a
1,2-cis-Dichloroethyene	156-59-2	246		a			-
1,2-trans-Dichloroethylene	156-60-5	221		a			-
1,3-Dichloropropene	542-75-6	1.0		a	0.33		a
1,1,2,2-Tetrachloroethylene (PCE)	127-18-4	50		a	93		a
1,1,2-Trichloroethylene (TCE)	79-01-6	134		a	29		a
chloroethene (Vinyl chloride)	75-01-4	202		a			-
Chlorobenzenes							
Chlorobenzene	108-90-7	58		a	150		a
1,2-Dichlorobenzene	95-50-1	88		a	54		a
1,3-Dichlorobenzene	541-73-1	83		a	267		a
1,4-Dichlorobenzene	106-46-7	35		a	57		a
1,2,3-Trichlorobenzene	87-61-6	69		a	70		a
1,2,4-Trichlorobenzene	120-82-1	1,700		c	775		b
1,3,5-Trichlorobenzene	108-70-3	66		a	67		a
Trichlorobenzene (mixed isomers)	12002-48-1	66		a	67		a
Monoaromatic hydrocarbons							
1,2,3-Trimethylbenzene	526-73-8	2,074		c	652		b
1,2,4-Trimethylbenzene	95-63-6	92		a	645		b
1,3,5-Trimethylbenzene	108-67-8	157		a	638		b
Benzene	71-43-2	113		a	4,038		b
Cymene, p- (4-Isopropyltoluene)	99-87-6	179		a	536		b
Ethylbenzene	100-41-4	272		a	33		a
Isopropylbenzene (Cumene)	98-82-8	33		a	984		b
Styrene (Vinyl benzene)	100-42-5	116		a	1,959		b
Toluene	108-88-3	145		a	23		a
Xylenes (total)	1330-20-7	103		a	50		a
Ketones							
2-Butanone (methyl ethyl ketone)	78-93-3	992		a	631		a
2-Hexanone (methyl butyl ketone)	591-78-6	2,828		b	15		a
2-Octanone (methyl hexyl ketone)	111-13-7	4.1		a	4.4		a
4-Methyl-2-pentanone (MIBK)	108-10-1	2,712		b	22		a
Acetone	67-64-1	40		a	36		a
Other VOCs							
1-Pentanol	71-41-0	7.3		a	7.3		a
2-Propanol	67-63-0	0.42		a	0.42		a
Acetonitrile	75-05-8	561		a	5,144		b
4-Bromophenyl phenyl ether	101-55-3	46		a	46		a
Bromoform (Tribromomethane)	75-25-2	73		a	102		a
Bromomethane (methyl bromide)	74-83-9	2.0		a	3,107		b
Carbon disulfide	75-15-0	3.6		a	0.5		a
Dibromochloromethane	124-48-1	102		a	11.1		a
Dichlorobromomethane	75-27-4	108		a	5,915		b

Table 2b
Region 4 Sediment Screening Values for Hazardous Waste Sites
for Narcotic Mode of Action

Chemical	*CAS*	*Freshwater Sediment Screening Value (µg/kg 1% OC)*		*Source*	*Marine/Estuarine Sediment Screening Value (µg/kg 1% OC)*		*Source*
		ESV	*RSV*		*ESV*	*RSV*	
Other VOCs							
Ethylene glycol	107-21-1	314		a	1,921		b
Hexachloroethane	67-72-1	24		a	24		a
Methanol	67-56-1	3.6		a	1,941		b
Methyl tert-butyl ether (MTBE)	1634-04-4	84		a	2,911		b
Propylene glycol	57-55-6	0.6		a	2,199		b
Tetrahydrofuran	109-99-9	1,183		a	4,372		b
Semivolatile Organic Compounds (SVOCs) µg/kg @ 1% OC							
Chlorobenzenes							
1,2,3,4-Tetrachlorobenzene	634-66-2	77		a	436		c
1,2,4,5-Tetrachlorobenzene	95-94-3	185		a	434		c
Hexachlorobenzene	118-74-1	0.32		a	310		c
Pentachlorobenzene	608-93-5	115		a	18		a
Phenols							
2,4-Dichlorophenol	120-83-2	54		a	3,885		b
2,4,6-Tribromophenol	118-79-6	45		a			
2,3,4,6-Tetrachlorophenol	58-90-2	36		a			
Nonylphenol	25154-52-3	1,268		a	327		a
Energetic SVOAs							
2-Nitrotoluene	88-72-2	185		a	8,315		b
3-Nitrotoluene	99-08-1	133		a	10,000		b
4-Nitrotoluene	99-99-0	131		a	9,065		b
Phthalates µg/kg @ 1% OC unless denoted by shading							
Bis(2-ethylhexyl)phthalate	117-81-7	182	2,647	d	182	2,647	d
Butyl benzyl phthalate	85-68-7	592		a	489		a
Diethyl phthalate	84-66-2	231		a	221		a
Dimethyl phthalate	131-11-3	348		a	3,000		b
Di-n-butyl phthalate	84-74-2	220	1,000	a, e	405		a
Di-n-octyl phthalate	117-84-0	513	1,100	e	300		b
PAHs µg/kg dw							
Low molecular weight PAHs (LMW-PAHs)							
1-Methylnaphthalene	90-12-0	*			*		
2-Methylnaphthalene	91-57-6	*			*		
Acenaphthene	83-32-9	*			*		
Acenaphthylene	208-96-8	*			*		
Anthracene	120-12-7	*			*		
Fluorene	86-73-7	*			*		
Naphthalene	91-20-3	*			*		
Phenanthrene	85-01-8	*			*		
Total LMW-PAHs		*			**312**		d
High molecular weight PAHs (HMW-PAHs)							
Benz(a)anthracene	56-55-3	*			*		
Benzo(a)pyrene	50-32-8	*			*		
Benzo(b)fluoranthene	205-99-2	*			*		
Benzo(g,h,i)perylene	191-24-2	*			*		
Benzo(k)fluoranthene	207-08-9	*			*		
Chrysene	218-01-9	*			*		
Dibenz(a,h)anthracene	53-70-3	*			*		
Fluoranthene	206-44-0	*			*		
Indeno(1,2,3-cd)pyrene	193-39-5	*			*		
Phenanthrene	85-01-8	*			*		
Pyrene	129-00-0	*			*		
Total HMW-PAHs		*		d	**655**		d
Total PAHs		**1,610**		f	**1,684**		d

Table 2b
Region 4 Sediment Screening Values for Hazardous Waste Sites
for Narcotic Mode of Action

Chemical	*CAS*	*Freshwater Sediment Screening Value (µg/kg 1% OC)*		*Source*	*Marine/Estuarine Sediment Screening Value (µg/kg 1% OC)*		*Source*
		ESV	*RSV*		*ESV*	*RSV*	
Other SVOCs µg/kg @ 1% OC unless denoted by shading							
1,1-Biphenyl	92-52-4	197		a	423		a
4-Bromophenyl Phenyl Ether	101-55-3	46		a	46		a
Benzoic Acid	65-85-0	2,900	3,800	e	650	650	e
Benzyl alcohol	100-51-6	1.4		a	57	73	e
Carbazole	86-74-8	900	1,100	e			-
Dibenzofuran	132-64-9	151	680	a, e	139		a
Isodecyl diphenyl phosphate	29761-21-5	89		a	301		b
Isophorone	78-59-1	600		a	2,177		b
N-Nitrosodiphenylamine	86-30-6	35		a	295		a
Nitrobenzene	98-95-3	559		a	21,670		b
Propylene glycol	57-55-6	0.6		a	2,198		b
Quinoline	91-22-5	2,774		c	2,774		c
Triphenyl phosphate	115-86-6	69		a	301		b

Table 2 Notes:
* see Total below.
Red font indicates a bioaccumulative chemical.
Gray shaded cells indicate concentration in µg/kg dry weight
ESV - Ecological Screening Value for Step 2
RSV - Refinement Screening Value for Step 3a
CAS = chemical abstract service registry number

Table 2a Sources:
a - Region 4 Sediment Model based on highest ranked surface water quality ESV from Table 1a See Equation 3 in text Section 6.2.2.
b - Region 4 Sediment Model based on: (ECOSAR minimum chronic value). See text.
c - Region 4 Sediment Model based on: (lowest predicted surface water value from McGrath & Di Toro (2009). See text.
d - MacDonald, D.D. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Florida Department of Environmental Protection. 1994 Florida Sediment Quality Assessment Guidelines for Florida Coastal Waters.
e - Washington State Sediment Management Standards, Cleanup Objectives. http://www.ecy.wa.gov/programs/tcp/smu/sed_standards.htm
f - MacDonald, D.D.; Ingersoll, C.G.; Smorong, D.E.; Lindskoog, R.A.; Sloane, G; and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Florida Department of Environmental Protection, Tallahassee, FL. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters. Used threshold effect concentration (TEC) for ESV.

Table 2c
Region 4 Step 3a Sediment Screening Values
for Polycyclic Aromatic Hydrocarbons (PAHs) at Hazardous Waste Sites

Chemical	*CAS*	*Freshwater Sediment Screening Values (µg/kg OC)*	*Source*	*Marine/Estuarine Sediment Screening Values (µg/kg OC)*	*Source*
		RSV		RSV	
Low Molecular Weight PAHs (LMW-PAHs)					
Acenaphthene	83-32-9	491	a	16	c
Acenaphthylene	208-96-8	452	a	66	c
Anthracene	120-12-7	594	a	220	c
Fluorene	86-73-7	538	a	23	c
C1-Fluorenes	-	611	a	-	-
C2-Fluorenes	-	686	a	-	-
C3-Fluorenes	-	769	a	-	-
1-Methyl naphthalene	90-12-0	446	a	131	b
2-Methyl naphthalene	91-57-6	447	a	116	b
2,6-Dimethyl naphthalene	581-42-0	513	a	44	b
2,3,5-Trimethylnaphthalene	2245-38-7	584	a	13	b
Naphthalene	91-20-3	385	a	99	c
C1-Naphthalenes	-	444	a	-	-
C2-Naphthalenes	-	510	a	-	-
C3-Naphthalenes	-	581	a	-	-
C4-Naphthalenes	-	657	a	-	-
1-Methyl phenanthrene	832-69-9	670	a	50	b
Phenanthrene	85-01-8	596	a	100	c
C1-Phenatherene/anthracenes	-	670	a	-	-
C2-Phenatherene/anthracenes	-	746	a	-	-
C3-Phenatherene/anthracenes	-	829	a	-	-
C4-Phenatherene/anthracenes	-	913	a	-	-
Thiophenes					
Benzothiophene	11095-43-5	569	b	226	b
Dibenzothiophene	132-65-0	1,860	b	156	b
C1-Dibenzothiophenes	-	1,146	b	-	-
C2-Dibenzothiophenes	-	898	b	-	-
C3-Dibenzothiophenes	-	664	b	-	-
C4-Dibenzothiophenes	-	466	b	-	-
Naphthothiophene	233-02-3	1,803	b	151	b
High Molecular Weight PAHs (HMW-PAHs)					
Benzo(a)anthracene	56-55-3	841	a	110	c
C1-Benzanthracene/chrysenes	-	929	a	-	-
C2-Benzanthracene/chrysenes	-	1,008	a	-	-
C3-Benzanthracene/chrysenes	-	1,112	a	-	-
C4-Benzanthracene/chrysenes	-	1,214	a	-	-
Benzo(b)fluoranthene	205-99-2	979	a	38	b
Benzo(k)fluoranthene	-	981	a	38	b
Benzo(g,h,i)perylene	191-24-2	1,095	a	230	c
Benzo(a)pyrene	50-32-8	965	a	31	c
Benzo(e)pyrene	192-97-2	967	a	99	b
Chrysene	218-01-9	844	a	25	c
Dibenz(a,h) anthracene	53-70-3	1,123	a	12	c
Fluoranthene	206-44-0	707	a	160	c
C1-Fluoranthene/pyrenes	-	770	a	-	-
Indeno(1,2,3-cd)pyrene	193-39-5	1,115	a	34	c
Perylene	198-55-0	967	a	17	b
Pyrene	129-00-0	697	a	1,000	c

Notes:
RSV - Refinement Screening Value

a - EPA (2003). Procedures for the Derivation of Equlibrium Partitioning Sediment Benchmarks(ESBs) for the Protection of Benthic Orgamisms: PAH Mixtures. EPA/600/R-02/013. The value listed represents the C_{OC}, PAH_i, FCV_i from the document. See text section 6.2.4.

b - Region 4 Sediment model using ECOSAR.

c - Washington State Sediment Management Standards, Cleanup Objectives. http://www.ecy.wa.gov/programs/tcp/smu/sed_standards.htm

Table 3
Region 4 Soil Screening Values for Hazardous Waste Sites

CHEMICAL	CAS	Screening Level (mg/kg)	Ref.	Receptor	Plants	Ref.	Soil Invertebrates	Ref.	Mammalian	Ref.	Avian	Ref.
Inorganic Compounds												
Metals												
Aluminum	7429-90-5	Narrative	a	All			Narrative	a				
Antimony	7440-36-0	0.27	a	All	11	c	78	a	0.27	a		
Arsenic	7440-38-2	18	a	All	18	a	60	b	46	a	43	a
Barium	7440-39-3	330	a	All	110	c	330	a	2,000	a	1,000	c
Beryllium	7440-41-7	10	b	All	10	b	40	a	18	c		
Boron	7440-42-8	7.5	c	All	36	c			56	c	7.5	c
Cadmium	7440-43-9	0.36	a	All	32	a	140	a	0.36	a	0.77	a
Chromium - Total	7440-47-3	28	c	All					45	c	28	c
Chromium III	16065-83-1	18	a	All			18	a	34	a	26	a
Chromium VI	18540-29-9	0.35	c	All	0.35	c	7.8	a	81	a	190	c
Cobalt	7440-48-4	13	a	All	13	a			230	a	120	a
Copper	7440-50-8	28	a	All	70	a	80	a	49	a	28	a
Iron	7439-89-6	Narrative	a	All			Narrative	a				
Lead	7439-92-1	11	a	All	120	a	1,700	a	56	a	11	a
Lithium	7439-93-2	2	b	P, M	2	b			38	c		
Manganese	7439-96-5	220	a	All	220	a	450	a	4,000	a	4,300	a
Mercury (total)	7439-97-6	0.1	b	All	0.3	b	0.1	b	1.7	c	0.013	c
Methylmercury	22967-92-6	0.00051	b	All	0.3	b	0.1	b	0.0031	c	0.00035	c
Molybdenum	7439-98-7	2	b	All	2	b			4.8	b	17	c
Nickel	7440-02-0	38	a	All	38	a	280	a	130	a	210	a
Selenium	7782-49-2	0.52	a	All	0.52	a	4.1	a	0.63	a	1.2	a
Silver	7440-22-4	4.2	a	All	560	a			14	a	4.2	a
Strontium	7440-24-6	96	c	M					96	c		
Thallium	7440-28-0	0.22	c	All	1	b			0.22	c	6.3	c
Tin	7440-31-5	50	b	P	50	b						
Uranium	7440-61-1	25	c	All	25	c			220	c	1,600	c
Vanadium	7440-62-2	7.8	a	All	60	c			280	a	7.8	a
Zinc	7440-66-6	46	a	All	160	a			79	a	46	a
Other Inorganics												
Ammonia	7664-41-7											
Bromine (total)	7726-95-6	10	b	P	10	b						
Cyanide (free)	57-12-5	0.1	c	SI, A			0.9	f			0.1	c
Fluoride	16984-48-8	32	c	M, A					580	c	32	c
Fluorine[†]	7782-41-4	200	b	P	200	b						
Iodine	7553-56-2	4	b	P	4	b						

Table 3
Region 4 Soil Screening Values for Hazardous Waste Sites

CHEMICAL	CAS	Screening Level (mg/kg)	Ref.	Receptor	Plants	Ref.	Soil Invertebrates	Ref.	Mammalian	Ref.	Avian	Ref.
Volatile Organic Compounds (VOCs)												
Chlorinated Alkanes												
1,1,1,2-Tetrachloroethane	630-20-6	0.07	d	SI			0.07	d				
1,1,2,2-Tetrachloroethane	79-34-5	0.19	d	SI			0.19	d				
1,1,1-Trichloroethane	71-55-6	0.04	d	All			0.04	d	260	c		
1,1,2-Trichloroethane	79-00-5	0.32	d	All			0.32	d				
1,1-Dichloroethane	75-34-3	0.14	d	All			0.14	d	210	c		
1,2-Dichloroethane	107-06-2	0.4	d	All			0.40	d	27	c	1.4	c
1,2-Dichloropropane	78-87-5	0.28	d	All			0.28	d				
Dichloromethane (Methylene chloride)	75-09-2	0.21	d	All	1,600	c	0.21	d	2.6	c		
Trichloromethane (chloroform)	67-66-3	0.05	d	All			0.05	d	8	c		
Tetrachloromethane (Carbon tetrachloride)	56-23-5	0.05	d	All			0.05	d				
Chlorinated Alkenes												
1,1-Dichloroethene/ethylene	75-35-4	0.04	d	All			0.04	d	11	c		
1,2-Dichloroethene (cis and trans)	540-59-0	0.04	d	All			0.04	d	23	c		
1,2-cis-Dichloroethyene	156-59-2	0.04	d	All			0.04	d				
1,2-trans-Dichloroethylene	156-60-5	0.04	d	All			0.04	d				
1,3-Dichloropropene	542-75-6	0.0	d	All			0.001	d				
Tetrachloroethene	127-18-4	0.06	d	All	10	c	0.06	d	0.18	c		
1,1,2-Trichloroethylene (TCE)	79-01-6	0.06	d	All			0.06	d	42	c		
Vinyl chloride	75-01-4	0.03	d	All			0.03	d	0.12	c		
Chlorobenzenes												
Chlorobenzene	108-90-7	2.4	c	All			2.4	c	43	c		
1,2-Dichlorobenzene	95-50-1	0.09	d	All			0.09	d	0.92	c		
1,3-Dichlorobenzene	541-73-1	0.1	d	All			0.08	d	0.73	c		
1,4-Dichlorobenzene	106-46-7	0.88	c	SI, M			1.2	c	0.88	c		
1,2,3-Trichlorobenzene	87-61-6	0.07	d	All			0.07	d				
1,2,4-Trichlorobenzene	120-82-1	0.27	c	All			1.2	c	0.27	c		
1,3,5-Trichlorobenzene	108-70-3	0.07	d	All			0.07	d				
Monoaromatic Hydrocarbons												
1,2,4-Trimethylbenzene	95-63-6	0.09	d	All			0.09	d				
1,3,5-Trimethylbenzene	108-67-8	0.16	d	All			0.16	d				
Benzene	71-43-2	0.12	d	All			0.12	d	24	c		
Cymene, p- (4-Isopropyltoluene)	99-87-6	0.18	d	All			0.18	d				
Ethylbenzene	100-41-4	0.27	d	All			0.27	d				
Isopropylbenzene (Cumene)	98-82-8	0.04	d	All			0.04	d				
Styrene (Vinyl benzene)	100-42-5	1.2	c	All	3.2	c	1.2	c				
Toluene	108-88-3	0.15	d	All	200	c	0.15	d	23	c		
Xylenes (total)	1330-20-7	0.1	d	All	100	c	0.1	d	1.4	c	41	c

Table 3
Region 4 Soil Screening Values for Hazardous Waste Sites

CHEMICAL	CAS	Screening Level (mg/kg)	Ref.	Receptor	Plants	Ref.	Soil Invertebrates	Ref.	Mammalian	Ref.	Avian	Ref.
Volatile Organic Compounds (VOCs)												
Ketones												
2-Butanone (Methyl Ethyl Ketone)	78-93-3	1.0	d	All			1.0	d	360	c		
2-Hexanone	591-78-6	0.36	c	SI, M, A			2.5	d	5.4	c	0.36	c
Acetone	67-64-1	1.2	c	M, A			0.04	d	1.2	c	14	c
Other VOCs												
Tribromomethane (Bromoform)	75-25-2	0.07	d	All			0.07	d				
Bromomethane (methyl bromide)	74-83-9	0.002	d	All			0.002	d				
Carbon Disulfide	75-15-0	0.005	d	All			0.005	d	0.82	c		
Ethylene glycol	107-21-1	0.31	d	All			0.31	d				
Hexachloroethane	67-72-1	0.024	d	All			0.024	d				
Hexane	110-54-3	0.007	d	All			0.007	d				
Tert-butyl methyl ether (MTBE)	1634-04-4	12.5	c	SI			12.5	c				
Semivolatile Organic Compounds (SVOCs)												
Chloroanilines												
3-Chloroaniline	108-42-9	20	b	P, SI	20	b	30	b				
4-Chloroaniline	106-47-8	1.0	c	P, SI	1	c	1.8	c				
3,4-Dichloroaniline	95-76-1	20	b	SI			20	b				
2,4,5-Trichloroaniline	636-30-6	20	b	P, SI	20	b	20	b				
Pentachloroaniline	527-20-8	0.62	d	SI			0.62	d				
Chlorobenzenes												
1,3-Dichlorobenzene	99-65-0	0.08	d	All			0.08	d	0.73	c		
1,2,3-Trichlorobenzene	87-61-6	0.07	d	All			0.07	d				
1,2,3,4-Tetrachlorobenzene	634-66-2	0.08	d	All			0.08	d				
1,2,4,5-Tetrachlorobenzene	95-94-3	0.18	d	All			0.18	d				
Hexachlorobenzene	118-74-1	0.079	c	All	10	c	10	c	0.2	c	0.079	c
Pentachlorobenzene	608-93-5	0.11	d	All			0.11	d				
Dichlorophenols												
Dichlorophenols (2,3-), (2,4-), (2,5-), (2,6-)	120-83-2	0.05	d	All			0.05	d				
3,4-Dichlorophenols (3,4-), (3,5-)	95-77-2	20	b	P, SI	20	b	20	b				
Trichlorophenols												
2,4,5-Trichlorophenol	95-95-4	0.03	d	All	4	b	0.03	d				
2,4,6-Trichlorophenol	88-06-2	0.09	d	All			0.09	d				
Tetrachlorophenols												
2,3,4,5-Tetrachlorophenol	4901-51-3	20	b	SI			20	b				
Tetrachlorophenols (2,3,4,6-), (2,3,5,6-)	58-90-2	0.04	d	All			0.04	d				

Table 3
Region 4 Soil Screening Values for Hazardous Waste Sites

CHEMICAL	CAS	Screening Level (mg/kg)	Ref.	Receptor	Plants	Ref.	Soil Invertebrates	Ref.	Mammalian	Ref.	Avian	Ref.
Semivolatile Organic Compounds (SVOCs)												
Other Phenols												
Chlorophenols (2-), (4-)	95-57-8	0.06	d	All			0.06	d	0.54	c	0.69	c
3-Chlorophenol	108-43-0	7	b	P, SI	7	b	10	b				
2,4-Dimethylphenol	105-67-9	0.04	d	SI			0.04	d				
2,4-Dinitrophenol	51-28-5	0.15	d	All	20	b	0.15	d				
4-Nitrophenol	100-02-7	7	b	SI			7	b				
2-Methylphenol (Cresol, o-)	95-48-7	0.1	d	All	0.67	c	0.1	d	590	c		
3-Methylphenol (Cresol, m-)	108-39-4	0.09	d	All	0.69	c	0.09	d				
4-Methylphenol (Cresol, p-)	106-44-5	0.08	d	All			0.08	d				
Nonylphenol	25154-52-3	1.27	d	SI			1.27	d				
Pentachlorophenol (PCP)	87-86-5	2.1	a	All	5	a	31	a	2.8	a	2.1	a
Phenol	108-95-2	0.79	c	All	0.79	c	1.8	c	38	c		
Energetic SVOCs												
2-Amino-4,6-dinitrotoluene	35572-78-2	14	c	SI, M, P	14	c	43	c	15	c		
4-Amino-2,6-dinitrotoluene	19406-51-0	12	c	SI, M, P	33	c	18	c	12	c		
1,3- Dinitrobenzene	99-65-0	0.073	d	All			0.034	d	0.073	c	0.15	c
2,4-Dinitrotoluene	121-14-2	6	c	SI, M, P	6	c	18	c	13	c		
2,6-Dinitrotoluene	606-20-2	4.1	c	All			30	c	4.1	c	52	c
HMX (Octahydro-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	16	c	SI, M, P	2,700	c	16	c	300	c		
Nitroglycerine	55-63-0	13	c	SI, M			13	c	71	c		
2-Nitrotoluene	88-72-2	0.19	d	All			0.19	d	9.9	c		
3-Nitrotoluene	99-08-1	0.13	d	All			0.13	d	12	c		
4-Nitrotoluene	99-99-0	0.14	d	All			0.14	d	22	c		
PETN (Pentaerythrite-tetranitrate)	78-11-5	100	c	M					100	c		
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	2.3	c	All			8.4	c	16	c	2.3	c
Tetryl (Methyl-2,4,6-trinitrophenylnitroamine)	479-45-8	1.5	c	M					1.5	c		
1,3,5-Trinitrobenzene	99-35-4	10	c	SI, M			10	c	120	c		
2,4,6-Trinitrotoluene (TNT)	118-96-7	7.6	c	All	62	c	32	c	96	c	7.6	c
Other SVOCs												
1,1'-Biphenyl	92-52-4	0.2	d	All	60	b	0.2	d				
3,3'- Dichlorobenzidine	91-94-1	0.03	d	All			0.03	d				
Benzoic acid	65-85-0	0.01	d	All			0.01	d	1	c		
Benzyl Alcohol	100-51-6	0.001	d	All			0.001	d	120	c		
Carbazole	86-74-8	0.16	d	All			0.16	d	80	c		
Dibenzofuran	132-64-9	0.15	d	All	6.1	c	0.15	d				
Hexachlorobutadiene	87-68-3	0.1	d	SI			0.1	d				
Hexachlorocyclopentadiene	77-47-4	0.001	d	All	10	b	0.001	d				
N-Nitrosodiphenylamine	86-30-6	0.12	d	All			0.12	d				
Nitrobenzene	98-95-3	2.2	c	SI, M			2.2	c	4.9	c		
Pentachloronitrobenzene	82-68-8	0.7	c	M, A					11	c	0.7	c

Table 3
Region 4 Soil Screening Values for Hazardous Waste Sites

CHEMICAL	CAS	Screening Level (mg/kg)	Ref.	Receptor	Plants	Ref.	Soil Invertebrates	Ref.	Mammalian	Ref.	Avian	Ref.
Semivolatile Organic Compounds (SVOCs)												
Phthalates												
Bis(2-ethylhexyl) phthalate	117-81-7	0.02	c	All			0.23	d	0.59	c	0.02	c
Butylbenzyl phthalate	85-68-7	0.59	d	All			0.59	d	90	c		
Diethylphthalate	84-66-2	0.23	d	All	100	c	0.23	d	3,600	c		
Dimethylphthalate	131-11-3	0.35	d	All			10	c	38	c		
Di-n-butyl phthalate	84-74-2	0.011	c	All	160	c	0.22	d	180	c	0.011	c
Di-n-octyl phthalate	117-84-0	0.21	c	All			0.21	d	0.91	c		
Polycyclic Aromatic Hydrocarbons (PAHs)												
Low Molecular Weight PAHs												
Acenaphthene	83-32-9	See Total			0.25	c			120	c		
Acenaphthylene	208-96-8	See Total							120	c		
Anthracene	120-12-7	See Total			6.8	c			210	c		
Fluorene	86-73-7	See Total					3.7	c	250	c		
1-Methyl naphthalene	90-12-0	See Total										
2-Methylnaphthalene	91-57-6	See Total							16	c		
2,6-Dimethyl naphthalene	581-42-0	See Total										
2,3,5-Trimethylnaphthalene	2245-38-7	See Total										
Naphthalene	91-20-3	See Total			1.0	c			9.7	c	5.7	c
1-Methyl phenanthrene	832-69-9	See Total										
Phenanthrene	85-01-8	See Total					5.5	c	10	c		
Total LMWPAHs	-	**29**	a	All			29	a	100	a		
High Molecular Weight PAHs												
Benzo(a)anthracene	56-55-3	See Total			18	c			3	c	1	c
Benzo(b)fluoranthene	205-99-2	See Total			18	c			38	c		
Benzo(k)fluoranthene	207-08-9	See Total							62	c		
Benzo(ghi)perylene	191-24-2	See Total							24	c		
Benzo(a)pyrene	50-32-8	See Total							53	c		
Benzo(e)pyrene	192-97-2	See Total										
Chrysene	218-01-9	See Total							2.4	c		
Dibenzo(a,h)anthracene	53-70-3	See Total							12	c		
Fluoranthene	206-44-0	See Total					10	c	22	c		
Indeno(1,2,3-cd)pyrene	193-39-5	See Total							62	c		
Perylene	198-55-0	See Total										
Pyrene	129-00-0	See Total					10	c	22	c	34	c
Total HMWPAHs	-	**1.1**	a	M			18	a	1.1	a		

Table 3
Region 4 Soil Screening Values for Hazardous Waste Sites

CHEMICAL	CAS	Screening Level (mg/kg)	Ref.	Receptor	Plants	Ref.	Soil Invertebrates	Ref.	Mammalian	Ref.	Avian	Ref.
Pesticides/Herbicides												
Acrolein	107-02-8	0.0001	d	All			0.0001	d				
Aldrin	309-00-2	0.037	c	SI, M			0.048	d	0.037	c		
Atrazine	1912-24-9	0.073	d	SI			0.073	d				
BHC - alpha	319-84-6	0.34	d	SI, M			0.34	d	58	c		
BHC - beta	319-85-7	0.27	c	M, A			0.0003	d	0.27	c	14	c
BHC - gamma (Lindane)	58-89-9	0.0094	c	P, M, A	0.1	c	0.0013	d	0.0094	c	0.21	c
Carbaryl	63-25-2	0.0025	d	All			0.0025	d				
Carbofuran	1563-66-2	0.0001	d	All			0.0001	d				
Chlordane - alpha	5103-71-9	0.27	c	P, M, A	2.2	c	0.17	d	0.27	c	0.28	c
Chlordane - gamma	12789-03-6	2.2	c	P, M, A	2.2	c	0.17	d	2.2	c	2.3	c
Chloropyrifos	2921-88-2	0.0035	d	All			0.0035	d				
Dinoseb	88-85-7	0.0054	d	All			0.0054	d				
DDD (sum 4,4- & 2,4-DDD)	50-29-3	0.0063	c	M, A			0.0001	d	4.1	c	0.0063	c
DDE (sum 4,4- & 2,4-DDE)	72-55-9	0.11	c	M, A			0.0038	d	3.7	c	0.11	c
DDT (sum 4,4- & 2,4-DDT)	72-54-8	0.044	c	All	4.1	c	3.37	d	0.044	c	0.36	c
DDT/DDE/DDD (total)	--	0.021	a	All					0.021	a	0.093	a
Diazinon	333-41-5	0.002	d	All			0.002	d				
Dieldrin	60-57-1	0.0049	a	All	10	c	0.1	d	0.0049	a	0.021	a
Endosulfan - alpha	959-98-8	0.64	c	M, A			0.0009	d	0.64	c	22	c
Endosulfan (alpha and beta)	115-29-7	0.0009	d	All			0.0009	d				
Endosulfan sulfate	1031-07-8	0.0065	d	All			0.0065	d				
Endrin	72-20-8	0.0014	c	All	0.0034	c	0.025	d	0.023	c	0.0014	c
Guthion	86-50-0	0.0006	d	All			0.0006	d				
Heptachlor	76-44-8	0.059	c	All	0.4	c	0.29	d	0.059	c	0.3	c
Heptachlor epoxide	1024-57-3	0.0004	d	All			0.0004	d				
Hexachlorocyclopentadiene	77-47-4	0.0008	d	All			0.0008	d				
Kepone (Chlordecone)	143-50-0	0.021	c	All			17	d	0.021	c	1.3	c
Malathion	121-75-5	0.0001	d	All			0.0001	d				
Methoxychlor	72-43-5	5	c	M, A			0.0025	d	5	c	18	c
Mirex	2385-85-5	0.014	d	All			0.014	d				
Parathion	56-38-2	0.0005	d	All			0.0005	d				
2,4,5-TP (Silvex)	93-72-1	12	d	SI			12	d				
Simazine	122-34-9	0.0001	d	All			0.0001	d				
Toxaphene	8001-35-2	4.1	d	M, A			0.38	d	5.9	c	4.1	c
Trifluralin	1582-09-8	0.0002	d	All			0.0002	d				

Table 3
Region 4 Soil Screening Values for Hazardous Waste Sites

CHEMICAL	CAS	Screening Level (mg/kg)	Ref.	Receptor	Plants	Ref.	Soil Invertebrates	Ref.	Mammalian	Ref.	Avian	Ref.
Polychlorinated Biphenyls (PCBs) and Dioxins/Furans												
PCDDs, PCDFs (ΣTEQ)	1746-01-6	0.0088	d	All			0.0088	d				
PCBs (sum) (Wildlife Based)	1336-36-3	0.33	d	All	40	b	0.33	d				
Aroclor-1016	12674-11-2	1	c	All					1	c		
Aroclor-1242	53469-21-9	0.041	c	All					0.38	c	0.041	c
Aroclor-1248	12672-29-6	0.0072	c	All					0.0072	c	0.041	c
Aroclor-1254	11097-69-1	0.014	c	All	160	c			0.44	c	0.041	c
Aroclor-1260	11096-82-5	0.88	c	All					10	c	0.88	c
Other												
2-Nitroaniline	88-74-4	5.4	c	M					5.4	c		
Diphenylamine	122-39-4	10	c	M, A					10	c	73	c
Trichlorofluoromethane	75-69-4	52	c	M					52	c		

Notes:
Sreening values in mg/kg.
All - ESV for protection of all receptors
A - ESV for protection of Avians
M - ESV for protection of Mammals
P - ESV for protection of Plants
SI - ESV for protection of soil invertebrates

LMWPAHs have less than 4 rings
HMWPAHs have 4 or more rings

Table 3 Sources:
a - USEPA (2007): Ecological Soil Screening Levels. http://www.epa.gov/ecotox/ecossl/
b - Oak Ridge National Laboratory:

Efroymson, R.A., M.E. Will, and G.W. Suter. 1997a. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-126/R2. http://www.esd.ornl.gov/programs/ecorisk/documents/tm126r21.pdf

Efroymson, R.A., M.E. Will, G.W. Suter, and A.C. Wooten. 1997b. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-95/R4. http://www.esd.ornl.gov/programs/ecorisk/documents/tm85r3.pdf

Efroymson, R.A., G.W. Suter, II, B.E. Sample, and D.S. Jones. 1997. Preliminary Remediation Goals for Ecological Endpoints. Oak Ridge National Laboratory, Oak Ridge, TN. 50 pp. ES/ER/TM-162/R2

c - Los Alamos National Laboratory (LANL). 2012. ECORISK Database Release 3.2. Environmental Programs, Engineering and Technology Division. September 2013. http://www.lanl.gov/community-environment/environmental-stewardship/protection/eco-risk-assessment.php

d - ECOSAR & Region 4 soil model. See text Section 6.3.

ATTACHMENT 3

MDEQ WATER QUALITY CRITERIA, 2007

(36 Sheets)

STATE OF MISSISSIPPI
WATER QUALITY CRITERIA FOR INTRASTATE, INTERSTATE, AND COASTAL WATERS

Adopted by Mississippi Commission on Environmental Quality: August 23, 2007

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STATE OF MISSISSIPPI
WATER QUALITY CRITERIA FOR INTRASTATE, INTERSTATE, AND COASTAL WATERS

SECTION I. GENERAL CONDITIONS:

1. Antidegradation: The policy inherent in the standards shall be to protect water quality existing at the time these water quality standards were adopted and to upgrade or enhance water quality within the State of Mississippi. Waters whose existing quality is better than the established standards will be maintained at high quality unless the Commission finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In no event, however, may degradation of water quality interfere with or become injurious to existing instream water uses. Further, in no case will water quality be degraded below (or above) the base levels set forth in these standards for the protection of the beneficial uses described herein. In addition, the State will assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control. Where the Commission determines that high quality waters constitute an outstanding National resource, such as waters of National and State Parks and Wildlife Refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected. For the purposes of this section, existing uses are defined as those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the Water Quality Criteria.

2. Sampling and Assessment: The limiting values of water quality herein described shall be measured by the Commission in waters under consideration as determined by good environmental engineering and scientific practice and after consultation with affected parties. Samples shall be taken from points so distributed over the seasons of the year, time of day, and area and depth of the waters being studied as to permit a realistic assessment of water quality.

   Samples shall be analyzed in accordance with methodology specified in 40 CFR 136 and with the latest edition of *Standard Methods for the Examination of Water and Wastewater* or other methods acceptable to the Commission.

3. Designated Use Attainability: Certain waters of the State may not fall within desired or prescribed limitations as outlined. In such instances the Commission may authorize exceptions to these limits, under the following conditions:

A. the designated use is not attainable because of natural background conditions; or

B. the designated use is not attainable because of irretrievable man-induced conditions; or

C. the application of effluent limitations for existing point sources is more stringent than those required pursuant to Section 301(b)(2)(A) and (B) of the Federal Water Pollution Control Act of 1972, as amended, in order to attain the designated use, would result in substantial and widespread adverse economic and social impact.

In no case shall it be permissible to deposit or introduce materials into waters of the State that will cause impairment of the reasonable or legitimate use of said waters.

4. Natural Conditions: Natural conditions are defined as background water quality conditions due only to non-anthropogenic sources. The criteria herein apply specifically with regard to substances attributed to sources (discharges, nonpoint sources, or instream activities) as opposed to natural phenomena. Waters may naturally have characteristics outside the limits established by these criteria. Therefore, naturally occurring conditions that fail to meet criteria should not be interpreted as violations of these criteria.

5. New Criteria: In view of the fact that industry is continuing to produce new materials whose characteristics and effects are unknown at this time or for which incomplete national criteria have been established, for the purposes of setting water quality standards or permit limits on a case-by-case basis, such materials shall be evaluated on their merits as information becomes available to the Commission. Sources of information shall include, but not be limited to, the latest edition of *Quality Criteria for Water*, prepared by the Environmental Protection Agency pursuant to Section 304(a) of the Federal Clean Water Act.

6. Applicable Flow: All criteria contained herein shall apply to all stages of stream flow greater than or equal to the 7-day, 10-year minimum flow in unregulated, natural streams, and the legally guaranteed minimum flow in regulated streams, unless otherwise provided in these regulations. This requirement shall not be interpreted to permit any unusual waste discharges during periods of lower flow. Notwithstanding the above, a stream flow equal to the 7-day, 2-year minimum flow in unregulated natural streams shall be utilized in establishing permit limitations for storm water permits. In cases in which either (1) the data are indefinite or inconclusive, or (2) the 7-day, 2-year minimum flow and/or the 7-day, 10-year minimum flow are inappropriate because of the hydrology of the area, other appropriate State and federal agencies will be consulted in establishing the applicable stream flow.

7. Mississippi River: The Mississippi River is classified for Fish and Wildlife use, but with the following additions to the criteria stated herein:

   Mineral Constituents: Not to exceed the following concentrations at any time:
   From Mississippi-Tennessee border to Vicksburg

Chlorides	60 mg/l
Sulfates	150 mg/l
TDS	425 mg/l

   From Vicksburg south to the Mississippi-Louisiana border

Chlorides	75 mg/l
Sulfates	120 mg/l
TDS	400 mg/l

8. Mixing Zones: It is recognized that limited areas of mixing are sometimes unavoidable; however, mixing zones shall not be used as a substitute for waste treatment. Mixing zones constitute an area whereby physical mixing of a wastewater effluent with a receiving water body occurs. Application of mixing zones shall be made on a case-by-case basis and shall only occur in cases involving large surface water bodies in which a long distance or large area is required for the wastewater to completely mix with the receiving water body.

   The location of a mixing zone shall not significantly alter the designated uses of the receiving water outside its established boundary. Adequate zones of passage for the migration and free movement of fish and other aquatic biota shall be maintained. Toxicity and human health concerns within the mixing zone shall be addressed as specified in the *Environmental Protection Agency Technical Support Document for Water Quality-Based Toxics Control* (EPA-505/2-90-001, March 1991) and amendments thereof. Under no circumstances shall mixing zones overlap or cover tributaries, nursery locations, locations of threatened or endangered species, or other ecologically sensitive areas.

9. Coastal Recreational Waters: Coastal Recreational Waters are marine and estuarine waters that are suitable for recreational purposes, including such water contact activities as swimming, wading, and water skiing. Coastal recreational waters do not include inland waters upstream of the mouth of a river or a stream having a natural connection to the open sea. Water quality monitoring for bacteria content is conducted on these waters to protect the health of bathers. Water contact is discouraged on Mississippi's public access bathing beaches along the shoreline of Jackson, Harrison, and Hancock Counties when enterococci exceed 104 colonies per 100 ml and in all other coastal recreational waters when enterococci exceed 501 colonies per 100 ml. When enterococci counts exceed 104 per 100 ml at the public access beaches, water contact advisories are issued by Mississippi's Beach Monitoring Task Force.

SECTION II. MINIMUM CONDITIONS APPLICABLE TO ALL WATERS:

1. Waters shall be free from substances attributable to municipal, industrial, agricultural, or other discharges that will settle to form putrescent or otherwise objectionable sludge deposits.

2. Waters shall be free from floating debris, oil, scum, and other floating materials attributable to municipal, industrial, agricultural, or other discharges in amounts sufficient to be unsightly or deleterious.

3. Waters shall be free from materials attributable to municipal, industrial, agricultural, or other discharges producing color, odor, taste, total suspended or dissolved solids, sediment, turbidity, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated use. Except as prohibited in Section I, Paragraph 8 above, the turbidity outside the limits of a 750-foot mixing zone shall not exceed the background turbidity at the time of discharge by more than 50 Nephelometric Turbidity Units (NTU). Exemptions to the turbidity standard may be granted under the following circumstances:

    A. in cases of emergency to protect the public health and welfare

    B. for environmental restoration projects which will result in reasonable and temporary deviations and which have been reviewed and approved by the Department.

4. Waters shall be free from substances attributable to municipal, industrial, agricultural, or other discharges in concentrations or combinations that are toxic or harmful to humans, animals, or aquatic life. Specific requirements for toxicity are found in Section II.10.

5. Municipal wastes, industrial wastes, or other wastes shall receive effective treatment or control in accordance with Section 301, 306, and 307 of the Federal Clean Water Act. A degree of treatment greater than defined in these sections may be required when necessary to protect legitimate water uses.

6. Designated Use Classifications: A water body classified as Public Water Supply, Recreation, or Shellfish Harvesting shall meet not only the criteria to support its respective use classification, but also shall meet the Fish and Wildlife criteria in order to support aquatic life.

7. Dissolved Oxygen: Dissolved oxygen concentrations shall be maintained at a daily average of not less than 5.0 mg/l with an instantaneous minimum of not less than 4.0 mg/l.

   When possible, samples should be taken from ambient sites according to the following guidelines:

   For waters that are not thermally stratified, such as unstratified lakes, lakes during turnover, streams, and rivers:

   At mid-depth if the total water column depth is 10 feet or less.
   At 5 feet from the water surface if the total water column depth is greater than 10 feet.

   For waters that are thermally stratified such as lakes, estuaries, and impounded streams:

   At mid-depth of the epilimnion if the epilimnion depth is 10 feet or less.
   At 5 feet from the water surface if the epilimnion depth is greater than 10 feet.

8. pH: The normal pH of the waters shall be 6.0 to 9.0 and shall not be caused to vary more than 1.0 unit within this range. Variations may be allowed on a case-by-case basis if the Commission determines that there will be no detrimental effect on the water body's designated uses as a result of the greater pH change. In black water streams and in those watersheds with highly acidic soils, the pH may be lower than 6.0 due to natural conditions.

9. Temperature: The maximum water temperature shall not exceed 90°F (32.2°C) in streams, lakes, and reservoirs, except that in the Tennessee River the temperature shall not exceed 86°F (30°C). In addition, the discharge of any heated waters into a stream, lake, or reservoir shall not raise temperatures more than 5°F (2.8°C) above natural conditions for temperatures.

   In lakes and reservoirs there shall be no withdrawals from or discharge of heated waters to the hypolimnion unless it can be shown that such discharge will be beneficial to water quality. In all waters the normal daily and seasonal temperature variations that were present before the addition of artificial heat shall be maintained.

   The maximum water temperature shall not exceed 90°F (32.2°C) in coastal or estuarine waters. In addition, the discharge of any heated waste into any coastal or estuarine waters shall not raise temperatures more than 4°F (2.2°C) above natural conditions for temperature during the period October through May nor more than 1.5°F (0.8°C) above natural background temperature during the period June through September.

   When ambient water temperatures naturally exceed 90°F (or 86°F in the Tennessee River), the discharge temperature of heated water must not exceed the ambient water temperature.

There shall be no thermal block to the migration of aquatic organisms. Requirements for zones of passage as referenced in Section I.8 shall apply. In addition to the general requirements of Section I.2, the temperature shall be measured at a depth of 5 feet in waters 10 feet or greater in depth; and for those waters less than 10 feet in depth, temperature criteria will be applied at mid-depth.

10. Toxic Substances:

A. Aquatic Life and Human Health Standards

(1) Aquatic Life - The concentration of toxic substances shall not result in chronic or acute toxicity or impairment of the uses of aquatic life. Any levels in excess of these values will be considered to result in chronic or acute toxicity, or the impairment of the uses of aquatic life. Regardless of direct measurements of chronic or acute toxicity, the concentrations of toxic substances shall not exceed the chronic or acute values, except as provided for in Sections 10.F(1) and 10.F(2).

(2) Human Health - The concentration of toxic substances shall not exceed the level necessary to protect human health through exposure routes of fish (and shellfish) tissue consumption, water consumption, or other routes identified as appropriate for the water body.

B. Numeric criteria for all waters are established herein for certain toxic pollutants for which the Environmental Protection Agency (EPA) has published national criteria for the protection of aquatic life and human health pursuant to Section 304(a) of the Federal Clean Water Act in addition to chlorine and ammonia. The pollutants are listed in Table 1 and are expressed as the dissolved phase of the parameter.

C. Ammonia toxicity shall be evaluated according to EPA guidelines published in *1999 Update of Ambient Water Quality Criteria for Ammonia*; EPA document number EPA-822-R-99-014 or *Ambient Water Quality Criteria for Ammonia (Saltwater) - 1989*; EPA document number 440/5-88-004. This material related to ammonia toxicity is hereby incorporated by reference including any subsequent amendments and editions.

D. Definitions: When applying acute or chronic toxicity or human health criteria, the following definitions shall apply:

(1) 7Q10 is the 7-day average low stream flow with a 10-year occurrence period.

(2) Mean Annual Flow is the total of daily mean flows for the full period of record divided by the total days for the period of record.

E. Application of Numerical Criteria:

(1) When evaluating human health effects all waters must comply with the Organisms Only criteria except for waters classified as Public Water Supply and all stream segments within 50 stream miles upstream of a drinking water intake. Stream segments that are classified as Public Water Supply or are within 50 miles upstream of a drinking water intake shall comply with the Water and Organisms criteria.

(2) When applying toxicity or human health criteria the following stream flows shall be used:

Acute Toxicity - 7Q10
Chronic Toxicity - 7Q10
Human Health - Mean Annual Flow

(3) Criteria for certain metals may be modified on a site-specific basis when a water effect ratio (WER) is conducted in accordance with VI.C.2.a. of *Mississippi Wastewater Regulations for National Pollutant Discharge Elimination System (NPDES) Permits, Underground Injection Control (UIC) Permits, State Permits, Water Quality Based Effluent Limitations and Water Quality Certification*. In these instances, the criterion for the specific metal in the affected water body shall be equal to the criterion concentrations calculated using the following equations:

$$CMC = WER * Acute \text{ and } CCC = WER * Chronic$$

Where: CCC = Criteria Continuous Concentration
CMC = Criteria Maximum Concentration
WER = Water Effects Ratio for a Specific Pollutant
Acute = Acute Criterion from Table 1
Chronic = Chronic Criterion from Table 1

When a WER has not been conducted, the criterion listed in Table 1 of this regulation shall apply because the value of the WER is presumed to equal one in the absence of data to indicate otherwise.

F. Discharge Specific Criteria:

(1) Existing Discharges

(a) The Commission may establish discharger specific alternative criteria for existing discharges if all of the following conditions are satisfied:

(i) Discharge existed prior to December 1, 1988.

(ii) Discharger performs acute and/or chronic bioassays and instream biological assessments and other evaluations as deemed appropriate by the Commission.

(iii) The designated use of the waters is maintained.

(b) All discharger specific alternative criteria will be subject to Mississippi public participation requirements for revisions to water quality standards and will be subject to review by the U. S. Environmental Protection Agency.

(2) New Source Discharges

(a) The Commission may establish discharger specific criteria for new source discharges if the discharger can demonstrate that established Water Quality Criteria are based on conditions not applicable to Mississippi such as, but not limited to, the use of species not indigenous to Mississippi.

(b) All discharger specific alternative criteria will be subject to Mississippi public participation requirements for revisions to water quality standards and will be subject to review by the U. S. Environmental Protection Agency.

G. Toxic and Human Health Parameters for which no Numeric Criteria have been Established:

(1) For those toxic and human health parameters for which no numeric criteria have been established, the Commission shall determine limitations using available references which shall include, but not be limited to, *Quality Criteria for Water* (Section 304(a)), Federal regulations under Section 307 of the Clean Water Act, and Federal regulations under Section 1412 of the Public Health Service Act as amended by the Safe Drinking Act (Pub. 93-523).

(2) Definitions:

(a) The not to be exceeded value for criteria published in 1980 or the one-hour average value for criteria published in 1985 or later shall be used as an acute toxicity number for calculating effluent limitations, establishing Total Maximum Daily Loads (TMDLs), or reviewing ambient water quality data.

(b) The 24-hour average for criteria published in 1980 or the 4-day average for criteria published in 1985 or later shall be used as a chronic toxicity number for calculating effluent limitations, establishing TMDLs, or reviewing ambient water quality data.

(c) If metals concentrations for criteria are hardness-dependent, the chronic and acute concentrations shall be based on 25 mg/l hardness if the ambient hardness is less than or equal to 25 mg/l. Concentrations shall be based on the actual mixed stream hardness.

(d) If separate criteria are given for fresh and salt waters, they shall be applied as appropriate.

(e) For non-carcinogens, these concentrations will be determined using a Reference Dose (RfD) as published by the U. S. Environmental Protection Agency pursuant to Section 304(a) of the Federal Water Pollution Act as amended unless a more recent RfD is issued by the U. S. Environmental Protection Agency as listed in the Integrated Risk Information System (IRIS) file, in which case the more recent value will be used. Water quality standards or criteria used to calculate water quality-based effluent limitations (and for all other purposes of water quality criteria under Section 303(c) of the Clean Water Act) to protect human health through the different exposure routes are determined as follows:

(i) Fish tissue consumption:

$$WQC = (RfD) \times Body\ Weight / (FCR \times BCF)$$

where: WQC = water quality criterion
RfD = reference dose
FCR = fish consumption rate (6.5 gm/person-day)
BCF = bioconcentration factor

BCF values are based on U. S. Environmental Protection Agency publications pursuant to Section 304(a) of the Clean Water Act. FCR values are average consumption rates for a 70 kg adult for a lifetime of the population; alternative FCR values may be used when it is considered necessary to protect localized populations which may be consuming fish at a higher rate.

(ii) Water consumption and fish tissue consumption:

$$WQC = (RfD) \times Body\ Weight / (WCR + (FCR \times BCF))$$

where: WQC = water quality criterion
RfD = reference dose
FCR = fish consumption rate (6.5 gm/person-day)
BCF = bioconcentration factor
WCR = water consumption rate (assumed to be 2 liters/day for adults)

The equations listed in this subparagraph will be used to develop water criteria or standards on a case-by-case basis for toxic substances that are not presently included in the water quality standards. Alternative FCR values may be used when it is considered necessary to protect localized populations that may be consuming fish at a higher rate.

(f) For carcinogens, the concentrations of toxic substances will not result in unacceptable health risk and will be based on a Carcinogenic Potency Factor (CPF). An unacceptable health risk for cancer will be considered to be more than one additional case of cancer per one million people exposed (10^{-6} risk level). The CPF is a measure of the cancer-causing potency of a substance estimated by the upper 95 percent confidence limit of the slope of a straight line calculated by the Linearized Multistage Model according to the U.S. Environmental Protection Agency Guidelines (FR 51(185): 33992-34003, and FR 45(231 Part V): 79318-79379). Water quality standards or criteria used to calculate water quality-based effluent limitations (and for all other purposes of water quality criteria under Section 303(c) of the Clean Water Act) to protect human health through the different exposure routes are determined as follows:

(i) Fish tissue consumption:

$$WQC = (Risk) \times Body\ Weight / (CPF \times (FCR \times BCF))$$

where: WQC = water quality criterion
Risk = risk factor (10^{-6})
CPF = cancer potency factor
FCR = fish consumption rate (6.5 gm/person-day)
BCF = bioconcentration factor

BCF values are based on U.S. Environmental Protection Agency publications pursuant to Section 304(a) of the Clean Water Act. FCR values are average consumption rates for a 70 kg adult for a lifetime of the population; alternative FCR values may be used when it is considered necessary to protect localized populations which may be consuming fish at a higher rate.

(ii) Water consumption (including a correction for fish consumption):

$$WQC = Risk \times Body\ Weight / (CPF \times (WCR + (FCR \times BCF)))$$

where: WQC = water quality criterion
Risk = risk factor (10^{-6})
CPF = cancer potency factor
FCR = fish consumption rate (6.5 gm/person-day)
BCF = bioconcentration factor
WCR = water consumption rate (assumed to be 2 liters/day for adults)

The equations listed in this subparagraph will be used to develop water criteria or standards on a case-by-case basis for toxic substances that are not presently included in the water quality standards. Alternative FCR values may be used when it is considered necessary to protect localized populations that may be consuming fish at a higher rate.

TABLE 1 Notes

a The CMC = $1/[(f_1/CMC_1) + (f_2/CMC_2)]$ where f_1 and f_2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC_1 and CMC_2 are 185.9 µg/l and 12.83 µg/l. The value in the table is calculated assuming a worst case scenario in which all selenium is present as selenate.

b Hardness dependent parameter. Criteria are indicated at hardness of 50 mg/l as $CaCO_3$. Equations for criteria calculation of hardness dependent parameters can be found in *Quality Criteria for Water*. The equation is applicable for instream hardness ranges from 25 mg/l to 400 mg/l. If instream hardness is less than 25 mg/l, then a hardness value of 25 mg/l should be used to calculate the criteria. If instream hardness is greater than 400 mg/l, then a hardness of 400 mg/l should be used to calculate the criteria.

c Criteria for pentachlorophenol are based on a pH dependent equation as found in *Quality Criteria for Water*. Values listed are for a pH of 7.0 s.u.

d Criteria for 2,3,7,8 TCDD based on a risk factor of one in one hundred thousand (10^{-5}).

e Site specific criteria for Mississippi Sound.

f Parameter subject to water effects ratio equations where:
CMC = WER * Acute
CCC = WER * Chronic

g Ammonia criteria are dependent on pH, temperature, and/or salinity. See Section II.10.C.

h Expressed as µg free cyanide (as CN)/L.

i Refers to the inorganic form only.

j Applies to the sum of α and β isomers.

k Applies to individual isomers of Endosulfan including α, β, and Endosulfan Sulfate.

m Chemical Abstracts Service (CAS) registry numbers, which provide a unique identification for each chemical.

TABLE 1
Numeric Criteria for All Waters (µg/l)

CAS [m]	Parameter	Fresh Water		Salt Water		Human Health	
		Acute	Chronic	Acute	Chronic	Organisms Only	Water & Organisms
309002	Aldrin	3.0		1.3		0.00014	0.00013
7664417	Ammonia	[g]	[g]	[g]	[g]		
7440382	Arsenic (III), Total Dissolved	340 [f]	150 [f]	69	36		
7440382	Arsenic, Total Dissolved					24 [l]	0.078 [l]
7440439	Cadmium, Total Dissolved	1.03 [b,f]	0.15 [b,f]	40	8.8	168	5
57749	Chlordane	2.4	0.0043	0.09	0.004	0.0022	0.0021
7782505	Chlorine	19	11	13	7.5		
18540299	Chromium (Hex), Total Dissolved	16 [f]	11 [f]	1100	50	1470	98
16065831	Chromium (III), Total Dissolved	323 [b,f]	42 [b,f]			140468	100
7440508	Copper, Total Dissolved	7.0 [b,f]	5.0 [b,f]	4.8	3.1	1000	1000
57125	Cyanide	22.0 [h]	5.2 [h]	1.0 [h]	1.0 [h]	220000	200
50293	4,4 DDT	1.1	0.001	0.13	0.001	0.00059	0.00059
60571	Dieldrin	0.24	0.056	0.71	0.0019	0.000144	0.000135
1746016	2,3,7,8 TCDD (Dioxin)					1.0 ppq [d]	1.0 ppq [d]
959988	alpha-Endolsulfan	0.22 [J]	0.056 [J]	0.034 [J]	0.0087 [J]	240 [k]	110 [k]
33213659	beta-Endosulfan	0.22 [J]	0.056 [J]	0.034 [J]	0.0087 [J]	240 [k]	110 [k]
1031078	Endosulfan Sulfate	0.22 [J]	0.056 [J]	0.034 [J]	0.0087 [J]	240 [k]	110 [k]
72208	Endrin	0.086	0.036	0.037	0.0023	0.814	0.76
76448	Heptachlor	0.52	0.0038	0.053	0.0036	0.000214	0.000208

58899	gamma-BHC (Lindane)	0.95	0.08	0.16		0.0625	0.0186
7439921	Lead, Total Dissolved	30 [b,f]	1.18 [b,f]	210	8.1		15
7439976	Mercury (II), Total Dissolved	2.1 [f]	0.012	1.8	0.025		
7439976	Mercury					0.153	0.151
7440020	Nickel, Total Dissolved	260 [b,f]	29 [b,f]	75	8.3	4584	607
				167 [e]	18.5 [e]		
108952	Phenol	300	102	300	58	300	300
87865	Pentachlorophenol	8.7 [c]	6.7 [c]	13 [c]	7.9 [c]	8.2	0.28
	PCB 1242	0.2	0.014	1.0	0.03		
	PCB 1254	0.2	0.014	1.0	0.03		
	PCB 1221	0.2	0.014	1.0	0.03		
	PCB 1232	0.2	0.014	1.0	0.03		
	PCB 1248	0.2	0.014	1.0	0.03		
	PCB 1260	0.2	0.014	1.0	0.03		
	PCB 1016	0.2	0.014	1.0	0.03		
	Total PCB					0.00035	0.00035
7782492	Selenium, Total Dissolved	11.8 [a,f]	4.6 [f]	290 [f]	71 [f]	3365	50
7440224	Silver, Total Dissolved	0.98 [b,f]		1.9			100
8001352	Toxaphene	0.73	0.0002	0.21	0.0002	0.00075	0.00073
7440666	Zinc, Total Dissolved	65 [b,f]	65 [b,f]	90	81	5000	5000

SECTION III. SPECIFIC WATER QUALITY CRITERIA:

1. PUBLIC WATER SUPPLY:

Water in this classification is for use as a source of raw water supply for drinking and food processing purposes. The water treatment process shall be approved by the Mississippi State Department of Health. The raw water supply shall be such that after the approved treatment process, it will satisfy the regulations established pursuant to Section 1412 of the Public Health Service Act as amended by the Safe Drinking Water Act (Pub. L. 93-523). Waters that meet the Public Water Supply criteria shall also be suitable for secondary contact recreation. Secondary contact recreation is defined as incidental contact with the water during activities such as wading, fishing, and boating, that are not likely to result in full body immersion. In considering the acceptability of a proposed site for disposal of bacteria latent wastewater in or near waters with the public water supply classification, the Permit Board shall consider the relative proximity of the discharge to water supply intakes.

A. Bacteria: For the months of May through October, when water contact recreation activities may be expected to occur, fecal coliform shall not exceed a geometric mean of 200 per 100 ml based on a minimum of 5 samples taken over a 30-day period with no less than 12 hours between individual samples, nor shall the samples examined during a 30-day period exceed 400 per 100 ml more than 10% of the time.

   For the months of November through April, when incidental recreational contact is not likely, fecal coliform shall not exceed 2000 per 100 ml as a geometric mean (either MPN or MF count) based on at least 5 samples taken over a 30-day period with no less than 12 hours between individual samples, nor shall the samples examined during a 30-day period exceed 4000 per 100 ml more than 10% of the time.

B. Chlorides (Cl): There shall be no substances added which will cause the chloride content to exceed 230 mg/l in freshwater streams.

C. Specific Conductance: There shall be no substances added to increase the conductivity above 500 micromhos/cm for freshwater streams.

D. Dissolved Solids: There shall be no substances added to the waters that will cause the dissolved solids to exceed 500 mg/l for freshwater streams.

E. Threshold Odor: There shall be no substances added which will cause the threshold odor number to exceed 24 (at 60°C) as a daily average.

F. Radioactive Substances: There shall be no radioactive substances added to the waters which will cause the gross beta activity (in the known absence of Strontium-90 and alpha emitters) to exceed 1000 picocuries per liter at any time.

G. Specific Chemical Constituents: In addition to the provisions in Section II.4. and 10., the following concentrations (dissolved) shall not be exceeded at any time:

Constituent	Concentration (mg/l)
Barium	2.0
Fluoride	2.0
Lead	0.015
Nitrate (as N)	10.0

2. SHELLFISH HARVESTING

Waters classified for this use are for propagation and harvesting shellfish for sale or use as a food product. These waters shall meet the requirements set forth in the latest edition of the *National Shellfish Sanitation Program, Manual of Operations, Part I, Sanitation of Shellfish Growing Areas*, as published by the U. S. Public Health Service. Waters that meet the Shellfish Harvesting Area Criteria shall also be suitable for recreational purposes. In considering the acceptability of a proposed site for disposal of bacteria latent wastewater in or near waters with this classification, the Permit Board shall consider the relative proximity of the discharge to shellfish harvesting beds.

A. Bacteria: The median fecal coliform MPN (Most Probable Number) of the water shall not exceed 14 per 100 ml, and not more than 10% of the samples shall ordinarily exceed an MPN of 43 per 100 ml in those portions or areas most probably exposed to fecal contamination during most unfavorable hydrographic and pollutive conditions.

3. RECREATION:

Waters in this classification are to be suitable for recreational purposes, including such water contact activities as swimming and water skiing. In considering the acceptability of a proposed site for disposal of bacteria latent wastewater in or near waters with this classification, the Permit Board shall consider the relative proximity of the discharge to areas of actual water contact activity.

A. Bacteria: Fecal coliform shall not exceed a geometric mean of 200 per 100 ml based on a minimum of 5 samples taken over a 30-day period with no less than 12 hours between individual samples, nor shall the samples examined during a 30-day period exceed 400 per 100 ml more than 10% of the time. For both marine and estuarine coastal recreational waters, Enterococci shall not exceed a seasonal (May – October and November – April) geometric mean of 35 per 100 ml based on a minimum of 20 samples collected during each season. Coastal recreational waters do not include inland waters upstream of the mouth of a river or a stream having a natural connection to the open sea.

B. Specific Conductance: There shall be no substances added to increase the conductivity above 1000 micromhos/cm for freshwater streams.

C. Dissolved Solids: There shall be no substances added to the water to cause the dissolved solids to exceed 750 mg/l as a monthly average value, nor exceed 1500 mg/l at any time for freshwater streams.

4. FISH AND WILDLIFE:

Waters in this classification are intended for fishing and for propagation of fish, aquatic life, and wildlife. Waters that meet the Fish and Wildlife Criteria shall also be suitable for secondary contact recreation. Secondary contact recreation is defined as incidental contact with the water during activities such as wading, fishing, and boating, that are not likely to result in full body immersion.

A. Bacteria: For the months of May through October, when water contact recreation activities may be expected to occur, fecal coliform shall not exceed a geometric mean of 200 per 100 ml based on a minimum of 5 samples taken over a 30-day period with no less than 12 hours between individual samples, nor shall the samples examined during a 30-day period exceed 400 per 100 ml more than 10% of the time.

For the months of November through April, when incidental recreational contact is not likely, fecal coliform shall not exceed a geometric mean of 2000 per100 ml based on a minimum of 5 samples taken over a 30-day period with no less than-12 hours between individual samples, nor shall the samples examined during a 30-day period exceed 4000 per 100 ml more than 10% of the time.

B. Specific Conductance: There shall be no substances added to increase the conductivity above 1000 micromhos/cm for freshwater streams.

C. Dissolved Solids: There shall be no substances added to the waters to cause the dissolved solids to exceed 750 mg/l as a monthly average value, nor exceed 1500 mg/l at any time for freshwater streams.

5. EPHEMERAL STREAM:

Waters in this classification do not support a fisheries resource and are not usable for human consumption or aquatic life. Ephemeral streams normally are natural watercourses, including natural watercourses that have been modified by channelization or manmade drainage ditches, that without the influent of point source discharges, flow only in direct response to precipitation or irrigation return-water discharge in the immediate vicinity and whose channels are normally above the groundwater table. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment

of aquatic life protection uses. These streams may contain a transient population of aquatic life during the portion of the year when there is suitable habitat for fish survival. Normally, aquatic habitat in these streams is not adequate to support a reproductive cycle for fish and other aquatic life. Wetlands are excluded from this classification.

Waters in this classification shall be protective of wildlife and humans that may come in contact with the waters. Waters contained in ephemeral streams shall also allow maintenance of the standards applicable to all downstream waters.

A. Provisions 1, 2, 3, and 5 of Section II (Minimum Conditions Applicable to All Waters) are applicable except as they relate to fish and other aquatic life. All aspects of provisions 4 and 10 of Section II concerning toxicity will apply to ephemeral streams, except for domestic or compatible domestic wastewater discharges which will be required to meet toxicity requirements in downstream waters not classified as ephemeral. Alternative methods may be utilized to determine the potential toxic effect of ammonia. Acutely toxic conditions are prohibited under any circumstances in waters in this classification.

B. Dissolved Oxygen: The dissolved oxygen shall be maintained at an appropriate level to avoid nuisance conditions.

C. Bacteria: The Permit Board may assign bacterial criteria where the probability of a public health hazard or other circumstances so warrant.

D. Definitions:

(1) Fisheries resource is defined as any water body which has a viable gamefish population as documented by the Mississippi Department of Wildlife Fisheries and Parks or has sufficient flow or physical characteristics to support the fishing use during times other than periods of flow after precipitation events or irrigation return water discharge.

(2) "Not usable for human consumption or aquatic life" means that sufficient flow or physical characteristics are not available to support these uses.

(3) "Flow only in response to precipitation or irrigation return water" means that without the influence of point source discharges the stream will be dry unless there has been recent rainfall or a discharge of irrigation return water.

(4) "Protective of wildlife and humans that may come in contact with the waters" means that toxic pollutants shall not be discharged in concentrations that will endanger wildlife or humans.

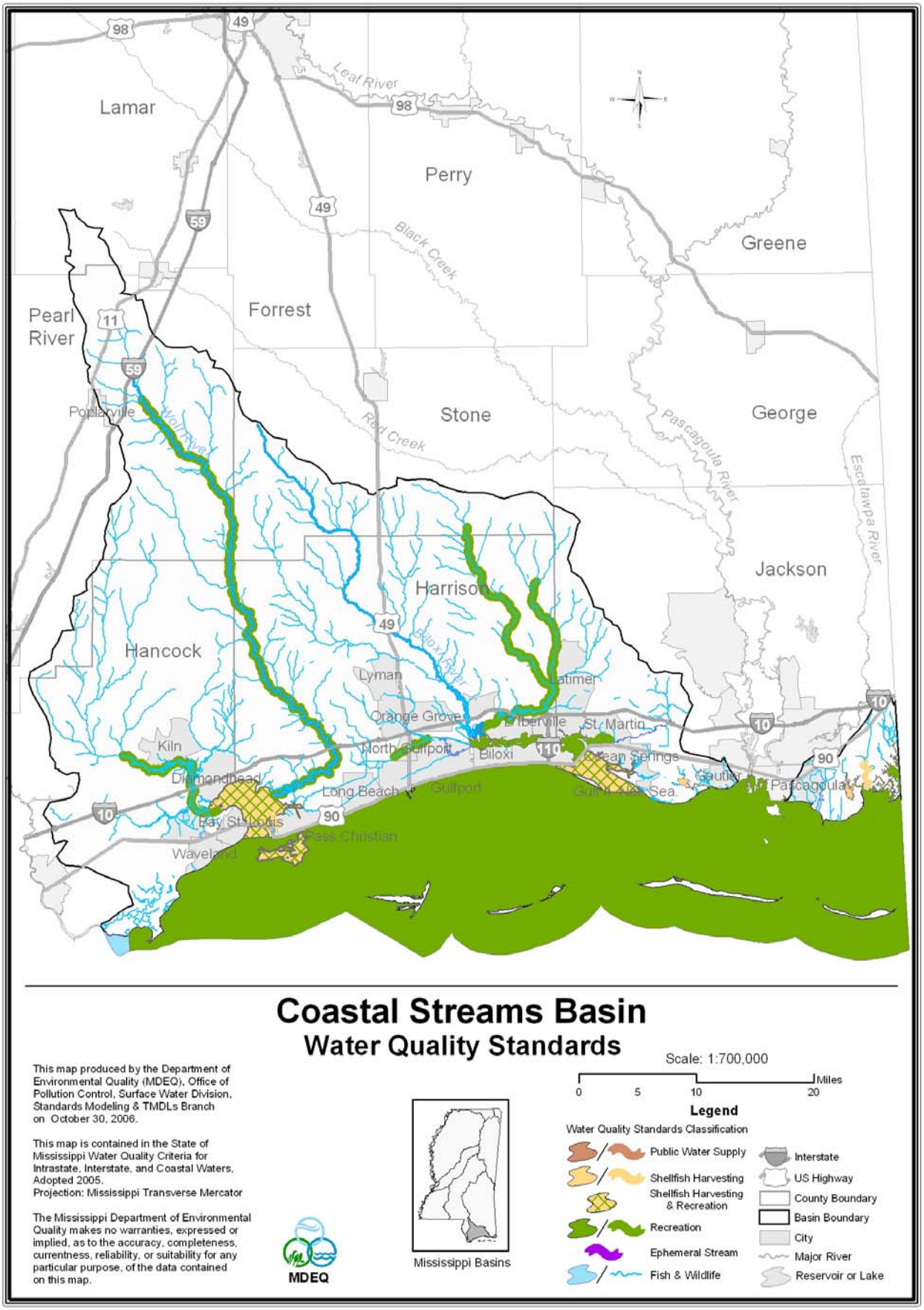
(5) "Nuisance conditions" means objectionable odors or aesthetic conditions that may generate complaints from the public.

Recommendations for assignment of the Ephemeral Stream classification shall be made to the Commission on Environmental Quality by the Permit Board after appropriate demonstration of physical and hydrological data. The Ephemeral Stream classification shall not be assigned where environmental circumstances are such that a nuisance or hazardous condition would result or public health is likely to be threatened. Alternate discharge points shall be investigated before the Ephemeral Stream classification is considered.

SECTION IV. DESIGNATED USES IN STATE WATERS:

All of the State waters not specifically listed below shall be classified as Fish and Wildlife. State waters carrying other classifications are:

Coastal Streams Basin		
Waters	**Location**	**Classification**
Back Bay of Biloxi	From Popps Ferry Bridge to Biloxi Bay	Recreation
Bangs Lake	From headwaters to the Mississippi Sound	Shellfish Harvesting
Bayou Cumbest	From headwaters to the Mississippi Sound	Shellfish Harvesting
Big Lake	From Bernard Bayou to the Popps Ferry Bridge	Recreation
Biloxi Bay	From Headwaters (US Hwy 90 Bridge) to the Mississippi Sound	Shellfish Harvesting Recreation
Davis Bayou	From headwaters to the Biloxi Bay	Shellfish Harvesting
Graveline Bay	From headwaters to Graveline Bayou	Shellfish Harvesting
Graveline Bayou	From Graveline Bay to the Mississippi Sound	Shellfish Harvesting
Jourdan River	From confluence of Bacon Bayou and Catahoula Creek to the St. Louis Bay	Recreation
Mallini Bayou	From St. Louis Bay to St. Louis Bay	Shellfish Harvesting
Mississippi Sound	Contiguous to Mississippi Coastline	Recreation
Old Fort Bayou	From Bayou Talla to Biloxi Bay	Recreation
Pass Christian Reef (off Henderson Point)	Mississippi Sound	Shellfish Harvesting Recreation
St. Louis Bay	Harrison and Hancock Counties	Shellfish Harvesting Recreation
Tchoutacabouffa River	From headwaters to the Back Bay of Biloxi	Recreation
Turkey Creek	From Forest Heights Middle School to Bernard Bayou	Recreation
Tuxachanie Creek	From headwaters to the Tchoutacabouffa River	Recreation
Wolf River	From MS Hwy 26 to the St. Louis Bay	Recreation



Coastal Streams Basin

Water Quality Standards

This map produced by the Department of Environmental Quality (MDEQ), Office of Pollution Control, Surface Water Division, Standards Modeling & TMDLs Branch on October 30, 2006.

This map is contained in the State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters, Adopted 2005.
Projection: Mississippi Transverse Mercator

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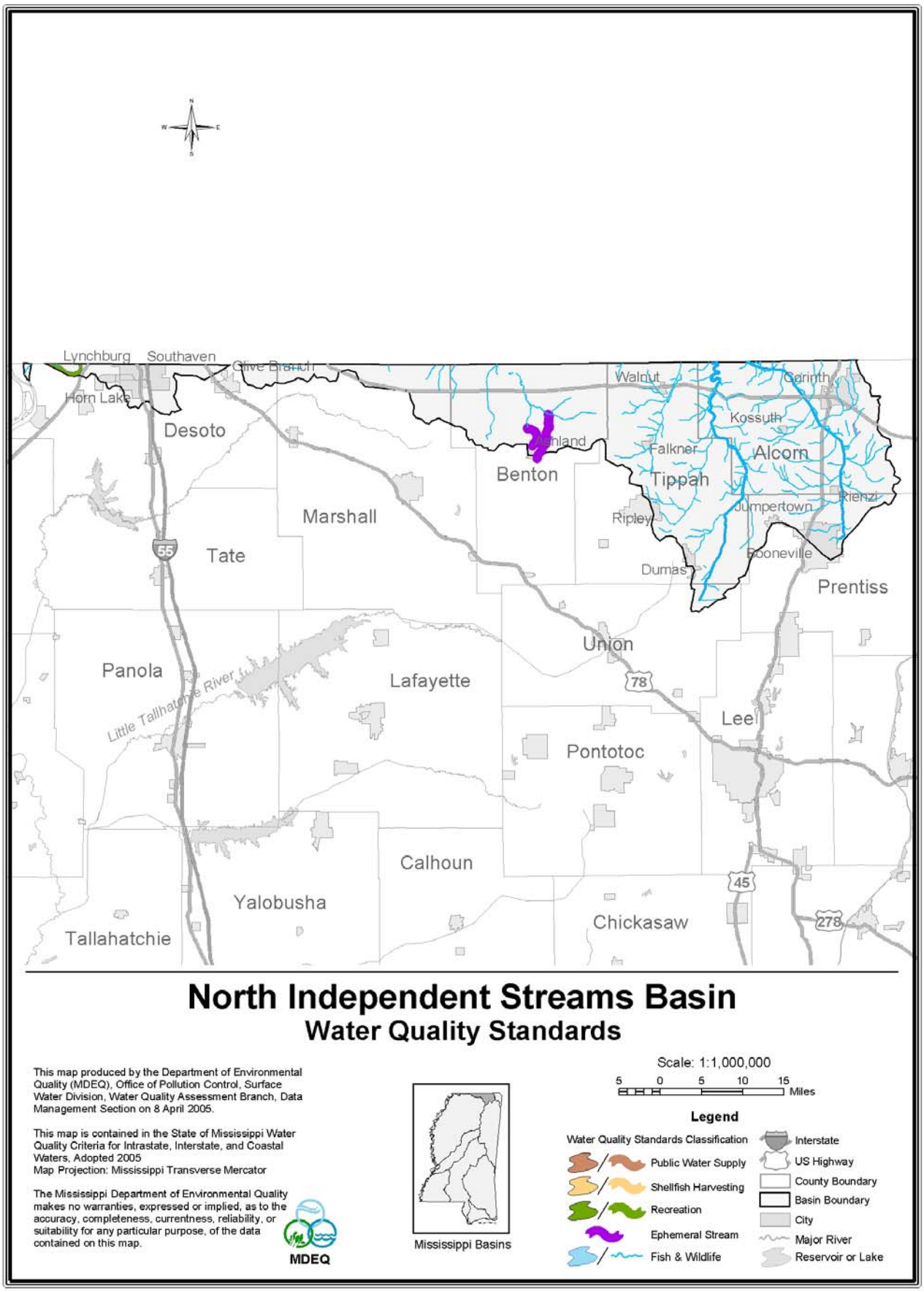
North Independent Streams Basin		
Waters	**Location**	**Classification**
Bowden Sand Ditch (East Lagoon)	From Ashland to Tubby Creek	Ephemeral
Drennan Sand Ditch (NW Lagoon)	From Ashland to Robinson Bottom	Ephemeral
Horn Lake	DeSoto County	Recreation
Tubby Creek	From River Mile 5.2 to River Mile 2.8	Ephemeral



North Independent Streams Basin

Water Quality Standards

This map produced by the Department of Environmental Quality (MDEQ), Office of Pollution Control, Surface Water Division, Water Quality Assessment Branch, Data Management Section on 8 April 2005.

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MDEQ

Mississippi Basins

Scale: 1:1,000,000

5 0 5 10 15 Miles

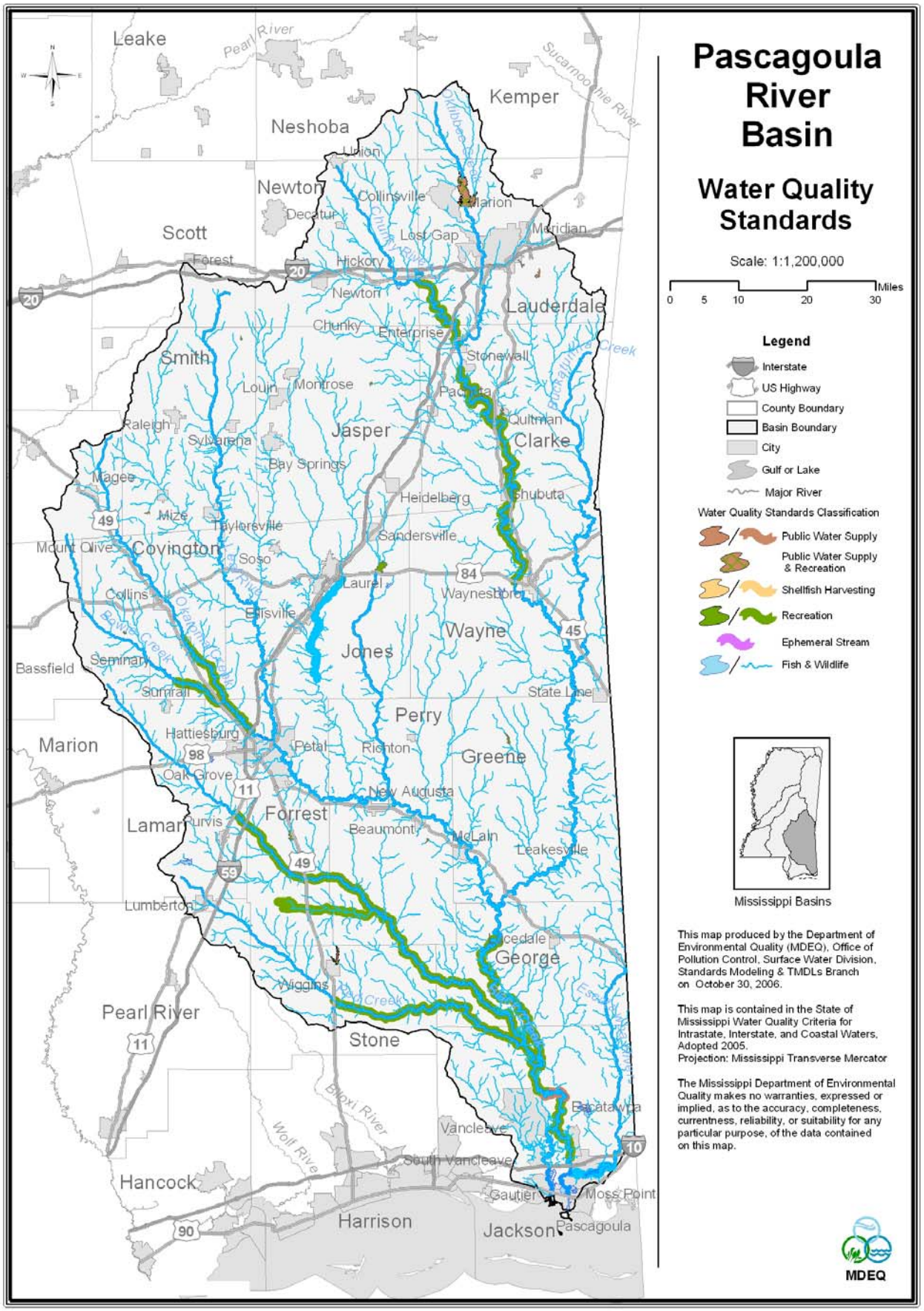
Legend

Water Quality Standards Classification
- Public Water Supply
- Shellfish Harvesting
- Recreation
- Ephemeral Stream
- Fish & Wildlife

- Interstate
- US Highway
- County Boundary
- Basin Boundary
- City
- Major River
- Reservoir or Lake

Pascagoula River Basin		
Waters	**Location**	**Classification**
Archusa Reservoir	Clarke County	Recreation
Beaverdam Creek	From headwaters in Perry and Forrest Counties to Black Creek	Recreation
Black Creek	From Hwy 11 to the Pascagoula River	Recreation
Bonita Reservoir	Lauderdale County	Public Water Supply
Bowie Creek	From MS Hwy 589 to the Bowie River	Recreation
Bowie River	From Bowie Creek to Interstate 59	Recreation
Chickasawhay River	From Stonewall to MS Hwy 84	Recreation
Chunky River	From US Hwy 80 to the Chickasawhay River	Recreation
Clarke State Park (Ivy Lake)	Clarke County	Recreation
Dry Creek Lake Site #3	Covington County	Recreation
Escatawpa River	From River Mile 10 to the Pascagoula River	Fish and Wildlife[1,2]
Flint Creek Reservoir	Stone County	Public Water Supply Recreation
Lake Bogue Homa	Jones County	Recreation
Lake Claude Bennett	Jasper County	Recreation
Lake Geiger	Forrest County	Recreation
Lake Marathon	Smith County	Recreation
Lake Mike Conner	Covington County	Recreation
Lake Perry	Perry County	Recreation
Lake Ross Barnett	Smith County	Recreation
Lake Shongela	Smith County	Recreation
Lakeland Park Lake	Wayne County	Recreation
Long Creek Reservoir	Lauderdale County	Public Water Supply
Okatibbee Reservoir	Lauderdale County	Public Water Supply Recreation
Okatoma Creek	From Seminary (MS Hwy 590) to the Bowie River	Recreation
Pascagoula River	From 5 miles north of Cumbest Bluff to Cumbest Bluff	Public Water Supply
Pascagoula River	From 6 miles north of MS Hwy 26 (George County) to Smear Bayou (Jackson County)	Recreation
Red Creek	From US Hwy 49 to Big Black Creek	Recreation
Turkey Creek Reservoir	Greene County	Recreation

1. The following dissolved oxygen standard is applicable: The dissolved oxygen shall not be less than 3.0 mg/l.
2. Remains under EPA review as of July 26, 2007.


Pascagoula River Basin
Water Quality Standards
Scale: 1:1,200,000
Miles
0 5 10 20 30
Legend
Interstate
US Highway
County Boundary
Basin Boundary
City
Gulf or Lake
Major River
Water Quality Standards Classification
Public Water Supply
Public Water Supply & Recreation
Shellfish Harvesting
Recreation
Ephemeral Stream
Fish & Wildlife
Mississippi Basins
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Projection: Mississippi Transverse Mercator
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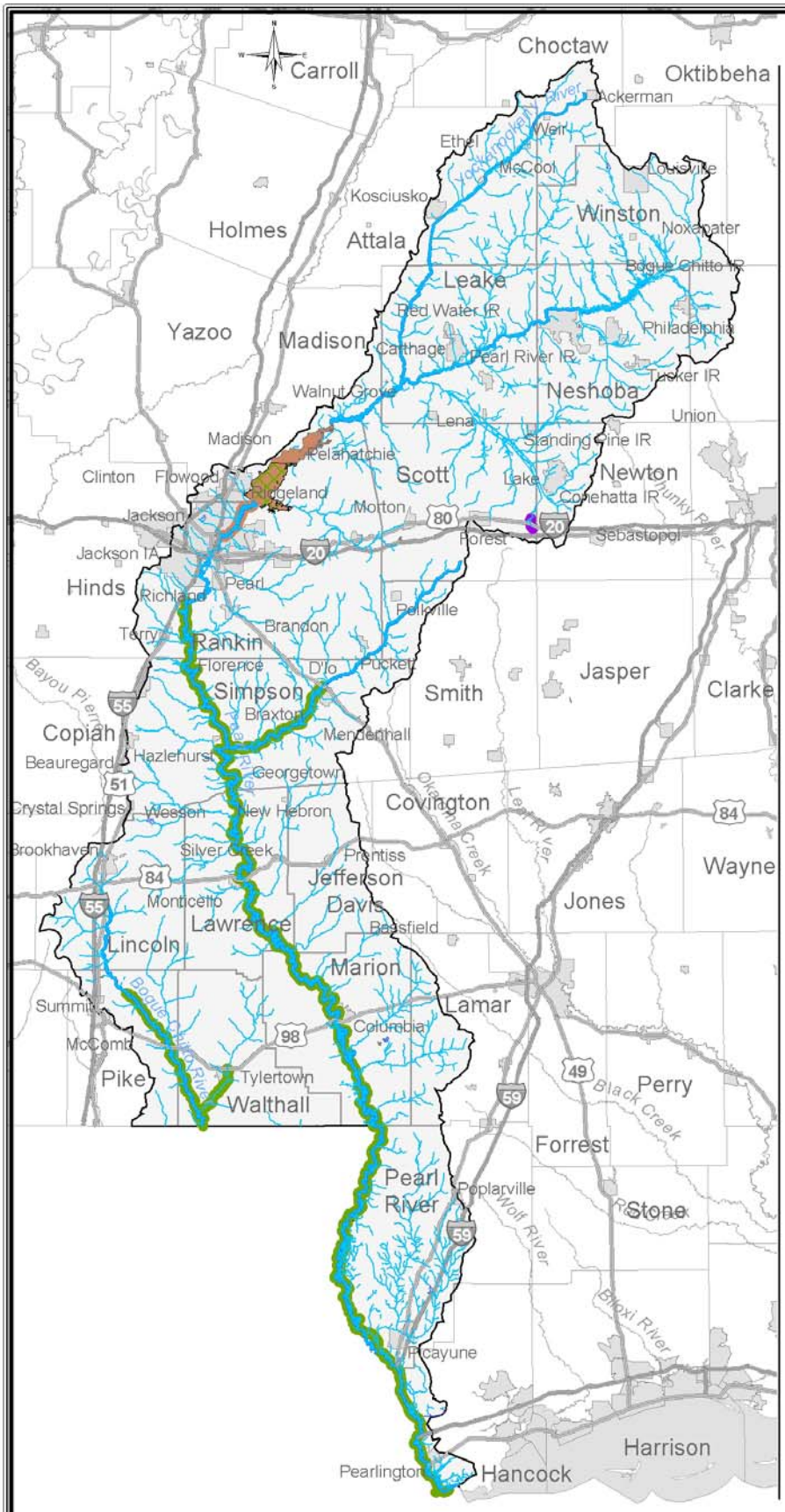
MDEQ
Leake
Pearl River
Kemper
Neshoba
Newton
Scott
Smith
Jasper
Clarke
Lauderdale
Covington
Jones
Wayne
Perry
Greene
Marion
Lamar
Forrest
Pearl River
Stone
George
Hancock
Harrison
Jackson
Pascagoula

Pearl River Basin		
Waters	**Location**	**Classification**
Barnett Reservoir	From River Bend to township line between T7N and T8N	Public Water Supply
Barnett Reservoir	From township line between T7N and T8N to the Reservoir Dam	Public Water Supply Recreation
Bogue Chitto River	From MS Hwy 570 to the MS/LA State Line	Recreation
Lake Columbia	Marion County	Recreation
Lake Dixie Springs	Pike County	Recreation
Magees Creek	From US Hwy 98 to the Bogue Chitto River	Recreation
Pearl River	From Barnett Reservoir to the City of Jackson Water Intake	Public Water Supply
Pearl River	From Byram Bridge to the Mississippi Sound	Recreation
Strong River	From US Hwy 49 to the Pearl River	Recreation
Shadow Lake (Roosevelt State Park)	Scott County	Recreation
Legion Lake	Simpson County	Recreation
Warrior Branch	From lake to Warrior Creek	Ephemeral



Pearl River Basin

Water Quality Standards

Scale: 1:1,500,000

5 0 5 10 15 Miles

Legend

- Interstate
- US Highway
- County Boundary
- Basin Boundary
- City
- Gulf or Reservoir
- Major River

Water Quality Standards Classification

- Public Water Supply
- Public Water Supply & Recreation
- Shellfish Harvesting
- Recreation
- Ephemeral Stream
- Fish & Wildlife

Mississippi Basins

This map produced by the Department of Environmental Quality (MDEQ), Office of Pollution Control, Surface Water Division, Water Quality Assessment Branch, Data Management Section on 11 April 2005.

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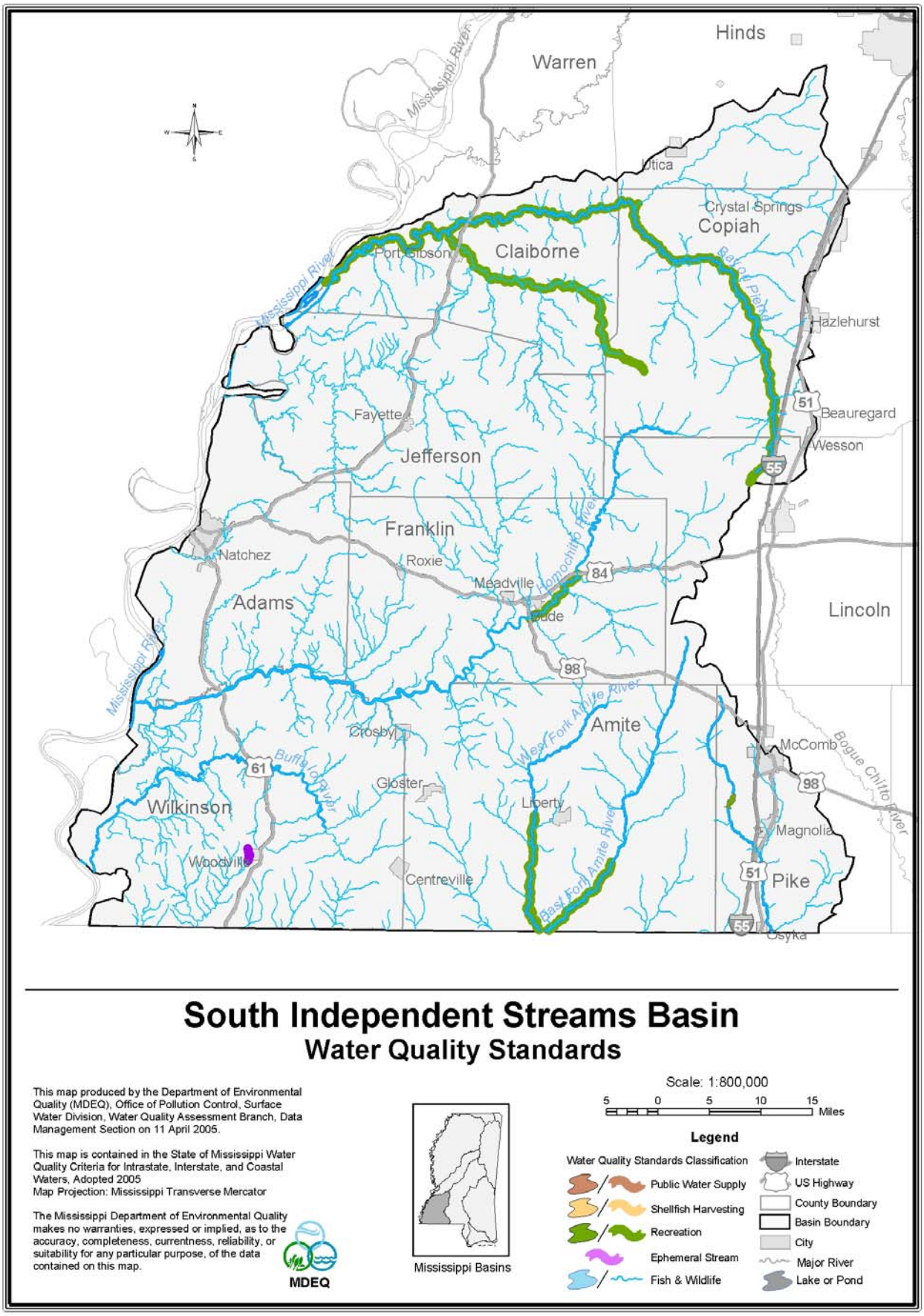
Projection: Mississippi Transverse Mercator

MDEQ

South Independent Streams Basin		
Waters	**Location**	**Classification**
Bayou Pierre	From headwaters to the Mississippi River	Recreation
Clear Springs Lake	Franklin County	Recreation
East Fork Amite River	From MS Hwy 584 to the MS/LA State Line	Recreation
Homochitto River	From US Hwy 84 to US Hwy 98	Recreation
Little Bayou Pierre	From headwaters to Bayou Pierre	Recreation
Percy Quinn State Park Lake	Pike County	Recreation
Unnamed Drainage Ditch (Westside Heights)	From Woodville to Bayou Sara	Ephemeral
West Fork Amite River	From MS Hwy 24 to the MS/LA State Line	Recreation



South Independent Streams Basin
Water Quality Standards

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MDEQ

Mississippi Basins

Scale: 1:800,000

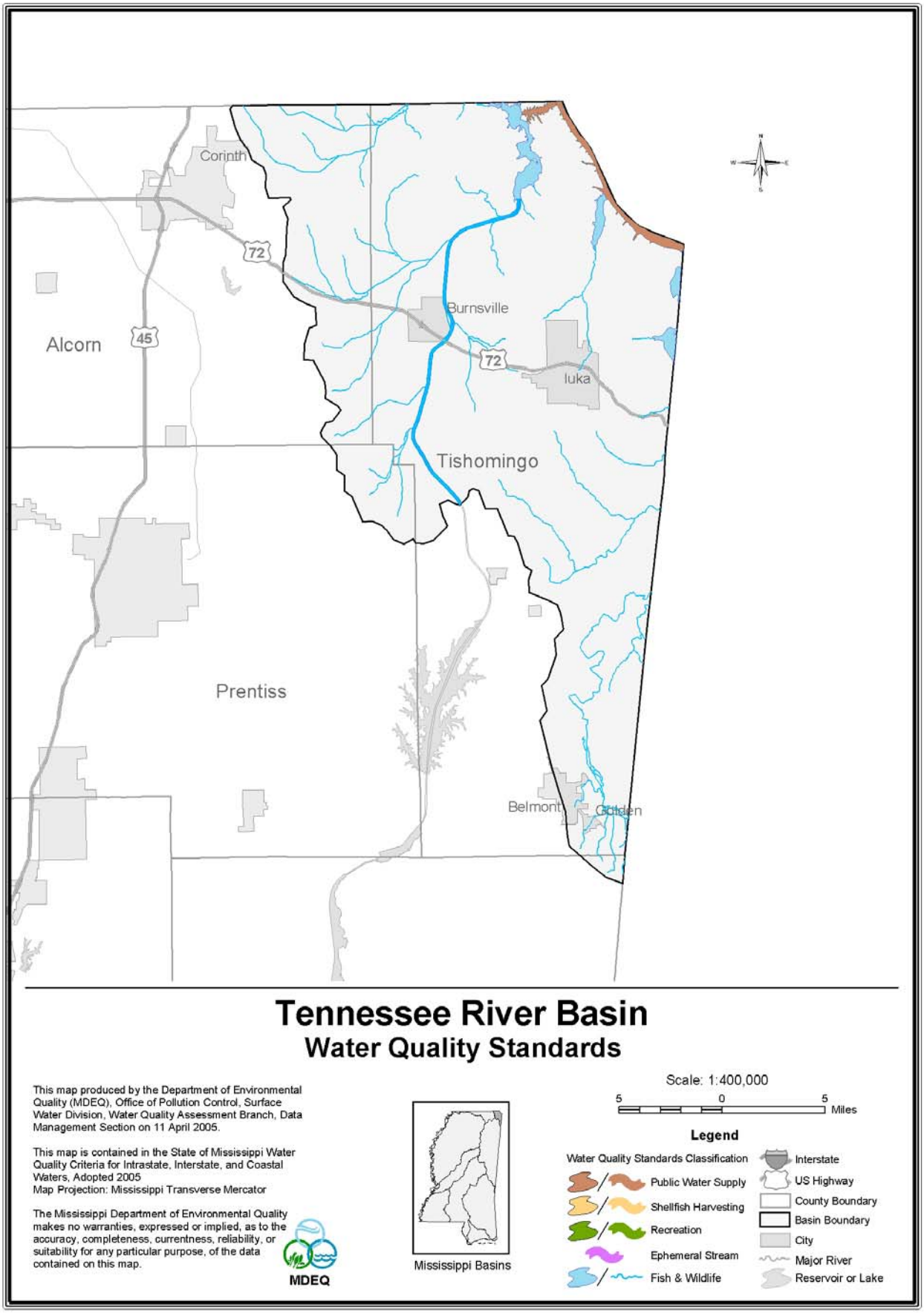
5 0 5 10 15 Miles

Legend

Water Quality Standards Classification
- Public Water Supply
- Shellfish Harvesting
- Recreation
- Ephemeral Stream
- Fish & Wildlife

- Interstate
- US Highway
- County Boundary
- Basin Boundary
- City
- Major River
- Lake or Pond

Tennessee River Basin		
Waters	**Location**	**Classification**
Tennessee River (Pickwick Lake)	From MS/AL State Line to the MS/TN State Line	Public Water Supply
Yellow Creek Embayment	Tishomingo County	Public Water Supply


Corinth
72
Burnsville
Alcorn
45
72
Iuka
Tishomingo
Prentiss
Belmont
Golden
Tennessee River Basin
Water Quality Standards
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Map Projection: Mississippi Transverse Mercator
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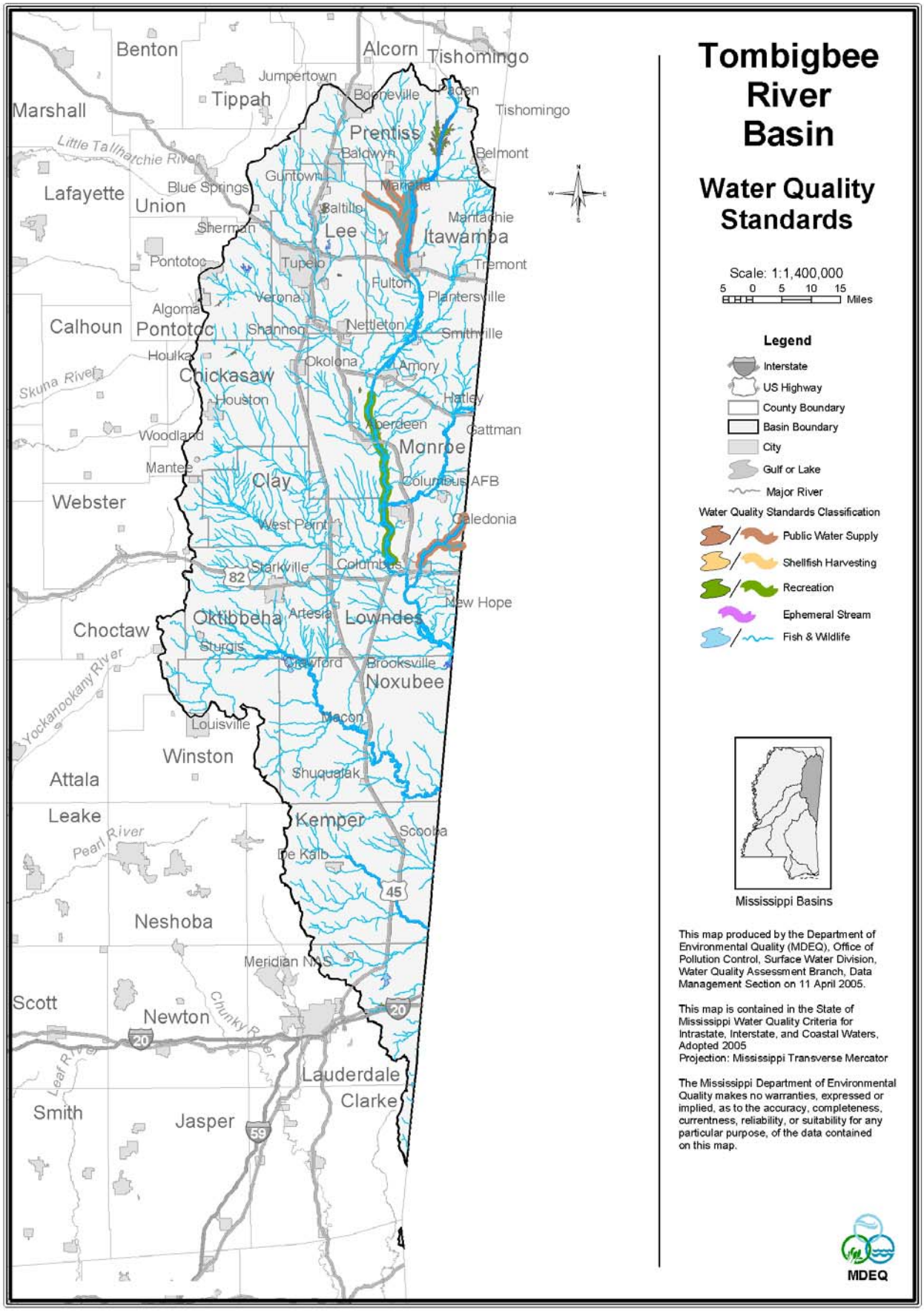
MDEQ
Mississippi Basins
Scale: 1:400,000
5 0 5 Miles
Legend
Water Quality Standards Classification
Public Water Supply
Shellfish Harvesting
Recreation
Ephemeral Stream
Fish & Wildlife
Interstate
US Highway
County Boundary
Basin Boundary
City
Major River
Reservoir or Lake

Tombigbee River Basin		
Waters	**Location**	**Classification**
Aberdeen Lake (Tenn-Tom Waterway)	From Mile 355.5 to Mile 364.3 (Normal Pool Elevation 190.0)	Recreation
Bay Springs Lake (Tenn-Tom Waterway)	From Mile 410.0 to Mile 419.0 (Normal Pool Elevation 414.0)	Recreation
Canal Section Pool "C" (Tenn-Tom Waterway)	From Mile 389.0 to Mile 396.4 (Normal Pool Elevation 270.0)	Recreation
Chiwapa Reservoir	Pontotoc County	Recreation
Choctaw Lake	Choctaw County	Recreation
Columbus Lake (Tenn-Tom Waterway)	From Mile 332.9 to Mile 355.5 (Normal Pool Elevation 163.0)	Recreation
Davis Lake	Chickasaw County	Recreation
Donivan Creek	From Natchez Trace Parkway to the Tombigbee River	Public Water Supply
Lake Lamar	Lee County	Recreation
Lake Lowndes	Lowndes County	Recreation
Lake Monroe	Monroe County	Recreation
Lake Tom Bailey	Lauderdale County	Recreation
Luxapallila Creek	From the MS/AL State Line to Hwy 50	Public Water Supply
Oktibbeha County Lake	Oktibbeha County	Recreation
Tenn-Tom Waterway		Public Water Supply
Twentymile Creek	From Natchez Trace Parkway to the Tombigbee River	Public Water Supply
Tombigbee River	From Boat Ramp Road to Hwy 78	Public Water Supply
Tombigbee State Park Reservoir	Lee County	Recreation
Yellow Creek	From the MS/AL State Line to Luxapallila Creek	Public Water Supply


Tombigbee River Basin
Water Quality Standards
Scale: 1:1,400,000
5 0 5 10 15
Miles
Legend
Interstate
US Highway
County Boundary
Basin Boundary
City
Gulf or Lake
Major River
Water Quality Standards Classification
Public Water Supply
Shellfish Harvesting
Recreation
Ephemeral Stream
Fish & Wildlife
Mississippi Basins
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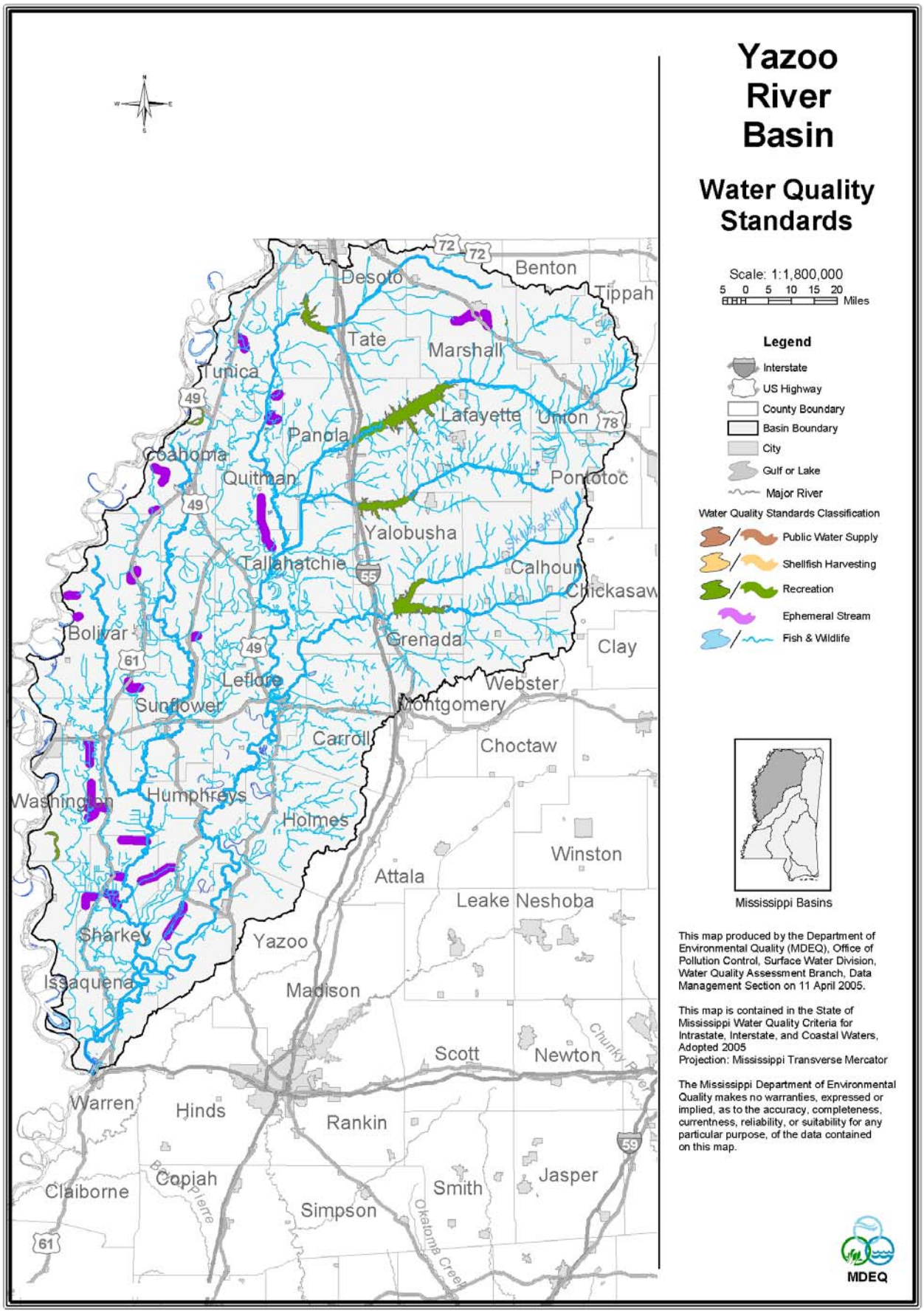
MDEQ
Benton
Alcorn
Tishomingo
Jumpertown
Tippah
Booneville
Marshall
Prentiss
Baldwyn
Belmont
Little Tallahatchie River
Guntown
Blue Springs
Lafayette
Union
Baldillo
Sherman
Lee
Itawamba
Pontotoc
Tupelo
Fulton
Tremont
Verona
Plantersville
Algoma
Calhoun
Shannon
Nettleton
Smithville
Houlka
Okolona
Amory
Chickasaw
Skuna River
Houston
Hatley
Aberdeen
Cattman
Woodland
Monroe
Webster
Clay
Columbus AFB
Caledonia
West Point
Starkville
Columbus
82
New Hope
Choctaw
Oktibbeha
Artesia
Lowndes
Sturgis
Crawford
Brooksville
Noxubee
Yockanookany River
Louisville
Macon
Winston
Attala
Shuqualak
Leake
Kemper
Scooba
Pearl River
De Kalb
45
Neshoba
Meridian NAS
Scott
Newton
Chunky River
20
Leaf River
Lauderdale
Clarke
Smith
Jasper
59

Yazoo River Basin		
Waters	**Location**	**Classification**
Arkabutla Reservoir	DeSoto and Tate Counties	Recreation
Canal #12	From Delta City to the Big Sunflower River	Ephemeral
Chewalla Reservoir	Marshall County	Recreation
Drainage Ditch #3	From Rosedale to Lane Bayou	Ephemeral
Enid Reservoir	Panola, Lafayette, and Yalobusha Counties	Recreation
Grenada Reservoir	Grenada County	Recreation
Lake Dumas	Tippah County	Recreation
Lake Washington	Washington County	Recreation
Little Tallahatchie River	From Sardis Reservoir to US Hwy 51	Recreation
Moon Lake	Coahoma County	Recreation
Nunnally Creek	From Holly Springs (Lagoons A and #1) to Pigeon Roost Creek	Ephemeral
Sardis Reservoir	Panola and Lafayette Counties	Recreation
Straight Bayou Drainage Main Ditch "A"	From Louise to Dowling Bayou	Ephemeral
Tillatoba Lake	Yalobusha County	Recreation
Unnamed Drainage Canal	From Anguilla to the Big Sunflower River	Ephemeral
Unnamed Drainage Ditch	From Arcola to Black Bayou	Ephemeral
Unnamed Drainage Ditch	From Beulah to Leban Bayou	Ephemeral
Unnamed Drainage Ditch	From Bobo to Annis Brake	Ephemeral
Unnamed Drainage Ditch	From Crenshaw to David Bayou	Ephemeral
Unnamed Drainage Ditch (Hollandale)	From Farm Fresh Catfish to Black Bayou	Ephemeral
Unnamed Drainage Ditch	From Farrell to Overcup Slough	Ephemeral
Unnamed Drainage Ditch	From Holly Springs (Lagoon A) to Nunnally Creek	Ephemeral
Unnamed Drainage Ditch	From Holly Springs (Lagoon #1) to Nunnally Creek	Ephemeral
Unnamed Drainage Ditch	From Holly Springs (Lagoon #3) to Big Spring Creek	Ephemeral
Unnamed Drainage Ditch	From Lambert to Muddy Bayou	Ephemeral

Yazoo River Basin Continued		
Waters	**Location**	**Classification**
Unnamed Drainage Ditch	From Leland to Black Bayou	Ephemeral
Unnamed Drainage Ditch	From Lurand to the Big Sunflower River	Ephemeral
Unnamed Drainage Ditch	From Rolling Fork (East Lagoon) to the Little Sunflower River	Ephemeral
Unnamed Drainage Ditch	From Rolling Fork (West Lagoon) to Indian Bayou	Ephemeral
Unnamed Drainage Ditch	From Ruleville to the Quiver River	Ephemeral
Unnamed Drainage Ditch	From Shaw to Porter Bayou	Ephemeral
Unnamed Drainage Ditch	From Shelby to Mound Bayou	Ephemeral
Unnamed Drainage Ditch	From Simmons Farm Raised Catfish (Yazoo County) to Lake George	Ephemeral
Unnamed Drainage Ditch	From Sledge to David Bayou	Ephemeral
Unnamed Drainage Ditch	From Tunica to Whiteoak Bayou	Ephemeral
Unnamed Drainage Ditch	From Winstonville to Mound Bayou	Ephemeral
Wall Doxey State Park Reservoir (Spring Lake)	Marshall County	Recreation


Yazoo River Basin
Water Quality Standards
Scale: 1:1,800,000
5 0 5 10 15 20
Miles
Legend
Interstate
US Highway
County Boundary
Basin Boundary
City
Gulf or Lake
Major River
Water Quality Standards Classification
Public Water Supply
Shellfish Harvesting
Recreation
Ephemeral Stream
Fish & Wildlife
Mississippi Basins
This map produced by the Department of Environmental Quality (MDEQ), Office of Pollution Control, Surface Water Division, Water Quality Assessment Branch, Data Management Section on 11 April 2005.
This map is contained in the State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters, Adopted 2005
Projection: Mississippi Transverse Mercator
The Mississippi Department of Environmental Quality makes no warranties, expressed or implied, as to the accuracy, completeness, currentness, reliability, or suitability for any particular purpose, of the data contained on this map.
MDEQ
Desoto
Benton
Tippah
Tate
Marshall
Tunica
Lafayette
Union
Panola
Coahoma
Quitman
Pontotoc
Yalobusha
Tallahatchie
Calhoun
Chickasaw
Bolivar
Grenada
Clay
Leflore
Webster
Sunflower
Montgomery
Carroll
Choctaw
Washington
Humphreys
Holmes
Winston
Attala
Leake
Neshoba
Sharkey
Yazoo
Issaquena
Madison
Scott
Newton
Warren
Hinds
Rankin
Copiah
Jasper
Claiborne
Smith
Simpson
Okatoma Creek
Chunky River
49
72
55
61
78
59