APPENDIX DD

Screening Level Ecological Risk Assessment (SLERA)

Screening Level Ecological Risk Assessment Report

Combe Fill South Landfill Superfund Site, Operable Unit 2

Remedial Investigation/Feasibility Study

EPA Work Assignment Number 018-RICO-0256, EPA Contract Number EP-W-09-009

Chester and Washington Townships, Morris County, New Jersey

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ABBREVIATIONS AND ACRONYMS

AUF	Area use factor
BCF	Bioconcentration factor
BERA	Baseline Ecological Risk Assessment
BHHRA	Baseline Human Health Risk Assessment
BTV	Background Threshold Value
BW	Body weight
CCC	Criterion continuous concentration
CF	Conversion factor
CFS	Combe Fill South
CLP	EPA Contract Laboratory Program
CMC	Criterion maximum concentration
COPC	Constituents of potential concern
CSM	Conceptual site model
DER	Data Evaluation Report
DESA	EPA Division of Environmental Sciences and Assessment
DOE	United States Department of Energy
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
EPC	Exposure point concentration
ERA	Ecological risk assessment
ERAGS	EPA Ecological Risk Assessment Guidance for Superfund
ETS	Endangered and threatened species
FCV	Final chronic value
FW2	Freshwater classification that is not FW1 or Pinelands waters
GWTP	Groundwater treatment plant
HDR	Henningson, Durham and Richardson Architecture and Engineering, P.C., in association with HDR Engineering, Inc.
HQ	Hazard quotient
HUC	Hydrologic unit code
IARC	International Agency for Research on Cancer
IR	Ingestion rate

IRIS	EPA Integrated Risk Information System
kg	Kilograms
Kow	Octanol-water partition coefficients
L/day	Liters per day
LMS	Lawler, Matusky & Skelly Engineers
LOAEL	Lowest observed adverse effect level
MATC	Maximum allowable toxicant concentration
MDL	Method detection limit
mg/kg-d	Milligrams per kilogram per day
mg/L	milligrams per liter
MDEQ	Michigan Department of Environmental Quality
NHP	Natural Heritage Program
NJDEP	New Jersey Department of Environmental Protection
NOAEL	No observed adverse effect level
NPL	Superfund National Priorities List
NRDA	Natural Resources Damage Assessment
OU1	Operable Unit 1
OU2	Operable Unit 2
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PPCP	Pharmaceuticals and personal care products
PEST	Pesticide
QAPP	Quality Assurance Project Plan
QL	Quantitation Limit
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ROS	Regression on Order Statistics
SCS	Special concern species
SLERA	Screening Level Ecological Risk Assessment
SMDP	Scientific management decision point
SOP	Standard operating procedure

SVOC	Semi-volatile organic compounds
TCL/TAL	EPA target compound list/target analyte list
TDS	Total dissolved solids
TIC	Tentatively identified compound
TOC	Total organic carbon
TRV	Toxicity reference value
TSCA	Toxic Substances Control Act
TSS	Total suspended solids
UCL	Upper confidence limit
ug/L	micrograms per liter
UNT	Unnamed tributary
USFWS	United States Department of Interior Fish and Wildlife Service
USL	Upper simultaneous limit
VOC	Volatile organic compound

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1 Introduction

Henningson, Durham & Richardson Architecture & Engineering, P.C. in association with HDR Engineering, Inc. (HDR), prepared this Screening Level Ecological Risk Assessment (SLERA) on behalf of the United States Environmental Protection Agency (EPA). This SLERA assesses the nature, magnitude and probability of potential harm to ecological resources posed by contamination at the Combe Fill South (CFS) Landfill Superfund Site, located in Chester and Washington Townships, Morris County, New Jersey. Completion of the associated Remedial Investigation/Feasibility Study (RI/FS) was in several phases between 2011 and 2017.

This SLERA is based upon the February 2, 2010 EPA Statement of Work, 2011 Quality Assurance Project Plan (QAPP, HDR 2011a) and Subtask 7.2 as described in the EPA-approved April 2011 RI/FS work plan (HDR 2011b). Performance of the RI/FS is under Work Assignment Number 018-RICO-0256, under EPA RAC 2 Contract Number EP-W-09-009.

This SLERA was developed to characterize the exposure setting and ecological receptor characteristics at the Combe Fill South Landfill Superfund Site. It identifies the current and future land use exposure pathways by which populations may be exposed to contaminants identified in surface water and sediment. The basis for the identification of exposure pathways included consideration of the sources and locations of contaminants, the likely environmental fate of the contaminants, and the location and activities of the potentially exposed populations.

Ecological risk assessments (ERAs) are conducted in a tiered manner in an eight-step process. This SLERA represents the initial two steps, which incorporate the four components of a risk assessment: 1) screening-level problem formulation, 2) toxicity evaluation, 3) exposure estimation, and 4) risk characterization via calculation of hazard quotients (HQ) in wildlife food chain modeling. An additional step, commonly referred to as Step 3A, is performed to determine if any of the Constituents of Potential Concern (COPCs) identified in the initial screening with HQs greater than 1 would be eliminated from the list if more realistic assumptions were applied (e.g., if 95% Upper Confidence Limits (UCLs) values were used instead of maximum detected concentrations).

Any potential hazards to ecological receptors identified in the SLERA are not considered definitive and may be evaluated further in later stages of EPA's eight-step ERA process, should it be determined that further evaluation is necessary. The conclusion of the SLERA represents the first scientific management decision point (SMDP) as specified in EPA Ecological Risk Assessment Guidance for Superfund (ERAGS, EPA 1997 and 1998).

Should the findings of the SLERA result in a determination that information is not adequate or there is an indication of adverse effects, a refined problem formulation will be developed, with input from EPA. This initiates the Baseline Ecological Risk Assessment (BERA) process, which provides a more detailed and focused assessment of the key components of potential ecological hazards. The BERA problem formulation will establish the goals, breadth, and focus of the assessment, based on refined assessment endpoints and potentially complete exposure pathways.

1.1 Purpose

SLERAs provide a general indication of the potential for ecological risk (or lack thereof) and may be conducted for several purposes including: 1) to estimate the likelihood that a particular ecological risk exists, 2) to identify the need for site-specific data collection efforts or 3) to focus site-specific ecological risk assessments where warranted.

Based on the results of the SLERA, EPA makes a determination for one of the following three decision points:

1. There is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk;
2. The information is not adequate to make a decision at this point, and the ecological risk assessment process will continue to Step 3; or
3. The information indicates a potential for adverse ecological effects, which warrants a more thorough assessment.

As indicated in decision points 2 and 3 above, additional evaluation can be completed at the end of SLERA to provide a more detailed assessment of the potential ecological risk at a site. This SLERA included an additional evaluation Step 3A to refine the COPC list and aquatic-based wildlife food chain modeling to assess the impacts of bioaccumulation and/or biomagnification of COPCs.

1.2 Report Organization

A description of the SLERA organization follows.

Section 1 Introduction: Identifies the purpose and organization of the SLERA.

Section 2 Screening Level Problem Formulation: Describes the site location and history, current habitats and endangered species and identified contamination.

Section 3 Sample Collection and Data Refinement: Describes the collection and preparation of data sets for the SLERA.

Section 4 Conceptual Site Model: Presents a conceptual site model (CSM) that identifies the exposure pathways and potentially exposed receptors as well as evaluation of representative species in food chain modeling.

Section 5 COPC Screening: Describes the identification process for ecological COPCs and provides Step 3A refinement of COPCs.

Section 6 Wildlife Exposure Dose Factors and Toxicity Values: Provides a discussion of the exposure factors, toxicity values, bioaccumulation models and the selection hierarchy for the wildlife food chain modeling.

Section 7 Risk Characterization: Presents the quantitative evaluation of aquatic biota, plants, and benthic invertebrates' exposure to COPCs in surface water and sediment as well as HQs for wildlife food chain modeling.

Section 8 Conclusions: Summary of the SLERA results.

Section 9 References: Provides information on the literature cited in the SLERA.

2 Screening-Level Problem Formulation

The Problem Formulation step of EPA's eight-step process for conducting ERAs consists of defining the nature and extent of the potential impacts to the ecosystem, what resources are at risk, what needs to be protected and what data are needed to develop a CSM and complete a defensible assessment. This section includes information related to the site's location, use history, existing habitats, threatened and endangered species, and the contamination present.

2.1 Site Description

2.1.1 Operable Unit 1

Combe Fill South Landfill Operable Unit 1 (OU1) is located at 98 Parker Road, Chester Township, Morris County, NJ (**Figure 2-1**). It is an inactive municipal landfill consisting of three separate fill areas capped and closed in the mid-1990s [New Jersey Department of Environmental Protection (NJDEP) 2011]. OU1 is the areal extent of the 115 acre property on which the landfill is located and includes the overburden and bedrock groundwater aquifers within the property boundaries. The Site lies within Washington and Chester Townships.

Beginning in the 1940s, operation of Combe Fill South landfill was for municipal refuse and solid waste and for the disposal of household and industrial wastes, animal carcasses, sewage sludge, septic tank wastes, chemicals and waste oils. Landfill operations ceased in 1981, followed by the Combe Fill Corporation bankruptcy filing and liquidation. According to records summarized in the 1986 Remedial Investigation (RI) report, conducted by Lawler, Matusky & Skelly Engineers (LMS 1986), about five million cubic yards of waste material are buried in the landfill.

Listing on the Superfund National Priorities List (NPL) occurred on September 1, 1983. EPA filed a Record of Decision (ROD) in 1986 and selected a remedy that included:

1. Providing an alternate water supply system for affected residents;
2. Covering the landfill with clay or a synthetic material to prevent surface water and rainwater from coming into contact with the buried wastes in accordance with Resource Conservation and Recovery Act (RCRA) requirements;
3. Installing a system to collect the landfill gases;
4. Pumping the shallow groundwater and leachate and treating it prior to discharge into East Trout Brook;
5. Installing controls to accommodate stormwater runoff and seasonal increases in precipitation; and
6. Performing an additional study to determine if the deep aquifer needs treatment (EPA 2013).

The landfill currently includes a roughly 65-acre multi-layered terraced cap, passive landfill gas venting system, shallow groundwater recovery and treatment system (referred to as the groundwater treatment plant (GWTP), security fencing, surface water

runoff controls, and a perimeter access road. OU1 consists of all media within the landfill property boundary including the overburden and bedrock groundwater aquifers.

2.1.2 Operable Unit 2

Overburden and bedrock groundwater, surface water and sediment outside the landfill property boundary comprise OU2. Investigations identified groundwater contamination in the deep aquifer, the main source of potable water in the area with the exception of a public water supply constructed in 2015 limited to properties impacted by contamination from the landfill (EPA 2015b). Private residential supply wells northeast of OU1 were previously impacted with chemicals, e.g. volatile organic compounds (VOCs) – 1,4-dioxane in particular - that had migrated from the landfill. Approximately 325 homes along Schoolhouse Lane, Parker Road and parts of Old Farmers Road were defined as being in need of an alternate water supply as a result of groundwater contamination emanating from the landfill.

EPA assumed the lead for a study of the deep aquifer and contaminated media outside the OU1 boundary in July 2009. The RI characterizes the nature and extent of this contamination as well as that within OU1 and evaluates potential exposure and the potential human health and ecological risks.

At the outset of the RI, the OU2 investigation area, extended well beyond the boundaries of the landfill property. It was generally bounded to the north by residential parcels on both sides of Schoolhouse Lane, to the east by Parker Road, and to the south and west by individual residential and agricultural (horse farm) lots adjacent to the landfill (**Figure 2-1**), covering approximately 444 acres. Adjustment of these boundaries occurred as necessary as the RI work progressed. The investigation area was extended to the north to the confluence of a Lamington River UNT and the Lamington River (known locally as the Black River), and to the south to a property adjoining a Trout Brook UNT (Trout Brook was historically referred to as West Trout Brook) on the south side of Parker Road. The other boundaries remain unchanged. Of note, these boundaries define the OU2 investigation area, not the extent of contamination. The RI provides the extent of contamination within OU1 and OU2.

The RI describes the geology, hydrology and hydrogeology of the study area. Consideration of pertinent information from the RI/FS Work Plan aided in the development of the SLERA.

2.2 Existing Habitats and Wetlands

Wildlife habitats and wetlands are described in detail in HDR's *Wildlife Technical Memorandum* and HDR's *Wetlands Delineation Report and Wetlands Functions and Values Assessment* (RI Appendices P and Q, respectively), provided as **Attachments E** and **F**, respectively. A summary of the information in those documents follows.

Combe Fill South is located in the Skylands region, which includes the Ridge and Valley and Highlands of New Jersey, and contains contiguous upland and wetland forests that support diverse animal populations.

The two basic habitat types identified are aquatic/riparian and terrestrial. Based on field observations during HDR's wildlife surveys, and information from NJDEP's Natural

Heritage Program (NHP) Landscape Project Skylands Habitat Maps (see **Figure 2-2**), there are five categories of habitats within the study area:

1. Deciduous wooded wetlands (with small areas of emergent/shrub vegetation);
2. Streams, ponds and ditches;
3. Brush/shrub land and forest edge;
4. Upland forests (includes coniferous and deciduous mix communities with varying crown closure percentages); and
5. Landfill and landfill edge.

There are four streams[1] with headwaters near the landfill:

1. Trout Brook [classified FW2-TP(C1)]
2. East Trout Brook [FW2-TP(C1)]
3. Lamington (Black) River UNT [FW2-TM(C1)]
4. Tanners Brook UNT [FW2-NT(C1)] (NJDEP 2005, 2016)

The stream depths range from less than six inches in East Trout Brook, Tanners Brook UNT, and Lamington River UNT to two feet in Trout Brook. Four ponds are up to seven feet deep based on field measurements and observations (HDR 2015c).

HDR delineated four wetland areas on May 9 through 12, and May 16 through 17, 2011 in accordance with the protocol described in the 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands Intermediate-Level Onsite Determination Methods*. These four areas correspond to wetlands mapped by the New Jersey Highlands Council. Two of the four areas (wetlands WA and WB) consist of contiguous wetlands (see **Figure 2-3**). The principal wetland function and values provided by the wetlands are wildlife habitat and sediment/toxicant retention.

HDR conducted wildlife surveys during seven visits in 2010 and four in 2011 with the intent to identify habitat usage by endangered and threatened species (ETS), special concern species (SCS) and other common wildlife that may be disturbed by RI activities, e.g., clearing access routes, well drilling and sampling. The field biologists observed and identified approximately 1200 mammals, birds, reptiles, and amphibians representing over 100 species.

2.3 Endangered Species, Threatened Species and Species of Special Concern

The potential and observed ETS and SCS are described in detail in HDR's *Wildlife Technical Memorandum* (RI Appendix P). The memorandum is included as **Attachment E**; a summary follows.

No federally-listed species were observed during the 2010 and 2011 wildlife surveys. However, two federally-listed bat species may occur. An EPA consultation with United

[1] FW – fresh water; TP – trout production; NT – non-trout; C1 – category one water body (the most stringent protection category).

States Department of Interior Fish and Wildlife Service (USFWS) identified the endangered Indiana bat (*Myotis sodalis*) and threatened northern long-eared bat (*Myotis septentrionalis*, USFWS 2015).

In 2010, HDR requested information from NJDEP to identify listed species that may occur. The agency identified five ETS and SCS using the NJDEP NHP Landscape Project (Version 3 for Highlands Region, NJDEP 2010):

- Barred owl (*Strix varia*, Rank 3, state threatened)
- Cooper's hawk (*Accipiter cooperii*, Rank 2 special concern)
- Red-shouldered hawk (*Buteo lineatus*, Rank 4 state endangered)
- Savannah sparrow (*Passerculus sandwichensis*, Rank 3 state threatened)
- Bobcat (*Lynx rufus*, Rank 4 state endangered*)*

As follow-up to the initial information request, review of the more recent Landscape Project data (Version 3.3, NJDEP 2017) indicated the same species listed above, with the exception of the Savannah sparrow, remain in the Landscape Project database as being present at or near the Site. An additional five listed species documented as occurring, include:

- Great blue heron (*Ardea herodias*, Rank 2 special concern)
- Maine snaketail (*Ophiogomphus mainensis*, Rank 2 special concern)
- Veery (*Catharus fuscescens*, Rank 2 special concern)
- Wood thrush (*Hylocichla mustelina*, Rank 2 special concern)
- Wood turtle (*Glyptemys insculpta*, Rank 3 state threatened)

State-listed species observed during the 2010 and 2011 wildlife surveys consisted of 16 bird species and one reptile species: two are endangered species, five are threatened species, and 10 are special concern species. The observed state-listed ETS and SCS are birds, except for the eastern box turtle (*Terrapene c. Carolina*).

2.4 Site Contamination

Section 5.4 of the RI describes the sources of site contamination in detail. These include the waste buried in the landfill and unexcavated waste within a portion of the former North Waste Cell that remains beneath a section of the perimeter road.

Construction of the landfill consisted of clearing overburden and placing waste directly on or near the bedrock surface. The landfill accepted municipal refuse and solid waste, as well as large amounts of pharmaceuticals and personal care products (PPCPs) wastes, most notably in the North Waste Cell area, but not exclusively in that location.

Landfill closure consisted of capping the landfill and constructing a shallow groundwater collection and treatment system. The collection system is primarily limited to recovering groundwater from the overburden, with the exception of one shallow bedrock extraction well. Shallow bedrock fractures serve as conduits through which transport of contaminated leachate into the deeper fracture network occurs in the immediate vicinity of the landfill.

Studies of nearby surface water bodies were to determine impacts from contaminated groundwater discharging to surface water. Historically, landfill leachate, as well as groundwater and surface water runoff from the southwestern portion of the landfill constituted the headwaters of East Trout Brook and Trout Brook (LMS 1986). Synoptic depth to groundwater measurement events and water level measurements during sampling throughout the field investigation provided information used to evaluate the groundwater/surface water interaction. Data loggers installed in each piezometer/stream gauge pair monitored surface water levels for a period of three months. It was determined that shallow groundwater discharges to surface water along Trout Brook to the south, Tanners Brook UNT to the west, and the Lamington River UNT along Schoolhouse Lane to the northeast, making these gaining streams. The upper portion of East Trout Brook to the southeast of the landfill may at times be a losing stream, while the lower portion is often a gaining stream.

East Trout Brook receives the GWTP effluent. In the absence of heavy precipitation and resulting overland flow, the effluent is the main source of water for the stream.

3 Sample Collection and Data Refinement

HDR collected and managed data as outlined in the Quality Assurance Project Plan (QAPP, HDR 2011a). The EPA Contract Laboratory Program (CLP) and EPA Division of Environmental Sciences and Assessment (DESA) laboratory performed sample analysis for the 2011 through 2017 sampling events. CLP data underwent Level 3 validation, with a subset of CLP data receiving Level 2B validation (EPA Region 2 2014a). DESA performed validation in accordance with EPA Region 2 standard operating procedure (SOP) #G26 (EPA Region 2 2014b). EPA provided validated electronic data deliverables (EDDs) to HDR. HDR submitted the EDDs to EPA Region 2 Superfund EDD Database Section personnel.

HDR reviewed and compiled the data in a Data Evaluation Report (DER, RI Appendix B) to determine whether the data met the project's data quality objectives (DQOs) of the QAPP, identify data gaps and determine the usability of the data for the SLERA. The project team refined the data set to standardize it and to better support the exposure, toxicity and risk assessments.

3.1 Surface Water

Groundwater flow to surface water may affect water quality, which could impact ecological receptors; therefore, surface water data are considered in the SLERA.

Investigation of the interaction of groundwater and surface water took place at nine locations along nearby streams and a wetland to correlate groundwater and surface water elevations and determine if potentially contaminated groundwater is discharging to surface waters. A site reconnaissance identified depositional areas in the streams and possible groundwater upwelling locations prior to sampling.

HDR conducted OU2 surface water sampling in November 2014 and background surface water sampling in 2017 (see **Section 3.4**); the sampling locations are on **Figure 3-1**. In 2014, there were 26 samples (including two field duplicates) collected along four streams

with headwaters near the landfill, i.e., Trout Brook, East Trout Brook, the Lamington River UNT and Tanners Brook UNT.

HDR conducted a separate evaluation of East Trout Brook data from the other surface water data in the COPC screening to determine if there are any impacts to surface water quality from the GWTP effluent discharge into this stream.

Surface water analyses consisted of EPA's target compound/analyte list (TCL/TAL) VOCs, semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs) and metals (total and dissolved), cyanide, total suspended solids (TSS), total dissolved solids (TDS), total organic carbon (TOC), alkalinity and chloride. Data tables are provided in the RI.

The DER evaluates the usability of the surface water data; all data met the DQOs and are deemed appropriate for the SLERA to evaluate surface water impacts.

3.2 Sediment

As with surface water, flow from groundwater to surface water and therefore, to sediment necessitated that sediment data be collected and considered in the data evaluation and in the SLERA.

HDR conducted OU2 sediment sampling in November 2014 and background sediment sampling in 2017 (see **Section 3.4**). In 2014, there were 26 sediment samples (including two field duplicates) collected along the same four streams as noted in **Section 3.1** above (see **Figure 3-1** for locations).

As noted, the East Trout Brook sampling locations are downstream of the landfill's GWTP effluent discharge. Evaluation of the East Trout Brook data considers potential impacts to sediment quality from the effluent discharge.

Analyses of sediment samples from 0.0 to 0.5 feet deep in the stream bed consisted of TCL/TAL SVOCs, pesticides, PCBs and metals, cyanide, TOC, grain size, percent moisture and pH. Analyses of deeper sediment samples from 0.5 to 1.0 feet below the stream bed were for TCL VOCs and moisture content. Data tables are included in the RI attachments.

The DER evaluates the usability of the sediment data; all data meet the DQOs, and are appropriate for use in the SLERA to evaluate sediment impacts.

3.3 Seeps and Springs

Local seeps and springs (considered to be expressions of groundwater quality) are identified on **Figure 3-1**. Groundwater discharges to the land surface via seepage into streams, ponds and wetlands; for example, groundwater surfacing at seeps constitutes the head waters of Trout Brook. A review of the source, location and characteristics of nearby seeps and springs indicates there is evidence that the spring in the southwest corner of a pond on the 21 Schoolhouse Lane property is hydraulically connected to well CF206D (HDR 2015b). These groundwater-surface water interactions are modeled using stream gauge and piezometer data, which are presented in the RI, Appendix S. In September 2017, HDR collected three water samples from Seep A, two from Seep B and

two from Spring A to further evaluate ecological exposures to these sources of potential contamination. The sampling locations are on **Figure 3-2**.

Sample analyses consisted of TCL/TAL VOCs, SVOCs, pesticides, PCBs and metals (total and dissolved); cyanide, TSS, TDS, TOC, alkalinity and chloride. The DER evaluates data usability; all data meet the project DQOs, and are appropriate for use in the SLERA to evaluate seeps and springs impacts.

3.4 Background Samples

Background sample locations were identified and sampled to support Step 3A of the SLERA. Based on multiple lines of evidence, HDR investigated areas that do not receive surface water run-off or groundwater recharge emanating from the landfill. Criteria for selection of sample locations included being as distant as possible from development and human activities to be considered as local natural background. In consultation with EPA, the selected areas were north-northwest of the landfill along the Tanners Brook UNT and along Tanner's Brook parallel to East Valley Brook Road.

The background sampling areas are in the same hydrologic unit code (HUC 14) boundary, but different sub-hydrologic unit code (HUC) than OU2. The two sub-watersheds and locations have similar characteristics, e.g., neither are part of a mapped Highlands Council groundwater recharge area or wetland (NJGIS 2012, NJDEP GIS 2018).

Groundwater quality is concerning relative to surface water quality because the streams in this area are largely groundwater fed (i.e., gaining streams). The background areas are west of the known groundwater divide that runs along the SW-NE trending ridgeline. Groundwater on this side of the divide flows toward the landfill and is upgradient of contaminant sources; therefore, the area would not be impacted by landfill leachate or runoff. The surficial geology of the area along the tributary is gneiss colluvium, which is similar to the predominantly weathered gneiss in OU2. The forested areas are located away from residential properties, reducing other potential anthropogenic impacts.

In September 2017, HDR collected co-located surface water and sediment background samples from nine locations within the two UNTs that feed into Tanners Brook and one pair of co-located surface water and sediment background samples from the main stem of Tanners Brook itself for a combined 21 samples (including one sediment field duplicate). See **Figure 3-2** for sampling locations.

Analysis of the background surface water and sediment samples was for the same parameters described in **Sections 3.1** and **3.2** for the site-related surface water and sediment samples.

The DER evaluates data usability; all data meet the project DQOs and are deemed appropriate for use in the SLERA.

3.5 Data Refinement

Refinement of data determined appropriate for use in the risk assessments included the following directives in accordance with EPA *Guidance for Data Useability in Risk Assessment (Part A)* (EPA 1992):

- Chemical concentrations qualified as not detected (i.e., U-qualified data) are evaluated as non-detects. Concentrations qualified as estimated (i.e., J-qualified data) are included for quantitative assessment. Rejected R-qualified data are not used.
- HDR compared the results of the field duplicate samples to the results of the associated parent samples and consolidated them into the data set by using the maximum result if constituents are detected in both the original and duplicate samples. The SLERA uses the detected value in the case of one detection and one non-detection in a parent/duplicate sample pair.

4 Conceptual Site Model

The CSM is a dynamic tool for understanding site conditions and potential exposure scenarios for ecological receptors that may be exposed to site-related contamination. An exposure pathway consists of:

- A source (e.g., landfill) and mechanism of chemical release;
- A retention or transport medium (e.g., groundwater);
- A point of contact (e.g., surface water) between the ecological receptor and the medium; and
- A route of exposure (e.g., ingestion) for the potential ecological receptor at the contact point.

An exposure pathway is complete only if all four components are present. The SLERA only evaluates complete exposure pathways quantitatively. A diagram of the CSM is included as **Figure 4-1**. The RI presents additional information related to the CSM including site background, setting, geology, hydrogeology, and extent of contamination.

4.1 Receptors

The definition of potential receptors is ecological populations that are subject to contaminant exposure. Both current and future land and water use conditions are considered when determining exposure scenarios. Current land-use consists primarily of low-density residential (lot sizes are generally more than two acres) amidst large parcels of cleared or forested rolling hills. Use of some of the larger parcels is for agricultural purposes. Expectations of future land use are the same - to remain predominantly residential with limited agriculture.

Table 4-1 presents the potential ecological feeding guilds with the rationale for evaluating the guilds quantitatively or qualitatively as well as identifying representative species for each feeding guild, incorporating information from EPA's *Wildlife Exposure Factors Handbook* (EPA 1993). **Figure 4-1 depicts** these exposure scenarios in diagram format.

Table 4-1. Representative Species for Feeding Guilds

Aquatic Feeding Guild	Exposure Media	Evaluation	Rationale	Representative Species
Biota	Surface water	Quantitative	Biota, including fish, surveys and sampling were not completed for the SLERA; there is a lack of exposure factors and toxicity reference values (TRVs) for this feeding guild. Evaluation of aquatic biota exposure is by comparing surface water concentrations to ecological screening benchmarks.	Biota
Benthic Invertebrates	Sediment	Quantitative	A benthic invertebrate survey was not completed for the SLERA; there is a lack of exposure factors and TRVs for this feeding guild. Evaluation of benthic invertebrate exposure is by comparing sediment concentrations to ecological screening benchmarks.	Benthic Invertebrates
Amphibians	Surface water, sediment	Quantitative	An amphibian survey was not completed for the SLERA; there is a lack of exposure factors and TRVs for this feeding guild. Evaluation of amphibian exposure is by comparing surface water and sediment concentrations to ecological screening benchmarks.	Amphibians
Plants	Sediment	Quantitative	A plant survey was not completed; there is a lack of plant tissue data. Evaluation of aquatic plant exposure is by comparing sediment concentrations to ecological screening benchmarks.	Plants
Avian Herbivore	Surface water, sediment, aquatic plants	Quantitative	Mallards have the potential to be on-Site and there are available exposure factors and TRVs; therefore, the species was selected as the representative for this feeding guild.	Mallard
Mammalian Herbivore	Surface water, sediment, aquatic plants	Quantitative	Muskrats have the potential to be on-Site and there are available exposure factors and TRVs; therefore, the species was selected as the representative for this feeding guild.	Muskrat
Avian Invertivore	Surface water, sediment, invertebrates	Quantitative	Spotted sandpipers have the potential to be on-Site and there are available exposure factors and TRVs; therefore, the species was selected as the representative for this feeding guild.	Spotted Sandpiper
Mammalian Invertivore	Surface water, sediment, invertebrates	Quantitative	Raccoons have been observed on-Site, are found in both aquatic and terrestrial environments and there are available exposure factors and TRVs; therefore, the species was selected as the representative for this feeding guild.	Raccoon
Avian Piscivore	Surface water, sediment, fish	Quantitative	Great blue herons have been observed on-Site, are found in both aquatic and terrestrial environments and there are available exposure factors and TRVs; therefore, the species was selected as the representative for this feeding guild.	Great Blue Heron
Mammalian Piscivore	Surface water, sediment, fish	Quantitative	Minks have the potential to be on-Site, are found in both aquatic and terrestrial environments and there are available exposure factors and TRVs; therefore, the species was selected as the representative for this feeding guild.	American Mink

4.2 Assessment and Measurement Endpoints

One regulatory goal of the Superfund program is “to reduce ecological risks to levels that will result in the recovery and maintenance of healthy local populations and communities of biota” (EPA 1999a). In support of this goal, the assessment endpoints and measurement endpoints are chosen as to protect the local populations of the identified resources. Adequate protection is protection of growth, reproduction, and survival of local ecological receptor populations.

4.2.1 Assessment Endpoints

Selection of assessment endpoints is by evaluation of the ecosystems, biotic communities and/or species, as well as the COPCs at the site. They assess the adverse effects of the COPCs and various toxicity factors, such as which species may be most impacted, what effects at what scale may occur, chemistry, bioavailability and the exposure pathway - including bioaccumulation in the food chain.

In accordance with the general goals above, the assessment endpoints for OU2 include:

- Reproduction, growth and survival of aquatic biota, benthic invertebrates, amphibians and plants; and
- Reproduction, growth, and survival of aquatic herbivores, invertivores and piscivores.

4.2.2 Measurement Endpoints

Measurement endpoints are ecological characteristics that can be measured, interpreted, and related to the valued ecological components chosen as the assessment endpoints; they are measures of biological effects, such as mortality and growth (EPA 1997).

HQs are one type of measurement endpoint. A HQ is the ratio of the estimated exposure of a receptor at a site to a "benchmark" exposure identified as being without significant risk of unacceptable adverse effect:

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

Exposure may be expressed as the concentration in an environmental medium (water, sediment, soil, diet); concentration in the tissues of an exposed receptor; or the amount of chemical ingested (i.e., exposure dose) by a receptor. Benchmark may be expressed as either the ecological screening benchmark or toxicity value for the constituent.

The measurement endpoints for this SLERA include:

- Comparison of surface water, seeps/springs water concentrations, as expressions of exposure, to surface water ecological benchmarks (see **Section 4.3**) to represent potential adverse effects to aquatic biota and amphibians;
- Comparison of sediment concentrations to sediment ecological benchmarks (see **Section 4.3**) to represent potential adverse effects to benthic invertebrates, amphibians, and plants; and
- Calculation of HQs in wildlife food chain modeling by calculating exposure doses and comparing the doses to toxicity values for aquatic herbivores, invertivores, and piscivores.

4.3 Ecological Screening Benchmarks

Compilation of ecological screening benchmarks for each environmental medium (i.e., surface water and sediment) was from various EPA and NJDEP sources applied in the SLERA using the following hierarchy:

- NJDEP Ecological Screening Criteria Freshwater Surface Water (FW2) Aquatic (acute and chronic) and Freshwater Sediment Lowest Effects Level (NJDEP 2009 and 2016);
- EPA National Recommended Water Quality Criteria Freshwater Criterion Maximum Concentrations (CMC, acute) and Criterion Continuous Concentrations (CCC, chronic) (EPA 2017b, see Aquatic Life Criteria table); and
- The minimum of the EPA Region 3 Freshwater Sediment Screening Benchmarks (EPA Region 3 2006) and EPA Region 5 RCRA Sediment Ecological Screening Levels (EPA Region 5 2003).

The NJDEP Ecological Screening Criteria FW2 Aquatic are promulgated values from New Jersey Administrative Code (N.J.A.C.) 7:9B *Surface Water Quality Standards* as well as screening values from other sources. The Clean Water Act's National Recommended Water Quality Criteria are promulgated values that reflect the latest scientific knowledge on ecological effects and welfare to plankton, fish, shellfish, wildlife, plants, aesthetics and recreation as well as incorporate the biological, physical and chemical properties of constituents (EPA 1986). The chosen screening benchmark for each medium is applied in COPC identification, which is discussed in **Section 5**. The screening benchmarks are presented in **Attachment A, SLERA Supporting Tables 1.1 to 1.5**.

Neither of the surface water screening criteria sources provide a criterion for 1,4-dioxane, the primary constituent of concern in groundwater. With concurrence from EPA, a 1,4-dioxane surface water criterion of 22,000 ug/L, taken from EPA Region 5 RCRA Ecological Screening Levels, is applied as a surrogate (EPA 2003 and 2015a). This final chronic value (FCV) represents a concentration that does not cause injurious or debilitating effects in an aquatic organism resulting from repeated, long-term exposure to a substance relative to the receptor's lifespan. It is calculated according to the methodology specified in R 323.1057(2) of the Michigan Department of Environmental Quality (MDEQ) Rule 57 of Part 4 *Water Quality Standards* (MDEQ 2015).

Surface water screening benchmarks differ for total and dissolved metals. EPA recommends using dissolved metals as a measure of exposure to ecological receptors, because it represents the bioavailable fraction of metals in water (EPA 2017b). However, as total metal concentrations are typically higher than dissolved metal concentrations, comparison of both total and dissolved concentrations to their respective screening benchmarks provides for a more conservative identification of COPCs.

Surface water screening benchmarks are calculated for hardness-dependent dissolved metals using published equations and conversion factors on EPA's National Recommended Water Quality Criteria website and NJDEP's Ecological Screening Criteria tables (EPA 2017b, NJDEP 2009 and 2016). For evaluation of surface water data from three of the four nearby water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT), the dissolved metals screening benchmarks are calculated for cadmium, copper, lead, nickel, silver and zinc using an average hardness of 21 milligrams per liter (mg/L). The hardness value was chosen after determining the average hardness for each of the three water bodies from analytical results and applying the lowest value – from the Tanners Brook UNT. As noted in **Section 3.2**, surface water data downstream of the GWTP are evaluated separately to determine any potential

impacts from the effluent discharge and thus, separate hardness-dependent dissolved criteria are calculated using the average hardness of 300 mg/L from East Trout Brook. The hardness-dependent dissolved criteria for seeps/springs are calculated using the average hardness of 43 mg/L. Calculations for hardness-dependent dissolved surface water benchmarks are in **Attachment A, Table 1.4**.

5 COPC Screening

Surface water, seep water, and sediment data are compared to conservative ecological screening benchmarks to identify COPCs.

5.1 Identification of COPCs

Maximum detected concentrations are screened against the ecological screening benchmarks compiled in **Section 4** to determine ecological COPCs. Constituents with maximum detected concentrations below the ecological screening benchmarks are understood not to pose ecological hazards and are not carried forward in the calculation of HQs in the wildlife food chain modeling.

The COPC surface water, seep water and sediment screening identification tables are presented in **Attachment A, Tables 1.1 to 1.6**. **Table 5-1** below and **Attachment A, Table 1.7** provide a summary of the identified COPCs.

COPCs were determined by comparing the maximum detected concentrations of constituents in surface water, seep and spring water, and sediment to ecological screening benchmarks using the hierarchy described in **Section 4.3**. Exceedances of screening benchmarks do not in and of themselves indicate that an unacceptable exposure exists. Rather, the exceedance of a screening level indicates the need for further evaluation in the SLERA. If the maximum detected concentration of a constituent is less than the screening benchmark, it is eliminated as a COPC because it is not expected to contribute significantly to unacceptable hazard. Constituents without a screening benchmark are retained as COPCs for further evaluation.

The COPC screening resulted in 36 COPCs being identified in surface water, seep and spring water and sediment, of which four are VOCs, 13 are SVOCs, two are pesticides and 17 are inorganics. **Table 5-1** provides the COPC count by medium.

Table 5-1. Summary of Constituents of Potential Concern

COPC Group	COPC	**Surface Water** (Trout Brook, Lamington River UNT and Tanners Brook UNT)	**Surface Water** (East Trout Brook)	**Seep / Spring Water**	**Sediment** (Trout Brook, Lamington River UNT and Tanners Brook UNT)	**Sediment** (East Trout Brook)
VOC	1,2,3-trichlorobenzene	Yes - NC	Yes - NC			
VOC	Acetone		Yes - NC			
VOC	Dichlorodifluoromethane		Yes - NC			
VOC	Diethyl Ether	Yes - NC	Yes - NC			
SVOC	2,3,4,6-tetrachlorophenol				Yes	
SVOC	Anthracene				Yes	
SVOC	Benzo(a)anthracene				Yes	
SVOC	Benzo(a)pyrene				Yes	
SVOC	Benzo(g,h,i)perylene				Yes	
SVOC	Benzo(k)fluoranthene				Yes	
SVOC	Benzyl Butyl Phthalate				Yes	
SVOC	Chrysene				Yes	
SVOC	Dibenz(a,h)anthracene				Yes	
SVOC	Fluoranthene				Yes	
SVOC	Indeno(1,2,3-c,d)pyrene				Yes	
SVOC	Phenanthrene				Yes	
SVOC	Pyrene				Yes	
PEST	4,4-DDD			Yes – NC		
PEST	Chlordane, alpha		Yes - NC			
INORGANIC	Aluminum	Yes	Yes - NC	Yes		
INORGANIC	Arsenic				Yes	Yes
INORGANIC	Barium				Yes - NC	Yes - NC
INORGANIC	Beryllium				Yes - NC	Yes - NC
INORGANIC	Cadmium	Yes - NC		Yes - NC	Yes	Yes
INORGANIC	Copper	Yes			Yes	
INORGANIC	Iron	Yes		Yes		Yes
INORGANIC	Lead	Yes	Yes		Yes	
INORGANIC	Manganese	Yes - NC	Yes - NC	Yes - NC		Yes
INORGANIC	Mercury				Yes	
INORGANIC	Selenium				Yes	Yes
INORGANIC	Silver		Yes		Yes	
INORGANIC	Vanadium				Yes - NC	Yes - NC
INORGANIC	Calcium	Yes - NC	Yes - NC	Yes - NC	Yes - NC	Yes - NC
INORGANIC	Magnesium	Yes - NC	Yes - NC	Yes - NC	Yes - NC	Yes - NC
INORGANIC	Potassium	Yes - NC	Yes - NC	Yes - NC	Yes - NC	Yes - NC
INORGANIC	Sodium	Yes - NC	Yes - NC	Yes - NC	Yes - NC	Yes - NC
	Total COPCs:	**12**	**13**	**10**	**27**	**12**

Note: Constituents that became a COPC because no screening benchmark was available are flagged with "NC".
Total and dissolved water concentrations for inorganics were compared to their respective screening benchmarks to provide for a more conservative identification of COPCs.[2]

[2] Evaluating the total and dissolved concentrations separately may lead to what may seem like an inconsistency in Table 5.1, i.e., aluminum. Aluminum (unfiltered) has a surface water benchmark whereas aluminum (filtered) does not. Aluminum was added as a COPC in Surface Water from Trout Brook, the Lamington River UNT, and Tanners Brook UNT because its unfiltered detected concentration was greater than the screening benchmark. In comparison, aluminum was added as a COPC in Surface Water from East Trout Brook because its filtered detected concentration did not have a screening benchmark for comparison and it is inappropriate to compare it to the unfiltered screening benchmark.

6 Wildlife Exposure Doses and Toxicity Values

The SLERA performs wildlife food chain modeling, which incorporates various exposure factors, toxicity values and bioaccumulation models described in this section.

6.1 Exposure Doses

In this SLERA, the exposure term in the HQ calculation of the wildlife food chain modeling is expressed as the amount of chemical ingested (i.e., exposure dose) by a receptor. The concentration term in the exposure dose is the maximum detected concentration. The exposure factors related to each wildlife representative species are incorporated into the calculation of an exposure dose for each constituent, medium and exposure pathway (e.g., ingestion of surface water). The equations for each type of exposure dose are as follows.

The surface water ingestion dose equation in units of milligrams per kilogram per day (mg/kg-d) is:

$$Surface\ Water\ Exposure\ Dose\ = \frac{EPC \times CF \times AUF \times IR}{BW}$$

Where:

EPC	=	exposure point concentration of COPC [micrograms per liter (ug/L)]
CF	=	conversion factor of 0.001 mg/ug
AUF	=	area use factor; based on foraging home range and conservatively assumed to be 1 (no units)
IR	=	ingestion rate; the amount of contaminated medium ingested over the exposure period [liters per day (L/day)]
BW	=	body weight; the average body weight over the exposure period [kilograms (kg)]

The sediment incidental ingestion dose equation (in units of mg/kg-d) is the same as the surface water ingestion dose, except the concentration term is in units of mg/kg.

In addition to the exposure dose for the ingestion of surface water and incidental ingestion of sediment, exposure doses are calculated for the food pathways (in units of mg/kg-d). The food exposure doses include a bioaccumulation factor (BAF) that converts the water or sediment concentration to a food concentration. These BAFs, many of which are in an equation format, are specific to each COPC and are provided in **Attachment A, Table 2.2**. The exposure dose calculation for food pathways is:

$$Food\ Exposure\ Dose\ = \frac{EPC \times BAF \times CF \times AUF \times IR}{BW}$$

The mallard and muskrat apply a sediment to aquatic plant BAF in the food exposure dose equation, the spotted sandpiper, and raccoon apply a sediment to benthic invertebrate tissue BAF and the great blue heron and American mink apply a surface water to fish bioconcentration factor (BCF).

The exposure factors in the equations above are based on data compiled in the EPA *Wildlife Exposure Factors Handbook* (EPA 1993). For instances where the Handbook identified multiple values for body weight and home range, the values from geographically more local studies are chosen; otherwise, the average of all of the values for an adult species is chosen. Despite the varying home range values, it was conservatively assumed that wildlife species reside and forage exclusively on-site and an AUF of one was applied for all species. Food ingestion rates are estimated using the equations presented in *Food Requirements of Wild Animals: Predictive Equations for Free-Living Mammals, Reptiles and Birds* (Nagy 2001), which provides ingestion rate equations that have been updated since EPA's Wildlife Exposure Factors Handbook was published. Beyer 1994 and Sample 1994 provide the percent sediment in food for each representative species. The exposure factors for each representative species, identified in **Table 4-1**, along with the rationale for each value are presented in **Attachment A, Table 2.1**.

Literature-based bioaccumulation models (i.e., BAFs and BCFs) are used to convert media concentrations to food concentrations (i.e., sediment to benthic invertebrate, sediment to aquatic plant and surface water to fish), which are presented in **Attachment A, Table 2.2.** Preference was given to regression-based models over values that assumed a linear relationship (EPA 2007b, 1999b, 2000, 2002a, 2007b and 2017c and d; Baes 1994; Bechtel Jacobs 1998; DOE 2012 and 2018). The SLERA conservatively assumes food consumption for all representative species as sole source, assuming the animal will eat 100% of one food type, even though representative species can have a varied diet in the natural environment.

6.2 Toxicity Values

In this SLERA, the benchmark term used in the HQ calculation of the wildlife food chain modeling is the wildlife TRV for each COPC, expressed in units of mg/kg-d. The TRVs express the potential non-cancer effects to identify thresholds for each constituent, and derive an estimate of the ecological exposure below which adverse effects are not expected to occur over a lifetime (EPA 1997). The TRVs are no observed adverse effect level (NOAELs) or lowest observed adverse effect levels (LOAELs), which were derived via animal experiments that evaluate long-term (chronic) exposures for adverse effects on survival, growth, or reproduction endpoints from relevant exposure routes (EPA 1997).

Selection of pertinent toxicological information on COPCs is from the following sources, in descending order of hierarchy:

1. EPA Eco-Soil Screening Levels documents, which include avian and mammalian TRVs receptors (EPA 2016a). The recommended NOAEL and the lowest bounded LOAEL above the NOAEL were selected.
2. Department of Energy (DOE) Los Alamos National Laboratory ECORISK Database version 3.3 (DOE 2015). The lowest of the recommended NOAEL and LOAEL values between models were selected.
3. DOE Oak Ridge National Laboratory Toxicological Benchmarks for Wildlife (Sample 1996). The recommended NOAEL and LOAEL values were selected.
4. EPA Integrated Risk Information System (IRIS) (EPA 2017a). Chemical profiles were reviewed to identify NOAEL and LOAEL values for mammals based on growth, survival, or reproductive endpoints.

For instances where a source identified a NOAEL, but a LOAEL was not provided in the same study, HDR reviewed the experimental designs of other studies that provided a LOAEL for that source to choose a LOAEL in which the exposure duration, experimental animal, and value most closely matched that of the NOAEL. **Attachment A, Table 2.3** provides the TRVs for each COPC with the rationale.

7 Risk Characterization

The SLERA includes performance of both qualitative and quantitative analyses to determine whether there are any potential threats in the assessment endpoints described in **Section 4.2**.

7.1 Aquatic Biota, Invertebrates, Amphibians and Plants Evaluation

7.1.1 Quantitative Evaluation

Evaluation of exposure of aquatic biota in surface water, amphibians in surface water and sediment, and invertebrates and plants in sediment to COPCs is by comparison of the EPCs of COPCs to the relevant ecological screening benchmarks. The exceedance tables are the same ones as those used for the COPC screening. Refer to **Attachment A, Tables 1.1 to 1.6**.

Tables 1.1 and 1.4 in Attachment A present the evaluation of surface water and sediment concentrations from Trout Brook, the Lamington River UNT, and Tanners Brook UNT for the COPCs identified in each medium.

The surface water concentrations are greater than the ecological benchmarks for 1,2,3-trichlorobenzene, diethyl ether, aluminum, cadmium, calcium, copper, iron, lead, magnesium, manganese, potassium, and sodium. The sediment concentrations are greater than the ecological benchmarks for 12 polycyclic aromatic hydrocarbons (PAHs), 2,3,4,6-tetrachlorophenol, and 14 inorganics.

Tables 1.2 and 1.5 in Attachment A present the evaluation of surface water and sediment concentrations from East Trout Brook to evaluate impacts downstream of the treatment plant for the COPCs identified in each medium.

The surface water concentrations are greater than the ecological benchmarks for 1,2,3-trichlorobenzene, acetone, dichlorodifluoromethane, diethyl ether, alpha-chlordane and eight inorganics. The sediment concentrations are greater than the ecological benchmarks for 12 inorganics.

Table 1.3 in **Attachment A** presents the evaluation of potential contamination in local seeps and springs. The concentrations are greater than the surface water ecological benchmarks for 4,4-DDD and nine inorganics.

The evaluation indicates that potential adverse impacts to aquatic biota, benthic invertebrates, amphibians, and plants may be associated with the surface water and sediment exposure pathways because of exposure to VOCs, pesticides and inorganics in surface water, and PAHs and inorganics in sediment. It is noted that VOCs and 4,4-DDD are retained as COPCs in surface water as they do not have ecological benchmarks for comparison.

7.1.2 Qualitative Evaluation

This SLERA includes a literature review of the ecological toxicity of 1,4-dioxane, the primary groundwater contaminant in the RI/FS, to evaluate potential adverse effects to aquatic biota, benthic invertebrates, and plants. This evaluation was completed to support the quantitative evaluation, even though 1,4-dioxane was not determined to be a COPC in surface water or sediment.

EPA's fact sheet on 1,4-dioxane indicates that 1,4-dioxane has low toxicity to aquatic organisms with toxicity values greater than 100 mg/L (EPA 1995). The fact sheet identifies a study of 1,4-dioxane in fathead minnows (*Pimephales promelas*), in which acute effects were seen at 10,000 mg/L, the highest NOAEL was 6000 mg/L, and the maximum allowable toxicant concentration (MATC) for a 32-day embryo-larval test was greater than 145 mg/L (EPA 1995). ATSDR's ToxFAQs™ for 1,4-dioxane states that "fish and plants will not accumulate 1,4-dioxane in their tissues" (ATSDR 2007). (HDR 2015a).

The April 2015 *Toxic Substances Control Act (TSCA) Work Plan Chemical Problem Formulation and Initial Assessment for 1,4-Dioxane* (EPA 2015d) concludes that there are low acute and chronic ecotoxicity to aquatic organisms and therefore, risks are expected to be low. While 1,4-dioxane does not readily biodegrade, it does not bioaccumulate (EPA 2015d). International studies were considered in the assessment, including work done by the International Agency for Research on Cancer (IARC), Environment Canada and Health Canada, and the European Chemical Agency.

The *Canadian Water Quality Guidelines for the Protection of Aquatic Life* provides a review of various toxicity thresholds for aquatic species exposed to 1,4-dioxane; chronic exposure to fish ranged from 145 to 6,933 mg/L, chronic exposure to aquatic invertebrates ranged from 635 to 1,250 mg/L, and chronic exposure to aquatic algae ranged from 575 to 5,600 mg/L. There is low potential for bioaccumulation, with BCFs of 0.2-0.7; bioconcentration processes are unlikely to be significant. The document

identifies a range for chronic exposure effects from approximately 100 mg/L (fathead minnow) to 10,000 mg/L (medaka fish). There are no recommended guidelines for short or long-term exposure in either fresh or seawater for 1,4-dioxane (CCME 2008).

Attachment D, Tables D-1 and D-2 provide summaries of acute and chronic aquatic toxicity data for 1,4-dioxane.

At the Site, the maximum detected concentrations of 1,4-dioxane in surface water are 0.035 mg/L from Trout Brook, Lamington River UNT, and Tanners Brook UNT, and 0.061 mg/L from East Trout Brook; these concentrations are well below the toxicity values noted above.

7.2 Wildlife Food Chain Modeling Evaluation

The exposure doses and the NOAEL and LOAEL TRVs described in **Section 6** were used to calculate HQs to assess the potential adverse impact to wildlife receptors via bioaccumulation.

7.2.1 Surface Water and Sediment from Trout Brook, Lamington River UNT & Tanners Brook UNT

Attachment A, Tables 3.1 to 3.6 provide the food chain modeling results for Trout Brook, Lamington River UNT, and Tanners Brook UNT.

Evaluation of contaminants in surface water and sediment from Trout Brook, the Lamington River UNT, and Tanners Brook UNT indicates that the NOAEL-based HQs and LOAEL-based HQs are less than one for all COPCs for the mallard, raccoon, and great blue heron. These species represent exposure to avian herbivores, mammalian invertivores, and avian piscivores. Therefore, the SLERA results indicate that no adverse impacts are expected to these aquatic feeding guilds from exposure to contaminants in surface water and sediment via the wildlife food chain modeling.

However, the selenium NOAEL-based HQ for the muskrat, representing mammalian herbivores, is slightly above 1 at 1.2 for exposure to selenium in sediment. The LOAEL-based HQ is less than 1.

The NOAEL-based HQs for the spotted sandpiper, representing avian invertivores, are slightly above 1 for copper, lead, mercury, selenium, and vanadium at 1.5, 1.3, 1.6, 2.1, and 3.4, respectively, for exposure to these five COPCs in sediment as well as copper and lead in surface water. The sediment to benthic invertebrate pathway contributes the most to these HQs. The LOAEL-based HQs are less than 1 for these COPCs, except for vanadium with a HQ of 1.7.

The aluminum HQ for the American mink, representing mammalian piscivores, is 25, which is due to the surface water to fish pathway with a BCF of 500. The LOAEL-based HQ is 2.5.

Therefore, potential adverse impacts to mammalian herbivores, avian invertivores, and mammalian piscivores may be associated with exposure to copper, lead, mercury, selenium, and vanadium in the sediment and aluminum, copper and lead in surface water from these three local water bodies. These surface water and sediment exposure pathways will be evaluated in Step 3A.

7.2.2 Surface Water and Sediment from East Trout Brook

Attachment A, Tables 4.1 to 4.6 provide the food chain modeling results for East Trout Brook.

Evaluation of contaminants in surface water and sediment from East Trout Brook, downstream of the permitted discharge from the GWTP, indicates the NOAEL-based HQs and LOAEL-based HQs are less than one for all COPCs for the mallard, raccoon, great blue heron, and American mink. Therefore, no adverse impacts are expected to these aquatic feeding guilds from exposure to contaminants in surface water and sediment from East Trout Brook.

The selenium NOAEL-based HQ for the muskrat, representing mammalian herbivores, is slightly above 1 at 1.2 for exposure to selenium in sediment. The LOAEL-based HQ is less than 1.

The selenium NOAEL-based HQ for the sandpiper, representing avian invertivore species, is 2.1 and its LOAEL-based HQ is 1.1 for exposure to this COPC in sediment. The vanadium NOAEL-based HQ is 4.0 and the LOAEL-based HQ is 2.0 for exposure to this COPC in sediment. All other HQs are less than 1 for this feeding guild.

Therefore, potential adverse impacts to mammalian herbivores and avian invertivores may be associated with exposure to selenium and vanadium in the sediment from East Trout Brook. These sediment exposure pathways will be evaluated in Step 3A.

7.3 SLERA Step 3A COPC Refinement

Additional evaluation was performed to review the conservative assumptions applied in the SLERA and determine if COPCs would vary if more realistic assumptions were used and as a means to help focus the SLERA. In this SLERA, the Step 3A (so called for its place in the eight-step SLERA process) is a refinement of the COPCs that have HQs greater than 1 in the wildlife food chain modeling. Applications of more realistic assumptions include replacing the maximum detected concentrations with 95% UCLs of the mean in the wildlife food chain modeling, comparing the data to background threshold values (BTVs), and using additional ecological benchmarks to determine whether or not COPCs can be eliminated from the SLERA. The Step 3A process for the six COPCs identified in **Section 7.2** (aluminum, copper, lead, mercury, selenium and vanadium) is described below and presented in **Attachment A, Tables 5.1 through 5.3.**

7.3.1 Exposure Point Concentrations

The maximum detected concentrations in the SLERA were replaced with 95% UCLs of the mean, which are upper estimates of the population mean at the Site. Calculation of the 95% UCL of the mean was conducted in accordance with EPA guidance (EPA 2015c). The ProUCL software package, version 5.1 was used to determine the underlying statistical distributions of the data sets and 95% UCLs of the mean.

The sample quantitation limit (QL) is typically used to represent non-detect concentrations whenever it is available (EPA 1989). If no QL is available, the method detection limit (MDL) is applied, and if not that, then the reporting detection limit is used for the risk calculations in accordance with established hierarchy (EPA 1989). The non-

detects are evaluated using ProUCL software and the value assigned to them is dependent upon the data distribution using the following methods:

- ProUCL applies the Regression on Order Statistics (ROS) methods for lognormal and gamma distributed data sets to provide a better estimate of the non-detected sample's true value based on actual detected concentrations.
- For normal distributions, ProUCL utilizes Kaplan-Meier estimates in lieu of the ROS methods because the ROS methods tend to yield biased and negative non-detect values for these distributions (EPA 2015c, 2016b).

First, 95% UCLs of the mean were calculated using ProUCL for COPCs identified in each medium and stream with NOAEL HQs greater than 1 in the wildlife food chain modeling:

- Surface water from Trout Brook, Lamington River UNT, and Tanners Brook UNT – aluminum, copper, and lead – presented in **Attachment A, Table 5.1**.
- Sediment from Trout Brook, Lamington River UNT, and Tanners Brook UNT – copper, lead, mercury, selenium, and vanadium – presented in **Attachment A, Table 5.2**.
- Sediment from East Trout Brook – selenium and vanadium – presented in **Attachment A, Table 5.3**.

If ProUCL recommended more than one UCL, professional judgment was used to choose the UCL based on the characteristics of the data set. If no UCLs were calculated due to low detection frequency, the maximum detected concentrations were used as the EPC. Supporting ProUCL documentation is provided in **Attachment B, Tables B.1 to B.4**.

Comparison of the EPCs to the ecological benchmarks indicates that these COPCs have EPCs greater than the ecological benchmarks, except for copper in sediment from Trout Brook, Lamington River UNT, and Tanners Brook UNT. Copper's 95% UCL of the mean of 12.23 mg/kg is less than the ecological benchmark of 16 mg/kg (NJDEP LEL) whereas previously, the maximum detected concentration of 28.2 mg/kg was greater than the NJDEP LEL. Therefore, copper in sediment from Trout Brook, Lamington River UNT, and Tanners Brook UNT was removed from the COPC list. Note that copper remains a COPC in surface water for this medium.

7.3.2 Background Threshold Values

Inorganic COPCs with concentrations greater than the ESCs, but whose concentrations are determined to be equal to or below background inorganic concentrations, typically do not require further evaluation in the SLERA.

Therefore, inorganic BTVs were developed using the analytical data from the background surface water and sediment samples collected in September 2017. The calculations used to determine BTVs are based on various EPA guidance (EPA 2002b, 2009, 2011 and 2015c) and other guidance documents (ITRC 2013, Idaho DEQ 2014). **Attachment C** contains the BTVs and the supporting information.

Calculation of BTVs

Attachment C, Table C.1 presents a summary of the calculated inorganic BTVs in surface water and sediment for constituents that were detected at least once; this includes 18 constituents in surface water and 13 in sediment. Note that although the wildlife food chain modeling refined the COPC list to six inorganic COPCs, BTVs are calculated for any inorganic constituent that was detected in the background samples.

Attachment C, Table C.2 presents the detected analytical data for the background samples. As with the preparation of the data for calculating 95% UCLs of the mean in **Section 5.2.1**, the detection limit was used to represent non-detect concentrations in ProUCL. However, the MDL was used instead of the QL, as the MDL is an objective measure that is not affected by sample-specific changes made by the laboratory and is lower, which would conservatively bias the BTVs lower.

The data were evaluated using box plots and the Dixon outlier test (used for data sets with less than 25 samples) in ProUCL to identify moderate to extreme outliers that could potentially skew the distribution of the data. The outlier methods identified at least one outlier for all of the constituents detected in surface water and cyanide and lead in sediment. The outliers are marked in **Table C.2**.

The outputs of the Dixon test are provided in **Table C.3** for surface water and **Table C.4** for sediment; outputs of the box plots are provided in **Table C.5** for surface water and **Table C.6** for sediment.

The outliers were removed from the data set if they were identified using either method. There were six sediment constituents whose data sets had one or two detects whose detects were removed as a result of the outlier tests and the data sets became non-detect. Refer to **Table C.1** for a comparison of the detect counts before and after the outlier tests were run.

The refined data sets were then input into ProUCL to calculate BTVs using 95% Upper Simultaneous Limits (USLs). The USLs are upper interval estimates below which all future observations are expected to fall in a background population. While ProUCL provides other methods to represent BTVs, the USLs were used because they are robust and result in fewer false positives (Idaho DEQ 2014). ProUCL calculates USLs assuming different distributions of the data sets. These USLs were reviewed and the final BTV is identified in **Table C.1** with the rationale for why it was selected. **Table C.7** presents the ProUCL output for USLs in surface water and **Table C.8** in sediment. For the six sediment constituents whose data sets became non-detect after removing outliers, the BTV defaulted to the maximum MDL (EPA 2011).

Using BTVs to Refine the COPC List

The inorganic BTVs for surface water and sediment are presented in **Attachment A, Tables 5.1 to 5.3**. For constituents for which a BTV was calculated, comparison of the site-related EPCs to the BTVs indicates the site-related EPCs are higher in surface water and sediment. Therefore, no COPCs were removed based on a comparison to BTVs.

7.3.3 Additional Ecological Benchmarks

The EPA Region 4 Ecological Screening Values for surface water and sediment (2018) and the EPA Region 5 RCRA Ecological Screening Levels for water were applied to fill in missing values of previously identified ecological benchmarks for the six COPCs in **Attachment A, Tables 5.1 to 5.3**. The ecological benchmarks were compared to the 95% UCLs of the mean for the COPCs on these tables. No COPCs were removed based on comparison to these additional ecological benchmarks.

7.3.4 Step 3A Wildlife Food Chain Modeling

The wildlife food chain modeling as part of Step 3A was performed using 95% UCLs of the mean, which represents a more realistic scenario, for the following COPCs, media, and receptors:

- Surface water and sediment from Trout Brook, Lamington River UNT, and Tanners Brook UNT –
    - Muskrat's exposure to selenium in sediment;
    - Spotted sandpiper's exposure to copper and lead in surface water and sediment; and mercury, selenium, and vanadium in sediment; and
    - American mink's exposure to aluminum in surface water.
- Sediment from East Trout Brook –
    - Muskrat's exposure to selenium; and
    - Spotted sandpiper's exposure to selenium and vanadium.

Other than the EPCs, no exposure factors (e.g., AUF) or toxicity values were changed. The evaluation is presented in **Attachment A, Tables 6.1 to 6.3** for exposure to COPCs in surface water and sediment from Trout Brook, Lamington River UNT, and Tanners Brook UNT for the muskrat, spotted sandpiper and American mink, respectively. **Attachment A, Tables 7.1 and 7.2** present the exposure to COPCs in sediment from East Trout Brook for the muskrat and spotted sandpiper.

<u>Trout Brook, Lamington River UNT and Tanners Brook UNT</u>

The results of the modeling indicate for a muskrat, the selenium HQs are less than 1, which means that no adverse impacts are expected from exposure to selenium in sediment under a realistic scenario for mammalian herbivores.

For a spotted sandpiper, the HQs for copper and lead are less than 1, which indicates that no adverse impacts are expected from exposure to these COPCs in surface water and sediment under a realistic scenario for avian invertivores. The NOAEL-based HQs for mercury, selenium, and vanadium remain above 1 at 1.6, 1.2 and 1.7, respectively, for exposure to these COPCs in sediment; however, the LOAEL-based HQs for these COPCs are all less than 1.

For an American mink, representing mammalian piscivores, the NOAEL-based HQ for aluminum is 8.8 for exposure to this COPC in surface water, whereas the LOAEL-based HQ is less than 1.

In summary, no adverse impacts are expected from exposure to these COPCs in surface water and sediment for these feeding guilds upon review of the LOAEL-based HQs and when using a more realistic scenario.

East Trout Brook

For a muskrat, the NOAEL-based HQ for selenium is 1.0, which represents unity and is not considered to represent unacceptable hazard. The LOAEL-based HQ is less than 1. This indicates that no adverse impacts are expected from exposure to selenium in in sediment from East Trout Brook under a realistic scenario for mammalian herbivores.

For a spotted sandpiper's exposure to selenium in sediment from East Trout Brook, the NOAEL-based HQ is 1.9 and the LOAEL-based HQ is less than 1. For exposure to vanadium in sediment from East Trout Brook, the NOAEL-based HQ for vanadium is 3.3 and the LOAEL-based HQ is 1.7.

In summary, no adverse impacts are expected from exposure to selenium in sediment from East Trout Brook. The HQs are slightly above 1 from exposure of avian invertivores to vanadium in sediment from East Trout Brook.

7.4 Seeps and Springs

Seeps and spring water are evaluated in this SLERA as being an expression of groundwater quality. As noted in **Section 3.2**, groundwater discharges to the land surface via seepage into streams, ponds and wetlands. The initial COPC screening of seeps and spring water identified inorganics and 4,4-DDD as COPCs in **Attachment A, Table 1.3**. The inorganic COPCs include aluminum, cadmium, calcium, iron, magnesium, manganese, potassium, sodium, and vanadium.

These COPCs were further evaluated using 95% UCLs of the mean to provide a more realistic scenario. The 95% UCLs of the mean were also compared to additional ecological screening benchmarks and BTVs as part of the Step 3A SLERA process. **Attachment A, Table 8.1** presents the refinement. **Attachment B, Table B.5** provides the supporting ProUCL documentation.

The COPC 4,4-DDD was eliminated since its EPC is less than the surface water ecological benchmark. Calcium, magnesium, potassium, and sodium were eliminated as they are essential nutrients and are below their ecological benchmarks. Aluminum, cadmium, iron, manganese, and vanadium remain as seep and spring water COPCs.

The seep and spring EPCs were compared to the surface water EPCs to identify any pattern in the detection of contaminants; the seep and spring EPCs vary between being higher or lower than the surface water EPCs.

The COPCs were further reviewed to determine if they are bioaccumulative and could potentially move up the food chain. This involved review of specific criteria to establish different lines of evidence, reviewing i.e., octanol-water partition coefficients (Kow) values, BCFs, and specific literature regarding their ability to bioaccumulate.

- Constituents with log Kow values greater than 3.5 are likely to bioaccumulate as they will tend to adsorb more readily to organic matter because of their low affinity to water (EPA 2000). Greater than a log Kow threshold of 4.5 is also

used to indicate bioaccumulative properties (ECHA 2017, Appendix R.11-1). None of these inorganic COPCs have log Kow values in the source (EPA 2017d).

- The fish BCFs are 500 for aluminum, 200 for cadmium, 200 for iron, 400 for manganese, and 0.1 for vanadium. These values are from the *Oak Ridge National Laboratory Risk Assessment Information System* (DOE 2018) and vanadium's fish BCF of 0.1 was taken from DOE's *Environmental Compliance and Area Completion Projects Regulatory Document Handbook for the Savannah River Site* (DOE 2012).

  EPA and other agencies have identified different thresholds for determining bioaccumulation (EPA 2000), such as a BCF of 2,000 used by ECHA (2017), and a BCF of 1,000 by the Great Lakes Initiative (EPA 2000). EPA's Persistent Bioconcentration and Toxic Chemicals Profiler uses a threshold of greater than a BCF of 1,000 to indicate bioaccumulative constituents (EPA 2012). None of these COPCs has a BCF greater than 1,000.

- Other sources of BCFs were reviewed. The United States National Institutes of Health's Hazardous Substances Data Bank includes a section on environmental bioconcentration for constituents. Review of this database indicates:
  - Aluminum is not bioaccumulative with BCFs of less than 300 in fish and shellfish and less than one in snails (NIH 2005a).
  - Cadmium has BCFs of 1,000 in freshwater plants, 4,000 in freshwater invertebrates, and 3,000 in freshwater fish (NIH 2012).
  - Iron has BCFs of less than one for invertebrates and fish (NIH 2005b).
  - Manganese is not bioaccumulative, yet BCFs in the thousands have been reported (NIH 2008).
  - Vanadium has BCFs of 380 to 630 for fish (NIH 2016).

Based on review of the above information, there is sufficient evidence indicating that no adverse ecological impact is expected from these COPCs in seeps and spring water.

7.5 Uncertainty Analysis

There is uncertainty inherent in the conclusions of this SLERA. This level of uncertainty results from the fact that most every step in the risk assessment process involves assumptions and unknowns, contributing to the total uncertainty in the final conclusions. These include, but are not limited to the following:

- Knowledge of the site, including its geology, hydrology, and habitat and past and current land use;
- Environmental parameters, chemistry, and sampling analysis;
- Assumptions in the derivation of ecological screening benchmarks;
- QAPP data requirements are not met for precision, accuracy, and completeness, which may result in potential data gaps (discussed further in the DER, RI Appendix B);

- Maximum concentrations applied as a measure of exposure for each ecological medium and receptor, which is a conservative assumption intentionally used to focus the risk assessment on those pathways and receptors potentially at risk. This likely overestimates the HQs; and
- Bioavailability of 100% of the chemical substance is assumed to be available for uptake by organisms. This assumption is known to be invalid for most chemical substances under varying environmental conditions and likely overestimates HQs.

A review of tentatively identified compounds (TICs) that are identified as PPCPs and as site-related constituents is discussed, along with toxicity information for the PPCPs, in the Baseline Human Health Risk Assessment (BHHRA, RI Appendix CC). There is one PPCP-related TIC in surface water, thiophosgene, and three in sediment: squalene, 1,1,2,2-tetrachloroethane, and heptadecyl-oxirane. HDR performed a review of the literature to identify ecological effects of these constituents:

- Thiophosgene is unlikely to accumulate in the body; it causes local irritation on contact, can cause intestinal tumors in mice. Its lethal dose to 50% of the sample population (LD_{50}) occurs at 929 mg/kg in rats via the ingestion exposure pathway (NIH 2002, 2016a).
- Squalene likely adsorbs to sediment and suspended solids and has a low BCF of 4 for aquatic organisms. Its LD_{50} occurs at 5,000 mg/kg in mice via the ingestion pathway (NIH 2015a).
- The TIC 1,1,2,2-tetrachloroethane is unlikely to adsorb to sediment, volatilizes from water, and has a BCF range of 4.5 – 13.2 in various fish. It has a LC_{50} range of 1.4 – 23 mg/L in aquatic invertebrates and fish (NIH 2015b).
- There is no readily available information regarding ecological effects of heptadecyl-oxirane or 1,1,2,2-tetrachloroethane.

Due to the limited data and lack of criteria related to ecological effects, there was no further evaluation of PPCPs in the SLERA.

8 Conclusions

The SLERA was prepared to evaluate potential hazards for aquatic biota, benthic invertebrates, amphibians, and plants as well as wildlife exposure to contaminants present in surface water, seep/spring water, and sediment. Plant exposure to contaminants is via uptake and root absorption while wildlife exposure is via ingestion of water, incidental sediment, plants, benthic invertebrates, and fish.

The evaluation of surface water and sediment exposure pathways from local streams and seep/spring pathways indicates that aquatic biota, benthic invertebrates, amphibians, and plants may potentially be adversely impacted by inorganics, PAHs, 2,3,4,6-tetrachlorophenol, and alpha-chlordane.

For wildlife exposure via bioaccumulation of COPCs in the food chain, the evaluation of surface water and sediment exposure pathways from the four local streams (Trout Brook, Lamington River UNT, Tanners Brook UNT, and East Trout Brook) have LOAEL-based

HQs less than 1 for all feeding guilds, except for a spotted sandpiper's, representing avian invertivores, exposure to vanadium in sediment from East Trout Brook with a HQ of 1.7. This HQ is slightly above the acceptable limit of 1.

In summary, the wildlife food chain modeling HQs are less than 1, except for one instance, and even though there are exceedances of the ecological benchmarks for the evaluation of benthic invertebrates, biota, and plants, groundwater treatment is expected to address the surface water exceedances.

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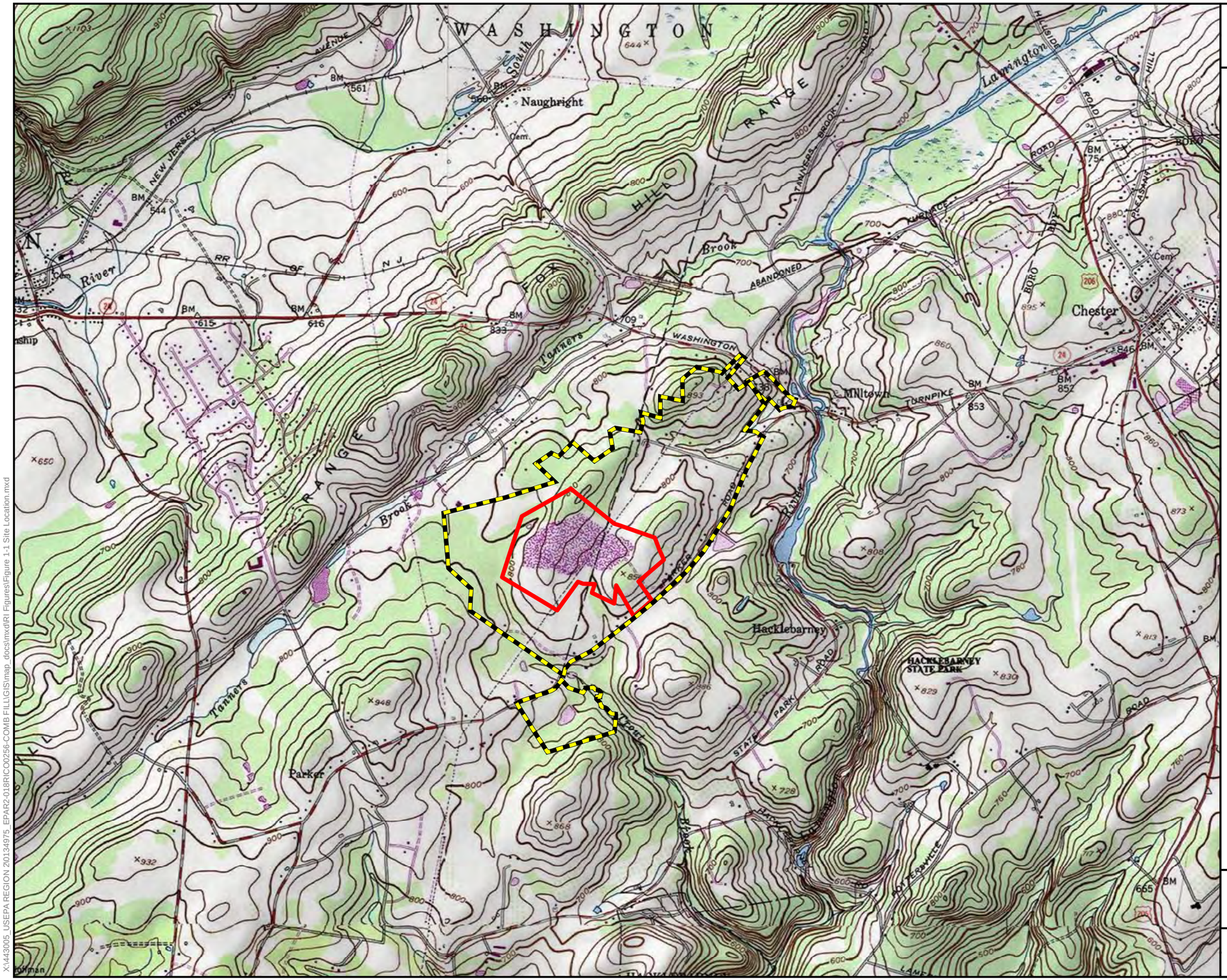
Figure 4-1 Ecological Conceptual Site Model

Combe Fill South Landfill Superfund Site OU2 RI/FS



Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

Coordinate System: NAD 1983 StatePlane New Jersey FIPS 2900 Feet
Projection: Transverse Mercator
Datum: North American 1983
Units: Foot US

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary

0 1,000 2,000 Feet

Site Location and Overview

Figure 2-1
May, 2018

X:\443005_USEPA REGION 20134975_EPAR2-018RICO0256-COMB FILL\GIS\map_docs\mxd\RI Figures\Figure 1-1 Site Location.mxd

Legend

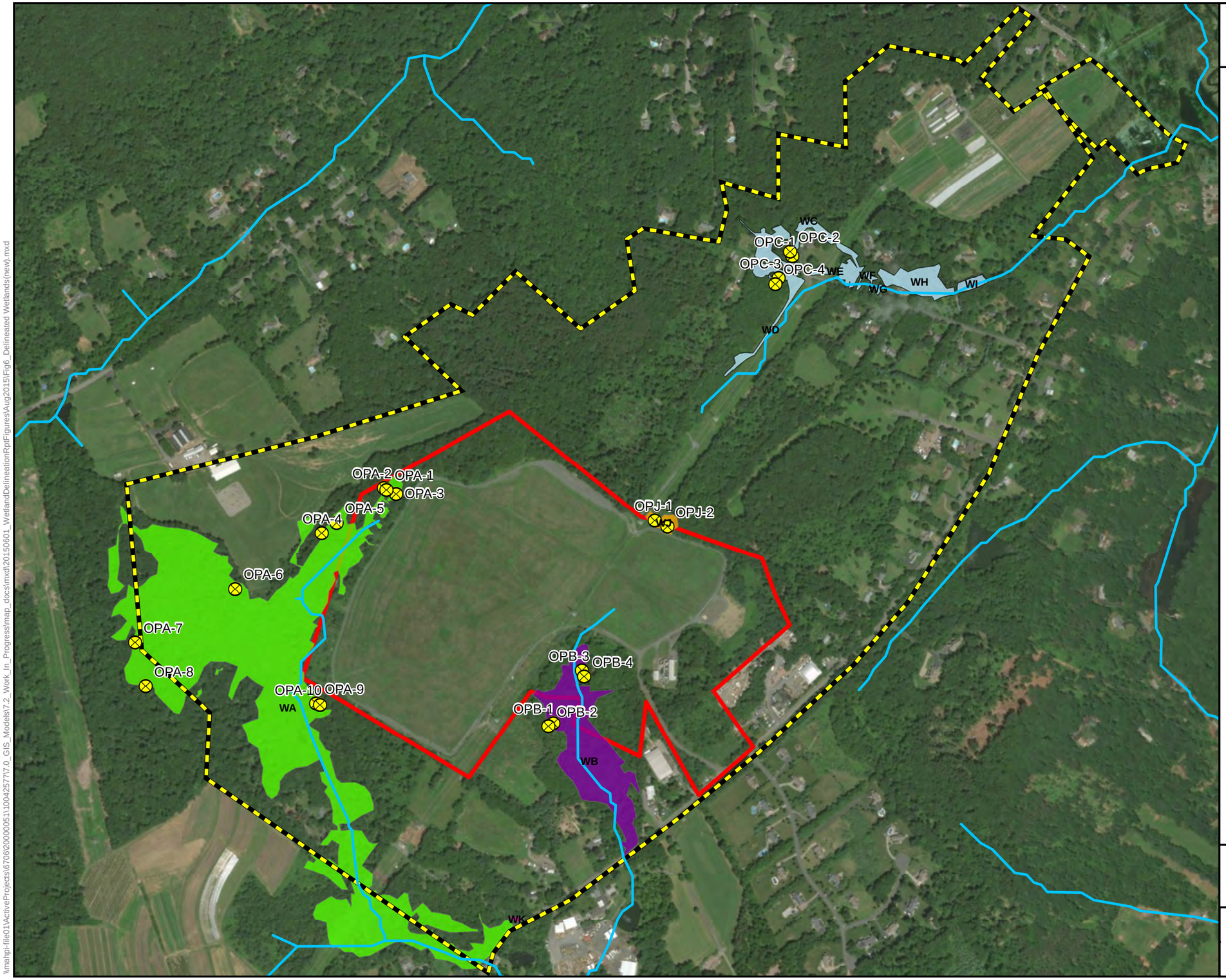
- AGRICULTURAL WETLANDS
- ALTERED
- ARTIFICIAL
- CONIFEROUS FOREST (10-50% CROWN
- CONIFEROUS FOREST (>50% CROWN
- CONIFEROUS WOODED
- CROPLAND AND
- DECIDUOUS
- DECIDUOUS FOREST (10-50% CROWN
- DECIDUOUS FOREST (>50% CROWN
- DECIDUOUS SCRUB/SHRUB
- DECIDUOUS WOODED
- DISTURBED WETLANDS
- HERBACEOUS
- MANAGED WETLAND IN MAINTAINED LAWN GREENSPACE
- MIXED DECIDUOUS/CONIFEROUS BRUSH/SHRUBLAND
- MIXED FOREST (>50% CONIFEROUS WITH 10%-50% CROWN CLOSURE)
- MIXED FOREST (>50% CONIFEROUS WITH >50% CROWN CLOSURE)
- MIXED FOREST (>50% DECIDUOUS WITH 10-50% CROWN CLOSURE)
- MIXED FOREST (>50% DECIDUOUS WITH >50% CROWN CLOSURE)
- NATURAL
- OLD FIELD (< 25% BRUSH
- OTHER
- UPLAND RIGHTS-OF-WAY
- UPLAND RIGHTS-OF-WAY
- WETLAND RIGHTS-OF-WAY
- Wildlife Point Count Stations
- OU2 Study

HDR

NJDEP Landscape Project Species-Based Habitat Patches

0 1,000 Feet

Job No.	Date	Figure No.
10042577	Feb 2017	2-2



Combe Fill South Landfill Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: Stream data obtained from USGS StreamStats Beta Version 3 for the State of NJ

Coordinates in New Jersey State Plane (NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary
- Observation Points
- Streams

Delineated Wetlands

- Wetland A
- Wetland B
- Wetland C Complex
- Wetland J
- Wetland K

0 250 500 1,000 Feet

Delineated Wetlands **Figure 2-3**

April 26, 2018

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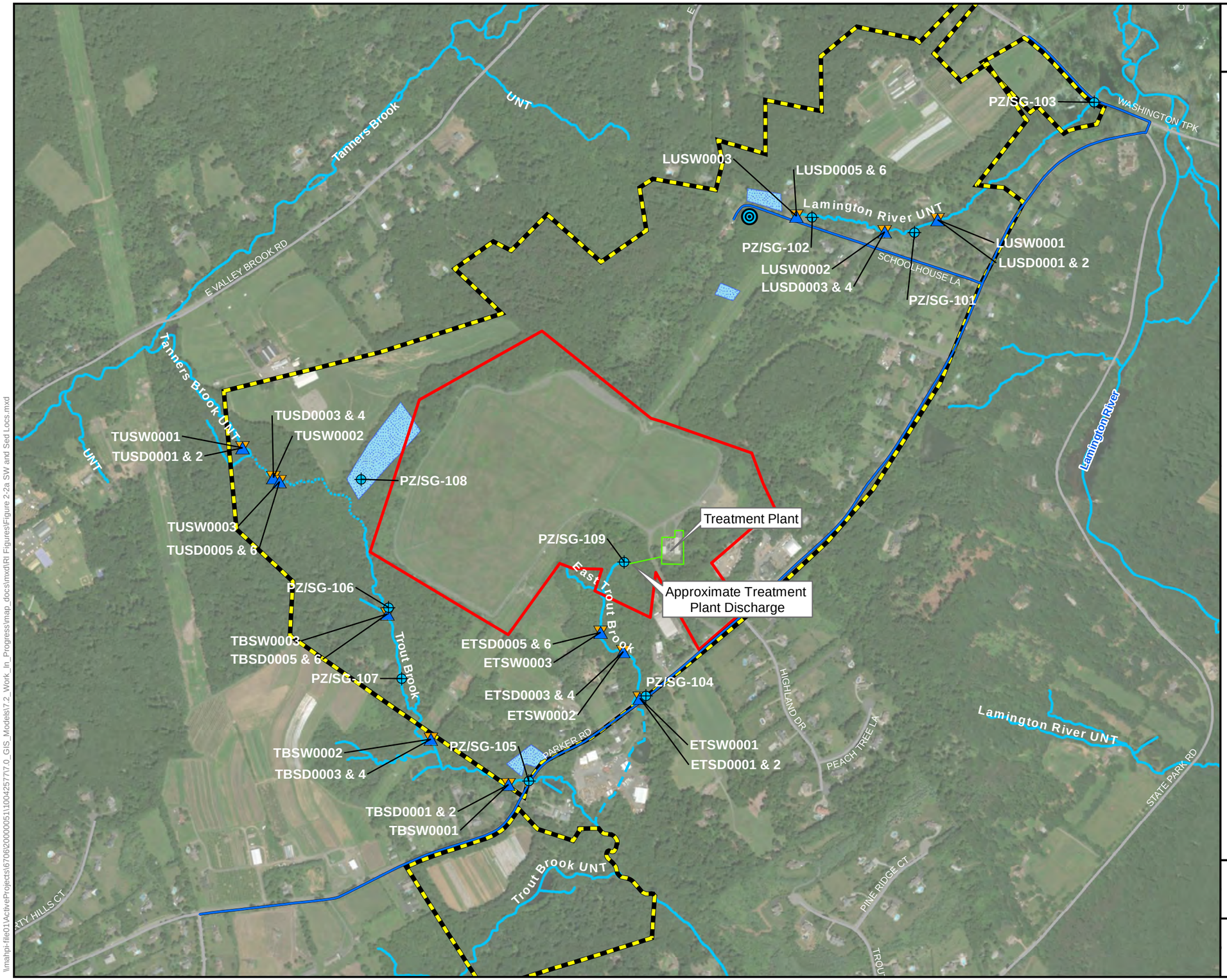


Combe Fill South Landfill Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane New Jersey FIPS 2900 Feet
Projection: Transverse Mercator
Datum: North American 1983
Units: Foot US

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary
- Surface Water Samples
- Sediment Samples
- Stream Gauge / Piezometer
- Surface Water
- Undefined Surface Water
- East Trout Brook culvert
- Springs
- Seeps
- Approximate Extent of 2015 Water Main Extension
- Streets

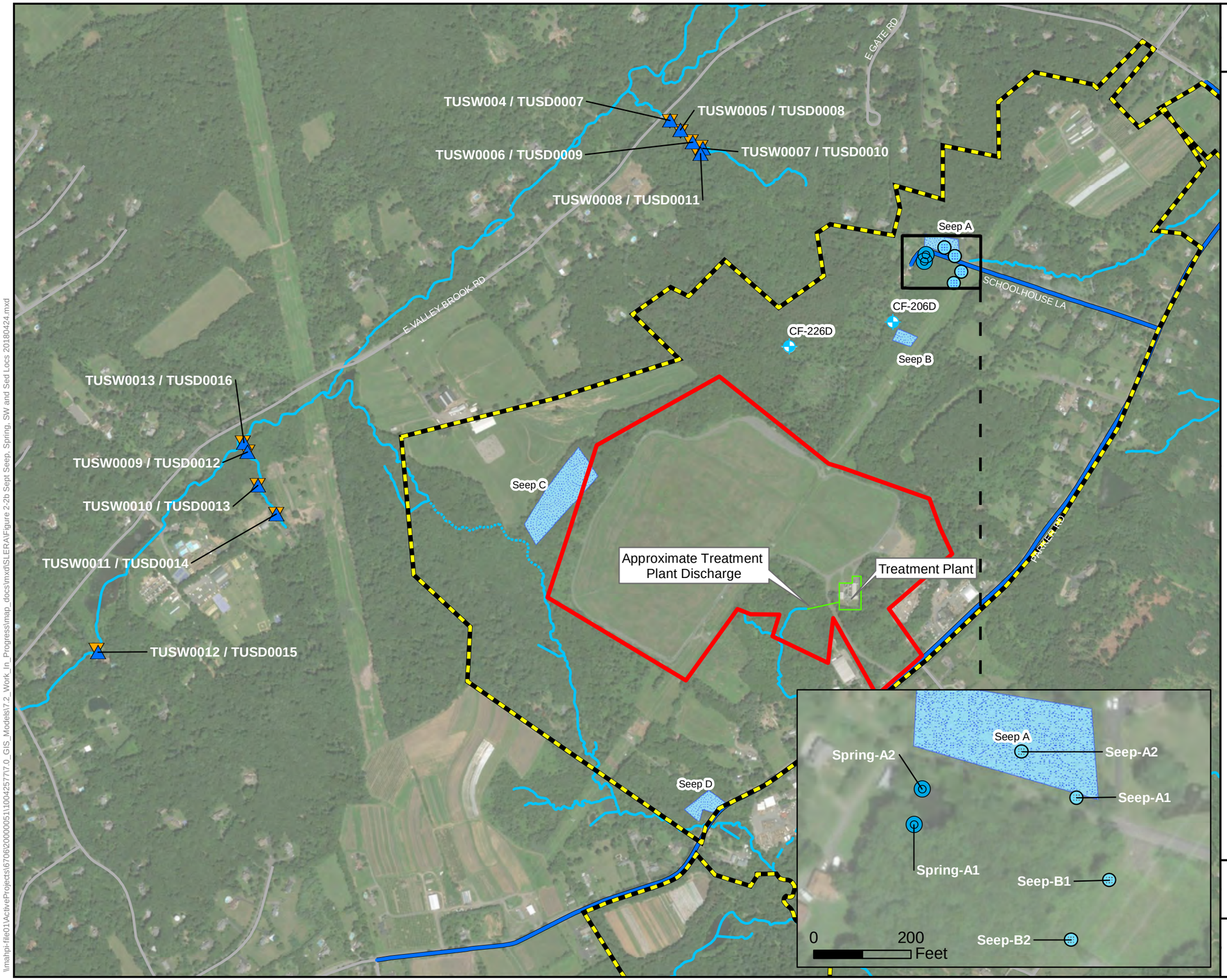
UNT = Unnamed Tributary

0 400 800 Feet

Locations of November 2014 Surface Water/Sediment Sampling; Piezometers and Stream Gauges

Figure 3-1
May, 2018

\\mahpi-file01\ActiveProjects\6706\2000005\1100425777\7.0_GIS_Models\7.2_Work_In_Progress\map_docs\mxd\RI Figures\Figure 2-2a SW and Sed Locs.mxd



Combe Fill South Landfill Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinate System: NAD 1983 StatePlane New Jersey FIPS 2900 Feet
Projection: Transverse Mercator
Datum: North American 1983
Units: Foot US

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary
- Surface Water Samples
- Sediment Samples
- Seeps
- Springs
- Groundwater Monitoring Wells
- Surface Water
- Undefined Surface Water
- East Trout Brook culvert
- Approximate Extent of 2015 Water Main Extension
- Streets

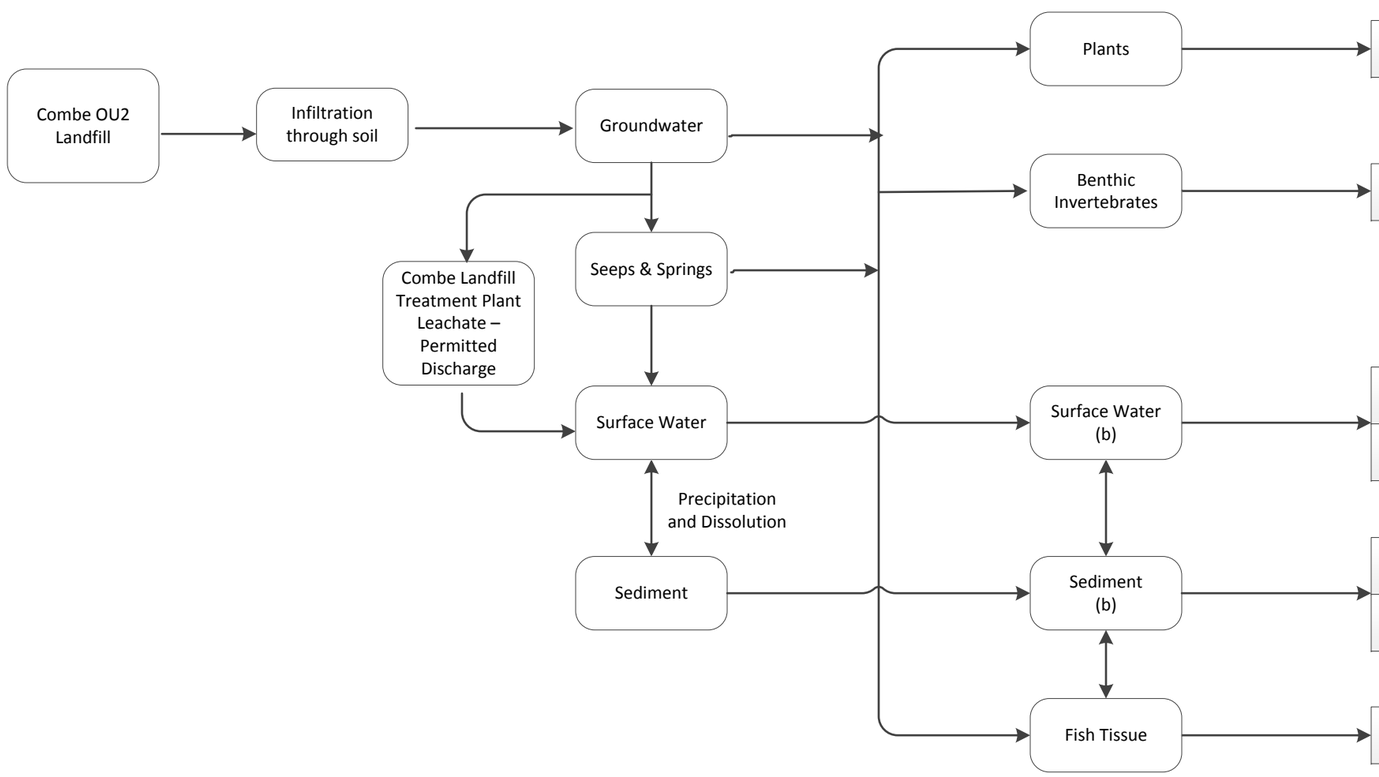
UNT = Unnamed Tributary

0 400 800 Feet

September 2017 Spring, Seep, Background Surface Water, and Sediment Sampling Locations

Figure 3-2
April, 2018

\\mahpi-file01\ActiveProjects\67062000005\1100425777\0_GIS_Models\7.2_Work_In_Progress\map_docs\mxd\SLERA\Figure 2-2b Sept Seep, Spring, SW and Sed Locs 20180424.mxd



	AQUATIC / RIPARIAN					
EXPOSURE ROUTE	Biota (fish)	Benthic Invertebrate	Plants	Avian / Mammalian Herbivore	Avian / Mammalian Invertivore	Avian / Mammalian Piscivore (c)
Ingestion	○	○	○	●	○	○
Ingestion	●	●	○	○	●	○
Ingestion	●	*	○	●	●	●
Direct Contact	●	●	●	*	*	*
Ingestion	●	●	○	●	●	●
Direct Contact	*	●	●	*	*	*
Ingestion	○	○	○	○	○	●

NOTES:

● Pathway assumed to be complete.

○ Pathway assumed to be incomplete.

* Pathway assumed to be insignificant.

(a) Exposure pathways are based on the current understanding of the Site and are subject to change.

(b) Surface water and sediment was evaluated for the nearby water bodies:
Trout Brook, East Trout Brook, Lamington River unnamed tributary (UNT) and Tanners Brook UNT.
East Trout Brook represents impacts downstream of the permitted discharge from the Treatment Plant.

(c) For piscivores, no fish tissue samples were collected; bioconcentration factors were used to model surface water concentrations to fish tissue concentrations.

U.S. Environmental Protection Agency
Combe Fill South Landfill RI/FS
Chester & Washington Townships, New Jersey

Figure 4-1
Ecological Conceptual Site Model
June, 2018

Attachment A

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Table 3.3 Risk Estimates for the Sandpiper (Avian Invertivore) from Exposure to Surface Water & Sediment in Trout Brook, Lamington River UNT & Tanners Brook UNT

Table 3.4 Risk Estimates for the Raccoon (Mammalian Invertivore) from Exposure to Surface Water & Sediment in Trout Brook, Lamington River UNT & Tanners Brook UNT

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Table 8.1 Step 3A – Refinement of Ecological COPCs for Seeps/Springs

TABLE 1.1
OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL COPCS FOR SURFACE WATER FROM TROUT BROOK, LAMINGTON RIVER UNT AND TANNERS BROOK UNT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water from Trout Brook, Lamington River UNT, Tanners Brook UNT

Exposure Point	T or D	Constituent Group	Constituent	CASRN	Minimum Detected Concentration (ug/L)	Qual	Maximum Detected Concentration (ug/L)	Qual	Location of Maximum Detected Concentration	Sample Count	Detection Frequency (%)	Range of Detection Limits	Concentration used for Screening (ug/L) (1)	Individual Ecological Screening Benchmarks								Hierarchy	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
														NJDEP ESC FW Chronic (ug/L)	Site-Specific, Hardness-Dependent NJDEP ESC FW Chronic (ug/L)	NJDEP ESC FW Acute (ug/L)	Site-Specific, Hardness-Dependent NJDEP ESC FW Acute (ug/L)	EPA WQC Aquatic Life FW CCC Chronic (ug/L)	Site-Specific, Hardness-Dependent EPA WQC Aquatic Life FW CCC Chronic (ug/L)	EPA WQC Aquatic Life FW CMC Acute (ug/L)	Site-Specific, Hardness-Dependent EPA WQC Aquatic Life FW CMC Acute (ug/L)	Surface Water Ecological Screening Benchmark (ug/L) (2) (3)		
Surface water	T	VOC	1,2,3-trichlorobenzene	87-61-6	0.41	J	0.41	J	TBSW0003	11	9	0.50 - 0.50	0.41	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	VOC	1,4-dioxane	123-91-1	0.48	J	35		TUSW0001	18	67	0.50 - 0.50	35	NC	NC	NC	NC	NC	NC	NC	NC	22000	N	Below screening benchmark.
Surface water	T	VOC	Diethyl Ether (Ethyl Ether)	60-29-7	2.2	J	4	J	TBSW0003	11	18	50 - 50	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	VOC	Trichloroethylene (TCE)	79-01-6	0.22	J	0.4	J	TBSW0001	11	18	0.50 - 0.50	0.4	47	NC	NC	NC	NC	NC	NC	NC	47	N	Below screening benchmark.
Surface water	T	INORGANIC	Aluminum	7429-90-5	77.8	J	2100		TUSW0003	18	67	200 - 200	2100	NC	NC	NC	NC	87	NC	750	NC	87	Y	Above screening benchmark.
Surface water	T	INORGANIC	Arsenic	7440-38-2	2.8	J	2.8	J	TBSW0002	18	6	10.0 - 10.0	2.8	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Surface water	T	INORGANIC	Barium	7440-39-3	12.3	J	49.3	J	LUSW0003	18	100	200 - 200	49.3	220	NC	NC	NC	NC	NC	NC	NC	220	N	Below screening benchmark.
Surface water	T	INORGANIC	Beryllium	7440-41-7	1.1	J	1.1	J	TUSW0003	18	6	5.0 - 5.0	1.1	3.6	NC	NC	NC	NC	NC	NC	NC	3.6	N	Below screening benchmark.
Surface water	T	INORGANIC	Cadmium	7440-43-9	0.28	J	0.28	J	TUSW0003	18	6	5.0 - 5.0	0.28	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No total screening benchmark. Above dissolved screening benchmark of 0.056 ug/L - see Table 1.4.
Surface water	T	INORGANIC	Calcium	7440-70-2	8150		24100		TBSW0002	18	100	5000 - 5000	24100	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	INORGANIC	Chromium, Total	7440-47-3	0.58	J	3.7	J	TUSW0003	18	33	10.0 - 10.0	3.7	42	NC	NC	NC	NC	NC	NC	NC	42	N	Below screening benchmark.
Surface water	T	INORGANIC	Cobalt	7440-48-4	0.87	J	3.9	J	TUSW0003	18	17	50.0 - 50.0	3.9	24	NC	NC	NC	NC	NC	NC	NC	24	N	Below screening benchmark.
Surface water	T	INORGANIC	Copper	7440-50-8	4.1	J	8	J	TUSW0003	18	17	25.0 - 25.0	8	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	See dissolved concentration rationale.
Surface water	T	INORGANIC	Iron	7439-89-6	46.2	J	5410		LUSW0003	18	100	100 - 100	5410	NC	NC	NC	NC	1000	NC	NC	NC	1000	Y	Above screening benchmark.
Surface water	T	INORGANIC	Lead	7439-92-1	2	J	26.6		TUSW0003	18	56	10.0 - 10.0	26.6	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	See dissolved concentration rationale.
Surface water	T	INORGANIC	Magnesium	7439-95-4	2780	J	7040		TBSW0001	18	100	5000 - 5000	7040	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	INORGANIC	Manganese	7439-96-5	20		381		TUSW0003	18	94	15.0 - 15.0	381	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	INORGANIC	Nickel	7440-02-0	1.8	J	4	J	TUSW0003	18	33	40.0 - 40.0	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Surface water	T	INORGANIC	Potassium	7440-09-7	567	J	1020	J	TBSW0002	18	39	5000 - 5000	1020	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	INORGANIC	Sodium	7440-23-5	2350	J	18300		TBSW0002	18	100	5000 - 5000	18300	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	INORGANIC	Vanadium	7440-62-2	5	J	9.2	J	TUSW0003	18	11	50.0 - 50.0	9.2	12	NC	NC	NC	NC	NC	NC	NC	12	N	Below screening benchmark.
Surface water	D	INORGANIC	Aluminum	7429-90-5	33.3	J	176	J	TUSW0003	18	56	200 - 200	176	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	See total concentration rationale.
Surface water	D	INORGANIC	Arsenic	7440-38-2	2.5	J	2.5	J	TBSW0003	18	6	10.0 - 10.0	2.5	150	NC	340	NC	150	NC	340	NC	150	N	Below screening benchmark.
Surface water	D	INORGANIC	Barium	7440-39-3	6.5	J	21.8	J	TBSW0003	18	100	200 - 200	21.8	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Surface water	D	INORGANIC	Beryllium	7440-41-7	0.84	J	0.84	J	TUSW0002	18	6	5.0 - 5.0	0.84	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Surface water	D	INORGANIC	Calcium	7440-70-2	6210		23400		TBSW0003	18	100	5000 - 5000	23400	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Chromium, Total	7440-47-3	1.8	J	1.8	J	TUSW0001	18	6	10.0 - 10.0	1.8	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Surface water	D	INORGANIC	Copper	7440-50-8	3.8	J	3.8	J	TBSW0002	18	6	25.0 - 25.0	3.8	NC	2.2	NC	2.9	1.45	NC	2.337	NC	2.2	Y	Above screening benchmark.
Surface water	D	INORGANIC	Iron	7439-89-6	134		488		TBSW0002	18	83	100 - 100	488	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	See total concentration rationale.
Surface water	D	INORGANIC	Lead	7439-92-1	2.1	J	9	J	TUSW0003	18	72	10.0 - 10.0	9	5.4	NC	38	NC	2.5	0.45	65	11	5.4	Y	Above screening benchmark.
Surface water	D	INORGANIC	Magnesium	7439-95-4	2320	J	7380		TBSW0001	18	100	5000 - 5000	7380	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Manganese	7439-96-5	7.3	J	158		TBSW0002	18	78	15.0 - 15.0	158	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Nickel	7440-02-0	1.7	J	4.1	J	LUSW0003	18	28	40.0 - 40.0	4.1	NC	12	NC	107	52	14	470	126	12	N	Below screening benchmark.
Surface water	D	INORGANIC	Potassium	7440-09-7	297	J	400	J	TBSW0001	18	11	5000 - 5000	400	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Sodium	7440-23-5	2480	J	17700		TBSW0001	18	100	5000 - 5000	17700	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Vanadium	7440-62-2	3.8	J	4.7	J	TUSW0003	18	22	50.0 - 50.0	4.7	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.

Notes:
(1) The maximum detected concentrations from the following three water bodies are used for the COPC screening: Trout Brook, Lamington River UNT and Tanners Brook UNT. Constituents with all non-detected concentrations are not shown.
(2) The COPC screening applies a hierarchy of criteria: NJDEP Ecological Screening Criteria Freshwater (Chronic and Acute) and then EPA National Water Quality Criteria (Chronic and Acute). Hardness-dependent NJ and EPA criteria are calculated for cadmium, copper, lead, nickel, silver and zinc using site-specific hardness; calculations are presented on Table 1.4 and a hardness of 21 mg/L is applied.
(3) None of the surface water sources provide a criterion for 1,4-dioxane, the primary constituent of concern in the OU2 study area; a criterion of 22,000 ug/L from EPA Region 5 RCRA Ecological Screening Level is applied as a surrogate.
(4) Inorganics that have total concentrations without a total screening benchmark, but have dissolved concentrations below the dissolved screening benchmark (or vice versa) are not placed on the COPC list.
The range of detection limits presented here are based on the hierarchy of applying the quantitation limit, followed by method detection limit and then reporting limit. As the quantitation limit accounts for sample-specific differences, it is typically greater than the method detection limit.

Abbreviations:
CCC -- Criterion continuous concentration
CMC -- Criteria maximum concentration
COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
FW -- Freshwater
NC -- No criterion
NJDEP -- New Jersey Department of Environmental Protection
Qual -- Qualifier
SWQS -- Surface water quality standard
T or D -- Total or dissolved
WQC -- Water quality criteria
ug/L -- Micrograms per liter
UNT -- Unnamed tributary
VOC -- Volatile organic compound
Y/N -- Yes or no

Qualifier:
J -- Estimated concentration

References:
NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2017. National Recommended Water Quality Criteria. Office of Water. Website Last Updated July 20, 2017. Available online: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table
EPA Region V. 2003. RCRA Ecological Screening Levels. August 22. Available online: https://archive.epa.gov/region5/waste/cars/web/html/esl.html

TABLE 1.2
OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL COPCS FOR SURFACE WATER FROM EAST TROUT BROOK
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water from East Trout Brook

Exposure Point	T or D	Constituent Group	Constituent		Minimum Detected Concentration (ug/L)	Qual	Maximum Detected Concentration (ug/L)	Qual	Location of Maximum Detected Concentration	Sample Count	Detection Frequency (%)	Range of Detection Limits	Concentration used for Screening (ug/L) (1)	Individual Ecological Screening Benchmarks								Hierarchy	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
														NJDEP ESC FW Chronic (ug/L)	Site-Specific, Hardness-Dependent NJDEP ESC FW Chronic (ug/L)	NJDEP ESC FW Acute (ug/L)	Site-Specific, Hardness-Dependent NJDEP ESC FW Acute (ug/L)	EPA WQC Aquatic Life FW CCC Chronic (ug/L)	Site-Specific EPA WQC Aquatic Life FW CCC Chronic (ug/L)	EPA WQC Aquatic Life FW CMC Acute (ug/L)	Site-Specific EPA WQC Aquatic Life FW CMC Acute (ug/L)	Surface Water Ecological Screening Benchmark (ug/L) (2) (3)		
Surface water	T	VOC	1,2,3-trichlorobenzene	87-61-6	0.25	J	0.25	J	ETSW0003	6	17	0.50 - 0.50	0.25	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	VOC	1,2,4-trichlorobenzene	120-82-1	0.3	J	0.3	J	ETSW0003	6	17	0.50 - 0.50	0.3	30	NC	NC	NC	NC	NC	NC	NC	30	N	Below screening benchmark.
Surface water	T	VOC	1,4-dioxane	123-91-1	21		61		ETSW0002	6	100	0.50 - 0.50	61	NC	NC	NC	NC	NC	NC	NC	NC	22000	N	Below screening benchmark.
Surface water	T	VOC	Acetone	67-64-1	2.7	J	2.7	J	ETSW0003	6	17	5.0 - 5.0	2.7	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	VOC	Dichlorodifluoromethane	75-71-8	0.16	J	0.16	J	ETSW0003	6	17	0.50 - 0.50	0.16	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	VOC	Diethyl Ether (Ethyl Ether)	60-29-7	2.5	J	2.5	J	ETSW0003	6	17	50 - 50	2.5	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	PESTICIDE	Chlordane, alpha	5103-71-9	0.0021	J	0.0048	J	ETSW0001	6	33	0.0050 - 0.0050	0.0048	0.0043	NC	2.4	NC	0.0043	NC	2.4	NC	0.0043	Y	Above screening benchmark.
Surface water	T	INORGANIC	Arsenic	7440-38-2	3.6	J	3.6	J	ETSW0002	6	17	10.0 - 10.0	3.6	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	No total screening benchmark. Below dissolved benchmark of 150 ug/L.
Surface water	T	INORGANIC	Barium	7440-39-3	8.3	J	15.7	J	ETSW0001	6	100	200 - 200	15.7	220	NC	NC	NC	NC	NC	NC	NC	220	N	Below screening benchmark.
Surface water	T	INORGANIC	Calcium	7440-70-2	30900		45100		ETSW0003	6	100	5000 - 5000	45100	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	INORGANIC	Chromium, Total	7440-47-3	0.95	J	7	J	ETSW0003	6	83	10.0 - 10.0	7	42	NC	NC	NC	NC	NC	NC	NC	42	N	Below screening benchmark.
Surface water	T	INORGANIC	Copper	7440-50-8	3.5	J	3.9	J	ETSW0002	6	50	25.0 - 25.0	3.9	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Surface water	T	INORGANIC	Iron	7439-89-6	56.3	J	139		ETSW0001	6	100	100 - 100	139	NC	NC	NC	NC	1000	NC	NC	NC	1000	N	Below screening benchmark.
Surface water	T	INORGANIC	Lead	7439-92-1	3	J	3.8	J	ETSW0002	6	83	10.0 - 10.0	3.8	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	See dissolved concentration rationale.
Surface water	T	INORGANIC	Magnesium	7439-95-4	11200		16200		ETSW0002	6	100	5000 - 5000	16200	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	INORGANIC	Manganese	7439-96-5	6.8	J	70.5		ETSW0001	6	100	15.0 - 15.0	70.5	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	INORGANIC	Nickel	7440-02-0	1.3	J	4	J	ETSW0001	6	83	40.0 - 40.0	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Surface water	T	INORGANIC	Potassium	7440-09-7	2500	J	3130	J	ETSW0003	6	100	5000 - 5000	3130	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	T	INORGANIC	Silver	7440-22-4	0.46	J	0.54	J	ETSW0002	6	33	10.0 - 10.0	0.54	0.12	NC	NC	NC	NC	NC	NC	NC	0.12	Y	Above screening benchmark.
Surface water	T	INORGANIC	Sodium	7440-23-5	62200		134000		ETSW0002	6	100	5000 - 5000	134000	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Aluminum	7429-90-5	32.5	J	64.2	J	ETSW0001	6	33	200 - 200	64.2	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark. Although the concentration is below total benchmark, it is unknown whether the concentration could be above a more conservative dissolved benchmark.
Surface water	D	INORGANIC	Barium	7440-39-3	7.8	J	13.4	J	ETSW0001	6	100	200 - 200	13.4	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Surface water	D	INORGANIC	Cadmium	7440-43-9	0.19	J	0.19	J	ETSW0002	6	17	5.0 - 5.0	0.19	NC	0.40	NC	4.2	0.25	1.64	2.0	5.0	0.40	N	Below screening benchmark.
Surface water	D	INORGANIC	Calcium	7440-70-2	31200		45800		ETSW0003	6	100	5000 - 5000	45800	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Chromium, Total	7440-47-3	1	J	1.1	J	ETSW0001	6	33	10.0 - 10.0	1.1	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Surface water	D	INORGANIC	Copper	7440-50-8	5	J	6.7	J	ETSW0001	6	50	25.0 - 25.0	6.7	NC	22	NC	36	1.45	NC	2.337	NC	22	N	Below screening benchmark.
Surface water	D	INORGANIC	Iron	7439-89-6	130		130		ETSW0001	6	17	100 - 100	130	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Surface water	D	INORGANIC	Lead	7439-92-1	2.3	J	5.4	J	ETSW0001	6	67	10.0 - 10.0	5.4	5.4	NC	38	NC	2.5	8.1	65	209	5.4	Y	Equal to screening benchmark.
Surface water	D	INORGANIC	Magnesium	7439-95-4	11000		15900		ETSW0003	6	100	5000 - 5000	15900	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Manganese	7439-96-5	6.2	J	43.3		ETSW0001	6	50	15.0 - 15.0	43.3	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Nickel	7440-02-0	1.9	J	3.6	J	ETSW0002	6	50	40.0 - 40.0	3.6	NC	112	NC	1005	52	132	470	1186	112	N	Below screening benchmark.
Surface water	D	INORGANIC	Potassium	7440-09-7	1760	J	1920	J	ETSW0001	6	50	5000 - 5000	1920	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Surface water	D	INORGANIC	Silver	7440-22-4	0.38	J	0.38	J	ETSW0003	6	17	10.0 - 10.0	0.38	NC	NC	NC	21	NC	NC	3.2	21	21	N	Below screening benchmark.
Surface water	D	INORGANIC	Sodium	7440-23-5	44100		133000		ETSW0001	6	100	5000 - 5000	133000	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.

Notes:
(1) The maximum detected concentrations from East Trout Brook are used for the COPC screening of surface water downstream of the Leachate Treatment Plant permitted discharge. Constituents with all non-detected concentrations are not shown.
(2) The COPC screening applies a hierarchy of criteria: NJDEP Ecological Screening Criteria Freshwater (Chronic and Acute) and then EPA National Water Quality Criteria (Chronic and Acute). Hardness-dependent NJ and EPA criteria are calculated for cadmium, copper, lead, nickel, silver and zinc using site-specific hardness; calculations are presented on Table 1.4 and a hardness of 300 mg/L is applied for East Trout Brook.
(3) None of the surface water sources provide a criterion for 1,4-dioxane, the primary constituent of concern in the OU2 study area; a criterion of 22,000 ug/L from EPA Region 5 RCRA Ecological Screening Level is applied. The criteria for chlordane total are applied to chlordane, alpha.
(4) Inorganics that have total concentrations without a screening benchmark, but have dissolved concentrations below the dissolved screening benchmark (or vice versa) are not placed on the COPC list.
The range of detection limits presented here are based on the hierarchy of applying the quantitation limit, followed by method detection limit and then reporting limit. As the quantitation limit accounts for sample-specific differences, it is typically greater than the method detection limit.

Abbreviations:
CCC -- Criterion continuous concentration
CMC -- Criteria maximum concentration
COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
FW -- Freshwater
NC -- No criterion
NJDEP -- New Jersey Department of Environmental Protection
Qual -- Qualifier
SWQS -- Surface water quality standard
T or D -- Total or dissolved
WQC -- Water quality criteria
ug/L -- Micrograms per liter
VOC -- Volatile organic compound
Y/N -- Yes or no

Qualifier:
J -- Estimated concentration

References:
NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2017. National Recommended Water Quality Criteria. Office of Water. Website Last Updated July 20, 2017. Available online: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table
EPA Region V. 2003. RCRA Ecological Screening Levels. August 22. Available online: https://archive.epa.gov/region5/waste/cars/web/html/esl.html

TABLE 1.3
OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL COPCS FOR SEEPS/SPRINGS
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Scenario Timeframe: Current/Future
Medium: Surface Water / Groundwater
Exposure Medium: Seeps and Springs in OU2

Exposure Point	T or D	Constituent Group	Constituent	CASRN	Minimum Detected Concentration (ug/L)	Qual	Maximum Detected Concentration (ug/L)	Qual	Location of Maximum Detected Concentration	Sample Count	Detect Count	Detection Ratio	Detection Frequency (%)	Range of Detection Limits	Concentration used for Screening (ug/L) (1)	Individual Ecological Screening Benchmarks								Hierarchy	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
																NJDEP ESC FW Chronic (ug/L)	Site-Specific, Hardness-Dependent NJDEP ESC FW Chronic (ug/L)	NJDEP ESC FW Acute (ug/L)	Site-Specific, Hardness-Dependent NJDEP ESC FW Acute (ug/L)	EPA WQC Aquatic Life FW CCC Chronic (ug/L)	Site-Specific, Hardness-Dependent EPA WQC Aquatic Life FW CCC Chronic (ug/L)	EPA WQC Aquatic Life FW CMC Acute (ug/L)	Site-Specific, Hardness-Dependent EPA WQC Aquatic Life FW CMC Acute (ug/L)	Surface Water Ecological Screening Benchmark (ug/L) (2) (3)		
Seep/Spring Water	T	VOC	1,4-Dioxane	123-91-1	3.5	D	5.9	D	SEEP_B1	6	2	2 / 6	33	0.1 - 1	5.9	NC	NC	NC	NC	NC	NC	NC	NC	22000	N	Below screening benchmark.
Seep/Spring Water	T	VOC	Chloroform	67-66-3	0.27	J	0.34	J	SEEP_B1	6	2	2 / 6	33	0.5 - 0.5	0.34	140	NC	NC	NC	NC	NC	NC	NC	140	N	Below screening benchmark.
Seep/Spring Water	T	PESTICIDE	4,4'-DDD	72-54-8	0.00042	J	0.00042	J	SPRING_A1	6	1	1 / 6	17	0.0013 - 0.0014	0.00042	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	T	PESTICIDE	BHC alpha	319-84-6	0.00098	J	0.00098	J	SPRING_A1	6	1	1 / 6	17	0.0013 - 0.0014	0.00098	12.4	NC	NC	NC	NC	NC	NC	NC	12.4	N	Below screening benchmark.
Seep/Spring Water	T	PESTICIDE	Endosulfan sulfate	1031-07-8	0.00044	J	0.00079	J	SPRING_A1	6	2	2 / 6	33	0.0013 - 0.0014	0.00079	2.22	NC	NC	NC	NC	NC	NC	NC	2.22	N	Below screening benchmark.
Seep/Spring Water	T	PESTICIDE	Endrin	72-20-8	0.00031	J	0.00048	J	SEEP_A2	6	2	2 / 6	33	0.0013 - 0.0014	0.00048	0.036	NC	0.086	NC	0.036	NC	0.086	NC	0.036	N	Below screening benchmark.
Seep/Spring Water	T	INORGANIC	Aluminum	7429-90-5	16.3	J	9820		SEEP_B2	6	6	6 / 6	100	20 - 20	9820	NC	NC	NC	NC	87	NC	750	NC	87	Y	Above screening benchmark.
Seep/Spring Water	T	INORGANIC	Arsenic	7440-38-2	1.4		3.5		SEEP_B2	6	4	4 / 6	67	1 - 1	3.5	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Seep/Spring Water	T	INORGANIC	Barium	7440-39-3	11.2		133		SEEP_B2	6	4	4 / 6	67	10 - 10	133	220	NC	NC	NC	NC	NC	NC	NC	220	N	Below screening benchmark.
Seep/Spring Water	T	INORGANIC	Beryllium	7440-41-7	0.18	J	1.9		SEEP_B2	6	2	2 / 6	33	1 - 1	1.9	3.6	NC	NC	NC	NC	NC	NC	NC	3.6	N	Below screening benchmark.
Seep/Spring Water	T	INORGANIC	Cadmium	7440-43-9	0.18	J	0.88	J	SEEP_B2	6	2	2 / 6	33	1 - 1	0.88	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No total screening benchmark. Above dissolved screening benchmark of 0.09 ug/L - see Table 1.4.
Seep/Spring Water	T	INORGANIC	Calcium	7440-70-2	6100		21400		SEEP_B2	6	6	6 / 6	100	500 - 500	21400	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	T	INORGANIC	Chromium (Total)	7440-47-3	0.3	J	14.8		SEEP_B2	6	5	5 / 6	83	2 - 2	14.8	42	NC	NC	NC	NC	NC	NC	NC	42	N	Below screening benchmark.
Seep/Spring Water	T	INORGANIC	Cobalt	7440-48-4	0.47	J	11.6		SEEP_B2	6	4	4 / 6	67	1 - 1	11.6	24	NC	NC	NC	NC	NC	NC	NC	24	N	Below screening benchmark.
Seep/Spring Water	T	INORGANIC	Copper	7440-50-8	0.43	J	18.5		SEEP_B2	6	6	6 / 6	100	2 - 2	18.5	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Seep/Spring Water	T	INORGANIC	Cyanide	57-12-5	1.9	J	3.2	J	SEEP_B2	6	5	5 / 6	83	10 - 10	3.2	5.2	NC	22	NC	5.2	NC	22	NC	5.2	N	Below screening benchmark.
Seep/Spring Water	T	INORGANIC	Iron	7439-89-6	196	J	32600		SEEP_B2	6	6	6 / 6	100	200 - 200	32600	NC	NC	NC	NC	1000	NC	NC	NC	1000	Y	Above screening benchmark.
Seep/Spring Water	T	INORGANIC	Lead	7439-92-1	0.21	J	29		SEEP_B2	6	6	6 / 6	100	1 - 1	29	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Seep/Spring Water	T	INORGANIC	Magnesium	7439-95-4	2040		6020		SEEP_B1	6	6	6 / 6	100	500 - 500	6020	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	T	INORGANIC	Manganese	7439-96-5	10.9	J	708		SEEP_A2	6	6	6 / 6	100	1 - 1	708	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	T	INORGANIC	Mercury	7439-97-6	0.25	J	4		SEEP_B2	6	3	3 / 6	50	0.2 - 0.2	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Seep/Spring Water	T	INORGANIC	Nickel	7440-02-0	0.32	J	11.9		SEEP_B2	6	6	6 / 6	100	1 - 1	11.9	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Seep/Spring Water	T	INORGANIC	Potassium	7440-09-7	1020		1590		SEEP_B2	6	6	6 / 6	100	500 - 500	1590	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	T	INORGANIC	Selenium	7782-49-2	1.2	J	1.2	J	SEEP_B2	6	1	1 / 6	17	5 - 5	1.2	NC	NC	NC	NC	1.5	NC	NC	NC	1.5	N	Below screening benchmark.
Seep/Spring Water	T	INORGANIC	Sodium	7440-23-5	3530		8310		SEEP_B1	6	6	6 / 6	100	500 - 500	8310	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	T	INORGANIC	Vanadium	7440-62-2	2.1	J	62.4		SEEP_B2	6	6	6 / 6	100	5 - 5	62.4	12	NC	NC	NC	NC	NC	NC	NC	12	Y	Above screening benchmark.
Seep/Spring Water	T	INORGANIC	Zinc	7440-66-6	1.3	J	79		SEEP_B2	6	6	6 / 6	100	2 - 2	79	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See dissolved concentration rationale.
Seep/Spring Water	D	INORGANIC	Aluminum	7429-90-5	22.6		22.6		SEEP_A2	6	1	1 / 6	17	20 - 20	22.6	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	See total concentration rationale.
Seep/Spring Water	D	INORGANIC	Arsenic	7440-38-2	0.8	J	1.9		SEEP_A2	6	6	6 / 6	100	1 - 1	1.9	150	NC	340	NC	150	NC	340	NC	150	N	Below screening benchmark.
Seep/Spring Water	D	INORGANIC	Barium	7440-39-3	8.6	J	16.3		SEEP_A2	6	6	6 / 6	100	10 - 10	16.3	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Seep/Spring Water	D	INORGANIC	Calcium	7440-70-2	5750		16900		SEEP_B1	6	6	6 / 6	100	500 - 500	16900	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	D	INORGANIC	Chromium (Total)	7440-47-3	0.32	J	0.35	J	SEEP_A2	6	4	4 / 6	67	2 - 2	0.35	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Seep/Spring Water	D	INORGANIC	Cobalt	7440-48-4	1.3		1.7		SEEP_A2	6	3	3 / 6	50	1 - 1	1.7	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Seep/Spring Water	D	INORGANIC	Copper	7440-50-8	0.33	J	0.48	J	SEEP_A1	6	4	4 / 6	67	2 - 2	0.48	NC	4.1	NC	5.7	2.37	NC	3.11	NC	2.37	N	Below screening benchmark.
Seep/Spring Water	D	INORGANIC	Cyanide	57-12-5	2.1	J	3.3	J	SPRING_A2	6	4	4 / 6	67	10 - 10	3.3	NC	NC	NC	NC	NC	NC	NC	NC	NC	N	See total concentration rationale.
Seep/Spring Water	D	INORGANIC	Iron	7439-89-6	117	J	2000		SEEP_B2	6	6	6 / 6	100	200 - 200	2000	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	D	INORGANIC	Lead	7439-92-1	0.2	J	0.2	J	SPRING_A2	6	1	1 / 6	17	1 - 1	0.2	5.4	NC	38	NC	2.5	0.99	65	25	0.99	N	Below screening benchmark.
Seep/Spring Water	D	INORGANIC	Magnesium	7439-95-4	2000		5370		SEEP_B1	6	6	6 / 6	100	500 - 500	5370	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	D	INORGANIC	Manganese	7439-96-5	8.6	J	552		SEEP_A2	6	6	6 / 6	100	1 - 1	552	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	D	INORGANIC	Mercury	7439-97-6	0.28	J	0.28	J	SEEP_B1	6	3	3 / 6	50	0.2 - 0.2	0.28	0.77	NC	1.4	NC	0.77	NC	1.4	NC	0.77	N	Below screening benchmark.
Seep/Spring Water	D	INORGANIC	Nickel	7440-02-0	0.16	J	0.94	J	SEEP_A2	6	6	6 / 6	100	1 - 1	0.94	NC	22	NC	194	52	25	470	229	22	N	Below screening benchmark.
Seep/Spring Water	D	INORGANIC	Potassium	7440-09-7	1030		1510		SPRING_A1	6	6	6 / 6	100	500 - 500	1510	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	D	INORGANIC	Sodium	7440-23-5	3670		8480		SEEP_B1	6	6	6 / 6	100	500 - 500	8480	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	D	INORGANIC	Vanadium	7440-62-2	0.92	J	0.92	J	SEEP_B1	6	1	1 / 6	17	5 - 5	0.92	NC	NC	NC	NC	NC	NC	NC	NC	NC	Y	No screening benchmark.
Seep/Spring Water	D	INORGANIC	Zinc	7440-66-6	0.37	J	2.8		SEEP_A2	6	6	6 / 6	100	2 - 2	2.8	NC	56	NC	56	120	58	120	57	56	N	Below screening benchmark.

Notes:
(1) The maximum detected concentrations from Seep A, Spring A and Seep B for the COPC screening. Constituents with all non-detected concentrations are not shown.
(2) The COPC screening applies a hierarchy of criteria: NJDEP Ecological Screening Criteria Freshwater (Chronic and Acute) and then EPA National Water Quality Criteria (Chronic and Acute). Hardness-dependent NJ and EPA criteria are calculated for cadmium, copper, lead, nickel, silver and zinc using site-specific hardness; calculations are presented on Table 1.4 and a hardness of 21 mg/L is applied.
(3) None of the surface water sources provide a criterion for 1,4-dioxane, the primary constituent of concern in the OU2 study area; a criterion of 22,000 ug/L from EPA Region 5 RCRA Ecological Screening Level is applied as a surrogate.
(4) Inorganics that have total concentrations without a total screening benchmark, but have dissolved concentrations below the dissolved screening benchmark (or vice versa) are not placed on the COPC list.
The range of detection limits presented here are based on the hierarchy of applying the quantitation limit, followed by method detection limit and then reporting limit. As the quantitation limit accounts for sample-specific differences, it is typically greater than the method detection limit.

Abbreviations:
CCC -- Criterion continuous concentration
CMC -- Criteria maximum concentration
COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
FW -- Freshwater
NC -- No criterion
NJDEP -- New Jersey Department of Environmental Protection
Qual -- Qualifier
SWQS -- Surface water quality standard
T or D -- Total or dissolved
WQC -- Water quality criteria
ug/L -- Micrograms per liter
UNT -- Unnamed tributary
VOC -- Volatile organic compound
Y/N -- Yes or no

Qualifier:
J -- Estimated concentration

References:
NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2017. National Recommended Water Quality Criteria. Office of Water. Website Last Updated July 20, 2017. Available online: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table
EPA Region V. 2003. RCRA Ecological Screening Levels. August 22. Available online: https://archive.epa.gov/region5/waste/cars/web/html/esl.html

TABLE 1.4
SITE-SPECIFIC DISSOLVED SURFACE WATER HARDNESS-DEPENDENT CALCULATIONS
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

T or D	Constituent Group	Constituent	CASRN	Criterion Name	Criterion Equation (ug/L)	Hardness-Dependent Criteria (ug/L)				
						Seeps/Springs	East Trout Brook	Lamington River UNT	Trout Brook	Tanners Brook UNT
D	INORG	Cadmium	7440-43-9	EPA Acute CMC Dissolved	e^(0.9789 (ln [hardness])-3.866)*[(1.136672-(ln[hardness]*0.041838)]	0.8	5.0	0.76	0.87	0.42
D	INORG	Lead	7439-92-1	EPA Acute CMC Dissolved	e^(1.273 (ln [hardness])-1.46)*[(1.46203-(ln[hardness]*0.145712)]	25	209	24	28	11
D	INORG	Nickel	7440-02-0	EPA Acute CMC Dissolved	e^(0.846 (ln [hardness])+2.255)(0.998)	229	1186	216	243	126
D	INORG	Silver	7440-22-4	EPA Acute CMC Dissolved	e^(1.72 (ln [hardness])-6.59)(0.85)	1	21	0.67	0.85	0.22
D	INORG	Zinc	7440-66-6	EPA Acute CMC Dissolved	e^(0.8473 (ln [hardness])+0.884)(0.978)	57	297	54	61	31
D	INORG	Cadmium	7440-43-9	EPA Chronic CCC Dissolved	e^(0.7977 (ln [hardness])-3.909)*[(1.101672-(ln[hardness]*0.041838)]	0.38	1.64	0.36	0.40	0.223
D	INORG	Lead	7439-92-1	EPA Chronic CCC Dissolved	e^(1.273 (ln [hardness])-4.705)*[(1.46203-(ln[hardness]*0.145712)]	0.99	8.1	0.92	1.1	0.45
D	INORG	Nickel	7440-02-0	EPA Chronic CCC Dissolved	e^(0.846 (ln [hardness])+0.0584)(0.997)	25	132	24	27	14
D	INORG	Silver	7440-22-4	EPA Chronic CCC Dissolved	No equation available; NJ has default criteria.	--	--	--	--	--
D	INORG	Zinc	7440-66-6	EPA Chronic CCC Dissolved	e^(0.8473 (ln [hardness])+0.884)(0.986)	58	300	54	61	32
D	INORG	Cadmium	7440-43-9	NJDEP Acute Dissolved	WER [e^(1.0166 (ln [hardness])-3.924)] 0.651	0.6	4.2	0.55	0.63	0.29
D	INORG	Copper	7440-50-8	NJDEP Acute Dissolved	WER [e^(0.9422 (ln [hardness])-1.7)] 0.908	5.7	36	5.4	6.1	2.9
D	INORG	Lead	7439-92-1	NJDEP Acute Dissolved	No equation available; NJ has default criteria.	--	--	--	--	--
D	INORG	Nickel	7440-02-0	NJDEP Acute Dissolved	WER [e^(0.846 (ln [hardness])+2.255)] 0.846	194	1005	183	206	107
D	INORG	Silver	7440-22-4	NJDEP Acute Dissolved	WER [e^(1.72 (ln [hardness])-6.59)] 0.85	1	21	0.67	0.85	0.22
D	INORG	Zinc	7440-66-6	NJDEP Acute Dissolved	WER [e^(0.8473 (ln [hardness])+0.884)] 0.950	56	289	52	59	31
D	INORG	Cadmium	7440-43-9	NJDEP Chronic Dissolved	WER [e^(0.7409 (ln [hardness])-4.719)] 0.651	0.09	0.40	0.089	0.10	0.056
D	INORG	Copper	7440-50-8	NJDEP Chronic Dissolved	WER [e^(0.8545 (ln [hardness])-1.702)] 0.908	4.1	22	3.9	4.4	2.2
D	INORG	Lead	7439-92-1	NJDEP Chronic Dissolved	No equation available; NJ has default criteria.	--	--	--	--	--
D	INORG	Nickel	7440-02-0	NJDEP Chronic Dissolved	WER [e^(0.846 (ln [hardness])+0.0584)] 0.846	22	112	20	23	12
D	INORG	Silver	7440-22-4	NJDEP Chronic Dissolved	No equation available; NJ has default criteria.	--	--	--	--	--
D	INORG	Zinc	7440-66-6	NJDEP Chronic Dissolved	WER [e^(0.8473 (ln [hardness])+0.884)] 0.950	56	289	52	59	31

Notes:
Hardness data is presented in the RI Report. The average hardness for each of the four water bodies and the seeps/springs near the Site is applied in the calculation of hardness-dependent criteria:

Hardness (mg/L)	Water Body
300	East Trout Brook
40	Lamington River unnamed tributary (UNT)
46	Trout Brook
21	Tanners Brook UNT
43	Seeps/Springs

In the above equations, hardness is directly correlated to the stringency of the criteria; the softer (smaller) the hardness value, the more stringent (smaller) the criterion.
Tanners Brook UNT has the lowest average hardness value (21 mg/L) when compared to that of Trout Brook and Lamington River UNT, which means its calculated hardness-dependent criteria are the most stringent. Therefore, the Tanners Brook UNT hardness-dependent dissolved criteria are applied in the COPC screening of surface water in Table 1.1.
The hardness-dependent dissolved criteria, based on a hardness of 300 mg/L, for East Trout Brook are applied in the COPC screening of surface water downstream from the Leachate Treatment Plant in Table 1.2.
The hardness-dependent dissolved criteria, based on a hardness of 43 mg/L, for seeps and springs are applied in the COPC screening in Table 1.3.

Abbreviations:
CCC -- Criterion continuous concentration
CMC -- Criteria maximum concentration
COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
mg/L -- Milligrams per liter
NJDEP -- New Jersey Department of Environmental Protection
T or D -- Total or dissolved
ug/L -- Micrograms per liter
UNT -- Unnamed tributary
WER -- Water equivalent ratio, assumed to be 1

References:
NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2017. National Recommended Water Quality Criteria. Office of Water. Website Last Updated July 20, 2017. Available online: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

TABLE 1.5
OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL COPCS FOR SEDIMENT FROM TROUT BROOK, LAMINGTON RIVER UNT AND TANNERS BROOK UNT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment from Trout Brook, Lamington River UNT, Tanners Brook UNT

Exposure Point	Constituent Group	Constituent	CASRN	Minimum Detected Concentration (mg/kg)	Qual	Maximum Detected Concentration (mg/kg)	Qual	Location of Maximum Detected Concentration	Sample Count	Detection Frequency (%)	Range of Detection Limits	Concentration used for Screening (mg/kg) (1)	Individual Ecological Screening Benchmarks			Hierarchy	COPC Flag (Y/N)	Rationale for Selection or Deletion
													NJDEP ESC FW Sediment LEL (mg/kg)	EPA Region 3 Sediment Ecological Benchmarks (mg/kg)	EPA Region 5 RCRA Sediment Screening Levels (mg/kg)	Sediment Ecological Benchmark (mg/kg)		
Sediment	VOC	Methylene Chloride	75-09-2	0.0024	J	0.0024	J	TUSD0003	18	6	0.005 - 0.005	0.0024	0.159	NC	0.159	0.159	N	Below screening benchmark.
Sediment	SVOC	2,3,4,6-tetrachlorophenol	58-90-2	0.77	NJ	0.77	NJ	LUSD0005	18	6	0.17 - 0.17	0.77	NC	0.284	0.129	0.129	Y	Above screening benchmark.
Sediment	SVOC	Anthracene	120-12-7	0.17	J	0.3	J	LUSD0001	18	11	0.17 - 0.17	0.3	0.0572	0.0572	0.0572	0.0572	Y	Above screening benchmark.
Sediment	SVOC	Benzo(a)anthracene	56-55-3	0.15	J	1.2		LUSD0001	18	17	0.17 - 0.17	1.2	0.108	0.108	0.108	0.108	Y	Above screening benchmark.
Sediment	SVOC	Benzo(a)pyrene	50-32-8	0.16	J	0.67		LUSD0001	18	17	0.17 - 0.17	0.67	0.15	0.15	0.15	0.15	Y	Above screening benchmark.
Sediment	SVOC	Benzo(b)fluoranthene	205-99-2	0.15	J	0.73		LUSD0001	18	17	0.17 - 0.17	0.73	10.4	NC	10.4	10.4	N	Below screening benchmark.
Sediment	SVOC	Benzo(g,h,i)perylene	191-24-2	0.11	J	0.32	J	LUSD0001	18	17	0.17 - 0.17	0.32	0.17	0.17	0.17	0.17	Y	Above screening benchmark.
Sediment	SVOC	Benzo(k)fluoranthene	207-08-9	0.14	J	0.73		LUSD0001	18	17	0.17 - 0.17	0.73	0.24	0.24	0.24	0.24	Y	Above screening benchmark.
Sediment	SVOC	Benzyl Butyl Phthalate	85-68-7	6.9		6.9		LUSD0001	18	6	0.17 - 0.17	6.9	1.97	10.9	1.97	1.97	Y	Above screening benchmark.
Sediment	SVOC	Chrysene	218-01-9	0.17	J	1.3		LUSD0001	18	17	0.17 - 0.17	1.3	0.166	0.166	0.166	0.166	Y	Above screening benchmark.
Sediment	SVOC	Dibenz(a,h)anthracene	53-70-3	0.15	J	0.15	J	LUSD0001	18	6	0.17 - 0.17	0.15	0.033	0.033	0.033	0.033	Y	Above screening benchmark.
Sediment	SVOC	Di-n-butyl Phthalate	84-74-2	0.064	J	0.17	J	LUSD0005	18	28	0.17 - 0.17	0.17	1.114	6.47	1.114	1.114	N	Below screening benchmark.
Sediment	SVOC	Fluoranthene	206-44-0	0.39		3.4		LUSD0001	18	17	0.17 - 0.17	3.4	0.423	0.423	0.423	0.423	Y	Above screening benchmark.
Sediment	SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5	0.099	J	0.34		LUSD0001	18	17	0.17 - 0.17	0.34	0.2	0.017	0.2	0.2	Y	Above screening benchmark.
Sediment	SVOC	Phenanthrene	85-01-8	0.12	J	0.88		LUSD0001	18	17	0.17 - 0.17	0.88	0.204	0.204	0.204	0.204	Y	Above screening benchmark.
Sediment	SVOC	Pyrene	129-00-0	0.25		1.7		LUSD0001	18	17	0.17 - 0.17	1.7	0.195	0.195	0.195	0.195	Y	Above screening benchmark.
Sediment	PESTICIDE	Endrin Aldehyde	7421-93-4	0.0026	J	0.0026	J	LUSD0001	18	6	0.0033 - 0.0033	0.0026	0.48	NC	0.48	0.48	N	Below screening benchmark.
Sediment	INORGANIC	Aluminum	7429-90-5	2250		16800	J	LUSD0001	18	100	20.0 - 20.0	16800	25500	NC	NC	25500	N	Below screening benchmark.
Sediment	INORGANIC	Antimony	7440-36-0	0.17	J	0.27	J	LUSD0005	18	11	6.0 - 6.0	0.27	NC	2	NC	2	N	Below screening benchmark.
Sediment	INORGANIC	Arsenic	7440-38-2	1.6		20		TUSD0002	18	100	1.0 - 1.0	20	6	9.8	9.79	6	Y	Above screening benchmark.
Sediment	INORGANIC	Barium	7440-39-3	12.4	J	118	J	LUSD0004	18	100	20.0 - 20.0	118	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Beryllium	7440-41-7	0.26	J	1.1	J	LUSD0001	18	83	0.50 - 0.50	1.1	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Cadmium	7440-43-9	0.15	J	1.5	J	LUSD0004	18	61	0.50 - 0.50	1.5	0.6	0.99	0.99	0.6	Y	Above screening benchmark.
Sediment	INORGANIC	Calcium	7440-70-2	301	J	4480	J	LUSD0004	18	100	500 - 500	4480	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Chromium, Total	7440-47-3	2		22.5		TBSD0005	18	100	1.0 - 1.0	22.5	26	43.4	43.4	26	N	Below screening benchmark.
Sediment	INORGANIC	Cobalt	7440-48-4	2.3	J	10.7	J	LUSD0001	18	100	5.0 - 5.0	10.7	50	50	50	50	N	Below screening benchmark.
Sediment	INORGANIC	Copper	7440-50-8	1.7	J	28.2	J	LUSD0004	18	100	2.5 - 2.5	28.2	16	31.6	31.6	16	Y	Above screening benchmark.
Sediment	INORGANIC	Iron	7439-89-6	2150		19400		LUSD0005	18	100	10.0 - 10.0	19400	NC	20000	NC	20000	N	Below screening benchmark.
Sediment	INORGANIC	Lead	7439-92-1	4.7	J	71.4	J	LUSD0004	18	100	1.0 - 1.0	71.4	31	35.8	35.8	31	Y	Above screening benchmark.
Sediment	INORGANIC	Magnesium	7439-95-4	365		3880	J	LUSD0004	18	100	500 - 500	3880	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Manganese	7439-96-5	12.7		393	J	TBSD0004	18	100	1.5 - 1.5	393	630	460	NC	630	N	Below screening benchmark.
Sediment	INORGANIC	Mercury	7439-97-6	0.27		0.27		TBSD0003	18	6	0.10 - 0.10	0.27	0.174	0.18	0.174	0.174	Y	Above screening benchmark.
Sediment	INORGANIC	Nickel	7440-02-0	1.5	J	13.5	J	LUSD0004	18	83	4.0 - 4.0	13.5	16	22.7	22.7	16	N	Below screening benchmark.
Sediment	INORGANIC	Potassium	7440-09-7	531		1250		TBSD0006	18	17	500 - 500	1250	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Selenium	7782-49-2	0.67	J	4.7	J	LUSD0004	18	100	3.5 - 3.5	4.7	NC	2	NC	2	Y	Above screening benchmark.
Sediment	INORGANIC	Silver	7440-22-4	0.27		0.56		LUSD0005	18	11	1.0 - 1.0	0.56	0.5	1	0.5	0.5	Y	Above screening benchmark.
Sediment	INORGANIC	Sodium	7440-23-5	28.7	J	270	J	LUSD0004	18	100	500 - 500	270	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Vanadium	7440-62-2	4.5		45.5	J	LUSD0004	18	100	5.0 - 5.0	45.5	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Zinc	7440-66-6	8.9		100	J	LUSD0004	18	100	6.0 - 6.0	100	120	121	121	120	N	Below screening benchmark.

Notes:
(1) The maximum detected sediment concentrations from the following three water bodies are used for the COPC screening: Trout Brook, Lamington River UNT and Tanners Brook UNT. Constituents with all non-detected concentrations are not shown.
(2) The COPC screening applies a hierarchy of criteria: NJDEP Ecological Screening Criteria Freshwater Sediment Lower Effects Level and then the minimum of the EPA Region 3 Sediment Ecological Benchmarks and EPA Region 5 RCRA Ecological Screening Levels.
The range of detection limits presented here are based on the hierarchy of applying the quantitation limit, followed by method detection limit and then reporting limit. As the quantitation limit accounts for sample-specific differences, it is typically greater than the method detection limit.

Abbreviations:
COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
ESC -- Ecological screening criteria
FW -- Freshwater
LEL -- Lower effects level
mg/kg -- Milligrams per kilogram
NC -- No criterion
NJDEP -- New Jersey Department of Environmental Protection
Qual -- Qualifier
RCRA -- Resource Conservation and Recovery Act
SVOC -- Semi-volatile organic compound
UNT -- Unnamed tributary
VOC -- Volatile organic compound
Y/N -- Yes or no

Qualifiers:
J -- Estimated concentration
NJ -- Tentative and estimated concentration

References:
NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2016. Ecological Soil Screening Levels. Various documents. Website Last Updated September 22. Available online: https://www.epa.gov/chemical-research/ecological-soil-screening-level
EPA Region III. 2006. Freshwater Sediment Screening Benchmarks. August. Available online: https://www.epa.gov/risk/freshwater-sediment-screening-benchmarks
EPA Region V. 2003. RCRA Ecological Screening Levels. August 22. Available online: https://archive.epa.gov/region5/waste/cars/web/html/esl.html

TABLE 1.6
OCCURRENCE, DISTRIBUTION, AND SELECTION OF ECOLOGICAL COPCS FOR SEDIMENT FROM EAST TROUT BROOK
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment from East Trout Brook

Exposure Point	Constituent Group	Constituent	CASRN	Minimum Detected Concentration (mg/kg)	Qual	Maximum Detected Concentration (mg/kg)	Qual	Location of Maximum Detected Concentration	Sample Count	Detection Frequency (%)	Range of Detection Limits	Concentration used for Screening (mg/kg) (1)	Individual Ecological Screening Benchmarks			Hierarchy	COPC Flag (Y/N)	Rationale for Selection or Deletion
													NJDEP ESC FW Sediment LEL (mg/kg)	EPA Region 3 Sediment Ecological Benchmarks (mg/kg)	EPA Region 5 RCRA Sediment Screening Levels (mg/kg)	Sediment Ecological Benchmark (mg/kg)		
Sediment	SVOC	Benzo(a)anthracene	56-55-3	0.092	J	0.092	J	ETSD0002	6	17	0.17 - 0.17	0.092	0.108	0.108	0.108	0.108	N	Below screening benchmark.
Sediment	SVOC	Benzo(a)pyrene	50-32-8	0.1	J	0.1	J	ETSD0002	6	17	0.17 - 0.17	0.1	0.15	0.15	0.15	0.15	N	Below screening benchmark.
Sediment	SVOC	Benzo(b)fluoranthene	205-99-2	0.093	J	0.093	J	ETSD0002	6	17	0.17 - 0.17	0.093	10.4	NC	10.4	10.4	N	Below screening benchmark.
Sediment	SVOC	Benzo(k)fluoranthene	207-08-9	0.11	J	0.11	J	ETSD0002	6	17	0.17 - 0.17	0.11	0.24	0.24	0.24	0.24	N	Below screening benchmark.
Sediment	SVOC	Bis(2-ethylhexyl) Phthalate	117-81-7	0.13	J	0.13	J	ETSD0004	6	17	0.17 - 0.17	0.13	0.182	0.18	0.182	0.182	N	Below screening benchmark.
Sediment	SVOC	Chrysene	218-01-9	0.12	J	0.12	J	ETSD0002	6	17	0.17 - 0.17	0.12	0.166	0.166	0.166	0.166	N	Below screening benchmark.
Sediment	SVOC	Fluoranthene	206-44-0	0.11	J	0.33		ETSD0002	6	33	0.17 - 0.17	0.33	0.423	0.423	0.423	0.423	N	Below screening benchmark.
Sediment	SVOC	Phenanthrene	85-01-8	0.13	J	0.13	J	ETSD0002	6	17	0.17 - 0.17	0.13	0.204	0.204	0.204	0.204	N	Below screening benchmark.
Sediment	SVOC	Pyrene	129-00-0	0.087	J	0.17	J	ETSD0002	6	33	0.17 - 0.17	0.17	0.195	0.195	0.195	0.195	N	Below screening benchmark.
Sediment	INORGANIC	Aluminum	7429-90-5	2920		14700		ETSD0006	6	100	20.0 - 20.0	14700	25500	NC	NC	25500	N	Below screening benchmark.
Sediment	INORGANIC	Arsenic	7440-38-2	2.5		8.3		ETSD0001	6	100	1.0 - 1.0	8.3	6	9.8	9.79	6	Y	Above screening benchmark.
Sediment	INORGANIC	Barium	7440-39-3	16.8		79.1		ETSD0006	6	100	20.0 - 20.0	79.1	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Beryllium	7440-41-7	0.36	J	1.4		ETSD0001	6	100	0.50 - 0.50	1.4	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Cadmium	7440-43-9	0.95		2.6		ETSD0001	6	83	0.50 - 0.50	2.6	0.6	0.99	0.99	0.6	Y	Above screening benchmark.
Sediment	INORGANIC	Calcium	7440-70-2	437		16000		ETSD0002	6	100	500 - 500	16000	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Chromium, Total	7440-47-3	4.5		18		ETSD0006	6	100	1.0 - 1.0	18	26	43.4	43.4	26	N	Below screening benchmark.
Sediment	INORGANIC	Cobalt	7440-48-4	3.2	J	12.3		ETSD0001	6	100	5.0 - 5.0	12.3	50	50	50	50	N	Below screening benchmark.
Sediment	INORGANIC	Copper	7440-50-8	2.3	J	12.8		ETSD0001	6	100	2.5 - 2.5	12.8	16	31.6	31.6	16	N	Below screening benchmark.
Sediment	INORGANIC	Iron	7439-89-6	7650		38600		ETSD0001	6	100	10.0 - 10.0	38600	NC	20000	NC	20000	Y	Above screening benchmark.
Sediment	INORGANIC	Lead	7439-92-1	5.4		16		ETSD0001	6	100	1.0 - 1.0	16	31	35.8	35.8	31	N	Below screening benchmark.
Sediment	INORGANIC	Magnesium	7439-95-4	423		8610		ETSD0002	6	100	500 - 500	8610	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Manganese	7439-96-5	104		1400		ETSD0001	6	100	1.5 - 1.5	1400	630	460	NC	630	Y	Above screening benchmark.
Sediment	INORGANIC	Nickel	7440-02-0	2.2	J	9		ETSD0001	6	100	4.0 - 4.0	9	16	22.7	22.7	16	N	Below screening benchmark.
Sediment	INORGANIC	Potassium	7440-09-7	429	J	429	J	ETSD0001	6	17	500 - 500	429	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Selenium	7782-49-2	1.3	J	4.9		ETSD0006	6	100	3.5 - 3.5	4.9	NC	2	NC	2	Y	Above screening benchmark.
Sediment	INORGANIC	Sodium	7440-23-5	60.3	J	264	J	ETSD0001	6	100	500 - 500	264	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Vanadium	7440-62-2	9.3		54.4		ETSD0006	6	100	5.0 - 5.0	54.4	NC	NC	NC	NC	Y	No screening benchmark.
Sediment	INORGANIC	Zinc	7440-66-6	18.8		57.9		ETSD0001	6	100	6.0 - 6.0	57.9	120	121	121	120	N	Below screening benchmark.

Notes:
(1) The maximum detected concentrations from East Trout Brook are used for the COPC screening of sediment downstream of the Leachate Treatment Plant permitted discharge. Constituents with all non-detected concentrations are not shown.
(2) The COPC screening applies a hierarchy of criteria: NJDEP Ecological Screening Criteria Freshwater Sediment Lower Effects Level and then the minimum of the EPA Region 3 Sediment Ecological Benchmarks and EPA Region 5 RCRA Ecological Screening Levels.
The range of detection limits presented here are based on the hierarchy of applying the quantitation limit, followed by method detection limit and then reporting limit. As the quantitation limit accounts for sample-specific differences, it is typically greater than the method detection limit.

Abbreviations:
COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
ESC -- Ecological screening criteria
FW -- Freshwater
LEL -- Lower effects level
mg/kg -- Milligrams per kilogram
NC -- No criterion
NJDEP -- New Jersey Department of Environmental Protection
Qual -- Qualifier
RCRA -- Resource Conservation and Recovery Act
SVOC -- Semi-volatile organic compound
Y/N -- Yes or no

Qualifiers:
J -- Estimated concentration

References:
NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2016. Ecological Soil Screening Levels. Various documents. Website Last Updated September 22. Available online: https://www.epa.gov/chemical-research/ecological-soil-screening-level
EPA Region III. 2006. Freshwater Sediment Screening Benchmarks. August. Available online: https://www.epa.gov/risk/freshwater-sediment-screening-benchmarks
EPA Region V. 2003. RCRA Ecological Screening Levels. August 22. Available online: https://archive.epa.gov/region5/waste/cars/web/html/esl.html

TABLE 1.7
SUMMARY OF ECOLOGICAL COPCS BASED ON EXCEEDANCES OF SCREENING BENCHMARKS
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

COPC Group	COPC	CASRN	**Surface Water** (Trout Brook, Lamington River UNT and Tanners Brook UNT)	**Surface Water** (East Trout Brook)	**Seeps/Springs**	**Sediment** (Trout Brook, Lamington River UNT and Tanners Brook UNT)	**Sediment** (East Trout Brook)
VOC	1,2,3-trichlorobenzene	87-61-6	Yes - NC	Yes - NC			
VOC	Acetone	67-64-1		Yes - NC			
VOC	Dichlorodifluoromethane	75-71-8		Yes - NC			
VOC	Diethyl Ether (Ethyl Ether)	60-29-7	Yes - NC	Yes - NC			
SVOC	2,3,4,6-tetrachlorophenol	58-90-2				Yes	
SVOC	Anthracene	120-12-7				Yes	
SVOC	Benzo(a)anthracene	56-55-3				Yes	
SVOC	Benzo(a)pyrene	50-32-8				Yes	
SVOC	Benzo(g,h,i)perylene	191-24-2				Yes	
SVOC	Benzo(k)fluoranthene	207-08-9				Yes	
SVOC	Benzyl Butyl Phthalate	85-68-7				Yes	
SVOC	Chrysene	218-01-9				Yes	
SVOC	Dibenz(a,h)anthracene	53-70-3				Yes	
SVOC	Fluoranthene	206-44-0				Yes	
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5				Yes	
SVOC	Phenanthrene	85-01-8				Yes	
SVOC	Pyrene	129-00-0				Yes	
PESTICIDE	4,4'-DDD	72-54-8			Yes - NC		
PESTICIDE	Chlordane, alpha	5103-71-9		Yes - NC			
INORGANIC	Aluminum	7429-90-5	Yes	Yes - NC	Yes		
INORGANIC	Arsenic	7440-38-2				Yes	Yes
INORGANIC	Barium	7440-39-3				Yes - NC	Yes - NC
INORGANIC	Beryllium	7440-41-7				Yes - NC	Yes - NC
INORGANIC	Cadmium	7440-43-9	Yes - NC		Yes - NC	Yes	Yes
INORGANIC	Copper	7440-50-8	Yes			Yes	
INORGANIC	Iron	7439-89-6	Yes		Yes		Yes
INORGANIC	Lead	7439-92-1	Yes	Yes		Yes	
INORGANIC	Manganese	7439-96-5	Yes - NC	Yes - NC	Yes - NC		Yes
INORGANIC	Mercury	7439-97-6				Yes	
INORGANIC	Selenium	7782-49-2				Yes	Yes
INORGANIC	Silver	7440-22-4		Yes		Yes	
INORGANIC	Vanadium	7440-62-2			Yes	Yes - NC	Yes - NC
INORGANIC	Calcium	7440-70-2	Yes - NC	Yes - NC	Yes - NC	Yes - NC	Yes - NC
INORGANIC	Magnesium	7439-95-4	Yes - NC	Yes - NC	Yes - NC	Yes - NC	Yes - NC
INORGANIC	Potassium	7440-09-7	Yes - NC	Yes - NC	Yes - NC	Yes - NC	Yes - NC
INORGANIC	Sodium	7440-23-5	Yes - NC	Yes - NC	Yes - NC	Yes - NC	Yes - NC
		Total COPCs:	**12**	**13**	**10**	**27**	**12**

Note:
Constituents that became a COPC because no screening benchmark was available are flagged with "NC".

Abbreviations:
NC -- No criterion
SVOC -- Semi-volatile organic compound
VOC -- Volatile organic compound

TABLE 2.1

WILDLIFE EXPOSURE FACTORS

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

Receptor				Exposure Factors								
Habitat Type	Receptor Group	Representative Species Common Name	Representative Species Scientific Name	Foraging Home Range (ha) (1)		Area Use Factor (AUF)	Body weight (kg) (2)		Ingestion Rates (IR)			
				Value	Basis		Value	Basis	Daily Food Ingestion Rate (kg dw/day) (3)	Percent Sediment in Food (4)	Incidental Sediment Ingestion Rate (kg dw/day) (4)	Water Ingestion Rate (L/day) (5)
Aquatic	Herbivore Avian	Mallard	*Anas platyrhynchos*	435	Average of all adult means; range of means is 111 - 620 ha	1	1.134	Average of adult means located throughout North America; 1,225 and 1,043 g	0.0769	3%	0.00254	0.0642
Aquatic	Herbivore Mammal	Muskrat	*Ondatra zibethicus*	0.134	Average of all adult means; range of means is 0.048 - 0.17	1	1.415	Average of all adult means in New York; 1,350 and 1,480 g	0.0818	2%	0.00196	0.135
Aquatic	Invertivore Avian	Spotted Sandpiper	*Acitis macularia*	0.25	Mean identified in source	1	0.043	Average of all adult means; 47.1 and 37.9 g	0.00759	10%	0.000759	0.00711
Aquatic	Invertivore Mammal	Raccoon	*Procyon lotor*	630	Average of all adult means; range of means is 39 - 2,560 ha	1	5.783	Average of all adult means; range of means is 3.67 - 7.6 kg	0.154	9%	0.0144	0.480
Aquatic	Piscivore Avian	Great Blue Heron	*Ardea herodias*	4.5	Average of all adult means; range is 0.6 - 8.4 ha	1	2.229	Adult mean located in eastern North America; 2,229 g	0.141	2%	0.00282	0.101
Aquatic	Piscivore Mammal	Mink	*Mustela vison*	770	Adult average located in North Dakota prairie; 770 ha	1	1.4	Upper range for adult for eastern races; < 1,400 g	0.0644	2%	0.00129	0.134

Notes:

(1) The foraging home range values are chosen based on locality or most similar region to the Site; otherwise, the average of available adult means is calculated (EPA 1993).

(2) Body weights are chosen based on locality or most similar region to the Site; otherwise, the average of available adult means is calculated (EPA 1993).

(3) Estimated daily food ingestion rate in units of kg dry weight/day are obtained from Nagy (2001):

Insectivorous birds: [0.540*(Body Weight)^0.705] for mallard and spotted sandpiper;

Carnivorous birds: [0.849*(Body Weight)^0.663] for heron;

Omnivorous mammals: [0.432*(Body Weight)^0.678] for raccoon;

Herbivorous mammals: [0.859*(Body Weight)^0.628] for muskrat; and

Carnivorous mammals: [0.153*(Body Weight)^0.834] for mink.

(4) Percent sediment in food is based on percent soil in food. The muskrat's percent sediment of 2.4% is based on the meadow vole, which is also a herbivore mammal. The sediment/soil incidental ingestion percent for a mink and heron is negligible at 2%, which is the method detection limit. The spotted sandpiper's percent sediment is 10% for values used in EPA Region 2. (Beyer 1994, Sample 1994)

(5) Water ingestion rate in units of L/day are obtained from EPA (1993):

All birds: 0.059*(Body Weight)^0.67; and

All mammals: 0.099*(Body Weight)^0.90.

Abbreviations:

AUF -- Area use factor - assumed conservatively to be 1

EPA -- Environmental Protection Agency

ha-- Hectare

IR -- Ingestion rate

kg -- Kilogram

L -- Liter

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TABLE 2.2
WILDLIFE BIOACCUMULATION MODELS
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

COPC Group	COPC	CASRN	Bioaccumulative?		Log Kow		Sediment to Invertebrates		Sediment to Aquatic Plants		Surface Water to Fish BCF (L/kg)	
			Value	Reference	Value	Reference	Equation	Reference	Equation	Reference	Value	Reference
VOC	1,2,3-trichlorobenzene	87-61-6	NA	--	4.05	EPA 2016	Ct = Cs * 10^(0.819*log(Kow) - 1.146)	EPA 1999, Section C-1.1	Ct = Cs * 10^(1.588 - 0.578*log(Kow))	EPA 1999, Section C-1.2	Ct = 665 * Cs	USDOE 2016
VOC	Acetone	67-64-1	NA	--	-0.24	EPA 2016	Ct = Cs * 10^(0.819*log(Kow) - 1.146)	EPA 1999, Section C-1.1	Ct = Cs * 10^(1.588 - 0.578*log(Kow))	EPA 1999, Section C-1.2	Ct = 3.16 * Cs	USDOE 2016
VOC	Dichlorodifluoromethane	75-71-8	NA	--	2.16	EPA 2017b	Ct = Cs * 10^(0.819*log(Kow) - 1.146)	EPA 1999, Section C-1.1	Ct = Cs * 10^(1.588 - 0.578*log(Kow))	EPA 1999, Section C-1.2	Ct = 6.15 * Cs	DOE 2018
VOC	Diethyl Ether (Ethyl Ether)	60-29-7	NA	--	0.89	EPA 2017b	Ct = Cs * 10^(0.819*log(Kow) - 1.146)	EPA 1999, Section C-1.1	Ct = Cs * 10^(1.588 - 0.578*log(Kow))	EPA 1999, Section C-1.2	Ct = 5.4 * Cs	DOE 2018
SVOC	2,3,4,6-tetrachlorophenol	58-90-2	NA	--	4.45	EPA 2017b	Ct = Cs * 10^(0.819*log(Kow) - 1.146)	EPA 1999, Section C-1.1	Ct = Cs * 10^(1.588 - 0.578*log(Kow))	EPA 1999, Section C-1.2	Ct = 200 * Cs	DOE 2018
SVOC	Anthracene	120-12-7	Yes	EPA 2000	4.45	EPA 2017b	Ct = 2.42 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = e ^ (0.7784 * ln(Cs) - 0.9887)	EPA 2007, Attach 4-1, Table 4b	Ct = 30 * Cs	EPA 2002
SVOC	Benzo(a)anthracene	56-55-3	Yes	EPA 2000	5.76	EPA 2017b	Ct = 1.59 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = e ^ (0.5944 * ln(Cs) - 2.7078)	EPA 2007, Attach 4-1, Table 4b	Ct = 30 * Cs	EPA 2002
SVOC	Benzo(a)pyrene	50-32-8	Yes	EPA 2000	6.13	EPA 2017b	Ct = 1.33 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = e ^ (0.9750 * ln(Cs) - 2.0615)	EPA 2007, Attach 4-1, Table 4b	Ct = 30 * Cs	EPA 2002
SVOC	Benzo(g,h,i)perylene	191-24-2	Yes	EPA 2000	6.7	EPA 2007, Table 5	Ct = 2.94 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = e ^ (1.1829 * ln(Cs) - 0.9313)	EPA 2007, Attach 4-1, Table 4b	Ct = 30 * Cs	EPA 2002
SVOC	Benzo(k)fluoranthene	207-08-9	Yes	EPA 2000	6.11	EPA 2017b	Ct = 2.60 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = e ^ (0.8595 * ln(Cs) - 2.1579)	EPA 2007, Attach 4-1, Table 4b	Ct = 30 * Cs	EPA 2002
SVOC	Benzyl Butyl Phthalate	85-68-7	NA	--	4.73	EPA 2017b	Ct = Cs * 10^(0.819*log(Kow) - 1.146)	EPA 1999, Section C-1.1	Ct = Cs * 10^(1.588 - 0.578*log(Kow))	EPA 1999, Section C-1.2	Ct = 414 * Cs	EPA 2002
SVOC	Chrysene	218-01-9	Yes	EPA 2000	5.81	EPA 2017b	Ct = 2.29 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = e ^ (0.5944 * ln(Cs) - 2.7078)	EPA 2007, Attach 4-1, Table 4b	Ct = 30 * Cs	EPA 2002
SVOC	Dibenz(a,h)anthracene	53-70-3	Yes	EPA 2000	6.75	EPA 2017b	Ct = 2.31 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = 0.13 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = 30 * Cs	EPA 2002
SVOC	Fluoranthene	206-44-0	Yes	EPA 2000	5.16	EPA 2017b	Ct = 3.04 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = 0.50 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = 1150 * Cs	EPA 2002
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5	Yes	EPA 2000	6.7	EPA 2017b	Ct = 2.86 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = 0.11 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = 30 * Cs	EPA 2002
SVOC	Phenanthrene	85-01-8	Yes	EPA 2000	4.55	EPA 2007, Table 5	Ct = 1.72 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = e ^ (0.6203 * ln(Cs) - 0.1665)	EPA 2007, Attach 4-1, Table 4b	Ct = 2510 * Cs	DOE 2018
SVOC	Pyrene	129-00-0	Yes	EPA 2000	4.88	EPA 2017b	Ct = 1.75 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = 0.72 * Cs	EPA 2007, Attach 4-1, Table 4b	Ct = 30 * Cs	EPA 2002
PEST	Chlordane, alpha	5103-71-9	Yes	EPA 2000	6.26	EPA 2017b, chlordane total	Ct = Cs * 10^(0.819*log(Kow) - 1.146)	EPA 1999, Section C-1.1	Ct = Cs * 10^(1.588 - 0.578*log(Kow))	EPA 1999, Section C-1.2	Ct = 14100 * Cs	EPA 2002, chlordane total
INORG	Aluminum	7429-90-5	NA	--	NA	--	Ct = 5.391 * Cs	EPA 1999, Table C-6, converted wet weight of 0.9 to dry weight by multiplying by 5.99 conversion factor identified at end of table.	Ct = 0.004 * Cs	EPA 1999, Table C-2 dry weight	Ct = 500 * Cs	DOE 2018
INORG	Arsenic	7440-38-2	Yes	EPA 2000	NA	--	log (Ct) = -0.292 + 0.754(LogCs)	Bechtel 1998, Table 3	Ct = 0.03752 * Cs	EPA 2007, Attach 4-1, Table 4a	Ct = 44 * Cs	EPA 2002
INORG	Barium	7440-39-3	NA	--	NA	--	Ct = 0.091 * Cs	EPA 2007, Attach 4-1, Table 4a	Ct = 0.156 * Cs	EPA 2007, Attach 4-1, Table 4a	Ct = 4 * Cs	DOE 2018
INORG	Beryllium	7440-41-7	NA	--	NA	--	Ct = 0.045 * Cs	EPA 2007, Attach 4-1, Table 4a	Ct = e ^ (0.7345 * ln(Cs) - 0.5361)	EPA 2007, Attach 4-1, Table 4a	Ct = 19 * Cs	EPA 2002
INORG	Cadmium	7440-43-9	Yes	EPA 2000	NA	--	log (Ct) = 0.0395 + 0.692(LogCs)	Bechtel 1998, Table 3	Ct = e ^ (0.546 * ln(Cs) - 0.475)	EPA 2007, Attach 4-1, Table 4a	Ct = 200 * Cs	DOE 2018
INORG	Copper	7440-50-8	Yes	EPA 2000	NA	--	log (Ct) = 1.089 + 0.278(LogCs)	Bechtel 1998, Table 3	Ct = e ^ (0.394 * ln(Cs) + 0.668)	EPA 2007, Attach 4-1, Table 4a	Ct = 36 * Cs	EPA 2002
INORG	Iron	7439-89-6	NA	--	NA	--	Ct = Cs	USDOE 2012, Section P.7.4, default to sediment concentration	Ct = Cs	None available, default to sediment concentration	Ct = 200 * Cs	DOE 2018
INORG	Lead	7439-92-1	Yes	EPA 2000	NA	--	log (Ct) = -0.776 + 0.801(LogCs)	Bechtel 1998, Table 3	Ct = e ^ (0.561 * ln(Cs) - 1.328)	EPA 2007, Attach 4-1, Table 4a	Ct = 300 * Cs	DOE 2018
INORG	Manganese	7439-96-5	NA	--	NA	--	ln (Ct) = 0.682 * ln(Cs) - 0.809	EPA 2007, Attach 4-1, Table 4a	Ct = 0.079 * Cs	EPA 2007, Attach 4-1, Table 4a	Ct = 400 * Cs	DOE 2018
INORG	Mercury	7439-97-6	Yes	EPA 2017a	0.62	EPA 2017b	log (Ct) = -0.67 + 0.327(LogCs)	Bechtel 1998, Table 3	Ct = 0.137 * Cs	EPA 1999, Table C-2 dry weight for methyl mercury	Ct = 5,500 * Cs	EPA 2002, 5,500 for freshwater in basis document
INORG	Selenium	7782-49-2	Yes	EPA 2000	NA	--	ln (Ct) = 0.733 * ln(Cs) - 0.075	EPA 2007, Attach 4-1, Table 4a	Ct = e ^ (1.104 * ln(Cs) - 0.677)	EPA 2007, Attach 4-1, Table 4a	Ct = 4.8 * Cs	EPA 2002
INORG	Silver	7440-22-4	Yes	EPA 2000	NA	--	Ct = 2.045 * Cs	EPA 2007, Attach 4-1, Table 4a	Ct = 0.014 * Cs	EPA 2007, Attach 4-1, Table 4a	Ct = 0.5 * Cs	EPA 2002
INORG	Vanadium	7440-62-2	NA	--	NA	--	Ct = 0.042 * Cs	EPA 2007, Attach 4-1, Table 4a	Ct = 0.00485 * Cs	EPA 2007, Attach 4-1, Table 4a	Ct = 0.01 * Cs	DOE 2012, Section P.7.4
INORG	Calcium	7440-70-2	NA	--	NA	--	Ct = Cs	USDOE 2012, Section P.7.4, default to sediment concentration	Ct = 0.35 * Cs	Baes 1994, Table 2.2 reproductive factor	Ct = Cs	USDOE 2012, Section P.7.4, default to surface water concentration
INORG	Magnesium	7439-95-4	NA	--	NA	--	Ct = Cs	USDOE 2012, Section P.7.4, default to sediment concentration	Ct = 0.55 * Cs	Baes 1994, Table 2.2 reproductive factor	Ct = Cs	USDOE 2012, Section P.7.4, default to surface water concentration
INORG	Potassium	7440-09-7	NA	--	NA	--	Ct = Cs	USDOE 2012, Section P.7.4, default to sediment concentration	Ct = 0.55 * Cs	Baes 1994, Table 2.2 reproductive factor	Ct = Cs	USDOE 2012, Section P.7.4, default to surface water concentration
INORG	Sodium	7440-23-5	NA	--	NA	--	Ct = Cs	USDOE 2012, Section P.7.4, default to sediment concentration	Ct = 0.055 * Cs	Baes 1994, Table 2.2 reproductive factor	Ct = Cs	USDOE 2012, Section P.7.4, default to surface water concentration

Hierarchies applied:
Bioaccumulative: EPA 2000, then EPA 2017a
Octanol-water partition coefficients (LogKow): EPA 2017b, then EPA 2007.
Sediment to invertebrates models: Bechtel 1998, next EPA 2007 and then EPA 1999.
Sediment to aquatic plants models: EPA 2007, then EPA 1999.
Surface water to fish bioconcentration factors (BCF): EPA 2002, next DOE 2016, DOE 2012.

Abbreviations:
BCF -- Bioconcentration factor
COPC -- Constituent of potential concern
Cs -- Concentration in sediment or surface water
Ct -- Concentration in tissue

References:
When no bioaccumulation equation or BAF is available, tissue concentration was assumed to be equivalent to the media concentration and a value of one was input.

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TABLE 2.3
WILDLIFE TOXICITY REFERENCE VALUES
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

COPC Group	COPC	CASRN	Avian				Mammalian			
			NOAEL (mg/kg-d)	LOAEL (mg/kg-d)	Basis	Ref	NOAEL (mg/kg-d)	LOAEL (mg/kg-d)	Basis	Ref
VOC	1,2,3-trichlorobenzene	87-61-6	NA	NA	NA	NA	NA	NA	NA	NA
VOC	Acetone	67-64-1	201	2010	NOAEL recommended by source, Tier 3 chronic critical study, Japanese quail, water/sediment model. LOAEL from same study as that of NOAEL.	2	10	50	NOAEL recommended by source, Tier 4 chronic critical study, rat, water/sediment model. LOAEL from same study as that of NOAEL.	2
VOC	Dichlorodifluoromethane	75-71-8	NA	NA	NA	NA	NA	NA	2 identifies 2310 NOAEL for exposure to air, but does not identify any TRVs for water or sediment.	2
VOC	Diethyl Ether (Ethyl Ether)	60-29-7	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	2,3,4,6-tetrachlorophenol	58-90-2	NA	NA	NA	NA	NA	NA	NA	NA
SVOC	Anthracene	120-12-7	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs.	1	65.6	328	NOAEL for low molecular weight PAHs recommended by source, from Verschuuren et al. 1976. LOAEL from same study as that of the NOAEL.	1
SVOC	Benzo(a)anthracene	56-55-3	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs.	1	0.615	3.07	NOAEL for high molecular weight PAHs recommended by source, from Culp et al. 1998. LOAEL from same study as that of the NOAEL.	1
SVOC	Benzo(a)pyrene	50-32-8	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs. Reference #2 does not identify any TRVs for avians.	1	0.615	3.07	NOAEL for high molecular weight PAHs recommended by source, from Culp et al. 1998. LOAEL from same study as that of the NOAEL.	1
SVOC	Benzo(g,h,i)perylene	191-24-2	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs.	1	0.615	3.07	NOAEL for high molecular weight PAHs recommended by source, from Culp et al. 1998. LOAEL from same study as that of the NOAEL.	1
SVOC	Benzo(k)fluoranthene	207-08-9	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs.	1	0.615	3.07	NOAEL for high molecular weight PAHs recommended by source, from Culp et al. 1998. LOAEL from same study as that of the NOAEL.	1
SVOC	Benzyl Butyl Phthalate	85-68-7	NA	NA	Reference #2 does not identify any TRVs for avians.	2	159	1590	NOAEL recommended by source, Tier 4 chronic, rat, water/sediment model. LOAEL from same study as that of NOAEL.	2
SVOC	Chrysene	218-01-9	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs.	1	0.615	3.07	NOAEL for high molecular weight PAHs recommended by source, from Culp et al. 1998. LOAEL from same study as that of the NOAEL.	1
SVOC	Dibenz(a,h)anthracene	53-70-3	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs.	1	0.615	3.07	NOAEL for high molecular weight PAHs recommended by source, from Culp et al. 1998. LOAEL from same study as that of the NOAEL.	1
SVOC	Fluoranthene	206-44-0	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs.	1	65.6	328	NOAEL for low molecular weight PAHs recommended by source, from Verschuuren et al. 1976. LOAEL from same study as that of the NOAEL.	1
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs.	1	0.615	3.07	NOAEL for high molecular weight PAHs recommended by source, from Culp et al. 1998. LOAEL from same study as that of the NOAEL.	1
SVOC	Phenanthrene	85-01-8	NA	NA	Eco-SSL does not identify TRVs; insufficient data for total PAHs.	1	65.6	328	NOAEL for low molecular weight PAHs recommended by source, from Verschuuren et al. 1976. LOAEL from same study as that of the NOAEL.	1
SVOC	Pyrene	129-00-0	20.5	205	NOAEL recommended by source, Tier 4 chronic critical study, bobwhite quail, sediment model. LOAEL from same study as that of NOAEL.	2	0.615	3.07	NOAEL for high molecular weight PAHs recommended by source, from Culp et al. 1998. LOAEL from same study as that of the NOAEL.	1
PEST	Chlordane, alpha	5103-71-9	2.14	10.7	NOAEL recommended by source, Tier 4 chronic, red-winged blackbird, water/sediment model. LOAEL from same study as that of NOAEL.	2	1.18	11.8	NOAEL recommended by source, Tier 4 chronic, rat, water/sediment model. LOAEL from same study as that of NOAEL.	2
INORG	Aluminum	7429-90-5	110	1100	NOAEL recommended by source, Tier 4 chronic, water model.	2	1.93	19.3	NOAEL recommended by source, Tier 4 chronic, water model.	2
INORG	Arsenic	7440-38-2	2.24	3.55	NOAEL recommended by source, from Holcman and Stibilj 1997. LOAEL from Howell and Hill 1978, lowest LOAEL above NOAEL and has similar study design to that of NOAEL.	1	1.04	1.66	NOAEL recommended by source, from Neiger and Osweiler 1989. LOAEL from same study as that of the NOAEL.	1
INORG	Barium	7440-39-3	73.5	131	NOAEL recommended by source, Tier 2 chronic geometric mean, bird, sediment model. LOAEL from same study as that of NOAEL.	2	51.8	121	NOAEL recommended by source, geometric mean of NOAELs for REP/GRO. LOAEL is lowest LOAEL above NOAEL for REP/GRO, not gavage exposure route, from Dietz et al.1992.	1

TABLE 2.3
WILDLIFE TOXICITY REFERENCE VALUES
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

COPC Group	COPC	CASRN	Avian				Mammalian			
			NOAEL (mg/kg-d)	LOAEL (mg/kg-d)	Basis	Ref	NOAEL (mg/kg-d)	LOAEL (mg/kg-d)	Basis	Ref
INORG	Beryllium	7440-41-7	NA	NA	Eco-SSL does not identify TRVs; insufficient data.	1	0.532	0.63	NOAEL recommended by source, from Schroeder and Mitchener 1975. LOAEL is lowest LOAEL above NOAEL for REP/GRO/SUR, from Schroeder and Mitchener 1975.	1
INORG	Cadmium	7440-43-9	1.47	2.37	NOAEL recommended by source, geometric mean of NOAELs for REP/GRO. LOAEL is lowest LOAEL above NOAEL for REP/GRO, from Leach *et al.* 1978.	1	0.77	7.7	NOAEL recommended by source, from Yuhas et al. 1979. LOAEL from same study as that of the NOAEL.	1
INORG	Copper	7440-50-8	4.05	12.1	NOAEL recommended by source, from Ankari et al. 1998. LOAEL from same study as that of the NOAEL.	1	5.60	9.34	NOAEL recommended by source, from Allcroft et al. 1961. LOAEL from same study as that of the NOAEL.	1
INORG	Iron	7439-89-6	NA	NA	Eco-SSL does not identify TRVs. Iron toxicity is dependent on pH, Eh andsoil-water conditions.	1	NA	NA	Eco-SSL does not identify TRVs. Iron toxicity is dependent on pH, Eh andsoil-water conditions. '2 does not identify any TRVs for mammals.	1
INORG	Lead	7439-92-1	1.63	3.26	NOAEL recommended by source, from Edens and Garlich1983. LOAEL from same study as that of the NOAEL.	1	4.70	8.9	NOAEL recommended by source, from Kimmel et al. 1980. LOAEL from same study as that of the NOAEL.	1
INORG	Manganese	7439-96-5	179	348	NOAEL recommended by source, geometric mean of NOAELs for REP/GRO. LOAEL is lowest LOAEL above NOAEL for REP/GRO, from Southern and Baker 1983.	1	51.5	65	NOAEL recommended by source, geometric mean of NOAELs for REP/GRO. LOAEL is lowest LOAEL above NOAEL for REP/GRO, from Cunningham et al. 1966.	1
INORG	Mercury	7439-97-6	0.019	0.19	NOAEL recommended by source, Tier 3 chronic critical study, Japanese quail, water model. LOAEL from same study as that of NOAEL.	2	1.41	14.1	NOAEL recommended by source, Tier 3 chronic critical study, mink, water/sediment model. LOAEL from same study as that of NOAEL.	2
INORG	Selenium	7782-49-2	0.29	0.579	NOAEL recommended by source, from El-Begearmi and Combs 1982. LOAEL from same study as that of the NOAEL.	1	0.143	0.215	NOAEL recommended by source, from Mahan and Moxon 1984. LOAEL from same study as that of the NOAEL.	1
INORG	Silver	7440-22-4	2.02	20.2	NOAEL recommended by source, lowest LOAEL for REP/GRO as surrogate divided by 10, from Jensen et al. 1974. LOAEL from same study.	1	6.02	60.2	NOAEL recommended by source, lowest LOAEL for REP/GRO as surrogate divided by 10, from Van Vleet 1976. LOAEL from same study.	1
INORG	Vanadium	7440-62-2	0.344	0.688	NOAEL recommended by source, from Hill 1979. LOAEL from same study as that of the NOAEL.	1	4.16	8.31	NOAEL recommended by source, from SaNAhez et al. 1991. LOAEL from same study as that of the NOAEL.	1
INORG	Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA
INORG	Magnesium	7439-95-4	NA	NA	NA	NA	NA	NA	NA	NA
INORG	Potassium	7440-09-7	NA	NA	NA	NA	NA	NA	NA	NA
INORG	Sodium	7440-23-5	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
Toxicity reference values (TRVs) are chosen based on a hierarchy from the following sources: EPA 2010, next DOE 2015, next Sample 1996 and then EPA IRIS.
When EPA Eco-SSL documents did not identify a LOAEL with the recommended NOAEL, a LOAEL was chosen that was the lowest value above the NOAEL for reproductive, growth or survival effects in which the study design was chronic (> 2 weeks) and exposure routes not gavage-related in accordance with EPA guidance.

TRVs for polycyclic aromatic hydrocarbons (PAHs) were applied based on the type of PAH, which is based on the number of aromatic rings in the compound. Low molecular weight PAHs have less than four aromatic rings while high molecular weight PAHs have four or more.

Abbreviations:
-- Not enough data for NOAEL or LOAEL derivation
COPC -- Constituent of potential concern
DOE -- Department of Energy
Eco SSL -- USEPA Ecological Soil Screening Level
EPA -- United States Environmental Protection Agency
GRO -- Growth
IRIS -- Integrated Risk Information System
LANL -- Los Alamos National Laboratory
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
NA -- Not available
NOAEL -- No observed adverse effect level
ORNL -- Oak Ridge National Laboratory
PAH -- Polycyclic aromatic hydrocarbon
REP -- Reproduction
SUR -- Survival
SVOC -- Semi-volatile organic compound
TRV -- Toxicity reference value
VOC -- Volatile organic compound

References:
(1) EPA. 2016. Ecological Soil Screening Levels. Various documents. Website Last Updated September 22.
(2) DOE. 2015. ECORISK Database (Release 3.3). LANL (Los Alamos National Laboratory). LA-UR-15-27397. Los Alamos, NM. October.
(3) Sample et al. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. DOE Oak Ridge National Laboratory (ORNL). ES/ER/TM-86/R3. June.
(4) EPA. 2017. Integrated Risk Information System (IRIS). Last Updated January 3.

TABLE 3.1
RISK ESTIMATES FOR THE MALLARD (AVIAN HERBIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN TROUT BROOK, LAMINGTON RIVER UNT, TANNERS BROOK UNT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: Trout Brook, Lamington River UNT, Tanners Brook UNT

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Aquatic Plant Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Aquatic Plant Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		4.10E-04			2.3E-05		2.3E-05	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1								2.0E+02	No Dose	2.0E+03	No Dose
VOC	Dichlorodifluoromethane	75-71-8								NA	No Dose	NA	No Dose
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		4.00E-03			2.3E-04		2.3E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2	7.70E-01		7.99E-02	1.7E-03		5.4E-03	7.1E-03	NA	No TRV	NA	No TRV
SVOC	Anthracene	120-12-7	3.00E-01		1.46E-01	6.7E-04		9.9E-03	1.1E-02	NA	No TRV	NA	No TRV
SVOC	Benzo(a)anthracene	56-55-3	1.20E+00		7.43E-02	2.7E-03		5.0E-03	7.7E-03	NA	No TRV	NA	No TRV
SVOC	Benzo(a)pyrene	50-32-8	6.70E-01		8.61E-02	1.5E-03		5.8E-03	7.3E-03	NA	No TRV	NA	No TRV
SVOC	Benzo(g,h,i)perylene	191-24-2	3.20E-01		1.02E-01	7.2E-04		6.9E-03	7.7E-03	NA	No TRV	NA	No TRV
SVOC	Benzo(k)fluoranthene	207-08-9	7.30E-01		8.82E-02	1.6E-03		6.0E-03	7.6E-03	NA	No TRV	NA	No TRV
SVOC	Benzyl Butyl Phthalate	85-68-7	6.90E+00		4.93E-01	1.5E-02		3.3E-02	4.9E-02	NA	No TRV	NA	No TRV
SVOC	Chrysene	218-01-9	1.30E+00		7.79E-02	2.9E-03		5.3E-03	8.2E-03	NA	No TRV	NA	No TRV
SVOC	Dibenz(a,h)anthracene	53-70-3	1.50E-01		1.95E-02	3.4E-04		1.3E-03	1.7E-03	NA	No TRV	NA	No TRV
SVOC	Fluoranthene	206-44-0	3.40E+00		1.70E+00	7.6E-03		1.2E-01	1.2E-01	NA	No TRV	NA	No TRV
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5	3.40E-01		3.74E-02	7.6E-04		2.5E-03	3.3E-03	NA	No TRV	NA	No TRV
SVOC	Phenanthrene	85-01-8	8.80E-01		7.82E-01	2.0E-03		5.3E-02	5.5E-02	NA	No TRV	NA	No TRV
SVOC	Pyrene	129-00-0	1.70E+00		1.22E+00	3.8E-03		8.3E-02	8.7E-02	2.1E+01	4.2E-03	2.1E+02	4.2E-04
PEST	Chlordane, alpha	5103-71-9								2.1E+00	No Dose	1.1E+01	No Dose
INORG	Aluminum	7429-90-5		2.10E+00			1.2E-01		1.2E-01	1.1E+02	1.1E-03	1.1E+03	1.1E-04
INORG	Arsenic	7440-38-2	2.00E+01		7.50E-01	4.5E-02		5.1E-02	9.6E-02	2.2E+00	4.3E-02	3.6E+00	2.7E-02
INORG	Barium	7440-39-3	1.18E+02		1.84E+01	2.6E-01		1.2E+00	1.5E+00	7.4E+01	2.1E-02	1.3E+02	1.2E-02
INORG	Beryllium	7440-41-7	1.10E+00		6.27E-01	2.5E-03		4.3E-02	4.5E-02	NA	No TRV	NA	No TRV
INORG	Cadmium	7440-43-9	1.50E+00	2.80E-04	7.76E-01	3.4E-03	1.6E-05	5.3E-02	5.6E-02	1.5E+00	3.8E-02	2.4E+00	2.4E-02
INORG	Copper	7440-50-8	2.82E+01	8.00E-03	7.27E+00	6.3E-02	4.5E-04	4.9E-01	5.6E-01	4.1E+00	1.4E-01	1.2E+01	4.6E-02
INORG	Iron	7439-89-6		5.41E+00			3.1E-01		3.1E-01	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1	7.14E+01	2.66E-02	2.91E+00	1.6E-01	1.5E-03	2.0E-01	3.6E-01	1.6E+00	2.2E-01	3.3E+00	1.1E-01
INORG	Manganese	7439-96-5		3.81E-01			2.2E-02		2.2E-02	1.8E+02	1.2E-04	3.5E+02	6.2E-05
INORG	Mercury	7439-97-6	2.70E-01		3.70E-02	6.0E-04		2.5E-03	3.1E-03	1.9E-02	1.6E-01	1.9E-01	1.6E-02
INORG	Selenium	7782-49-2	4.70E+00		2.81E+00	1.1E-02		1.9E-01	2.0E-01	2.9E-01	6.9E-01	5.8E-01	3.5E-01
INORG	Silver	7440-22-4	5.60E-01		7.84E-03	1.3E-03		5.3E-04	1.8E-03	2.0E+00	8.8E-04	2.0E+01	8.8E-05
INORG	Vanadium	7440-62-2	4.55E+01		2.21E-01	1.0E-01		1.5E-02	1.2E-01	3.4E-01	3.4E-01	6.9E-01	1.7E-01
INORG	Calcium	7440-70-2	4.48E+03	2.41E+01	1.57E+03	1.0E+01	1.4E+00	1.1E+02	1.2E+02	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	3.88E+03	7.04E+00	2.13E+03	8.7E+00	4.0E-01	1.4E+02	1.5E+02	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	1.25E+03	1.02E+00	6.88E+02	2.8E+00	5.8E-02	4.7E+01	4.9E+01	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.70E+02	1.83E+01	1.49E+01	6.0E-01	1.0E+00	1.0E+00	2.6E+00	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from three of the four water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT).
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 3.2
RISK ESTIMATES FOR THE MUSKRAT (MAMMALIAN HERBIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN TROUT BROOK, LAMINGTON RIVER UNT, TANNERS BROOK UNT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: Trout Brook, Lamington River UNT, Tanners Brook UNT

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Aquatic Plant Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Aquatic Plant Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		4.10E-04			3.9E-05		3.9E-05	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1								1.0E+01	No Dose	5.0E+01	No Dose
VOC	Dichlorodifluoromethane	75-71-8								NA	No Dose	NA	No Dose
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		4.00E-03			3.8E-04		3.8E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2	7.70E-01		7.99E-02	1.1E-03		4.6E-03	5.7E-03	NA	No TRV	NA	No TRV
SVOC	Anthracene	120-12-7	3.00E-01		1.46E-01	4.2E-04		8.4E-03	8.8E-03	6.6E+01	1.3E-04	3.3E+02	2.7E-05
SVOC	Benzo(a)anthracene	56-55-3	1.20E+00		7.43E-02	1.7E-03		4.3E-03	6.0E-03	6.2E-01	9.7E-03	3.1E+00	1.9E-03
SVOC	Benzo(a)pyrene	50-32-8	6.70E-01		8.61E-02	9.3E-04		5.0E-03	5.9E-03	6.2E-01	9.6E-03	3.1E+00	1.9E-03
SVOC	Benzo(g,h,i)perylene	191-24-2	3.20E-01		1.02E-01	4.4E-04		5.9E-03	6.4E-03	6.2E-01	1.0E-02	3.1E+00	2.1E-03
SVOC	Benzo(k)fluoranthene	207-08-9	7.30E-01		8.82E-02	1.0E-03		5.1E-03	6.1E-03	6.2E-01	9.9E-03	3.1E+00	2.0E-03
SVOC	Benzyl Butyl Phthalate	85-68-7	6.90E+00		4.93E-01	9.6E-03		2.8E-02	3.8E-02	1.6E+02	2.4E-04	1.6E+03	2.4E-05
SVOC	Chrysene	218-01-9	1.30E+00		7.79E-02	1.8E-03		4.5E-03	6.3E-03	6.2E-01	1.0E-02	3.1E+00	2.1E-03
SVOC	Dibenz(a,h)anthracene	53-70-3	1.50E-01		1.95E-02	2.1E-04		1.1E-03	1.3E-03	6.2E-01	2.2E-03	3.1E+00	4.3E-04
SVOC	Fluoranthene	206-44-0	3.40E+00		1.70E+00	4.7E-03		9.8E-02	1.0E-01	6.6E+01	1.6E-03	3.3E+02	3.1E-04
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5	3.40E-01		3.74E-02	4.7E-04		2.2E-03	2.6E-03	6.2E-01	4.3E-03	3.1E+00	8.6E-04
SVOC	Phenanthrene	85-01-8	8.80E-01		7.82E-01	1.2E-03		4.5E-02	4.6E-02	6.6E+01	7.1E-04	3.3E+02	1.4E-04
SVOC	Pyrene	129-00-0	1.70E+00		1.22E+00	2.4E-03		7.1E-02	7.3E-02	6.2E-01	1.2E-01	3.1E+00	2.4E-02
PEST	Chlordane, alpha	5103-71-9								1.2E+00	No Dose	1.2E+01	No Dose
INORG	Aluminum	7429-90-5		2.10E+00			2.0E-01		2.0E-01	1.9E+00	1.0E-01	1.9E+01	1.0E-02
INORG	Arsenic	7440-38-2	2.00E+01		7.50E-01	2.8E-02		4.3E-02	7.1E-02	1.0E+00	6.8E-02	1.7E+00	4.3E-02
INORG	Barium	7440-39-3	1.18E+02		1.84E+01	1.6E-01		1.1E+00	1.2E+00	5.2E+01	2.4E-02	1.2E+02	1.0E-02
INORG	Beryllium	7440-41-7	1.10E+00		6.27E-01	1.5E-03		3.6E-02	3.8E-02	5.3E-01	7.1E-02	6.3E-01	6.0E-02
INORG	Cadmium	7440-43-9	1.50E+00	2.80E-04	7.76E-01	2.1E-03	2.7E-05	4.5E-02	4.7E-02	7.7E-01	6.1E-02	7.7E+00	6.1E-03
INORG	Copper	7440-50-8	2.82E+01	8.00E-03	7.27E+00	3.9E-02	7.6E-04	4.2E-01	4.6E-01	5.6E+00	8.2E-02	9.3E+00	4.9E-02
INORG	Iron	7439-89-6		5.41E+00			5.2E-01		5.2E-01	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1	7.14E+01	2.66E-02	2.91E+00	9.9E-02	2.5E-03	1.7E-01	2.7E-01	4.7E+00	5.7E-02	8.9E+00	3.0E-02
INORG	Manganese	7439-96-5		3.81E-01			3.6E-02		3.6E-02	5.2E+01	7.1E-04	6.5E+01	5.6E-04
INORG	Mercury	7439-97-6	2.70E-01		3.70E-02	3.7E-04		2.1E-03	2.5E-03	1.4E+00	1.8E-03	1.4E+01	1.8E-04
INORG	Selenium	7782-49-2	4.70E+00		2.81E+00	6.5E-03		1.6E-01	1.7E-01	1.4E-01	**1.2E+00**	2.2E-01	7.8E-01
INORG	Silver	7440-22-4	5.60E-01		7.84E-03	7.8E-04		4.5E-04	1.2E-03	6.0E+00	2.0E-04	6.0E+01	2.0E-05
INORG	Vanadium	7440-62-2	4.55E+01		2.21E-01	6.3E-02		1.3E-02	7.6E-02	4.2E+00	1.8E-02	8.3E+00	9.1E-03
INORG	Calcium	7440-70-2	4.48E+03	2.41E+01	1.57E+03	6.2E+00	2.3E+00	9.1E+01	9.9E+01	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	3.88E+03	7.04E+00	2.13E+03	5.4E+00	6.7E-01	1.2E+02	1.3E+02	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	1.25E+03	1.02E+00	6.88E+02	1.7E+00	9.8E-02	4.0E+01	4.2E+01	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.70E+02	1.83E+01	1.49E+01	3.7E-01	1.7E+00	8.6E-01	3.0E+00	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from three of the four water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT).
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 3.3
RISK ESTIMATES FOR THE SANDPIPER (AVIAN INVERTIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN TROUT BROOK, LAMINGTON RIVER UNT, TANNERS BROOK UNT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: Trout Brook, Lamington River UNT, Tanners Brook UNT

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Benthic Invert. Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Benthic Invert. Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		4.10E-04			6.9E-05		6.9E-05	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1								2.0E+02	No Dose	2.0E+03	No Dose
VOC	Dichlorodifluoromethane	75-71-8								NA	No Dose	NA	No Dose
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		4.00E-03			6.7E-04		6.7E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2	7.70E-01		2.43E+02	1.4E-02		4.3E+01	4.3E+01	NA	No TRV	NA	No TRV
SVOC	Anthracene	120-12-7	3.00E-01		7.26E-01	5.4E-03		1.3E-01	1.4E-01	NA	No TRV	NA	No TRV
SVOC	Benzo(a)anthracene	56-55-3	1.20E+00		1.91E+00	2.1E-02		3.4E-01	3.6E-01	NA	No TRV	NA	No TRV
SVOC	Benzo(a)pyrene	50-32-8	6.70E-01		8.91E-01	1.2E-02		1.6E-01	1.7E-01	NA	No TRV	NA	No TRV
SVOC	Benzo(g,h,i)perylene	191-24-2	3.20E-01		9.41E-01	5.7E-03		1.7E-01	1.7E-01	NA	No TRV	NA	No TRV
SVOC	Benzo(k)fluoranthene	207-08-9	7.30E-01		1.90E+00	1.3E-02		3.4E-01	3.5E-01	NA	No TRV	NA	No TRV
SVOC	Benzyl Butyl Phthalate	85-68-7	6.90E+00		3.69E+03	1.2E-01		6.6E+02	6.6E+02	NA	No TRV	NA	No TRV
SVOC	Chrysene	218-01-9	1.30E+00		2.98E+00	2.3E-02		5.3E-01	5.6E-01	NA	No TRV	NA	No TRV
SVOC	Dibenz(a,h)anthracene	53-70-3	1.50E-01		3.47E-01	2.7E-03		6.2E-02	6.5E-02	NA	No TRV	NA	No TRV
SVOC	Fluoranthene	206-44-0	3.40E+00		1.03E+01	6.1E-02		1.8E+00	1.9E+00	NA	No TRV	NA	No TRV
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5	3.40E-01		9.72E-01	6.1E-03		1.7E-01	1.8E-01	NA	No TRV	NA	No TRV
SVOC	Phenanthrene	85-01-8	8.80E-01		1.51E+00	1.6E-02		2.7E-01	2.9E-01	NA	No TRV	NA	No TRV
SVOC	Pyrene	129-00-0	1.70E+00		2.98E+00	3.0E-02		5.3E-01	5.6E-01	2.1E+01	2.7E-02	2.1E+02	2.7E-03
PEST	Chlordane, alpha	5103-71-9								2.1E+00	No Dose	1.1E+01	No Dose
INORG	Aluminum	7429-90-5		2.10E+00			3.5E-01		3.5E-01	1.1E+02	3.2E-03	1.1E+03	3.2E-04
INORG	Arsenic	7440-38-2	2.00E+01		4.89E+00	3.6E-01		8.7E-01	1.2E+00	2.2E+00	5.5E-01	3.6E+00	3.5E-01
INORG	Barium	7440-39-3	1.18E+02		1.07E+01	2.1E+00		1.9E+00	4.0E+00	7.4E+01	5.5E-02	1.3E+02	3.1E-02
INORG	Beryllium	7440-41-7	1.10E+00		4.95E-02	2.0E-02		8.8E-03	2.8E-02	NA	No TRV	NA	No TRV
INORG	Cadmium	7440-43-9	1.50E+00	2.80E-04	1.45E+00	2.7E-02	4.7E-05	2.6E-01	2.9E-01	1.5E+00	1.9E-01	2.4E+00	1.2E-01
INORG	Copper	7440-50-8	2.82E+01	8.00E-03	3.11E+01	5.0E-01	1.3E-03	5.5E+00	6.1E+00	4.1E+00	**1.5E+00**	1.2E+01	5.0E-01
INORG	Iron	7439-89-6		5.41E+00			9.1E-01		9.1E-01	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1	7.14E+01	2.66E-02	5.11E+00	1.3E+00	4.5E-03	9.1E-01	2.2E+00	1.6E+00	**1.3E+00**	3.3E+00	6.7E-01
INORG	Manganese	7439-96-5		3.81E-01			6.4E-02		6.4E-02	1.8E+02	3.6E-04	3.5E+02	1.8E-04
INORG	Mercury	7439-97-6	2.70E-01		1.39E-01	4.8E-03		2.5E-02	3.0E-02	1.9E-02	**1.6E+00**	1.9E-01	1.6E-01
INORG	Selenium	7782-49-2	4.70E+00		2.88E+00	8.4E-02		5.2E-01	6.0E-01	2.9E-01	**2.1E+00**	5.8E-01	**1.0E+00**
INORG	Silver	7440-22-4	5.60E-01		1.15E+00	1.0E-02		2.0E-01	2.1E-01	2.0E+00	1.1E-01	2.0E+01	1.1E-02
INORG	Vanadium	7440-62-2	4.55E+01		1.91E+00	8.1E-01		3.4E-01	1.2E+00	3.4E-01	**3.4E+00**	6.9E-01	**1.7E+00**
INORG	Calcium	7440-70-2	4.48E+03	2.41E+01	4.48E+03	8.0E+01	4.0E+00	8.0E+02	8.8E+02	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	3.88E+03	7.04E+00	3.88E+03	6.9E+01	1.2E+00	6.9E+02	7.6E+02	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	1.25E+03	1.02E+00	1.25E+03	2.2E+01	1.7E-01	2.2E+02	2.5E+02	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.70E+02	1.83E+01	2.70E+02	4.8E+00	3.1E+00	4.8E+01	5.6E+01	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from three of the four water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT).
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
Invert -- Invertebrate
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 3.4
RISK ESTIMATES FOR THE RACCOON (MAMMALIAN INVERTIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN TROUT BROOK, LAMINGTON RIVER UNT, TANNERS BROOK UN
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: Trout Brook, Lamington River UNT, Tanners Brook UNT

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Benthic Invert. Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Benthic Invert. Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		4.10E-04			3.4E-05		3.4E-05	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1								1.0E+01	No Dose	5.0E+01	No Dose
VOC	Dichlorodifluoromethane	75-71-8								NA	No Dose	NA	No Dose
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		4.00E-03			3.3E-04		3.3E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2	7.70E-01		2.43E+02	1.9E-03		6.4E+00	6.4E+00	NA	No TRV	NA	No TRV
SVOC	Anthracene	120-12-7	3.00E-01		7.26E-01	7.5E-04		1.9E-02	2.0E-02	6.6E+01	3.1E-04	3.3E+02	6.1E-05
SVOC	Benzo(a)anthracene	56-55-3	1.20E+00		1.91E+00	3.0E-03		5.1E-02	5.4E-02	6.2E-01	8.7E-02	3.1E+00	1.7E-02
SVOC	Benzo(a)pyrene	50-32-8	6.70E-01		8.91E-01	1.7E-03		2.4E-02	2.5E-02	6.2E-01	4.1E-02	3.1E+00	8.3E-03
SVOC	Benzo(g,h,i)perylene	191-24-2	3.20E-01		9.41E-01	8.0E-04		2.5E-02	2.6E-02	6.2E-01	4.2E-02	3.1E+00	8.4E-03
SVOC	Benzo(k)fluoranthene	207-08-9	7.30E-01		1.90E+00	1.8E-03		5.0E-02	5.2E-02	6.2E-01	8.5E-02	3.1E+00	1.7E-02
SVOC	Benzyl Butyl Phthalate	85-68-7	6.90E+00		3.69E+03	1.7E-02		9.8E+01	9.8E+01	1.6E+02	6.2E-01	1.6E+03	6.2E-02
SVOC	Chrysene	218-01-9	1.30E+00		2.98E+00	3.2E-03		7.9E-02	8.2E-02	6.2E-01	1.3E-01	3.1E+00	2.7E-02
SVOC	Dibenz(a,h)anthracene	53-70-3	1.50E-01		3.47E-01	3.7E-04		9.2E-03	9.6E-03	6.2E-01	1.6E-02	3.1E+00	3.1E-03
SVOC	Fluoranthene	206-44-0	3.40E+00		1.03E+01	8.5E-03		2.7E-01	2.8E-01	6.6E+01	4.3E-03	3.3E+02	8.6E-04
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5	3.40E-01		9.72E-01	8.5E-04		2.6E-02	2.7E-02	6.2E-01	4.3E-02	3.1E+00	8.7E-03
SVOC	Phenanthrene	85-01-8	8.80E-01		1.51E+00	2.2E-03		4.0E-02	4.2E-02	6.6E+01	6.5E-04	3.3E+02	1.3E-04
SVOC	Pyrene	129-00-0	1.70E+00		2.98E+00	4.2E-03		7.9E-02	8.3E-02	6.2E-01	1.4E-01	3.1E+00	2.7E-02
PEST	Chlordane, alpha	5103-71-9								1.2E+00	No Dose	1.2E+01	No Dose
INORG	Aluminum	7429-90-5		2.10E+00			1.7E-01		1.7E-01	1.9E+00	9.0E-02	1.9E+01	9.0E-03
INORG	Arsenic	7440-38-2	2.00E+01		4.89E+00	5.0E-02		1.3E-01	1.8E-01	1.0E+00	1.7E-01	1.7E+00	1.1E-01
INORG	Barium	7440-39-3	1.18E+02		1.07E+01	2.9E-01		2.9E-01	5.8E-01	5.2E+01	1.1E-02	1.2E+02	4.8E-03
INORG	Beryllium	7440-41-7	1.10E+00		4.95E-02	2.7E-03		1.3E-03	4.1E-03	5.3E-01	7.6E-03	6.3E-01	6.4E-03
INORG	Cadmium	7440-43-9	1.50E+00	2.80E-04	1.45E+00	3.7E-03	2.3E-05	3.8E-02	4.2E-02	7.7E-01	5.5E-02	7.7E+00	5.5E-03
INORG	Copper	7440-50-8	2.82E+01	8.00E-03	3.11E+01	7.0E-02	6.6E-04	8.2E-01	9.0E-01	5.6E+00	1.6E-01	9.3E+00	9.6E-02
INORG	Iron	7439-89-6		5.41E+00			4.5E-01		4.5E-01	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1	7.14E+01	2.66E-02	5.11E+00	1.8E-01	2.2E-03	1.4E-01	3.2E-01	4.7E+00	6.7E-02	8.9E+00	3.6E-02
INORG	Manganese	7439-96-5		3.81E-01			3.2E-02		3.2E-02	5.2E+01	6.1E-04	6.5E+01	4.9E-04
INORG	Mercury	7439-97-6	2.70E-01		1.39E-01	6.7E-04		3.7E-03	4.4E-03	1.4E+00	3.1E-03	1.4E+01	3.1E-04
INORG	Selenium	7782-49-2	4.70E+00		2.88E+00	1.2E-02		7.7E-02	8.8E-02	1.4E-01	6.2E-01	2.2E-01	4.1E-01
INORG	Silver	7440-22-4	5.60E-01		1.15E+00	1.4E-03		3.0E-02	3.2E-02	6.0E+00	5.3E-03	6.0E+01	5.3E-04
INORG	Vanadium	7440-62-2	4.55E+01		1.91E+00	1.1E-01		5.1E-02	1.6E-01	4.2E+00	3.9E-02	8.3E+00	2.0E-02
INORG	Calcium	7440-70-2	4.48E+03	2.41E+01	4.48E+03	1.1E+01	2.0E+00	1.2E+02	1.3E+02	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	3.88E+03	7.04E+00	3.88E+03	9.7E+00	5.8E-01	1.0E+02	1.1E+02	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	1.25E+03	1.02E+00	1.25E+03	3.1E+00	8.5E-02	3.3E+01	3.6E+01	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.70E+02	1.83E+01	2.70E+02	6.7E-01	1.5E+00	7.2E+00	9.4E+00	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from three of the four water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT)
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
Invert -- Invertebrate
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weigh
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 3.5
RISK ESTIMATES FOR THE GREAT BLUE HERON (AVIAN PISCIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN TROUT BROOK, LAMINGTON RIVER UNT, TANNERS BROOK UNT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: Trout Brook, Lamington River UNT, Tanners Brook UNT

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Surface Water to Fish Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Fish Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		4.10E-04	2.73E-01		1.9E-05	1.7E-02	1.7E-02	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1								2.0E+02	No Dose	2.0E+03	No Dose
VOC	Dichlorodifluoromethane	75-71-8								NA	No Dose	NA	No Dose
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		4.00E-03	2.16E-02		1.8E-04	1.4E-03	1.5E-03	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2	7.70E-01			9.7E-04			9.7E-04	NA	No TRV	NA	No TRV
SVOC	Anthracene	120-12-7	3.00E-01			3.8E-04			3.8E-04	NA	No TRV	NA	No TRV
SVOC	Benzo(a)anthracene	56-55-3	1.20E+00			1.5E-03			1.5E-03	NA	No TRV	NA	No TRV
SVOC	Benzo(a)pyrene	50-32-8	6.70E-01			8.5E-04			8.5E-04	NA	No TRV	NA	No TRV
SVOC	Benzo(g,h,i)perylene	191-24-2	3.20E-01			4.0E-04			4.0E-04	NA	No TRV	NA	No TRV
SVOC	Benzo(k)fluoranthene	207-08-9	7.30E-01			9.2E-04			9.2E-04	NA	No TRV	NA	No TRV
SVOC	Benzyl Butyl Phthalate	85-68-7	6.90E+00			8.7E-03			8.7E-03	NA	No TRV	NA	No TRV
SVOC	Chrysene	218-01-9	1.30E+00			1.6E-03			1.6E-03	NA	No TRV	NA	No TRV
SVOC	Dibenz(a,h)anthracene	53-70-3	1.50E-01			1.9E-04			1.9E-04	NA	No TRV	NA	No TRV
SVOC	Fluoranthene	206-44-0	3.40E+00			4.3E-03			4.3E-03	NA	No TRV	NA	No TRV
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5	3.40E-01			4.3E-04			4.3E-04	NA	No TRV	NA	No TRV
SVOC	Phenanthrene	85-01-8	8.80E-01			1.1E-03			1.1E-03	NA	No TRV	NA	No TRV
SVOC	Pyrene	129-00-0	1.70E+00			2.1E-03			2.1E-03	2.1E+01	1.0E-04	2.1E+02	1.0E-05
PEST	Chlordane, alpha	5103-71-9								2.1E+00	No Dose	1.1E+01	No Dose
INORG	Aluminum	7429-90-5		2.10E+00	1.05E+03		9.5E-02	6.6E+01	6.6E+01	1.1E+02	6.0E-01	1.1E+03	6.0E-02
INORG	Arsenic	7440-38-2	2.00E+01			2.5E-02			2.5E-02	2.2E+00	1.1E-02	3.6E+00	7.1E-03
INORG	Barium	7440-39-3	1.18E+02			1.5E-01			1.5E-01	7.4E+01	2.0E-03	1.3E+02	1.1E-03
INORG	Beryllium	7440-41-7	1.10E+00			1.4E-03			1.4E-03	NA	No TRV	NA	No TRV
INORG	Cadmium	7440-43-9	1.50E+00	2.80E-04	5.60E-02	1.9E-03	1.3E-05	3.5E-03	5.4E-03	1.5E+00	3.7E-03	2.4E+00	2.3E-03
INORG	Copper	7440-50-8	2.82E+01	8.00E-03	2.88E-01	3.6E-02	3.6E-04	1.8E-02	5.4E-02	4.1E+00	1.3E-02	1.2E+01	4.5E-03
INORG	Iron	7439-89-6		5.41E+00	1.08E+03		2.5E-01	6.8E+01	6.9E+01	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1	7.14E+01	2.66E-02	7.98E+00	9.0E-02	1.2E-03	5.0E-01	6.0E-01	1.6E+00	3.7E-01	3.3E+00	1.8E-01
INORG	Manganese	7439-96-5		3.81E-01	1.52E+02		1.7E-02	9.6E+00	9.6E+00	1.8E+02	5.4E-02	3.5E+02	2.8E-02
INORG	Mercury	7439-97-6	2.70E-01			3.4E-04			3.4E-04	1.9E-02	1.8E-02	1.9E-01	1.8E-03
INORG	Selenium	7782-49-2	4.70E+00			5.9E-03			5.9E-03	2.9E-01	2.0E-02	5.8E-01	1.0E-02
INORG	Silver	7440-22-4	5.60E-01			7.1E-04			7.1E-04	2.0E+00	3.5E-04	2.0E+01	3.5E-05
INORG	Vanadium	7440-62-2	4.55E+01			5.7E-02			5.7E-02	3.4E-01	1.7E-01	6.9E-01	8.4E-02
INORG	Calcium	7440-70-2	4.48E+03	2.41E+01	2.41E+01	5.7E+00	1.1E+00	1.5E+00	8.3E+00	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	3.88E+03	7.04E+00	7.04E+00	4.9E+00	3.2E-01	4.4E-01	5.7E+00	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	1.25E+03	1.02E+00	1.02E+00	1.6E+00	4.6E-02	6.4E-02	1.7E+00	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.70E+02	1.83E+01	1.83E+01	3.4E-01	8.3E-01	1.2E+00	2.3E+00	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from three of the four water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT).
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BCFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times BCF \times AUF \times IR}{BW}$$

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

TABLE 3.6
RISK ESTIMATES FOR THE MINK (MAMMALIAN PISCIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN TROUT BROOK, LAMINGTON RIVER UNT, TANNERS BROOK UNT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: Trout Brook, Lamington River UNT, Tanners Brook UNT

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Surface Water to Fish Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Fish Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		4.10E-04	2.73E-01		3.9E-05	1.3E-02	1.3E-02	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1								1.0E+01	No Dose	5.0E+01	No Dose
VOC	Dichlorodifluoromethane	75-71-8								NA	No Dose	NA	No Dose
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		4.00E-03	2.16E-02		3.8E-04	9.9E-04	1.4E-03	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2	7.70E-01			7.1E-04			7.1E-04	NA	No TRV	NA	No TRV
SVOC	Anthracene	120-12-7	3.00E-01			2.8E-04			2.8E-04	6.6E+01	4.2E-06	3.3E+02	8.4E-07
SVOC	Benzo(a)anthracene	56-55-3	1.20E+00			1.1E-03			1.1E-03	6.2E-01	1.8E-03	3.1E+00	3.6E-04
SVOC	Benzo(a)pyrene	50-32-8	6.70E-01			6.2E-04			6.2E-04	6.2E-01	1.0E-03	3.1E+00	2.0E-04
SVOC	Benzo(g,h,i)perylene	191-24-2	3.20E-01			2.9E-04			2.9E-04	6.2E-01	4.8E-04	3.1E+00	9.6E-05
SVOC	Benzo(k)fluoranthene	207-08-9	7.30E-01			6.7E-04			6.7E-04	6.2E-01	1.1E-03	3.1E+00	2.2E-04
SVOC	Benzyl Butyl Phthalate	85-68-7	6.90E+00			6.3E-03			6.3E-03	1.6E+02	4.0E-05	1.6E+03	4.0E-06
SVOC	Chrysene	218-01-9	1.30E+00			1.2E-03			1.2E-03	6.2E-01	1.9E-03	3.1E+00	3.9E-04
SVOC	Dibenz(a,h)anthracene	53-70-3	1.50E-01			1.4E-04			1.4E-04	6.2E-01	2.2E-04	3.1E+00	4.5E-05
SVOC	Fluoranthene	206-44-0	3.40E+00			3.1E-03			3.1E-03	6.6E+01	4.8E-05	3.3E+02	9.5E-06
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5	3.40E-01			3.1E-04			3.1E-04	6.2E-01	5.1E-04	3.1E+00	1.0E-04
SVOC	Phenanthrene	85-01-8	8.80E-01			8.1E-04			8.1E-04	6.6E+01	1.2E-05	3.3E+02	2.5E-06
SVOC	Pyrene	129-00-0	1.70E+00			1.6E-03			1.6E-03	6.2E-01	2.5E-03	3.1E+00	5.1E-04
PEST	Chlordane, alpha	5103-71-9								1.2E+00	No Dose	1.2E+01	No Dose
INORG	Aluminum	7429-90-5		2.10E+00	1.05E+03		2.0E-01	4.8E+01	4.8E+01	1.9E+00	**2.5E+01**	1.9E+01	**2.5E+00**
INORG	Arsenic	7440-38-2	2.00E+01			1.8E-02			1.8E-02	1.0E+00	1.8E-02	1.7E+00	1.1E-02
INORG	Barium	7440-39-3	1.18E+02			1.1E-01			1.1E-01	5.2E+01	2.1E-03	1.2E+02	9.0E-04
INORG	Beryllium	7440-41-7	1.10E+00			1.0E-03			1.0E-03	5.3E-01	1.9E-03	6.3E-01	1.6E-03
INORG	Cadmium	7440-43-9	1.50E+00	2.80E-04	5.60E-02	1.4E-03	2.7E-05	2.6E-03	4.0E-03	7.7E-01	5.2E-03	7.7E+00	5.2E-04
INORG	Copper	7440-50-8	2.82E+01	8.00E-03	2.88E-01	2.6E-02	7.7E-04	1.3E-02	4.0E-02	5.6E+00	7.1E-03	9.3E+00	4.3E-03
INORG	Iron	7439-89-6		5.41E+00	1.08E+03		5.2E-01	5.0E+01	5.0E+01	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1	7.14E+01	2.66E-02	7.98E+00	6.6E-02	2.5E-03	3.7E-01	4.3E-01	4.7E+00	9.3E-02	8.9E+00	4.9E-02
INORG	Manganese	7439-96-5		3.81E-01	1.52E+02		3.6E-02	7.0E+00	7.0E+00	5.2E+01	1.4E-01	6.5E+01	1.1E-01
INORG	Mercury	7439-97-6	2.70E-01			2.5E-04			2.5E-04	1.4E+00	1.8E-04	1.4E+01	1.8E-05
INORG	Selenium	7782-49-2	4.70E+00			4.3E-03			4.3E-03	1.4E-01	3.0E-02	2.2E-01	2.0E-02
INORG	Silver	7440-22-4	5.60E-01			5.1E-04			5.1E-04	6.0E+00	8.6E-05	6.0E+01	8.6E-06
INORG	Vanadium	7440-62-2	4.55E+01			4.2E-02			4.2E-02	4.2E+00	1.0E-02	8.3E+00	5.0E-03
INORG	Calcium	7440-70-2	4.48E+03	2.41E+01	2.41E+01	4.1E+00	2.3E+00	1.1E+00	7.5E+00	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	3.88E+03	7.04E+00	7.04E+00	3.6E+00	6.7E-01	3.2E-01	4.6E+00	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	1.25E+03	1.02E+00	1.02E+00	1.1E+00	9.8E-02	4.7E-02	1.3E+00	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.70E+02	1.83E+01	1.83E+01	2.5E-01	1.8E+00	8.4E-01	2.8E+00	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from three of the four water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT).
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BCFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times BCF \times AUF \times IR}{BW}$$

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

TABLE 4.1
RISK ESTIMATES FOR THE MALLARD (AVIAN HERBIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN EAST TROUT BROOK
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: East Trout Brook

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Aquatic Plant Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Aquatic Plant Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		2.50E-04			1.4E-05		1.4E-05	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1		2.70E-03			1.5E-04		1.5E-04	2.0E+02	7.6E-07	2.0E+03	7.6E-08
VOC	Dichlorodifluoromethane	75-71-8		1.60E-04			9.1E-06		9.1E-06	NA	No TRV	NA	No TRV
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		2.50E-03			1.4E-04		1.4E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2								NA	No Dose	NA	No Dose
SVOC	Anthracene	120-12-7								NA	No Dose	NA	No Dose
SVOC	Benzo(a)anthracene	56-55-3								NA	No Dose	NA	No Dose
SVOC	Benzo(a)pyrene	50-32-8								NA	No Dose	NA	No Dose
SVOC	Benzo(g,h,i)perylene	191-24-2								NA	No Dose	NA	No Dose
SVOC	Benzo(k)fluoranthene	207-08-9								NA	No Dose	NA	No Dose
SVOC	Benzyl Butyl Phthalate	85-68-7								NA	No Dose	NA	No Dose
SVOC	Chrysene	218-01-9								NA	No Dose	NA	No Dose
SVOC	Dibenz(a,h)anthracene	53-70-3								NA	No Dose	NA	No Dose
SVOC	Fluoranthene	206-44-0								NA	No Dose	NA	No Dose
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5								NA	No Dose	NA	No Dose
SVOC	Phenanthrene	85-01-8								NA	No Dose	NA	No Dose
SVOC	Pyrene	129-00-0								2.1E+01	No Dose	2.1E+02	No Dose
PEST	Chlordane, alpha	5103-71-9		4.80E-06			2.7E-07		2.7E-07	2.1E+00	1.3E-07	1.1E+01	2.5E-08
INORG	Aluminum	7429-90-5		6.42E-02			3.6E-03		3.6E-03	1.1E+02	3.3E-05	1.1E+03	3.3E-06
INORG	Arsenic	7440-38-2	8.30E+00		3.11E-01	1.9E-02		2.1E-02	4.0E-02	2.2E+00	1.8E-02	3.6E+00	1.1E-02
INORG	Barium	7440-39-3	7.91E+01		1.23E+01	1.8E-01		8.4E-01	1.0E+00	7.4E+01	1.4E-02	1.3E+02	7.7E-03
INORG	Beryllium	7440-41-7	1.40E+00		7.49E-01	3.1E-03		5.1E-02	5.4E-02	NA	No TRV	NA	No TRV
INORG	Cadmium	7440-43-9	2.60E+00		1.05E+00	5.8E-03		7.1E-02	7.7E-02	1.5E+00	5.2E-02	2.4E+00	3.2E-02
INORG	Copper	7440-50-8								4.1E+00	No Dose	1.2E+01	No Dose
INORG	Iron	7439-89-6	3.86E+04		3.86E+04	8.6E+01		2.6E+03	2.7E+03	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1		3.80E-03			2.2E-04		2.2E-04	1.6E+00	1.3E-04	3.3E+00	6.6E-05
INORG	Manganese	7439-96-5	1.40E+03	7.05E-02	1.11E+02	3.1E+00	4.0E-03	7.5E+00	1.1E+01	1.8E+02	5.9E-02	3.5E+02	3.1E-02
INORG	Mercury	7439-97-6								1.9E-02	No Dose	1.9E-01	No Dose
INORG	Selenium	7782-49-2	4.90E+00		2.94E+00	1.1E-02		2.0E-01	2.1E-01	2.9E-01	7.2E-01	5.8E-01	3.6E-01
INORG	Silver	7440-22-4		5.40E-04			3.1E-05		3.1E-05	2.0E+00	1.5E-05	2.0E+01	1.5E-06
INORG	Vanadium	7440-62-2	5.44E+01		2.64E-01	1.2E-01		1.8E-02	1.4E-01	3.4E-01	4.1E-01	6.9E-01	2.0E-01
INORG	Calcium	7440-70-2	1.60E+04	4.51E+01	5.60E+03	3.6E+01	2.6E+00	3.8E+02	4.2E+02	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	8.61E+03	1.62E+01	4.74E+03	1.9E+01	9.2E-01	3.2E+02	3.4E+02	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	4.29E+02	3.13E+00	2.36E+02	9.6E-01	1.8E-01	1.6E+01	1.7E+01	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.64E+02	1.34E+02	1.45E+01	5.9E-01	7.6E+00	9.8E-01	9.2E+00	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from East Trout Brook downstream of the Leachate Treatment Plant permitted discharge. Aluminum applies the filtered EPC as unfiltered
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 4.2
RISK ESTIMATES FOR THE MUSKRAT (MAMMALIAN HERBIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN EAST TROUT BROOK
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: East Trout Brook

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Aquatic Plant Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Aquatic Plant Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		2.50E-04			2.4E-05		2.4E-05	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1		2.70E-03			2.6E-04		2.6E-04	1.0E+01	2.6E-05	5.0E+01	5.2E-06
VOC	Dichlorodifluoromethane	75-71-8		1.60E-04			1.5E-05		1.5E-05	NA	No TRV	NA	No TRV
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		2.50E-03			2.4E-04		2.4E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2								NA	No Dose	NA	No Dose
SVOC	Anthracene	120-12-7								6.6E+01	No Dose	3.3E+02	No Dose
SVOC	Benzo(a)anthracene	56-55-3								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzo(a)pyrene	50-32-8								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzo(g,h,i)perylene	191-24-2								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzo(k)fluoranthene	207-08-9								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzyl Butyl Phthalate	85-68-7								1.6E+02	No Dose	1.6E+03	No Dose
SVOC	Chrysene	218-01-9								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Dibenz(a,h)anthracene	53-70-3								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Fluoranthene	206-44-0								6.6E+01	No Dose	3.3E+02	No Dose
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Phenanthrene	85-01-8								6.6E+01	No Dose	3.3E+02	No Dose
SVOC	Pyrene	129-00-0								6.2E-01	No Dose	3.1E+00	No Dose
PEST	Chlordane, alpha	5103-71-9		4.80E-06			4.6E-07		4.6E-07	1.2E+00	3.9E-07	1.2E+01	3.9E-08
INORG	Aluminum	7429-90-5		6.42E-02			6.1E-03		6.1E-03	1.9E+00	3.2E-03	1.9E+01	3.2E-04
INORG	Arsenic	7440-38-2	8.30E+00		3.11E-01	1.2E-02		1.8E-02	3.0E-02	1.0E+00	2.8E-02	1.7E+00	1.8E-02
INORG	Barium	7440-39-3	7.91E+01		1.23E+01	1.1E-01		7.1E-01	8.2E-01	5.2E+01	1.6E-02	1.2E+02	6.8E-03
INORG	Beryllium	7440-41-7	1.40E+00		7.49E-01	1.9E-03		4.3E-02	4.5E-02	5.3E-01	8.5E-02	6.3E-01	7.2E-02
INORG	Cadmium	7440-43-9	2.60E+00		1.05E+00	3.6E-03		6.1E-02	6.4E-02	7.7E-01	8.3E-02	7.7E+00	8.3E-03
INORG	Copper	7440-50-8								5.6E+00	No Dose	9.3E+00	No Dose
INORG	Iron	7439-89-6	3.86E+04		3.86E+04	5.4E+01		2.2E+03	2.3E+03	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1		3.80E-03			3.6E-04		3.6E-04	4.7E+00	7.7E-05	8.9E+00	4.1E-05
INORG	Manganese	7439-96-5	1.40E+03	7.05E-02	1.11E+02	1.9E+00	6.7E-03	6.4E+00	8.3E+00	5.2E+01	1.6E-01	6.5E+01	1.3E-01
INORG	Mercury	7439-97-6								1.4E+00	No Dose	1.4E+01	No Dose
INORG	Selenium	7782-49-2	4.90E+00		2.94E+00	6.8E-03		1.7E-01	1.8E-01	1.4E-01	**1.2E+00**	2.2E-01	8.2E-01
INORG	Silver	7440-22-4		5.40E-04			5.2E-05		5.2E-05	6.0E+00	8.6E-06	6.0E+01	8.6E-07
INORG	Vanadium	7440-62-2	5.44E+01		2.64E-01	7.5E-02		1.5E-02	9.1E-02	4.2E+00	2.2E-02	8.3E+00	1.1E-02
INORG	Calcium	7440-70-2	1.60E+04	4.51E+01	5.60E+03	2.2E+01	4.3E+00	3.2E+02	3.5E+02	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	8.61E+03	1.62E+01	4.74E+03	1.2E+01	1.5E+00	2.7E+02	2.9E+02	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	4.29E+02	3.13E+00	2.36E+02	6.0E-01	3.0E-01	1.4E+01	1.5E+01	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.64E+02	1.34E+02	1.45E+01	3.7E-01	1.3E+01	8.4E-01	1.4E+01	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from East Trout Brook downstream of the Leachate Treatment Plant permitted discharge. Aluminum applies the filtered EPC as unfiltered
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 4.3
RISK ESTIMATES FOR THE SANDPIPER (AVIAN INVERTIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN EAST TROUT BROOK
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: East Trout Brook

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Benthic Invert. Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Benthic Invert. Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		2.50E-04			4.2E-05		4.2E-05	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1		2.70E-03			4.5E-04		4.5E-04	2.0E+02	2.2E-06	2.0E+03	2.2E-07
VOC	Dichlorodifluoromethane	75-71-8		1.60E-04			2.7E-05		2.7E-05	NA	No TRV	NA	No TRV
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		2.50E-03			4.2E-04		4.2E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2								NA	No Dose	NA	No Dose
SVOC	Anthracene	120-12-7								NA	No Dose	NA	No Dose
SVOC	Benzo(a)anthracene	56-55-3								NA	No Dose	NA	No Dose
SVOC	Benzo(a)pyrene	50-32-8								NA	No Dose	NA	No Dose
SVOC	Benzo(g,h,i)perylene	191-24-2								NA	No Dose	NA	No Dose
SVOC	Benzo(k)fluoranthene	207-08-9								NA	No Dose	NA	No Dose
SVOC	Benzyl Butyl Phthalate	85-68-7								NA	No Dose	NA	No Dose
SVOC	Chrysene	218-01-9								NA	No Dose	NA	No Dose
SVOC	Dibenz(a,h)anthracene	53-70-3								NA	No Dose	NA	No Dose
SVOC	Fluoranthene	206-44-0								NA	No Dose	NA	No Dose
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5								NA	No Dose	NA	No Dose
SVOC	Phenanthrene	85-01-8								NA	No Dose	NA	No Dose
SVOC	Pyrene	129-00-0								2.1E+01	No Dose	2.1E+02	No Dose
PEST	Chlordane, alpha	5103-71-9		4.80E-06			8.0E-07		8.0E-07	2.1E+00	3.8E-07	1.1E+01	7.5E-08
INORG	Aluminum	7429-90-5		6.42E-02			1.1E-02		1.1E-02	1.1E+02	9.8E-05	1.1E+03	9.8E-06
INORG	Arsenic	7440-38-2	8.30E+00		2.52E+00	1.5E-01		4.5E-01	6.0E-01	2.2E+00	2.7E-01	3.6E+00	1.7E-01
INORG	Barium	7440-39-3	7.91E+01		7.20E+00	1.4E+00		1.3E+00	2.7E+00	7.4E+01	3.7E-02	1.3E+02	2.1E-02
INORG	Beryllium	7440-41-7	1.40E+00		6.30E-02	2.5E-02		1.1E-02	3.6E-02	NA	No TRV	NA	No TRV
INORG	Cadmium	7440-43-9	2.60E+00		2.12E+00	4.6E-02		3.8E-01	4.3E-01	1.5E+00	2.9E-01	2.4E+00	1.8E-01
INORG	Copper	7440-50-8								4.1E+00	No Dose	1.2E+01	No Dose
INORG	Iron	7439-89-6	3.86E+04		3.86E+04	6.9E+02		6.9E+03	7.6E+03	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1		3.80E-03			6.4E-04		6.4E-04	1.6E+00	3.9E-04	3.3E+00	2.0E-04
INORG	Manganese	7439-96-5	1.40E+03	7.05E-02	6.23E+01	2.5E+01	1.2E-02	1.1E+01	3.6E+01	1.8E+02	2.0E-01	3.5E+02	1.0E-01
INORG	Mercury	7439-97-6								1.9E-02	No Dose	1.9E-01	No Dose
INORG	Selenium	7782-49-2	4.90E+00		2.97E+00	8.8E-02		5.3E-01	6.2E-01	2.9E-01	**2.1E+00**	5.8E-01	**1.1E+00**
INORG	Silver	7440-22-4		5.40E-04			9.0E-05		9.0E-05	2.0E+00	4.5E-05	2.0E+01	4.5E-06
INORG	Vanadium	7440-62-2	5.44E+01		2.28E+00	9.7E-01		4.1E-01	1.4E+00	3.4E-01	**4.0E+00**	6.9E-01	**2.0E+00**
INORG	Calcium	7440-70-2	1.60E+04	4.51E+01	1.60E+04	2.9E+02	7.5E+00	2.9E+03	3.2E+03	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	8.61E+03	1.62E+01	8.61E+03	1.5E+02	2.7E+00	1.5E+03	1.7E+03	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	4.29E+02	3.13E+00	4.29E+02	7.7E+00	5.2E-01	7.7E+01	8.5E+01	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.64E+02	1.34E+02	2.64E+02	4.7E+00	2.2E+01	4.7E+01	7.4E+01	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from East Trout Brook downstream of the Leachate Treatment Plant permitted discharge. Aluminum applies the filtered EPC as unfiltered
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
Invert -- Invertebrate
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 4.4
RISK ESTIMATES FOR THE RACCOON (MAMMALIAN INVERTIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN EAST TROUT BROOK
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: East Trout Brook

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Benthic Invert. Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Benthic Invert. Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		2.50E-04			2.1E-05		2.1E-05	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1		2.70E-03			2.2E-04		2.2E-04	1.0E+01	2.2E-05	5.0E+01	4.5E-06
VOC	Dichlorodifluoromethane	75-71-8		1.60E-04			1.3E-05		1.3E-05	NA	No TRV	NA	No TRV
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		2.50E-03			2.1E-04		2.1E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2								NA	No Dose	NA	No Dose
SVOC	Anthracene	120-12-7								6.6E+01	No Dose	3.3E+02	No Dose
SVOC	Benzo(a)anthracene	56-55-3								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzo(a)pyrene	50-32-8								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzo(g,h,i)perylene	191-24-2								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzo(k)fluoranthene	207-08-9								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzyl Butyl Phthalate	85-68-7								1.6E+02	No Dose	1.6E+03	No Dose
SVOC	Chrysene	218-01-9								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Dibenz(a,h)anthracene	53-70-3								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Fluoranthene	206-44-0								6.6E+01	No Dose	3.3E+02	No Dose
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Phenanthrene	85-01-8								6.6E+01	No Dose	3.3E+02	No Dose
SVOC	Pyrene	129-00-0								6.2E-01	No Dose	3.1E+00	No Dose
PEST	Chlordane, alpha	5103-71-9		4.80E-06			4.0E-07		4.0E-07	1.2E+00	3.4E-07	1.2E+01	3.4E-08
INORG	Aluminum	7429-90-5		6.42E-02			5.3E-03		5.3E-03	1.9E+00	2.8E-03	1.9E+01	2.8E-04
INORG	Arsenic	7440-38-2	8.30E+00		2.52E+00	2.1E-02		6.7E-02	8.8E-02	1.0E+00	8.4E-02	1.7E+00	5.3E-02
INORG	Barium	7440-39-3	7.91E+01		7.20E+00	2.0E-01		1.9E-01	3.9E-01	5.2E+01	7.5E-03	1.2E+02	3.2E-03
INORG	Beryllium	7440-41-7	1.40E+00		6.30E-02	3.5E-03		1.7E-03	5.2E-03	5.3E-01	9.7E-03	6.3E-01	8.2E-03
INORG	Cadmium	7440-43-9	2.60E+00		2.12E+00	6.5E-03		5.6E-02	6.3E-02	7.7E-01	8.2E-02	7.7E+00	8.2E-03
INORG	Copper	7440-50-8								5.6E+00	No Dose	9.3E+00	No Dose
INORG	Iron	7439-89-6	3.86E+04		3.86E+04	9.6E+01		1.0E+03	1.1E+03	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1		3.80E-03			3.2E-04		3.2E-04	4.7E+00	6.7E-05	8.9E+00	3.5E-05
INORG	Manganese	7439-96-5	1.40E+03	7.05E-02	6.23E+01	3.5E+00	5.9E-03	1.7E+00	5.2E+00	5.2E+01	1.0E-01	6.5E+01	7.9E-02
INORG	Mercury	7439-97-6								1.4E+00	No Dose	1.4E+01	No Dose
INORG	Selenium	7782-49-2	4.90E+00		2.97E+00	1.2E-02		7.9E-02	9.1E-02	1.4E-01	6.4E-01	2.2E-01	4.2E-01
INORG	Silver	7440-22-4		5.40E-04			4.5E-05		4.5E-05	6.0E+00	7.5E-06	6.0E+01	7.5E-07
INORG	Vanadium	7440-62-2	5.44E+01		2.28E+00	1.4E-01		6.1E-02	2.0E-01	4.2E+00	4.7E-02	8.3E+00	2.4E-02
INORG	Calcium	7440-70-2	1.60E+04	4.51E+01	1.60E+04	4.0E+01	3.7E+00	4.2E+02	4.7E+02	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	8.61E+03	1.62E+01	8.61E+03	2.1E+01	1.3E+00	2.3E+02	2.5E+02	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	4.29E+02	3.13E+00	4.29E+02	1.1E+00	2.6E-01	1.1E+01	1.3E+01	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.64E+02	1.34E+02	2.64E+02	6.6E-01	1.1E+01	7.0E+00	1.9E+01	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from East Trout Brook downstream of the Leachate Treatment Plant permitted discharge. Aluminum applies the filtered EPC as unfiltered
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
Invert -- Invertebrate
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 4.5
RISK ESTIMATES FOR THE GREAT BLUE HERON (AVIAN PISCIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN EAST TROUT BROOK
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: East Trout Brook

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Surface Water to Fish Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Fish Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		2.50E-04	1.66E-01		1.1E-05	1.1E-02	1.1E-02	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1		2.70E-03	8.53E-03		1.2E-04	5.4E-04	6.6E-04	2.0E+02	3.3E-06	2.0E+03	3.3E-07
VOC	Dichlorodifluoromethane	75-71-8		1.60E-04	9.84E-04		7.2E-06	6.2E-05	6.9E-05	NA	No TRV	NA	No TRV
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		2.50E-03	1.35E-02		1.1E-04	8.5E-04	9.7E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2								NA	No Dose	NA	No Dose
SVOC	Anthracene	120-12-7								NA	No Dose	NA	No Dose
SVOC	Benzo(a)anthracene	56-55-3								NA	No Dose	NA	No Dose
SVOC	Benzo(a)pyrene	50-32-8								NA	No Dose	NA	No Dose
SVOC	Benzo(g,h,i)perylene	191-24-2								NA	No Dose	NA	No Dose
SVOC	Benzo(k)fluoranthene	207-08-9								NA	No Dose	NA	No Dose
SVOC	Benzyl Butyl Phthalate	85-68-7								NA	No Dose	NA	No Dose
SVOC	Chrysene	218-01-9								NA	No Dose	NA	No Dose
SVOC	Dibenz(a,h)anthracene	53-70-3								NA	No Dose	NA	No Dose
SVOC	Fluoranthene	206-44-0								NA	No Dose	NA	No Dose
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5								NA	No Dose	NA	No Dose
SVOC	Phenanthrene	85-01-8								NA	No Dose	NA	No Dose
SVOC	Pyrene	129-00-0								2.1E+01	No Dose	2.1E+02	No Dose
PEST	Chlordane, alpha	5103-71-9		4.80E-06	6.77E-02		2.2E-07	4.3E-03	4.3E-03	2.1E+00	2.0E-03	1.1E+01	4.0E-04
INORG	Aluminum	7429-90-5		6.42E-02	3.21E+01		2.9E-03	2.0E+00	2.0E+00	1.1E+02	1.8E-02	1.1E+03	1.8E-03
INORG	Arsenic	7440-38-2	8.30E+00			1.0E-02			1.0E-02	2.2E+00	4.7E-03	3.6E+00	3.0E-03
INORG	Barium	7440-39-3	7.91E+01			1.0E-01			1.0E-01	7.4E+01	1.4E-03	1.3E+02	7.6E-04
INORG	Beryllium	7440-41-7	1.40E+00			1.8E-03			1.8E-03	NA	No TRV	NA	No TRV
INORG	Cadmium	7440-43-9	2.60E+00			3.3E-03			3.3E-03	1.5E+00	2.2E-03	2.4E+00	1.4E-03
INORG	Copper	7440-50-8								4.1E+00	No Dose	1.2E+01	No Dose
INORG	Iron	7439-89-6	3.86E+04			4.9E+01			4.9E+01	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1		3.80E-03	1.14E+00		1.7E-04	7.2E-02	7.2E-02	1.6E+00	4.4E-02	3.3E+00	2.2E-02
INORG	Manganese	7439-96-5	1.40E+03	7.05E-02	2.82E+01	1.8E+00	3.2E-03	1.8E+00	3.6E+00	1.8E+02	2.0E-02	3.5E+02	1.0E-02
INORG	Mercury	7439-97-6								1.9E-02	No Dose	1.9E-01	No Dose
INORG	Selenium	7782-49-2	4.90E+00			6.2E-03			6.2E-03	2.9E-01	2.1E-02	5.8E-01	1.1E-02
INORG	Silver	7440-22-4		5.40E-04	2.70E-04		2.4E-05	1.7E-05	4.2E-05	2.0E+00	2.1E-05	2.0E+01	2.1E-06
INORG	Vanadium	7440-62-2	5.44E+01			6.9E-02			6.9E-02	3.4E-01	2.0E-01	6.9E-01	1.0E-01
INORG	Calcium	7440-70-2	1.60E+04	4.51E+01	4.51E+01	2.0E+01	2.0E+00	2.8E+00	2.5E+01	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	8.61E+03	1.62E+01	1.62E+01	1.1E+01	7.3E-01	1.0E+00	1.3E+01	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	4.29E+02	3.13E+00	3.13E+00	5.4E-01	1.4E-01	2.0E-01	8.8E-01	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.64E+02	1.34E+02	1.34E+02	3.3E-01	6.1E+00	8.5E+00	1.5E+01	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from East Trout Brook downstream of the Leachate Treatment Plant permitted discharge. Aluminum applies the filtered EPC as unfiltered
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BCFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times BCF \times AUF \times IR}{BW}$$

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

TABLE 4.6
RISK ESTIMATES FOR THE MINK (MAMMALIAN PISCIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN EAST TROUT BROOK
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: East Trout Brook

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Surface Water to Fish Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Fish Ingestion					
VOC	1,2,3-trichlorobenzene	87-61-6		2.50E-04	1.66E-01		2.4E-05	7.6E-03	7.7E-03	NA	No TRV	NA	No TRV
VOC	Acetone	67-64-1		2.70E-03	8.53E-03		2.6E-04	3.9E-04	6.5E-04	1.0E+01	6.5E-05	5.0E+01	1.3E-05
VOC	Dichlorodifluoromethane	75-71-8		1.60E-04	9.84E-04		1.5E-05	4.5E-05	6.1E-05	NA	No TRV	NA	No TRV
VOC	Diethyl Ether (Ethyl Ether)	60-29-7		2.50E-03	1.35E-02		2.4E-04	6.2E-04	8.6E-04	NA	No TRV	NA	No TRV
SVOC	2,3,4,6-tetrachlorophenol	58-90-2								NA	No Dose	NA	No Dose
SVOC	Anthracene	120-12-7								6.6E+01	No Dose	3.3E+02	No Dose
SVOC	Benzo(a)anthracene	56-55-3								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzo(a)pyrene	50-32-8								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzo(g,h,i)perylene	191-24-2								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzo(k)fluoranthene	207-08-9								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Benzyl Butyl Phthalate	85-68-7								1.6E+02	No Dose	1.6E+03	No Dose
SVOC	Chrysene	218-01-9								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Dibenz(a,h)anthracene	53-70-3								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Fluoranthene	206-44-0								6.6E+01	No Dose	3.3E+02	No Dose
SVOC	Indeno(1,2,3-c,d)pyrene	193-39-5								6.2E-01	No Dose	3.1E+00	No Dose
SVOC	Phenanthrene	85-01-8								6.6E+01	No Dose	3.3E+02	No Dose
SVOC	Pyrene	129-00-0								6.2E-01	No Dose	3.1E+00	No Dose
PEST	Chlordane, alpha	5103-71-9		4.80E-06	6.77E-02		4.6E-07	3.1E-03	3.1E-03	1.2E+00	2.6E-03	1.2E+01	2.6E-04
INORG	Aluminum	7429-90-5		6.42E-02	3.21E+01		6.1E-03	1.5E+00	1.5E+00	1.9E+00	7.7E-01	1.9E+01	7.7E-02
INORG	Arsenic	7440-38-2	8.30E+00			7.6E-03			7.6E-03	1.0E+00	7.3E-03	1.7E+00	4.6E-03
INORG	Barium	7440-39-3	7.91E+01			7.3E-02			7.3E-02	5.2E+01	1.4E-03	1.2E+02	6.0E-04
INORG	Beryllium	7440-41-7	1.40E+00			1.3E-03			1.3E-03	5.3E-01	2.4E-03	6.3E-01	2.0E-03
INORG	Cadmium	7440-43-9	2.60E+00			2.4E-03			2.4E-03	7.7E-01	3.1E-03	7.7E+00	3.1E-04
INORG	Copper	7440-50-8								5.6E+00	No Dose	9.3E+00	No Dose
INORG	Iron	7439-89-6	3.86E+04			3.5E+01			3.5E+01	NA	No TRV	NA	No TRV
INORG	Lead	7439-92-1		3.80E-03	1.14E+00		3.6E-04	5.2E-02	5.3E-02	4.7E+00	1.1E-02	8.9E+00	5.9E-03
INORG	Manganese	7439-96-5	1.40E+03	7.05E-02	2.82E+01	1.3E+00	6.7E-03	1.3E+00	2.6E+00	5.2E+01	5.0E-02	6.5E+01	4.0E-02
INORG	Mercury	7439-97-6								1.4E+00	No Dose	1.4E+01	No Dose
INORG	Selenium	7782-49-2	4.90E+00			4.5E-03			4.5E-03	1.4E-01	3.2E-02	2.2E-01	2.1E-02
INORG	Silver	7440-22-4		5.40E-04	2.70E-04		5.2E-05	1.2E-05	6.4E-05	6.0E+00	1.1E-05	6.0E+01	1.1E-06
INORG	Vanadium	7440-62-2	5.44E+01			5.0E-02			5.0E-02	4.2E+00	1.2E-02	8.3E+00	6.0E-03
INORG	Calcium	7440-70-2	1.60E+04	4.51E+01	4.51E+01	1.5E+01	4.3E+00	2.1E+00	2.1E+01	NA	No TRV	NA	No TRV
INORG	Magnesium	7439-95-4	8.61E+03	1.62E+01	1.62E+01	7.9E+00	1.6E+00	7.4E-01	1.0E+01	NA	No TRV	NA	No TRV
INORG	Potassium	7440-09-7	4.29E+02	3.13E+00	3.13E+00	3.9E-01	3.0E-01	1.4E-01	8.4E-01	NA	No TRV	NA	No TRV
INORG	Sodium	7440-23-5	2.64E+02	1.34E+02	1.34E+02	2.4E-01	1.3E+01	6.2E+00	1.9E+01	NA	No TRV	NA	No TRV

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from East Trout Brook downstream of the Leachate Treatment Plant permitted discharge. Aluminum applies the filtered EPC as unfiltered
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BCFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times BCF \times AUF \times IR}{BW}$$

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

TABLE 5.1

STEP 3A - REFINEMENT OF ECOLOGICAL COPCS FOR SURFACE WATER FROM TROUT BROOK, LAMINGTON RIVER UNT AND TANNERS BROOK UNT

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water from Trout Brook, Lamington River UNT, Tanners Brook UNT

Exposure Point	T or D	COPC Group	COPC	CASRN	Maximum Detected Concentration (ug/L)	95% UCL (ug/L) (1)	95% UCL Method	ProUCL Notes	Exposure Point Concentration (ug/L) (2)	Background Threshold Value (ug/L) (3)	Hierarchy: Surface Water Ecological Screening Benchmark (ug/L) (4)	COPC Flag (Y/N)	Rationale for Selection or Deletion
Surface water	T	INORGANIC	Aluminum	7429-90-5	2,100	736.4	Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)		736.4	450	87	Y	Above screening benchmark.
Surface water	T	INORGANIC	Copper	7440-50-8	8	8.136	95% KM (t) UCL	f, i	8	1.391	1.58	Y	Above screening benchmark.
Surface water	T	INORGANIC	Lead	7439-92-1	26.6	7.146	KM H-UCL		7.146	1.594	1.17	Y	Above screening benchmark.

Notes:

The COPC refinement determines site-related COPCs through use of 95% upper confidence limits (UCLs), background concentrations and additional ecological screening benchmarks (EPA Region 4).

(1) The 95% UCL was calculated using data from three water bodies: Trout Brook, Lamington River UNT and Tanners Brook UNT. Supporting calculations are provided in Attachment B.

(2) The exposure point concentration is the minimum of the maximum detected concentration and 95% UCL.

(3) Background threshold values were calculated using data from the September 2017 background area sampling along Tanners Brook. Supporting calculations are provided in Attachment C.

(4) The COPC screening applies a hierarchy of criteria: NJDEP Ecological Screening Criteria Freshwater (Chronic and Acute) and EPA National Water Quality Criteria (Chronic and Acute). EPA Region 5 RCRA Ecological Screening Levels for water and EPA Region 4 Freshwater Screening Values (Chronic and Acute) are applied when no other value is available. Hardness-dependent NJ and EPA criteria are calculated for copper using site-specific hardness; calculations are presented on Table 1.4 and a hardness of 21 mg/L is applied.

Abbreviations:

COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
NJDEP -- New Jersey Department of Environmental Protection
T or D -- Total or dissolved
ug/L -- Micrograms per liter
UNT -- Unnamed tributary
Y/N -- Yes or no

ProUCL Notes and Warnings:

f Data set has only 3 Detected Values.
i Suggested UCL exceeds the maximum observation.

References:

NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2017. National Recommended Water Quality Criteria. Office of Water. Website Last Updated July 20, 2017. Available online: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table
EPA Region IV. 2018. Ecological Risk Assessment Supplemental Guidance. March. Available online: https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance
EPA Region V. 2003. RCRA Ecological Screening Levels. August 22. Available online: https://archive.epa.gov/region5/waste/cars/web/html/esl.html

TABLE 5.2

STEP 3A - REFINEMENT OF ECOLOGICAL COPCS FOR SEDIMENT FROM TROUT BROOK, LAMINGTON RIVER UNT AND TANNERS BROOK UNT

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

Scenario Timeframe: Current/Future

Medium: Sediment

Exposure Medium: Sediment from Trout Brook, Lamington River UNT, Tanners Brook UNT

Exposure Point	COPC Group	COPC	CASRN	Maximum Detected Concentration (mg/kg)	95% UCL (mg/kg) (1)	95% UCL Method	ProUCL Notes	Exposure Point Concentration (ug/L) (2)	Background Threshold Value (ug/L) (3)	Hierarchy Sediment Ecological Benchmark (mg/kg) (4)	COPC Flag (Y/N)	Rationale for Selection or Deletion
Sediment	INORGANIC	Copper	7440-50-8	28.2	12.23	95% Student's-t UCL		12.23	10.21	16	N	Below screening benchmark.
Sediment	INORGANIC	Lead	7439-92-1	71.4	39.44	95% Chebyshev (Mean, Sd) UCL		39.44	9.596	31	Y	Above screening benchmark.
Sediment	INORGANIC	Mercury	7439-97-6	0.27	--	No UCL calculated, insufficient detects	d, g	0.27	ND	0.174	Y	Above screening benchmark.
Sediment	INORGANIC	Selenium	7782-49-2	4.7	2.331	95% Student's-t UCL		2.331	ND	2	Y	Above screening benchmark.
Sediment	INORGANIC	Vanadium	7440-62-2	45.5	22.83	95% Student's-t UCL		22.83	19.03	NC	Y	No screening benchmark.

Notes:

The COPC refinement determines site-related COPCs through use of 95% upper confidence limits (UCLs), background concentrations and additional ecological screening benchmarks (EPA Region 4).

(1) The 95% UCL was calculated using data from three water bodies: Trout Brook, Lamington River UNT and Tanners Brook UNT. Supporting calculations are provided in Attachment B.

(2) The exposure point concentration is the minimum of the maximum detected concentration and 95% UCL.

(3) Background threshold values were calculated using data from the September 2017 background area sampling along Tanners Brook. Supporting calculations are provided in Attachment C.

(4) The COPC screening applies a hierarchy of criteria: NJDEP Ecological Screening Criteria Freshwater Sediment Lower Effects Level and then the minimum of the EPA Region 3 Sediment Freshwater Ecological Benchmarks and EPA Region 5 RCRA Ecological Screening Levels. EPA Region 4 Sediment Freshwater Refined for Non-Narcotic Mode of Action Screening Values are applied when no other value is available.

Abbreviations:

COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
mg/kg -- Milligrams per kilogram
NC -- No criterion
NJDEP -- New Jersey Department of Environmental Protection
RCRA -- Resource Conservation and Recovery Act
UNT -- Unnamed tributary
Y/N -- Yes or no

ProUCL Notes and Warnings:

d Data set has only 1 Distinct Detected Values.
g The data set was not processed.

References:

NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2000. Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment. February.
EPA. 2016. Ecological Soil Screening Levels. Various documents. Website Last Updated September 22. Available online: https://www.epa.gov/chemical-research/ecological-soil-screening-level
EPA Region III. 2006. Freshwater Sediment Screening Benchmarks. August. Available online: https://www.epa.gov/risk/freshwater-sediment-screening-benchmarks
EPA Region IV. 2018. Ecological Risk Assessment Supplemental Guidance. March. Available online: https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance
EPA Region V. 2003. RCRA Ecological Screening Levels. August 22. Available online: https://archive.epa.gov/region5/waste/cars/web/html/esl.html

TABLE 5.3
STEP 3A - REFINEMENT OF ECOLOGICAL COPCS FOR SEDIMENT FROM EAST TROUT BROOK
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment from East Trout Brook

Exposure Point	COPC Group	COPC	CASRN	Maximum Detected Concentration (mg/kg)	95% UCL (mg/kg) (1)	95% UCL Method	ProUCL Notes	Exposure Point Concentration (ug/L) (2)	Background Threshold Value (mg/kg) (3)	Hierarchy	COPC Flag (Y/N)	Rationale for Selection or Deletion (6)
										Sediment Ecological Benchmark (mg/kg) (4)		
Sediment	INORGANIC	Selenium	7782-49-2	4.9	4.204	95% Student's-t UCL	h	4.204	ND	2	Y	Above screening benchmark.
Sediment	INORGANIC	Vanadium	7440-62-2	54.4	45.06	95% Student's-t UCL	h	45.06	19.03	NC	Y	No screening benchmark.

Notes:
The COPC refinement determines site-related COPCs through use of 95% upper confidence limits (UCLs), background concentrations and additional ecological screening benchmarks (EPA Region 4).
(1) The 95% UCL was calculated using data from East Trout Brook. Supporting calculations are provided in Attachment B.
(2) The exposure point concentration is the minimum of the maximum detected concentration and 95% UCL.
(3) Background threshold values were calculated using data from the September 2017 background area sampling along Tanners Brook. Supporting calculations are provided in Attachment C.
(4) The COPC screening applies a hierarchy of criteria: NJDEP Ecological Screening Criteria Freshwater Sediment Lower Effects Level and then the minimum of the EPA Region 3 Sediment Ecological Benchmarks and EPA Region 5 RCRA Ecological Screening Levels. EPA Region 4 Sediment Freshwater Refined for Non-Narcotic Mode of Action Screening Values are applied when no other value is available.

Abbreviations:
COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
mg/kg -- Milligrams per kilogram
NC -- No criterion
NJDEP -- New Jersey Department of Environmental Protection
RCRA -- Resource Conservation and Recovery Act
Y/N -- Yes or no

ProUCL Notes and Warnings:
h Sample size is small (e.g., <10).

References:

NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2000. Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment. February.
EPA. 2016. Ecological Soil Screening Levels. Various documents. Website Last Updated September 22. Available online: https://www.epa.gov/chemical-research/ecological-soil-screening-level
EPA Region III. 2006. Freshwater Sediment Screening Benchmarks. August. Available online: https://www.epa.gov/risk/freshwater-sediment-screening-benchmarks
EPA Region IV. 2018. Ecological Risk Assessment Supplemental Guidance. March. Available online: https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance
EPA Region V. 2003. RCRA Ecological Screening Levels. August 22. Available online: https://archive.epa.gov/region5/waste/cars/web/html/esl.html

TABLE 6.1
RISK ESTIMATES FOR THE MUSKRAT (MAMMALIAN HERBIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN TROUT BROOK, LAMINGTON RIVER UNT, TANNERS BROOK UNT - STEP 3A
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: Trout Brook, Lamington River UNT, Tanners Brook UNT - Step 3A

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Aquatic Plant Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Aquatic Plant Ingestion					
INORG	Selenium	7782-49-2	2.33E+00		1.29E+00	3.2E-03		7.5E-02	7.8E-02	1.4E-01	5.5E-01	2.2E-01	3.6E-01

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from three of the four water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT).
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 6.2
RISK ESTIMATES FOR THE SANDPIPER (AVIAN INVERTIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN TROUT BROOK, LAMINGTON RIVER UNT, TANNERS BROOK UNT - STEP 3A
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: Trout Brook, Lamington River UNT, Tanners Brook UNT - Step 3A

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Benthic Invert. Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Benthic Invert. Ingestion					
INORG	Copper	7440-50-8		8.00E-03			1.3E-03		1.3E-03	4.1E+00	3.3E-04	1.2E+01	1.1E-04
INORG	Lead	7439-92-1	3.94E+01	7.15E-03	3.18E+00	7.0E-01	1.2E-03	5.7E-01	1.3E+00	1.6E+00	7.8E-01	3.3E+00	3.9E-01
INORG	Mercury	7439-97-6	2.70E-01		1.39E-01	4.8E-03		2.5E-02	3.0E-02	1.9E-02	**1.6E+00**	1.9E-01	1.6E-01
INORG	Selenium	7782-49-2	2.33E+00		1.73E+00	4.2E-02		3.1E-01	3.5E-01	2.9E-01	**1.2E+00**	5.8E-01	6.0E-01
INORG	Vanadium	7440-62-2	2.28E+01		9.59E-01	4.1E-01		1.7E-01	5.8E-01	3.4E-01	**1.7E+00**	6.9E-01	8.4E-01

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from three of the four water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT).
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
Invert -- Invertebrate
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 6.3
RISK ESTIMATES FOR THE MINK (MAMMALIAN PISCIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN TROUT BROOK, LAMINGTON RIVER UNT, TANNERS BROOK UNT - STEP 3A
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: Trout Brook, Lamington River UNT, Tanners Brook UNT - Step 3A

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Surface Water to Fish Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Fish Ingestion					
INORG	Aluminum	7429-90-5		7.36E-01	3.68E+02		7.0E-02	1.7E+01	1.7E+01	1.9E+00	**8.8E+00**	1.9E+01	8.8E-01

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from three of the four water bodies (Trout Brook, Lamington River UNT and Tanners Brook UNT).
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BCFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times BCF \times AUF \times IR}{BW}$$

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

TABLE 7.1
RISK ESTIMATES FOR THE MUSKRAT (MAMMALIAN HERBIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN EAST TROUT BROOK - STEP 3A
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: East Trout Brook - Step 3A

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Aquatic Plant Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Aquatic Plant Ingestion					
INORG	Selenium	7782-49-2	4.20E+00		2.48E+00	5.8E-03		1.4E-01	1.5E-01	1.4E-01	**1.0E+00**	2.2E-01	6.9E-01

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from East Trout Brook downstream of the Leachate Treatment Plant permitted discharge. Aluminum applies the filtered EPC as unfiltered
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 7.2
RISK ESTIMATES FOR THE SANDPIPER (AVIAN INVERTIVORE) FROM EXPOSURE TO SURFACE WATER & SEDIMENT IN EAST TROUT BROOK - STEP 3A
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Exposure Medium: East Trout Brook - Step 3A

COPC Group	COPC	CASRN	Exposure Point Concentration			Exposure Dose (mg/kg-d)			Total Exposure Dose (mg/kg-d)	NOAEL TRV (mg/kg-d)	NOAEL HQ	LOAEL TRV (mg/kg-d)	LOAEL HQ
			Sediment (mg/kg)	Surface Water (mg/L)	Sediment to Benthic Invert. Tissue (mg/kg dw)	Sediment Ingestion	Surface Water Ingestion	Benthic Invert. Ingestion					
INORG	Selenium	7782-49-2	4.20E+00		2.66E+00	7.5E-02		4.7E-01	5.5E-01	2.9E-01	**1.9E+00**	5.8E-01	9.5E-01
INORG	Vanadium	7440-62-2	4.51E+01		1.89E+00	8.1E-01		3.4E-01	1.1E+00	3.4E-01	**3.3E+00**	6.9E-01	**1.7E+00**

Notes:
Exposure point concentrations are the maximum detected concentrations for total (unfiltered) samples collected from East Trout Brook downstream of the Leachate Treatment Plant permitted discharge. Aluminum applies the filtered EPC as unfiltered
Wildlife exposure factors are summarized in Table 2.1.
Diet was assumed to consist exclusively of one food type. Predicted tissue concentrations are based on the bioaccumulation models (BAFs) that are presented in Table 2.2.
Toxicity reference values (NOAELs/LOAELs) are summarized in Table 2.3.
Blank cells denote not detected or not analyzed results.

Abbreviations:
AUF -- Area use factor
BW -- Body weight
COPC -- Constituent of potential concern
HQ -- Hazard quotient
Invert -- Invertebrate
IR -- Ingestion rate of soil, water or food
LOAEL -- Lowest observed adverse effect level
mg/kg-d -- Milligrams per kilogram per day
mg/kg dw -- Miligrams per kilogram dry weight
mg/L -- Milligrams per liter
NOAEL -- No observed adverse effect level
TRV -- Toxicity reference value

Equations:

$$Exposure\ Dose = \frac{EPC \times IR \times BAF \times AUF}{BW}$$

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

TABLE 8.1
STEP 3A - REFINEMENT OF ECOLOGICAL COPCS FOR SEEPS/SPRINGS
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Scenario Timeframe: Current/Future
Medium: Surface Water / Groundwater
Exposure Medium: Seeps and Springs in OU2

Exposure Point	T or D	Constituent Group	Constituent	CASRN	Maximum Detected Concentration (ug/L)	95% UCL (ug/L) (1)	95% UCL Method	ProUCL Notes	Exposure Point Concentration (ug/L) (2)	Background Threshold Value (ug/L) (3)	Hierarchy Surface Water Ecological Screening Benchmark (ug/L) (4)	COPC Flag (Y/N)	Rationale for Selection or Deletion
Seep/Spring Water	T	PESTICIDE	4,4'-DDD	72-54-8	0.00042	--	No UCL calculated, insufficient detects	d, g, h	0.00042	ND	0.01	N	Below screening benchmark.
Seep/Spring Water	T	INORGANIC	Aluminum	7429-90-5	9,820	29,146	95% Adjusted Gamma UCL	h, i	9,820	450	87	Y	Above screening benchmark.
Seep/Spring Water	T	INORGANIC	Cadmium	7440-43-9	0.88	2.056	95% KM (Chebyshev) UCL	e, h, i	0.88	ND	0.15	Y	Above screening benchmark.
Seep/Spring Water	T	INORGANIC	Calcium	7440-70-2	16,700	14,513	95% Student's-t UCL	h	14,513	9,228	116,000	N	Below screening benchmark. Essential nutrient.
Seep/Spring Water	T	INORGANIC	Iron	7439-89-6	32,600	69,592	95% Adjusted Gamma UCL	h, i	32,600	2,014	1,000	Y	Above screening benchmark.
Seep/Spring Water	T	INORGANIC	Magnesium	7439-95-4	5,320	4,520	95% Student's-t UCL	h	4,520	3,861	82,000	N	Below screening benchmark. Essential nutrient.
Seep/Spring Water	T	INORGANIC	Manganese	7439-96-5	708	1,971	95% Adjusted Gamma UCL	h, i	708	65.09	93	Y	Above screening benchmark.
Seep/Spring Water	T	INORGANIC	Potassium	7440-09-7	1,590	1,542	95% Student's-t UCL	h	1,542	1,244	53,000	N	Below screening benchmark. Essential nutrient.
Seep/Spring Water	T	INORGANIC	Sodium	7440-23-5	8,310	6,821	95% Student's-t UCL		6,821	4,875	680,000	N	Below screening benchmark. Essential nutrient.
Seep/Spring Water	T	INORGANIC	Vanadium	7440-62-2	62.4	--	No UCL suggested	b, h	62.4	0.66	12	Y	Above screening benchmark.
Seep/Spring Water	D	INORGANIC	Aluminum	7429-90-5	22.6	--	No UCL calculated, insufficient detects	d, g, h	22.6	2.5	NC	Y	No screening benchmark.
Seep/Spring Water	D	INORGANIC	Calcium	7440-70-2	16,900	14,015	95% Student's-t UCL	h	14,015	8,749	NC	N	Essential nutrient.
Seep/Spring Water	D	INORGANIC	Iron	7439-89-6	2,000	1,328	95% Student's-t UCL	h	1,328	197.1	NC	N	Essential nutrient.
Seep/Spring Water	D	INORGANIC	Magnesium	7439-95-4	5,370	4,307	95% Student's-t UCL	h	4,307	3,744	NC	N	Essential nutrient.
Seep/Spring Water	D	INORGANIC	Manganese	7439-96-5	552	316.8	95% Student's-t UCL	h	316.8	44.54	NC	Y	No screening benchmark.
Seep/Spring Water	D	INORGANIC	Potassium	7440-09-7	1,510	1,505	95% Student's-t UCL	h	1,505	1,142	NC	N	Essential nutrient.
Seep/Spring Water	D	INORGANIC	Sodium	7440-23-5	8,480	7,520	95% Student's-t UCL	h	7,520	5,168	NC	N	Essential nutrient.
Seep/Spring Water	D	INORGANIC	Vanadium	7440-62-2	0.92	--	No UCL calculated, insufficient detects	d, g, h	0.92	ND	NC	Y	No screening benchmark.

Notes:
The COPC refinement determines site-related COPCs through use of 95% upper confidence limits (UCLs), background concentrations, additional screening criteria (USEPA Region 4) and identification as an essential nuturient.
(1) The 95% UCL was calculated using data from Seep A, Spring A and Seep B. Supporting calculations are provided in Attachment B.
(2) The exposure point concentration is the minimum of the maximum detected concentration and 95% UCL.
(3) Background threshold values were calculated using data from the September 2017 background area sampling along Tanners Brook. Supporting calculations are provided in Attachment C.
(4) The COPC screening applies a hierarchy of criteria: NJDEP Ecological Screening Criteria Freshwater (Chronic and Acute), EPA National Water Quality Criteria (Chronic and Acute) and EPA Region 5 RCRA Ecological Screening Levels. EPA Region 4 Freshwater Screening Values (Chronic and Acute) are applied when no other value is available. Hardness-dependent NJ and EPA criteria are calculated for cadmium, copper, iron, nickel, silver and zinc using site-specific hardness; calculations are presented on Table 1.4 and a hardness of 21 mg/L is applied.

Abbreviations:
COPC -- Constituent of potential concern
EPA -- United States Environmental Protection Agency
NC -- No criterion
NJDEP -- New Jersey Department of Environmental Protection
T or D -- Total or dissolved
ug/L -- Micrograms per liter
UNT -- Unnamed tributary
VOC -- Volatile organic compound
Y/N -- Yes or no

ProUCL Notes and Warnings:
a The highest UCL is chosen when ProUCL suggested more than one UCL. H-UCL was not chosen.
b One or more recommended UCL not available.
c All data are non-detects.
d Data set has only 1 Distinct Detected Values.
e Data set has only 2 Detected Values.
f Data set has only 3 Detected Values.
g The data set was not processed.
h Sample size is small (e.g., <10).
i Suggested UCL exceeds the maximum observation.

References:
NJDEP. 2009. Ecological Screening Criteria. March 10. Available online: http://www.nj.gov/dep/srp/guidance/ecoscreening/
EPA. 2017. National Recommended Water Quality Criteria. Office of Water. Website Last Updated July 20, 2017. Available online: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table
EPA Region IV. 2018. Ecological Risk Assessment Supplemental Guidance. March. Available online: https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance
EPA Region V. 2003. RCRA Ecological Screening Levels. August 22. Available online: https://archive.epa.gov/region5/waste/cars/web/html/esl.html

Attachment B

Contents:

Table B.1 ProUCL Data Input for All Media

Table B.2 ProUCL Output for Surface Water from Trout Brook, Lamington River UNT and Tanners Brook UNT

Table B.3 ProUCL Output for Sediment from Trout Brook, Lamington River UNT, and Tanners Brook UNT

Table B.4 ProUCL Output for Sediment from East Trout Brook

Table B.5 ProUCL Output for Seeps/Springs

TABLE B.1

PROUCL DATA INPUT FOR ALL MEDIA

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:

The data set provided here are for constituents of potential concern (COPCs) by medium to calculate 95% upper confidence limits of the mean (UCLs) using USEPA ProUCL software for the risk assessment. Sediment and unfiltered surface water data are presented.

The COPC list has been refined to those with hazard quotients greater than 1 in the wildlife food chain modeling for the Step 3A evaluation.

The maximum of the field duplicate and parent sample results was applied. The detection limit is presented in hierarchy of quantitation limit, then method detection limit and then reporting limit. Refer to the Remedial Investigation Report for the complete data set.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Location	Sample ID	Sample Type	Sample Date	Start Depth	End Depth	Depth Unit	Analysis Date	Analytical Method	T or D	COPC Group	CASRN	Qualifier	Detection Limit	Unit
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	5.2	1	TBSD0005	TBSD0005-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	11.6	1	LUSD0005	LUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/28/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	18.2	1	LUSD0002	LUSD0002-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8	J	2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	6.5	1	TBSD0002	TBSD0002-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	14.3	1	LUSD0001	LUSD0001-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8	J	2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	11.2	1	TUSD0005	TUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	4	1	LUSD0003	LUSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	3	1	TUSD0002	TUSD0002-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8	J	2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	6.2	1	TBSD0003	TBSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	7.5	1	TUSD0004	TUSD0004-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	8	1	TBSD0004	TBSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	28.2	1	LUSD0004	LUSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7440-50-8	J	2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	2.9	1	TBSD0006	TBSD0006-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	7.2	1	LUSD0006	LUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/28/2014	E200.7	T	INORGANIC	7440-50-8	J	2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	1.7	1	TUSD0001	TUSD0001-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8	J	2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	19.5	1	TUSD0006	TUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	11	1	TUSD0003	TUSD0003-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8		2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Copper_7440-50-8_T	2.2	1	TBSD0001	TBSD0001-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-50-8	J	2.5	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	6.9	1	TUSD0005	TUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	4.7	1	TBSD0004	TBSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1	J	1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	10.9	1	LUSD0005	LUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/28/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	5.6	1	TBSD0001	TBSD0001-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	9.4	1	TUSD0003	TUSD0003-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	10.1	1	TBSD0003	TBSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	8.2	1	TBSD0002	TBSD0002-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	9.5	1	TUSD0006	TUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	9.1	1	LUSD0006	LUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/28/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	6.8	1	TBSD0006	TBSD0006-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	6.4	1	TUSD0004	TUSD0004-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	23	1	TUSD0001	TUSD0001-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	5.7	1	TBSD0005	TBSD0005-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	44.3	1	LUSD0001	LUSD0001-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1	J	1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	36.4	1	LUSD0002	LUSD0002-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1	J	1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	7.7	1	LUSD0003	LUSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7439-92-1	J	1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	71.4	1	LUSD0004	LUSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7439-92-1	J	1	mg/kg
Sediment from Trout, Lamington, Tanners	Lead_7439-92-1_T	59	1	TUSD0002	TUSD0002-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7439-92-1		1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TBSD0001	TBSD0001-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	LUSD0004	LUSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	UJ	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TBSD0004	TBSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	LUSD0005	LUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/26/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	LUSD0003	LUSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TUSD0003	TUSD0003-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TUSD0005	TUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	LUSD0006	LUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/26/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TBSD0002	TBSD0002-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TUSD0006	TUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TUSD0002	TUSD0002-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	LUSD0001	LUSD0001-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	UJ	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	LUSD0002	LUSD0002-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	UJ	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.27	1	TBSD0003	TBSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6		0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TUSD0004	TUSD0004-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TBSD0006	TBSD0006-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TBSD0005	TBSD0005-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Mercury_7439-97-6_T	0.1	0	TUSD0001	TUSD0001-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E245.5	T	INORGANIC	7439-97-6	U	0.1	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	2.6	1	TBSD0002	TBSD0002-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	1.4	1	TUSD0002	TUSD0002-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	3.3	1	LUSD0002	LUSD0002-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	1.5	1	TBSD0003	TBSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	0.96	1	TUSD0001	TUSD0001-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	2.1	1	TBSD0004	TBSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	2.1	1	TUSD0006	TUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	1	1	TBSD0006	TBSD0006-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	0.67	1	TUSD0004	TUSD0004-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	4.7	1	LUSD0004	LUSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	0.99	1	TBSD0001	TBSD0001-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	1.3	1	LUSD0006	LUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/28/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	4	1	LUSD0001	LUSD0001-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	1.7	1	LUSD0003	LUSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	0.94	1	TBSD0005	TBSD0005-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	0.88	1	TUSD0005	TUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	2.2	1	LUSD0005	LUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/28/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Selenium_7782-49-2_T	1.2	1	TUSD0003	TUSD0003-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	28.1	1	LUSD0002	LUSD0002-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2	J	5	mg/kg

TABLE B.1

PROUCL DATA INPUT FOR ALL MEDIA

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:

The data set provided here are for constituents of potential concern (COPCs) by medium to calculate 95% upper confidence limits of the mean (UCLs) using USEPA ProUCL software for the risk assessment. Sediment and unfiltered surface water data are presented.

The COPC list has been refined to those with hazard quotients greater than 1 in the wildlife food chain modeling for the Step 3A evaluation.

The maximum of the field duplicate and parent sample results was applied. The detection limit is presented in hierarchy of quantitation limit, then method detection limit and then reporting limit. Refer to the Remedial Investigation Report for the complete data set.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Location	Sample ID	Sample Type	Sample Date	Start Depth	End Depth	Depth Unit	Analysis Date	Analytical Method	T or D	COPC Group	CASRN	Qualifier	Detection Limit	Unit
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	23.5	1	TBSD0002	TBSD0002-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	14.6	1	TBSD0005	TBSD0005-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	14.4	1	TUSD0005	TUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	10.3	1	LUSD0006	LUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/28/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	24.6	1	LUSD0005	LUSD0005-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/28/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	12.1	1	LUSD0003	LUSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	5.2	1	TUSD0002	TUSD0002-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	7.4	1	TBSD0001	TBSD0001-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	10.9	1	TUSD0004	TUSD0004-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	45.5	1	LUSD0004	LUSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7440-62-2	J	5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	14.2	1	TBSD0003	TBSD0003-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	21.4	1	TBSD0004	TBSD0004-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	7.4	1	TBSD0006	TBSD0006-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/21/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	31.5	1	LUSD0001	LUSD0001-SD-AA-AB-RS-0	N	11/12/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2	J	5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	32.6	1	TUSD0006	TUSD0006-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	4.5	1	TUSD0001	TUSD0001-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from Trout, Lamington, Tanners	Vanadium_7440-62-2_T	20.8	1	TUSD0003	TUSD0003-SD-AA-AB-RS-0	N	11/13/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Seep/Spring Water	1,4-Dioxane_123-91-1_T	0.1	0	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/8/2017	E625	T	VOC	123-91-1	U	0.1	ug/l
Seep/Spring Water	1,4-Dioxane_123-91-1_T	3.5	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/10/2017	E625	T	VOC	123-91-1	D	1	ug/l
Seep/Spring Water	1,4-Dioxane_123-91-1_T	5.9	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/10/2017	E625	T	VOC	123-91-1	D	1	ug/l
Seep/Spring Water	1,4-Dioxane_123-91-1_T	0.1	0	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/8/2017	E625	T	VOC	123-91-1	U	0.1	ug/l
Seep/Spring Water	1,4-Dioxane_123-91-1_T	0.1	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/7/2017	E625	T	VOC	123-91-1	U	0.1	ug/l
Seep/Spring Water	1,4-Dioxane_123-91-1_T	0.1	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/8/2017	E625	T	VOC	123-91-1	U	0.1	ug/l
Seep/Spring Water	Chloroform_67-66-3_T	0.5	0	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/4/2017	E524.2	T	VOC	67-66-3	U	0.5	ug/l
Seep/Spring Water	Chloroform_67-66-3_T	0.5	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	9/28/2017	E524.2	T	VOC	67-66-3	U	0.5	ug/l
Seep/Spring Water	Chloroform_67-66-3_T	0.27	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/4/2017	E524.2	T	VOC	67-66-3	J	0.5	ug/l
Seep/Spring Water	Chloroform_67-66-3_T	0.34	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/4/2017	E524.2	T	VOC	67-66-3	J	0.5	ug/l
Seep/Spring Water	Chloroform_67-66-3_T	0.5	0	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	9/28/2017	E524.2	T	VOC	67-66-3	U	0.5	ug/l
Seep/Spring Water	Chloroform_67-66-3_T	0.5	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	9/27/2017	E524.2	T	VOC	67-66-3	U	0.5	ug/l
Seep/Spring Water	4,4'-DDD_72-54-8_T	0.0014	0	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/3/2017	SW8081B	T	PEST	72-54-8	U	0.0014	ug/l
Seep/Spring Water	4,4'-DDD_72-54-8_T	0.0014	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	72-54-8	U	0.0014	ug/l
Seep/Spring Water	4,4'-DDD_72-54-8_T	0.0014	0	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	72-54-8	U	0.0014	ug/l
Seep/Spring Water	4,4'-DDD_72-54-8_T	0.0014	0	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/3/2017	SW8081B	T	PEST	72-54-8	U	0.0014	ug/l
Seep/Spring Water	4,4'-DDD_72-54-8_T	0.0014	0	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/3/2017	SW8081B	T	PEST	72-54-8	U	0.0014	ug/l
Seep/Spring Water	4,4'-DDD_72-54-8_T	0.00042	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	72-54-8	J	0.0013	ug/l
Seep/Spring Water	BHC alpha_319-84-6_T	0.00098	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	319-84-6	J	0.0013	ug/l
Seep/Spring Water	BHC alpha_319-84-6_T	0.0014	0	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/3/2017	SW8081B	T	PEST	319-84-6	U	0.0014	ug/l
Seep/Spring Water	BHC alpha_319-84-6_T	0.0014	0	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/3/2017	SW8081B	T	PEST	319-84-6	U	0.0014	ug/l
Seep/Spring Water	BHC alpha_319-84-6_T	0.0014	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	319-84-6	U	0.0014	ug/l
Seep/Spring Water	BHC alpha_319-84-6_T	0.0014	0	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	319-84-6	U	0.0014	ug/l
Seep/Spring Water	BHC alpha_319-84-6_T	0.0014	0	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/3/2017	SW8081B	T	PEST	319-84-6	U	0.0014	ug/l
Seep/Spring Water	Endosulfan sulfate_1031-07-8_T	0.00044	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/3/2017	SW8081B	T	PEST	1031-07-8	J	0.0014	ug/l
Seep/Spring Water	Endosulfan sulfate_1031-07-8_T	0.00079	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	1031-07-8	J	0.0013	ug/l
Seep/Spring Water	Endosulfan sulfate_1031-07-8_T	0.0014	0	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	1031-07-8	U	0.0014	ug/l
Seep/Spring Water	Endosulfan sulfate_1031-07-8_T	0.0014	0	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/3/2017	SW8081B	T	PEST	1031-07-8	U	0.0014	ug/l
Seep/Spring Water	Endosulfan sulfate_1031-07-8_T	0.0014	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	1031-07-8	U	0.0014	ug/l
Seep/Spring Water	Endosulfan sulfate_1031-07-8_T	0.0014	0	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/3/2017	SW8081B	T	PEST	1031-07-8	U	0.0014	ug/l
Seep/Spring Water	Endrin_72-20-8_T	0.0014	0	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/3/2017	SW8081B	T	PEST	72-20-8	U	0.0014	ug/l
Seep/Spring Water	Endrin_72-20-8_T	0.0014	0	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/3/2017	SW8081B	T	PEST	72-20-8	U	0.0014	ug/l
Seep/Spring Water	Endrin_72-20-8_T	0.00031	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	72-20-8	J	0.0014	ug/l
Seep/Spring Water	Endrin_72-20-8_T	0.00048	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	72-20-8	J	0.0014	ug/l
Seep/Spring Water	Endrin_72-20-8_T	0.0014	0	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/3/2017	SW8081B	T	PEST	72-20-8	U	0.0014	ug/l
Seep/Spring Water	Endrin_72-20-8_T	0.0013	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	9/29/2017	SW8081B	T	PEST	72-20-8	U	0.0013	ug/l
Seep/Spring Water	Aluminum_7429-90-5_T	16.3	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7429-90-5	J	20	ug/l
Seep/Spring Water	Aluminum_7429-90-5_T	40.8	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7429-90-5		20	ug/l
Seep/Spring Water	Aluminum_7429-90-5_T	9820	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7429-90-5		20	ug/l
Seep/Spring Water	Aluminum_7429-90-5_T	711	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7429-90-5		20	ug/l
Seep/Spring Water	Aluminum_7429-90-5_T	90.3	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7429-90-5		20	ug/l
Seep/Spring Water	Aluminum_7429-90-5_T	186	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7429-90-5		20	ug/l
Seep/Spring Water	Arsenic_7440-38-2_T	1.5	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-38-2		1	ug/l
Seep/Spring Water	Arsenic_7440-38-2_T	1	0	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-38-2	U	1	ug/l
Seep/Spring Water	Arsenic_7440-38-2_T	2.2	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-38-2		1	ug/l
Seep/Spring Water	Arsenic_7440-38-2_T	3.5	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-38-2		1	ug/l
Seep/Spring Water	Arsenic_7440-38-2_T	1.4	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-38-2		1	ug/l
Seep/Spring Water	Arsenic_7440-38-2_T	1	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-38-2	U	1	ug/l
Seep/Spring Water	Barium_7440-39-3_T	18	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-39-3		10	ug/l
Seep/Spring Water	Barium_7440-39-3_T	133	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-39-3		10	ug/l
Seep/Spring Water	Barium_7440-39-3_T	11.2	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-39-3		10	ug/l
Seep/Spring Water	Barium_7440-39-3_T	19.1	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-39-3		10	ug/l
Seep/Spring Water	Barium_7440-39-3_T	10	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-39-3	U	10	ug/l
Seep/Spring Water	Barium_7440-39-3_T	10	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-39-3	U	10	ug/l
Seep/Spring Water	Beryllium_7440-41-7_T	0.18	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-41-7	J	1	ug/l
Seep/Spring Water	Beryllium_7440-41-7_T	1	0	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-41-7	U	1	ug/l
Seep/Spring Water	Beryllium_7440-41-7_T	1	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-41-7	U	1	ug/l

TABLE B.1

PROUCL DATA INPUT FOR ALL MEDIA

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:

The data set provided here are for constituents of potential concern (COPCs) by medium to calculate 95% upper confidence limits of the mean (UCLs) using USEPA ProUCL software for the risk assessment. Sediment and unfiltered surface water data are presented.

The COPC list has been refined to those with hazard quotients greater than 1 in the wildlife food chain modeling for the Step 3A evaluation.

The maximum of the field duplicate and parent sample results was applied. The detection limit is presented in hierarchy of quantitation limit, then method detection limit and then reporting limit. Refer to the Remedial Investigation Report for the complete data set.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Location	Sample ID	Sample Type	Sample Date	Start Depth	End Depth	Depth Unit	Analysis Date	Analytical Method	T or D	COPC Group	CASRN	Qualifier	Detection Limit	Unit
Seep/Spring Water	Beryllium_7440-41-7_T	1.9	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-41-7		1	ug/l
Seep/Spring Water	Beryllium_7440-41-7_T	1	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-41-7	U	1	ug/l
Seep/Spring Water	Beryllium_7440-41-7_T	1	0	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-41-7	U	1	ug/l
Seep/Spring Water	Cadmium_7440-43-9_T	1	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-43-9	U	1	ug/l
Seep/Spring Water	Cadmium_7440-43-9_T	0.88	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-43-9	J	1	ug/l
Seep/Spring Water	Cadmium_7440-43-9_T	1	0	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-43-9	U	1	ug/l
Seep/Spring Water	Cadmium_7440-43-9_T	1	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-43-9	U	1	ug/l
Seep/Spring Water	Cadmium_7440-43-9_T	1	0	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-43-9	U	1	ug/l
Seep/Spring Water	Cadmium_7440-43-9_T	0.18	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-43-9	J	1	ug/l
Seep/Spring Water	Calcium_7440-70-2_T	6610	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-70-2		500	ug/l
Seep/Spring Water	Calcium_7440-70-2_T	7690	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-70-2		500	ug/l
Seep/Spring Water	Calcium_7440-70-2_T	5720	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-70-2		500	ug/l
Seep/Spring Water	Calcium_7440-70-2_T	8980	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-70-2		500	ug/l
Seep/Spring Water	Calcium_7440-70-2_T	16700	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-70-2		500	ug/l
Seep/Spring Water	Calcium_7440-70-2_T	16700	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-70-2		500	ug/l
Seep/Spring Water	Chromium (Total)_7440-47-3_T	0.3	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-47-3	J	2	ug/l
Seep/Spring Water	Chromium (Total)_7440-47-3_T	0.48	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-47-3	J	2	ug/l
Seep/Spring Water	Chromium (Total)_7440-47-3_T	2	0	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-47-3	U	2	ug/l
Seep/Spring Water	Chromium (Total)_7440-47-3_T	0.49	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-47-3	J	2	ug/l
Seep/Spring Water	Chromium (Total)_7440-47-3_T	14.8	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-47-3		2	ug/l
Seep/Spring Water	Chromium (Total)_7440-47-3_T	0.96	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-47-3	J	2	ug/l
Seep/Spring Water	Cobalt_7440-48-4_T	1	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-48-4	U	1	ug/l
Seep/Spring Water	Cobalt_7440-48-4_T	11.6	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-48-4		1	ug/l
Seep/Spring Water	Cobalt_7440-48-4_T	0.47	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-48-4	J	1	ug/l
Seep/Spring Water	Cobalt_7440-48-4_T	1	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-48-4	U	1	ug/l
Seep/Spring Water	Cobalt_7440-48-4_T	2.6	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-48-4		1	ug/l
Seep/Spring Water	Cobalt_7440-48-4_T	2.1	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-48-4		1	ug/l
Seep/Spring Water	Copper_7440-50-8_T	3.3	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-50-8		2	ug/l
Seep/Spring Water	Copper_7440-50-8_T	0.44	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-50-8	J	2	ug/l
Seep/Spring Water	Copper_7440-50-8_T	0.43	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-50-8	J	2	ug/l
Seep/Spring Water	Copper_7440-50-8_T	0.46	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-50-8	J	2	ug/l
Seep/Spring Water	Copper_7440-50-8_T	0.57	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-50-8	J	2	ug/l
Seep/Spring Water	Copper_7440-50-8_T	18.5	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-50-8		2	ug/l
Seep/Spring Water	Cyanide_57-12-5_T	1.9	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	9/28/2017	E335.2	T	INORGANIC	57-12-5	J	10	ug/l
Seep/Spring Water	Cyanide_57-12-5_T	3.2	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/5/2017	E335.2	T	INORGANIC	57-12-5	J	10	ug/l
Seep/Spring Water	Cyanide_57-12-5_T	2.6	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	9/28/2017	E335.2	T	INORGANIC	57-12-5	J	10	ug/l
Seep/Spring Water	Cyanide_57-12-5_T	2.2	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/5/2017	E335.2	T	INORGANIC	57-12-5	J	10	ug/l
Seep/Spring Water	Cyanide_57-12-5_T	2	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	9/28/2017	E335.2	T	INORGANIC	57-12-5	J	10	ug/l
Seep/Spring Water	Cyanide_57-12-5_T	10	0	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/5/2017	E335.2	T	INORGANIC	57-12-5	U	10	ug/l
Seep/Spring Water	Iron_7439-89-6_T	32600	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7439-89-6		200	ug/l
Seep/Spring Water	Iron_7439-89-6_T	196	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-89-6	J	200	ug/l
Seep/Spring Water	Iron_7439-89-6_T	1400	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7439-89-6		200	ug/l
Seep/Spring Water	Iron_7439-89-6_T	2190	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-89-6		200	ug/l
Seep/Spring Water	Iron_7439-89-6_T	2470	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7439-89-6		200	ug/l
Seep/Spring Water	Iron_7439-89-6_T	493	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-89-6		200	ug/l
Seep/Spring Water	Lead_7439-92-1_T	4.8	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7439-92-1		1	ug/l
Seep/Spring Water	Lead_7439-92-1_T	0.26	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-92-1	J	1	ug/l
Seep/Spring Water	Lead_7439-92-1_T	29	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7439-92-1		1	ug/l
Seep/Spring Water	Lead_7439-92-1_T	0.35	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-92-1	J	1	ug/l
Seep/Spring Water	Lead_7439-92-1_T	0.9	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7439-92-1	J	1	ug/l
Seep/Spring Water	Lead_7439-92-1_T	0.21	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-92-1	J	1	ug/l
Seep/Spring Water	Magnesium_7439-95-4_T	2200	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7439-95-4		500	ug/l
Seep/Spring Water	Magnesium_7439-95-4_T	2950	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-95-4		500	ug/l
Seep/Spring Water	Magnesium_7439-95-4_T	2040	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-95-4		500	ug/l
Seep/Spring Water	Magnesium_7439-95-4_T	2480	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-95-4		500	ug/l
Seep/Spring Water	Magnesium_7439-95-4_T	5320	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7439-95-4		500	ug/l
Seep/Spring Water	Magnesium_7439-95-4_T	4980	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7439-95-4		500	ug/l
Seep/Spring Water	Manganese_7439-96-5_T	22	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7439-96-5		1	ug/l
Seep/Spring Water	Manganese_7439-96-5_T	10.9	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-96-5	J	1	ug/l
Seep/Spring Water	Manganese_7439-96-5_T	67.5	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7439-96-5		1	ug/l
Seep/Spring Water	Manganese_7439-96-5_T	486	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7439-96-5		1	ug/l
Seep/Spring Water	Manganese_7439-96-5_T	22.7	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-96-5		1	ug/l
Seep/Spring Water	Manganese_7439-96-5_T	708	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7439-96-5		1	ug/l
Seep/Spring Water	Mercury_7439-97-6_T	0.2	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/4/2017	E245.2	T	INORGANIC	7439-97-6	U	0.2	ug/l
Seep/Spring Water	Mercury_7439-97-6_T	0.2	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/4/2017	E245.2	T	INORGANIC	7439-97-6	U	0.2	ug/l
Seep/Spring Water	Mercury_7439-97-6_T	0.25	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E245.2	T	INORGANIC	7439-97-6	J	0.2	ug/l
Seep/Spring Water	Mercury_7439-97-6_T	0.26	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E245.2	T	INORGANIC	7439-97-6	J	0.2	ug/l
Seep/Spring Water	Mercury_7439-97-6_T	4	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E245.2	T	INORGANIC	7439-97-6		0.2	ug/l
Seep/Spring Water	Mercury_7439-97-6_T	0.2	0	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/4/2017	E245.2	T	INORGANIC	7439-97-6	U	0.2	ug/l
Seep/Spring Water	Nickel_7440-02-0_T	0.42	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-02-0	J	1	ug/l
Seep/Spring Water	Nickel_7440-02-0_T	0.87	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-02-0	J	1	ug/l
Seep/Spring Water	Nickel_7440-02-0_T	1.1	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-02-0		1	ug/l
Seep/Spring Water	Nickel_7440-02-0_T	11.9	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-02-0		1	ug/l
Seep/Spring Water	Nickel_7440-02-0_T	0.32	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-02-0	J	1	ug/l

TABLE B.1

PROUCL DATA INPUT FOR ALL MEDIA

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:

The data set provided here are for constituents of potential concern (COPCs) by medium to calculate 95% upper confidence limits of the mean (UCLs) using USEPA ProUCL software for the risk assessment. Sediment and unfiltered surface water data are presented.

The COPC list has been refined to those with hazard quotients greater than 1 in the wildlife food chain modeling for the Step 3A evaluation.

The maximum of the field duplicate and parent sample results was applied. The detection limit is presented in hierarchy of quantitation limit, then method detection limit and then reporting limit. Refer to the Remedial Investigation Report for the complete data set.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Location	Sample ID	Sample Type	Sample Date	Start Depth	End Depth	Depth Unit	Analysis Date	Analytical Method	T or D	COPC Group	CASRN	Qualifier	Detection Limit	Unit
Seep/Spring Water	Nickel_7440-02-0_T	0.67	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-02-0	J	1	ug/l
Seep/Spring Water	Potassium_7440-09-7_T	1100	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-09-7		500	ug/l
Seep/Spring Water	Potassium_7440-09-7_T	1590	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-09-7		500	ug/l
Seep/Spring Water	Potassium_7440-09-7_T	1020	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-09-7		500	ug/l
Seep/Spring Water	Potassium_7440-09-7_T	1370	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-09-7		500	ug/l
Seep/Spring Water	Potassium_7440-09-7_T	1500	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-09-7		500	ug/l
Seep/Spring Water	Potassium_7440-09-7_T	1510	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-09-7		500	ug/l
Seep/Spring Water	Selenium_7782-49-2_T	5	0	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7782-49-2	U	5	ug/l
Seep/Spring Water	Selenium_7782-49-2_T	5	0	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7782-49-2	U	5	ug/l
Seep/Spring Water	Selenium_7782-49-2_T	5	0	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7782-49-2	U	5	ug/l
Seep/Spring Water	Selenium_7782-49-2_T	1.2	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7782-49-2	J	5	ug/l
Seep/Spring Water	Selenium_7782-49-2_T	5	0	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7782-49-2	U	5	ug/l
Seep/Spring Water	Selenium_7782-49-2_T	5	0	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7782-49-2	U	5	ug/l
Seep/Spring Water	Sodium_7440-23-5_T	5420	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-23-5		500	ug/l
Seep/Spring Water	Sodium_7440-23-5_T	8310	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-23-5		500	ug/l
Seep/Spring Water	Sodium_7440-23-5_T	3530	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-23-5		500	ug/l
Seep/Spring Water	Sodium_7440-23-5_T	5080	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-23-5		500	ug/l
Seep/Spring Water	Sodium_7440-23-5_T	6180	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-23-5		500	ug/l
Seep/Spring Water	Sodium_7440-23-5_T	3700	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-23-5		500	ug/l
Seep/Spring Water	Vanadium_7440-62-2_T	3.8	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-62-2	J	5	ug/l
Seep/Spring Water	Vanadium_7440-62-2_T	3.8	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-62-2	J	5	ug/l
Seep/Spring Water	Vanadium_7440-62-2_T	2.1	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-62-2	J	5	ug/l
Seep/Spring Water	Vanadium_7440-62-2_T	2.5	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-62-2	J	5	ug/l
Seep/Spring Water	Vanadium_7440-62-2_T	2.1	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-62-2	J	5	ug/l
Seep/Spring Water	Vanadium_7440-62-2_T	62.4	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-62-2		5	ug/l
Seep/Spring Water	Zinc_7440-66-6_T	10.3	1	SPRING_A2	SPRING_A2-SW-AC-0	N	9/25/2017	1		ft	10/12/2017	E200.8	T	INORGANIC	7440-66-6		2	ug/l
Seep/Spring Water	Zinc_7440-66-6_T	3	1	SEEP_A2	SEEP_A2-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-66-6		2	ug/l
Seep/Spring Water	Zinc_7440-66-6_T	2.5	1	SEEP_B1	SEEP_B1-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-66-6		2	ug/l
Seep/Spring Water	Zinc_7440-66-6_T	2	1	SEEP_A1	SEEP_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-66-6		2	ug/l
Seep/Spring Water	Zinc_7440-66-6_T	79	1	SEEP_B2	SEEP_B2-SW-AA-0	N	9/26/2017	0		ft	10/12/2017	E200.8	T	INORGANIC	7440-66-6		2	ug/l
Seep/Spring Water	Zinc_7440-66-6_T	1.3	1	SPRING_A1	SPRING_A1-SW-AA-0	N	9/22/2017	0		ft	10/3/2017	E200.8	T	INORGANIC	7440-66-6	J	2	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	200	0	TBSW0001	TBSW0001-SW-AB-RS1-0	N	11/11/2014	1	1	ft	11/17/2014	E200.7	T	INORGANIC	7429-90-5	U	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	372	1	LUSW0001	LUSW0001-SW-AF-RS2-0	N	11/18/2014	5	5	ft	11/29/2014	E200.7	T	INORGANIC	7429-90-5		200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	200	0	LUSW0003	LUSW0003-SW-AD-RS1-0	N	11/13/2014	3	3	ft	11/28/2014	E200.7	T	INORGANIC	7429-90-5	U	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	200	0	TUSW0001	TUSW0001-SW-AA-RS1-0	N	11/13/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7429-90-5	U	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	200	0	LUSW0001	LUSW0001-SW-AF-RS1-0	N	11/12/2014	5	5	ft	11/17/2014	E200.7	T	INORGANIC	7429-90-5	U	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	77.8	1	TBSW0003	TBSW0003-SW-AA-RS1-0	N	11/12/2014			ft	11/17/2014	E200.7	T	INORGANIC	7429-90-5	J	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	237	1	TUSW0001	TUSW0001-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7429-90-5		200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	200	0	LUSW0002	LUSW0002-SW-AA-RS1-0	N	11/12/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7429-90-5	U	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	200	0	TBSW0002	TBSW0002-SW-AA-RS1-0	N	11/12/2014			ft	11/17/2014	E200.7	T	INORGANIC	7429-90-5	U	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	208	1	LUSW0002	LUSW0002-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7429-90-5		200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	101	1	TUSW0002	TUSW0002-SW-AA-RS1-0	N	11/13/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7429-90-5	J	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	307	1	TBSW0003	TBSW0003-SW-AA-RS2-0	N	11/19/2014			ft	11/29/2014	E200.7	T	INORGANIC	7429-90-5		200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	984	1	LUSW0003	LUSW0003-SW-AD-RS2-0	N	11/18/2014	3	3	ft	11/29/2014	E200.7	T	INORGANIC	7429-90-5		200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	134	1	TBSW0001	TBSW0001-SW-AB-RS2-0	N	11/18/2014	1	1	ft	11/20/2014	E200.7	T	INORGANIC	7429-90-5	J	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	206	1	TBSW0002	TBSW0002-SW-AB-RS2-0	N	11/18/2014	1	1	ft	11/20/2014	E200.7	T	INORGANIC	7429-90-5	J	200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	734	1	TUSW0003	TUSW0003-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7429-90-5		200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	2100	1	TUSW0003	TUSW0003-SW-AA-RS1-0	N	11/13/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7429-90-5		200	ug/l
Surface Water from Trout, Lamington, Tanners	Aluminum_7429-90-5_T	337	1	TUSW0002	TUSW0002-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7429-90-5		200	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	LUSW0003	LUSW0003-SW-AD-RS1-0	N	11/13/2014	3	3	ft	11/28/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TBSW0003	TBSW0003-SW-AA-RS1-0	N	11/12/2014			ft	11/17/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	LUSW0002	LUSW0002-SW-AA-RS1-0	N	11/12/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	6.4	1	LUSW0003	LUSW0003-SW-AD-RS2-0	N	11/18/2014	3	3	ft	11/29/2014	E200.7	T	INORGANIC	7440-50-8	J	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TBSW0002	TBSW0002-SW-AA-RS1-0	N	11/12/2014			ft	11/17/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	4.1	1	TBSW0003	TBSW0003-SW-AA-RS2-0	N	11/19/2014			ft	11/29/2014	E200.7	T	INORGANIC	7440-50-8	J	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TBSW0002	TBSW0002-SW-AB-RS2-0	N	11/18/2014	1	1	ft	11/20/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TUSW0002	TUSW0002-SW-AA-RS1-0	N	11/13/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	LUSW0001	LUSW0001-SW-AF-RS1-0	N	11/12/2014	5	5	ft	11/17/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TBSW0001	TBSW0001-SW-AB-RS2-0	N	11/18/2014	1	1	ft	11/20/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TUSW0001	TUSW0001-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TUSW0001	TUSW0001-SW-AA-RS1-0	N	11/13/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	LUSW0001	LUSW0001-SW-AF-RS2-0	N	11/18/2014	5	5	ft	11/29/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TBSW0001	TBSW0001-SW-AB-RS1-0	N	11/11/2014	1	1	ft	11/17/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	LUSW0002	LUSW0002-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TUSW0003	TUSW0003-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	8	1	TUSW0003	TUSW0003-SW-AA-RS1-0	N	11/13/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7440-50-8	J	25	ug/l
Surface Water from Trout, Lamington, Tanners	Copper_7440-50-8_T	25	0	TUSW0002	TUSW0002-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7440-50-8	U	25	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	10	0	LUSW0003	LUSW0003-SW-AD-RS1-0	N	11/13/2014	3	3	ft	11/28/2014	E200.7	T	INORGANIC	7439-92-1	U	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	3.4	1	TUSW0001	TUSW0001-SW-AA-RS1-0	N	11/13/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7439-92-1	J	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	2.9	1	TBSW0001	TBSW0001-SW-AB-RS2-0	N	11/18/2014	1	1	ft	11/20/2014	E200.7	T	INORGANIC	7439-92-1	J	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	10	0	TBSW0003	TBSW0003-SW-AA-RS2-0	N	11/19/2014			ft	11/29/2014	E200.7	T	INORGANIC	7439-92-1	U	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	10	0	LUSW0002	LUSW0002-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7439-92-1	U	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	3.8	1	LUSW0001	LUSW0001-SW-AF-RS1-0	N	11/12/2014	5	5	ft	11/17/2014	E200.7	T	INORGANIC	7439-92-1	J	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	10	0	TBSW0002	TBSW0002-SW-AA-RS1-0	N	11/12/2014			ft	11/17/2014	E200.7	T	INORGANIC	7439-92-1	U	10	ug/l

TABLE B.1

PROUCL DATA INPUT FOR ALL MEDIA

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:

The data set provided here are for constituents of potential concern (COPCs) by medium to calculate 95% upper confidence limits of the mean (UCLs) using USEPA ProUCL software for the risk assessment. Sediment and unfiltered surface water data are presented.

The COPC list has been refined to those with hazard quotients greater than 1 in the wildlife food chain modeling for the Step 3A evaluation.

The maximum of the field duplicate and parent sample results was applied. The detection limit is presented in hierarchy of quantitation limit, then method detection limit and then reporting limit. Refer to the Remedial Investigation Report for the complete data set.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Location	Sample ID	Sample Type	Sample Date	Start Depth	End Depth	Depth Unit	Analysis Date	Analytical Method	T or D	COPC Group	CASRN	Qualifier	Detection Limit	Unit
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	4.2	1	TUSW0002	TUSW0002-SW-AA-RS1-0	N	11/13/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7439-92-1	J	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	3.3	1	TBSW0001	TBSW0001-SW-AB-RS1-0	N	11/11/2014	1	1	ft	11/17/2014	E200.7	T	INORGANIC	7439-92-1	J	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	10.5	1	LUSW0003	LUSW0003-SW-AD-RS2-0	N	11/18/2014	3	3	ft	11/29/2014	E200.7	T	INORGANIC	7439-92-1		10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	2	1	TBSW0002	TBSW0002-SW-AB-RS2-0	N	11/18/2014	1	1	ft	11/20/2014	E200.7	T	INORGANIC	7439-92-1	J	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	10	0	LUSW0001	LUSW0001-SW-AF-RS2-0	N	11/18/2014	5	5	ft	11/29/2014	E200.7	T	INORGANIC	7439-92-1	U	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	2.8	1	TBSW0003	TBSW0003-SW-AA-RS1-0	N	11/12/2014			ft	11/17/2014	E200.7	T	INORGANIC	7439-92-1	J	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	10	0	TUSW0001	TUSW0001-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7439-92-1	U	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	10	0	LUSW0002	LUSW0002-SW-AA-RS1-0	N	11/12/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7439-92-1	U	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	10	0	TUSW0002	TUSW0002-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7439-92-1	U	10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	26.6	1	TUSW0003	TUSW0003-SW-AA-RS1-0	N	11/13/2014	0	0	ft	11/17/2014	E200.7	T	INORGANIC	7439-92-1		10	ug/l
Surface Water from Trout, Lamington, Tanners	Lead_7439-92-1_T	13.6	1	TUSW0003	TUSW0003-SW-AA-RS2-0	N	11/18/2014	0	0	ft	11/29/2014	E200.7	T	INORGANIC	7439-92-1		10	ug/l
Sediment from East Trout	Selenium_7782-49-2_T	1.3	1	ETSD0005	ETSD0005-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from East Trout	Selenium_7782-49-2_T	4.9	1	ETSD0006	ETSD0006-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2		3.5	mg/kg
Sediment from East Trout	Selenium_7782-49-2_T	2.9	1	ETSD0002	ETSD0002-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from East Trout	Selenium_7782-49-2_T	3.9	1	ETSD0003	ETSD0003-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2		3.5	mg/kg
Sediment from East Trout	Selenium_7782-49-2_T	3.7	1	ETSD0001	ETSD0001-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/17/2014	E200.7	T	INORGANIC	7782-49-2		3.5	mg/kg
Sediment from East Trout	Selenium_7782-49-2_T	2	1	ETSD0004	ETSD0004-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7782-49-2	J	3.5	mg/kg
Sediment from East Trout	Vanadium_7440-62-2_T	44.8	1	ETSD0001	ETSD0001-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/17/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from East Trout	Vanadium_7440-62-2_T	26.5	1	ETSD0002	ETSD0002-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from East Trout	Vanadium_7440-62-2_T	54.4	1	ETSD0006	ETSD0006-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from East Trout	Vanadium_7440-62-2_T	32.3	1	ETSD0003	ETSD0003-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from East Trout	Vanadium_7440-62-2_T	9.3	1	ETSD0005	ETSD0005-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg
Sediment from East Trout	Vanadium_7440-62-2_T	24.5	1	ETSD0004	ETSD0004-SD-AA-AB-RS-0	N	11/11/2014	0	0.5	ft	11/18/2014	E200.7	T	INORGANIC	7440-62-2		5	mg/kg

TABLE B.2

PROUCL OUTPUT FOR SURFACE WATER FROM TROUT BROOK, LAMINGTON RIVER UNT AND TANNERS BROOK UNT

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/21/2018 1:31:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

result (aluminum_7429-90-5_t)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	13
Number of Detects	12	Number of Non-Detects	6
Number of Distinct Detects	12	Number of Distinct Non-Detects	1
Minimum Detect	77.8	Minimum Non-Detect	200
Maximum Detect	2100	Maximum Non-Detect	200
Variance Detects	330735	Percent Non-Detects	33.33%
Mean Detects	483.2	SD Detects	575.1
Median Detects	272	CV Detects	1.19
Skewness Detects	2.372	Kurtosis Detects	6.023
Mean of Logged Detects	5.717	SD of Logged Detects	0.956

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.688	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.327	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	356.9	KM Standard Error of Mean	119.3
KM SD	483.9	95% KM (BCA) UCL	597.4
95% KM (t) UCL	564.3	95% KM (Percentile Bootstrap) UCL	558
95% KM (z) UCL	553	95% KM Bootstrap t UCL	861.8
90% KM Chebyshev UCL	714.7	95% KM Chebyshev UCL	876.7
97.5% KM Chebyshev UCL	1102	99% KM Chebyshev UCL	1544

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.563	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.251	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.219	k star (bias corrected MLE)	0.97
Theta hat (MLE)	396.3	Theta star (bias corrected MLE)	498.1
nu hat (MLE)	29.26	nu star (bias corrected)	23.28
Mean (detects)	483.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	325.7
Maximum	2100	Median	170
SD	516.4	CV	1.585
k hat (MLE)	0.237	k star (bias corrected MLE)	0.235
Theta hat (MLE)	1374	Theta star (bias corrected MLE)	1388
nu hat (MLE)	8.535	nu star (bias corrected)	8.446
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (8.45, α)	2.996	Adjusted Chi Square Value (8.45, β)	2.692
95% Gamma Approximate UCL (use when n>=50)	918.3	95% Gamma Adjusted UCL (use when n<50)	1022

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	356.9	SD (KM)	483.9
Variance (KM)	234194	SE of Mean (KM)	119.3

k hat (KM)	0.544	k star (KM)	0.49
nu hat (KM)	19.58	nu star (KM)	17.65
theta hat (KM)	656.3	theta star (KM)	728
80% gamma percentile (KM)	585.6	90% gamma percentile (KM)	969.4
95% gamma percentile (KM)	1381	99% gamma percentile (KM)	2394

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.65, α)	9.136	Adjusted Chi Square Value (17.65, β)	8.552
95% Gamma Approximate KM-UCL (use when n>=50)	689.3	95% Gamma Adjusted KM-UCL (use when n<50)	736.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	353.6	Mean in Log Scale	5.291
SD in Original Scale	500.1	SD in Log Scale	1.03
95% t UCL (assumes normality of ROS data)	558.7	95% Percentile Bootstrap UCL	569.9
95% BCA Bootstrap UCL	654.7	95% Bootstrap t UCL	841.8
95% H-UCL (Log ROS)	659.4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.352	KM Geo Mean	211.1
KM SD (logged)	0.917	95% Critical H Value (KM-Log)	2.519
KM Standard Error of Mean (logged)	0.232	95% H-UCL (KM -Log)	562.8
KM SD (logged)	0.917	95% Critical H Value (KM-Log)	2.519
KM Standard Error of Mean (logged)	0.232		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	355.4	Mean in Log Scale	5.347
SD in Original Scale	498.5	SD in Log Scale	0.939
95% t UCL (Assumes normality)	559.9	95% H-Stat UCL	583

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

amma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	736.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (copper_7440-50-8_t)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	4
Number of Detects	3	Number of Non-Detects	15
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	4.1	Minimum Non-Detect	25
Maximum Detect	8	Maximum Non-Detect	25
Variance Detects	3.843	Percent Non-Detects	83.33%
Mean Detects	6.167	SD Detects	1.96
Median Detects	6.4	CV Detects	0.318
Skewness Detects	-0.528	Kurtosis Detects	N/A
Mean of Logged Detects	1.782	SD of Logged Detects	0.34

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.989	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	

Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	6.167	KM Standard Error of Mean	1.132
KM SD	1.601	95% KM (BCA) UCL	N/A
95% KM (t) UCL	8.136	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	8.028	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	9.562	95% KM Chebyshev UCL	11.1
97.5% KM Chebyshev UCL	13.24	99% KM Chebyshev UCL	17.43

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	13.71	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.45	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	82.25	nu star (bias corrected)	N/A
Mean (detects)	6.167		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	2.272	Mean	6.254
Maximum	11.13	Median	6.244
SD	2.379	CV	0.38
k hat (MLE)	6.748	k star (bias corrected MLE)	5.661
Theta hat (MLE)	0.927	Theta star (bias corrected MLE)	1.105
nu hat (MLE)	242.9	nu star (bias corrected)	203.8
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (203.78, α)	171.8	Adjusted Chi Square Value (203.78, β)	168.9
95% Gamma Approximate UCL (use when n>=50)	7.42	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	6.167	SD (KM)	1.601
Variance (KM)	2.562	SE of Mean (KM)	1.132
k hat (KM)	14.84	k star (KM)	12.41
nu hat (KM)	534.3	nu star (KM)	446.6
theta hat (KM)	0.415	theta star (KM)	0.497
80% gamma percentile (KM)	7.572	90% gamma percentile (KM)	8.49
95% gamma percentile (KM)	9.3	99% gamma percentile (KM)	10.95

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (446.58, α)	398.6	Adjusted Chi Square Value (446.58, β)	394.2
95% Gamma Approximate KM-UCL (use when n>=50)	6.909	95% Gamma Adjusted KM-UCL (use when n<50)	6.985

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.253	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	6.423	Mean in Log Scale	1.782
SD in Original Scale	2.625	SD in Log Scale	0.408
95% t UCL (assumes normality of ROS data)	7.499	95% Percentile Bootstrap UCL	7.406
95% BCA Bootstrap UCL	7.563	95% Bootstrap t UCL	7.675
95% H-UCL (Log ROS)	7.822		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.782	KM Geo Mean	5.943
KM SD (logged)	0.278	95% Critical H Value (KM-Log)	1.837
KM Standard Error of Mean (logged)	0.196	95% H-UCL (KM -Log)	6.991
KM SD (logged)	0.278	95% Critical H Value (KM-Log)	1.837
KM Standard Error of Mean (logged)	0.196		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	11.44	Mean in Log Scale	2.402
SD in Original Scale	2.52	SD in Log Scale	0.308
95% t UCL (Assumes normality)	12.48	95% H-Stat UCL	13.31

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 8.136

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (lead_7439-92-1_t)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	11
Number of Detects	10	Number of Non-Detects	8
Number of Distinct Detects	10	Number of Distinct Non-Detects	1
Minimum Detect	2	Minimum Non-Detect	10
Maximum Detect	26.6	Maximum Non-Detect	10
Variance Detects	60.35	Percent Non-Detects	44.44%
Mean Detects	7.31	SD Detects	7.769
Median Detects	3.6	CV Detects	1.063
Skewness Detects	2.054	Kurtosis Detects	4.196
Mean of Logged Detects	1.622	SD of Logged Detects	0.833

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.695	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.356	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.483	KM Standard Error of Mean	1.469
KM SD	5.877	95% KM (BCA) UCL	8.342
95% KM (t) UCL	8.039	95% KM (Percentile Bootstrap) UCL	7.941
95% KM (z) UCL	7.9	95% KM Bootstrap t UCL	11.95
90% KM Chebyshev UCL	9.891	95% KM Chebyshev UCL	11.89
97.5% KM Chebyshev UCL	14.66	99% KM Chebyshev UCL	20.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.962	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.739	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.332	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.271	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.506	k star (bias corrected MLE)	1.121
Theta hat (MLE)	4.855	Theta star (bias corrected MLE)	6.523
nu hat (MLE)	30.11	nu star (bias corrected)	22.41
Mean (detects)	7.31		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.609
Maximum	26.6	Median	3.508

SD	6.307	CV	1.124
k hat (MLE)	0.83	k star (bias corrected MLE)	0.729
Theta hat (MLE)	6.755	Theta star (bias corrected MLE)	7.694
nu hat (MLE)	29.89	nu star (bias corrected)	26.24
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (26.24, α)	15.57	Adjusted Chi Square Value (26.24, β)	14.78
95% Gamma Approximate UCL (use when n>=50)	9.456	95% Gamma Adjusted UCL (use when n<50)	9.96

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.483	SD (KM)	5.877
Variance (KM)	34.54	SE of Mean (KM)	1.469
k hat (KM)	0.87	k star (KM)	0.762
nu hat (KM)	31.33	nu star (KM)	27.44
theta hat (KM)	6.3	theta star (KM)	7.193
80% gamma percentile (KM)	8.983	90% gamma percentile (KM)	13.49
95% gamma percentile (KM)	18.1	99% gamma percentile (KM)	29.03

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (27.44, α)	16.5	Adjusted Chi Square Value (27.44, β)	15.68
95% Gamma Approximate KM-UCL (use when n>=50)	9.123	95% Gamma Adjusted KM-UCL (use when n<50)	9.595

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.858	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.289	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.748	Mean in Log Scale	1.443
SD in Original Scale	6.051	SD in Log Scale	0.724
95% t UCL (assumes normality of ROS data)	8.229	95% Percentile Bootstrap UCL	8.221
95% BCA Bootstrap UCL	9.285	95% Bootstrap t UCL	11.39
95% H-UCL (Log ROS)	8.189		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.407	KM Geo Mean	4.085
KM SD (logged)	0.653	95% Critical H Value (KM-Log)	2.183
KM Standard Error of Mean (logged)	0.171	95% H-UCL (KM -Log)	7.146
KM SD (logged)	0.653	95% Critical H Value (KM-Log)	2.183
KM Standard Error of Mean (logged)	0.171		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	6.283	Mean in Log Scale	1.616
SD in Original Scale	5.775	SD in Log Scale	0.606
95% t UCL (Assumes normality)	8.651	95% H-Stat UCL	8.274

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	7.146

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TABLE B.3

PROUCL OUTPUT FOR SEDIMENT FROM TROUT BROOK, LAMINGTON RIVER UNT AND TANNERS BROOK UNT

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/21/2018 1:40:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

result (copper_7440-50-8_t)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	1.7	Mean	9.356
Maximum	28.2	Median	7.35
SD	7.02	Std. Error of Mean	1.655
Coefficient of Variation	0.75	Skewness	1.326

Normal GOF Test

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	12.23	95% Adjusted-CLT UCL (Chen-1995)	12.63
		95% Modified-t UCL (Johnson-1978)	12.32

Gamma GOF Test

A-D Test Statistic	0.175	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.753	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.102	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.206	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.014	k star (bias corrected MLE)	1.716
Theta hat (MLE)	4.644	Theta star (bias corrected MLE)	5.453
nu hat (MLE)	72.52	nu star (bias corrected)	61.77
MLE Mean (bias corrected)	9.356	MLE Sd (bias corrected)	7.142
		Approximate Chi Square Value (0.05)	44.69
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	43.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	12.93	95% Adjusted Gamma UCL (use when n<50)	13.35

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.098	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.202	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.531	Mean of logged Data	1.968
Maximum of Logged Data	3.339	SD of logged Data	0.781

Assuming Lognormal Distribution

95% H-UCL	15.11	90% Chebyshev (MVUE) UCL	15.14
95% Chebyshev (MVUE) UCL	17.7	97.5% Chebyshev (MVUE) UCL	21.24
99% Chebyshev (MVUE) UCL	28.21		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	12.08	95% Jackknife UCL	12.23

95% Standard Bootstrap UCL	12.08	95% Bootstrap-t UCL	13.23
95% Hall's Bootstrap UCL	13.17	95% Percentile Bootstrap UCL	12.13
95% BCA Bootstrap UCL	12.43		
90% Chebyshev(Mean, Sd) UCL	14.32	95% Chebyshev(Mean, Sd) UCL	16.57
97.5% Chebyshev(Mean, Sd) UCL	19.69	99% Chebyshev(Mean, Sd) UCL	25.82

Suggested UCL to Use

95% Student's-t UCL 12.23

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (lead_7439-92-1_t)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	0
Minimum	4.7	Mean	18.62
Maximum	71.4	Median	9.25
SD	20.27	Std. Error of Mean	4.778
Coefficient of Variation	1.089	Skewness	1.728

Normal GOF Test

Shapiro Wilk Test Statistic	0.686	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.37	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	26.93	95% Adjusted-CLT UCL (Chen-1995)	28.56
		95% Modified-t UCL (Johnson-1978)	27.25

Gamma GOF Test

A-D Test Statistic	1.806	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.76	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.328	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.208	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.342	k star (bias corrected MLE)	1.155
Theta hat (MLE)	13.88	Theta star (bias corrected MLE)	16.12
nu hat (MLE)	48.3	nu star (bias corrected)	41.58
MLE Mean (bias corrected)	18.62	MLE Sd (bias corrected)	17.32
		Approximate Chi Square Value (0.05)	27.8
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	26.72

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	27.84	95% Adjusted Gamma UCL (use when n<50)	28.97

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.833	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.202	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.548	Mean of logged Data	2.507
Maximum of Logged Data	4.268	SD of logged Data	0.864

Assuming Lognormal Distribution

95% H-UCL	29.74	90% Chebyshev (MVUE) UCL	28.86

95% Chebyshev (MVUE) UCL	34.08	97.5% Chebyshev (MVUE) UCL	41.33
99% Chebyshev (MVUE) UCL	55.56		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	26.48	95% Jackknife UCL	26.93
95% Standard Bootstrap UCL	26.37	95% Bootstrap-t UCL	30.64
95% Hall's Bootstrap UCL	27.73	95% Percentile Bootstrap UCL	26.93
95% BCA Bootstrap UCL	28.27		
90% Chebyshev(Mean, Sd) UCL	32.95	95% Chebyshev(Mean, Sd) UCL	39.44
97.5% Chebyshev(Mean, Sd) UCL	48.46	99% Chebyshev(Mean, Sd) UCL	66.16

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	39.44

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (mercury_7439-97-6_t)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	2
Number of Detects	1	Number of Non-Detects	17
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

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

The data set for variable result (mercury_7439-97-6_t) was not processed!

result (selenium_7782-49-2_t)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	0.67	Mean	1.863
Maximum	4.7	Median	1.45
SD	1.141	Std. Error of Mean	0.269
Coefficient of Variation	0.612	Skewness	1.331

Normal GOF Test

Shapiro Wilk Test Statistic	0.85	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2.331	95% Adjusted-CLT UCL (Chen-1995)	2.396
		95% Modified-t UCL (Johnson-1978)	2.345

Gamma GOF Test

A-D Test Statistic	0.503	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.136	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.205	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.406	k star (bias corrected MLE)	2.875
Theta hat (MLE)	0.547	Theta star (bias corrected MLE)	0.648
nu hat (MLE)	122.6	nu star (bias corrected)	103.5
MLE Mean (bias corrected)	1.863	MLE Sd (bias corrected)	1.099

		Approximate Chi Square Value (0.05)	81.03
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	79.12

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.38	95% Adjusted Gamma UCL (use when n<50)	2.438

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.133	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.202	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.4	Mean of logged Data	0.468
Maximum of Logged Data	1.548	SD of logged Data	0.557

Assuming Lognormal Distribution

95% H-UCL	2.47	90% Chebyshev (MVUE) UCL	2.605
95% Chebyshev (MVUE) UCL	2.949	97.5% Chebyshev (MVUE) UCL	3.425
99% Chebyshev (MVUE) UCL	4.361		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2.306	95% Jackknife UCL	2.331
95% Standard Bootstrap UCL	2.297	95% Bootstrap-t UCL	2.48
95% Hall's Bootstrap UCL	2.515	95% Percentile Bootstrap UCL	2.313
95% BCA Bootstrap UCL	2.392		
90% Chebyshev(Mean, Sd) UCL	2.67	95% Chebyshev(Mean, Sd) UCL	3.036
97.5% Chebyshev(Mean, Sd) UCL	3.543	99% Chebyshev(Mean, Sd) UCL	4.54

Suggested UCL to Use

95% Student's-t UCL	2.331

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (vanadium_7440-62-2_t)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	4.5	Mean	18.28
Maximum	45.5	Median	14.5
SD	11.11	Std. Error of Mean	2.62
Coefficient of Variation	0.608	Skewness	0.871

Normal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	22.83	95% Adjusted-CLT UCL (Chen-1995)	23.16
		95% Modified-t UCL (Johnson-1978)	22.92

Gamma GOF Test

A-D Test Statistic	0.202	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.119	**Kolmogorov-Smirnov Gamma GOF Test**	

5% K-S Critical Value	0.205	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.814	k star (bias corrected MLE)	2.382
Theta hat (MLE)	6.495	Theta star (bias corrected MLE)	7.673
nu hat (MLE)	101.3	nu star (bias corrected)	85.76
MLE Mean (bias corrected)	18.28	MLE Sd (bias corrected)	11.84
		Approximate Chi Square Value (0.05)	65.41
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	63.71

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	23.96	95% Adjusted Gamma UCL (use when n<50)	24.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.13	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.202	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.504	Mean of logged Data	2.718
Maximum of Logged Data	3.818	SD of logged Data	0.656

Assuming Lognormal Distribution

95% H-UCL	26.6	90% Chebyshev (MVUE) UCL	27.6
95% Chebyshev (MVUE) UCL	31.71	97.5% Chebyshev (MVUE) UCL	37.41
99% Chebyshev (MVUE) UCL	48.62		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	22.59	95% Jackknife UCL	22.83
95% Standard Bootstrap UCL	22.57	95% Bootstrap-t UCL	23.74
95% Hall's Bootstrap UCL	23.66	95% Percentile Bootstrap UCL	22.52
95% BCA Bootstrap UCL	22.85		
90% Chebyshev(Mean, Sd) UCL	26.14	95% Chebyshev(Mean, Sd) UCL	29.7
97.5% Chebyshev(Mean, Sd) UCL	34.64	99% Chebyshev(Mean, Sd) UCL	44.34

Suggested UCL to Use

95% Student's-t UCL	22.83

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TABLE B.4

PROUCL OUTPUT FOR SEDIMENT FROM EAST TROUT BROOK

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/21/2018 1:44:06 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

result (selenium_7782-49-2_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	1.3	Mean	3.117
Maximum	4.9	Median	3.3
SD	1.321	Std. Error of Mean	0.539
Coefficient of Variation	0.424	Skewness	-0.136

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4.204	95% Adjusted-CLT UCL (Chen-1995)	3.972
		95% Modified-t UCL (Johnson-1978)	4.199

Gamma GOF Test

A-D Test Statistic	0.251	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.212	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.698	k star (bias corrected MLE)	2.96
Theta hat (MLE)	0.547	Theta star (bias corrected MLE)	1.053
nu hat (MLE)	68.38	nu star (bias corrected)	35.52
MLE Mean (bias corrected)	3.117	MLE Sd (bias corrected)	1.811
		Approximate Chi Square Value (0.05)	22.89
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	19.31

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4.838	95% Adjusted Gamma UCL (use when n<50)	5.734

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.262	Mean of logged Data	1.046
Maximum of Logged Data	1.589	SD of logged Data	0.49

Assuming Lognormal Distribution

95% H-UCL	5.698	90% Chebyshev (MVUE) UCL	5.028
95% Chebyshev (MVUE) UCL	5.882	97.5% Chebyshev (MVUE) UCL	7.068
99% Chebyshev (MVUE) UCL	9.396		

TABLE B.4

PROUCL OUTPUT FOR SEDIMENT FROM EAST TROUT BROOK

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4.004	95% Jackknife UCL	4.204
95% Standard Bootstrap UCL	3.924	95% Bootstrap-t UCL	4.155
95% Hall's Bootstrap UCL	3.887	95% Percentile Bootstrap UCL	3.917
95% BCA Bootstrap UCL	3.9		
90% Chebyshev(Mean, Sd) UCL	4.735	95% Chebyshev(Mean, Sd) UCL	5.468
97.5% Chebyshev(Mean, Sd) UCL	6.485	99% Chebyshev(Mean, Sd) UCL	8.484

Suggested UCL to Use

95% Student's-t UCL 4.204

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

result (vanadium_7440-62-2_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	9.3	Mean	31.97
Maximum	54.4	Median	29.4
SD	15.92	Std. Error of Mean	6.5
Coefficient of Variation	0.498	Skewness	0.0876

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	45.06	95% Adjusted-CLT UCL (Chen-1995)	42.91
		95% Modified-t UCL (Johnson-1978)	45.1

Gamma GOF Test

A-D Test Statistic	0.258	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.868	k star (bias corrected MLE)	2.045
Theta hat (MLE)	8.263	Theta star (bias corrected MLE)	15.63
nu hat (MLE)	46.42	nu star (bias corrected)	24.54
MLE Mean (bias corrected)	31.97	MLE Sd (bias corrected)	22.35
		Approximate Chi Square Value (0.05)	14.26
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	11.53

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	55.01	95% Adjusted Gamma UCL (use when n<50)	68.02

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**

5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.249	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.23	Mean of logged Data	3.33
Maximum of Logged Data	3.996	SD of logged Data	0.619

Assuming Lognormal Distribution

95% H-UCL	76.5	90% Chebyshev (MVUE) UCL	57.37
95% Chebyshev (MVUE) UCL	68.56	97.5% Chebyshev (MVUE) UCL	84.09
99% Chebyshev (MVUE) UCL	114.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	42.66	95% Jackknife UCL	45.06
95% Standard Bootstrap UCL	41.62	95% Bootstrap-t UCL	48.54
95% Hall's Bootstrap UCL	50.77	95% Percentile Bootstrap UCL	41.6
95% BCA Bootstrap UCL	41.9		
90% Chebyshev(Mean, Sd) UCL	51.47	95% Chebyshev(Mean, Sd) UCL	60.3
97.5% Chebyshev(Mean, Sd) UCL	72.56	99% Chebyshev(Mean, Sd) UCL	96.64

Suggested UCL to Use

95% Student's-t UCL	45.06

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TABLE B.5

PROUCL OUTPUT FOR SEEPS/SPRINGS

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.12/21/2018 1:37:00 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

result (1,4-dioxane_123-91-1_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	3
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	3.5	Minimum Non-Detect	0.1
Maximum Detect	5.9	Maximum Non-Detect	0.1
Variance Detects	2.88	Percent Non-Detects	66.67%
Mean Detects	4.7	SD Detects	1.697
Median Detects	4.7	CV Detects	0.361
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	1.514	SD of Logged Detects	0.369

Warning: Data set has only 2 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.633	KM Standard Error of Mean	1.314
KM SD	2.276	95% KM (BCA) UCL	N/A
95% KM (t) UCL	4.282	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	3.795	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	5.576	95% KM Chebyshev UCL	7.362
97.5% KM Chebyshev UCL	9.841	99% KM Chebyshev UCL	14.71

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	15	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.313	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	60	nu star (bias corrected)	N/A
Mean (detects)	4.7		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.633	SD (KM)	2.276
Variance (KM)	5.182	SE of Mean (KM)	1.314
k hat (KM)	0.515	k star (KM)	0.369
nu hat (KM)	6.178	nu star (KM)	4.422
theta hat (KM)	3.173	theta star (KM)	4.432
80% gamma percentile (KM)	2.608	90% gamma percentile (KM)	4.678
95% gamma percentile (KM)	6.98	99% gamma percentile (KM)	12.82

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (4.42, α)	0.895	Adjusted Chi Square Value (4.42, β)	0.456
95% Gamma Approximate KM-UCL (use when n>=50)	8.068	95% Gamma Adjusted KM-UCL (use when n<50)	15.84

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.203	Mean in Log Scale	0.393
SD in Original Scale	2.116	SD in Log Scale	0.994
95% t UCL (assumes normality of ROS data)	3.943	95% Percentile Bootstrap UCL	3.582
95% BCA Bootstrap UCL	3.984	95% Bootstrap t UCL	7.849
95% H-UCL (Log ROS)	15.05		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.03	KM Geo Mean	0.357
KM SD (logged)	1.805	95% Critical H Value (KM-Log)	6.988
KM Standard Error of Mean (logged)	1.042	95% H-UCL (KM -Log)	513.5
KM SD (logged)	1.805	95% Critical H Value (KM-Log)	6.988
KM Standard Error of Mean (logged)	1.042		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.6	Mean in Log Scale	-1.493
SD in Original Scale	2.518	SD in Log Scale	2.335
95% t UCL (Assumes normality)	3.672	95% H-Stat UCL	38548

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	4.282	KM H-UCL	513.5
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (4,4'-ddd_72-54-8_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	2
Number of Detects	1	Number of Non-Detects	5
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

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

The data set for variable result (4,4'-ddd_72-54-8_t) was not processed!

result (aluminum_7429-90-5_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	2
Number of Detects	1	Number of Non-Detects	5
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

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

The data set for variable result (aluminum_7429-90-5_d) was not processed!

result (aluminum_7429-90-5_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	16.3	Mean	1811
Maximum	9820	Median	138.2
SD	3932	Std. Error of Mean	1605
Coefficient of Variation	2.172	Skewness	2.426

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.547	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.443	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5045	95% Adjusted-CLT UCL (Chen-1995)	6150
		95% Modified-t UCL (Johnson-1978)	5311

Gamma GOF Test

A-D Test Statistic	0.628	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.764	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.291	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.356	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.315	k star (bias corrected MLE)	0.269
Theta hat (MLE)	5745	Theta star (bias corrected MLE)	6739
nu hat (MLE)	3.782	nu star (bias corrected)	3.224
MLE Mean (bias corrected)	1811	MLE Sd (bias corrected)	3493
		Approximate Chi Square Value (0.05)	0.442
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	13212	95% Adjusted Gamma UCL (use when n<50)	29146

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.791	Mean of logged Data	5.331
Maximum of Logged Data	9.192	SD of logged Data	2.29

Assuming Lognormal Distribution

95% H-UCL	22542890	90% Chebyshev (MVUE) UCL	3986
95% Chebyshev (MVUE) UCL	5251	97.5% Chebyshev (MVUE) UCL	7005
99% Chebyshev (MVUE) UCL	10452		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4451	95% Jackknife UCL	5045
95% Standard Bootstrap UCL	4293	95% Bootstrap-t UCL	103360
95% Hall's Bootstrap UCL	48163	95% Percentile Bootstrap UCL	4951
95% BCA Bootstrap UCL	5178		
90% Chebyshev(Mean, Sd) UCL	6627	95% Chebyshev(Mean, Sd) UCL	8808
97.5% Chebyshev(Mean, Sd) UCL	11836	99% Chebyshev(Mean, Sd) UCL	17783

Suggested UCL to Use

95% Adjusted Gamma UCL 29146

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (arsenic_7440-38-2_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.8	Mean	1.368
Maximum	1.9	Median	1.5
SD	0.43	Std. Error of Mean	0.176
Coefficient of Variation	0.314	Skewness	-0.395

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.205	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.722	95% Adjusted-CLT UCL (Chen-1995)	1.627
		95% Modified-t UCL (Johnson-1978)	1.717

Gamma GOF Test

A-D Test Statistic	0.446	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.85	k star (bias corrected MLE)	5.537
Theta hat (MLE)	0.126	Theta star (bias corrected MLE)	0.247
nu hat (MLE)	130.2	nu star (bias corrected)	66.45
MLE Mean (bias corrected)	1.368	MLE Sd (bias corrected)	0.581
		Approximate Chi Square Value (0.05)	48.69
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	43.25

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1.867	95% Adjusted Gamma UCL (use when n<50)	2.102

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.223	Mean of logged Data	0.267
Maximum of Logged Data	0.642	SD of logged Data	0.346

Assuming Lognormal Distribution

95% H-UCL	1.982	90% Chebyshev (MVUE) UCL	1.953
95% Chebyshev (MVUE) UCL	2.217	97.5% Chebyshev (MVUE) UCL	2.582
99% Chebyshev (MVUE) UCL	3.3		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.657	95% Jackknife UCL	1.722
95% Standard Bootstrap UCL	1.631	95% Bootstrap-t UCL	1.672

95% Hall's Bootstrap UCL	1.581	95% Percentile Bootstrap UCL	1.633
95% BCA Bootstrap UCL	1.602		
90% Chebyshev(Mean, Sd) UCL	1.895	95% Chebyshev(Mean, Sd) UCL	2.133
97.5% Chebyshev(Mean, Sd) UCL	2.464	99% Chebyshev(Mean, Sd) UCL	3.115

Suggested UCL to Use

95% Student's-t UCL 1.722

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

result (arsenic_7440-38-2_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	1.4	Minimum Non-Detect	1
Maximum Detect	3.5	Maximum Non-Detect	1
Variance Detects	0.937	Percent Non-Detects	33.33%
Mean Detects	2.15	SD Detects	0.968
Median Detects	1.85	CV Detects	0.45
Skewness Detects	1.297	Kurtosis Detects	1
Mean of Logged Detects	0.696	SD of Logged Detects	0.421

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.767	KM Standard Error of Mean	0.412
KM SD	0.873	95% KM (BCA) UCL	N/A
95% KM (t) UCL	2.596	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	2.444	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	3.001	95% KM Chebyshev UCL	3.561
97.5% KM Chebyshev UCL	4.337	99% KM Chebyshev UCL	5.862

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.372	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.658	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.286	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.338	k star (bias corrected MLE)	2.001
Theta hat (MLE)	0.293	Theta star (bias corrected MLE)	1.074
nu hat (MLE)	58.71	nu star (bias corrected)	16.01
Mean (detects)	2.15		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.464

Maximum	3.5	Median	1.45
SD	1.301	CV	0.889
k hat (MLE)	0.629	k star (bias corrected MLE)	0.426
Theta hat (MLE)	2.327	Theta star (bias corrected MLE)	3.439
nu hat (MLE)	7.551	nu star (bias corrected)	5.109
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (5.11, α)	1.203	Adjusted Chi Square Value (5.11, β)	0.652
95% Gamma Approximate UCL (use when n>=50)	6.219	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.767	SD (KM)	0.873
Variance (KM)	0.762	SE of Mean (KM)	0.412
k hat (KM)	4.095	k star (KM)	2.158
nu hat (KM)	49.14	nu star (KM)	25.9
theta hat (KM)	0.431	theta star (KM)	0.818
80% gamma percentile (KM)	2.621	90% gamma percentile (KM)	3.375
95% gamma percentile (KM)	4.091	99% gamma percentile (KM)	5.673

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.90, α)	15.3	Adjusted Chi Square Value (25.90, β)	12.46
95% Gamma Approximate KM-UCL (use when n>=50)	2.99	95% Gamma Adjusted KM-UCL (use when n<50)	3.672

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.255	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.642	Mean in Log Scale	0.302
SD in Original Scale	1.089	SD in Log Scale	0.701
95% t UCL (assumes normality of ROS data)	2.538	95% Percentile Bootstrap UCL	2.357
95% BCA Bootstrap UCL	2.49	95% Bootstrap t UCL	3.01
95% H-UCL (Log ROS)	4.681		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.464	KM Geo Mean	1.59
KM SD (logged)	0.443	95% Critical H Value (KM-Log)	2.507
KM Standard Error of Mean (logged)	0.209	95% H-UCL (KM -Log)	2.883
KM SD (logged)	0.443	95% Critical H Value (KM-Log)	2.507
KM Standard Error of Mean (logged)	0.209		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.6	Mean in Log Scale	0.233
SD in Original Scale	1.135	SD in Log Scale	0.788
95% t UCL (Assumes normality)	2.534	95% H-Stat UCL	5.784

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.596

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (barium_7440-39-3_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	8.6	Mean	11.47
Maximum	16.3	Median	9.45
SD	3.722	Std. Error of Mean	1.52

Coefficient of Variation	0.325	Skewness	0.929

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.718	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.359	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	14.53	95% Adjusted-CLT UCL (Chen-1995)	14.58
		95% Modified-t UCL (Johnson-1978)	14.62

Gamma GOF Test

A-D Test Statistic	0.905	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.698	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.364	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.332	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	12.55	k star (bias corrected MLE)	6.387
Theta hat (MLE)	0.914	Theta star (bias corrected MLE)	1.795
nu hat (MLE)	150.6	nu star (bias corrected)	76.64
MLE Mean (bias corrected)	11.47	MLE Sd (bias corrected)	4.537
		Approximate Chi Square Value (0.05)	57.47
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	51.52

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	15.29	95% Adjusted Gamma UCL (use when n<50)	17.06

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.742	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.341	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.152	Mean of logged Data	2.399
Maximum of Logged Data	2.791	SD of logged Data	0.304

Assuming Lognormal Distribution

95% H-UCL	15.62	90% Chebyshev (MVUE) UCL	15.7
95% Chebyshev (MVUE) UCL	17.63	97.5% Chebyshev (MVUE) UCL	20.3
99% Chebyshev (MVUE) UCL	25.56		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	13.97	95% Jackknife UCL	14.53
95% Standard Bootstrap UCL	13.74	95% Bootstrap-t UCL	32.2
95% Hall's Bootstrap UCL	40.99	95% Percentile Bootstrap UCL	13.87
95% BCA Bootstrap UCL	13.92		
90% Chebyshev(Mean, Sd) UCL	16.03	95% Chebyshev(Mean, Sd) UCL	18.09
97.5% Chebyshev(Mean, Sd) UCL	20.96	99% Chebyshev(Mean, Sd) UCL	26.59

Suggested UCL to Use

95% Student's-t UCL	14.53	or 95% Modified-t UCL	14.62

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (barium_7440-39-3_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	11.2	Minimum Non-Detect	10
Maximum Detect	133	Maximum Non-Detect	10
Variance Detects	3429	Percent Non-Detects	33.33%
Mean Detects	45.33	SD Detects	58.55
Median Detects	18.55	CV Detects	1.292
Skewness Detects	1.978	Kurtosis Detects	3.932
Mean of Logged Detects	3.287	SD of Logged Detects	1.096

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.684	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.423	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	33.55	KM Standard Error of Mean	21.04
KM SD	44.63	95% KM (BCA) UCL	N/A
95% KM (t) UCL	75.94	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	68.15	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	96.66	95% KM Chebyshev UCL	125.3
97.5% KM Chebyshev UCL	164.9	99% KM Chebyshev UCL	242.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.672	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.666	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.423	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.402	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.085	k star (bias corrected MLE)	0.438
Theta hat (MLE)	41.79	Theta star (bias corrected MLE)	103.5
nu hat (MLE)	8.677	nu star (bias corrected)	3.502
Mean (detects)	45.33		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	30.22
Maximum	133	Median	14.6
SD	51.04	CV	1.689
k hat (MLE)	0.257	k star (bias corrected MLE)	0.24
Theta hat (MLE)	117.6	Theta star (bias corrected MLE)	126.1
nu hat (MLE)	3.083	nu star (bias corrected)	2.875
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (2.87, α)	0.336	Adjusted Chi Square Value (2.87, β)	0.151
95% Gamma Approximate UCL (use when n>=50)	258.3	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	33.55	SD (KM)	44.63
Variance (KM)	1992	SE of Mean (KM)	21.04
k hat (KM)	0.565	k star (KM)	0.394
nu hat (KM)	6.782	nu star (KM)	4.724

theta hat (KM)	59.36	theta star (KM)	85.22
80% gamma percentile (KM)	54.04	90% gamma percentile (KM)	95.03
95% gamma percentile (KM)	140.2	99% gamma percentile (KM)	253.9

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.72, α)	1.027	Adjusted Chi Square Value (4.72, β)	0.538
95% Gamma Approximate KM-UCL (use when n>=50)	154.3	95% Gamma Adjusted KM-UCL (use when n<50)	294.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.812	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	30.77	Mean in Log Scale	2.327
SD in Original Scale	50.65	SD in Log Scale	1.735
95% t UCL (assumes normality of ROS data)	72.44	95% Percentile Bootstrap UCL	70.39
95% BCA Bootstrap UCL	76.05	95% Bootstrap t UCL	201
95% H-UCL (Log ROS)	8588		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.959	KM Geo Mean	19.27
KM SD (logged)	0.903	95% Critical H Value (KM-Log)	3.779
KM Standard Error of Mean (logged)	0.426	95% H-UCL (KM -Log)	133.2
KM SD (logged)	0.903	95% Critical H Value (KM-Log)	3.779
KM Standard Error of Mean (logged)	0.426		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	31.88	Mean in Log Scale	2.728
SD in Original Scale	49.91	SD in Log Scale	1.213
95% t UCL (Assumes normality)	72.94	95% H-Stat UCL	445.8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	125.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (beryllium_7440-41-7_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	3
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.18	Minimum Non-Detect	1
Maximum Detect	1.9	Maximum Non-Detect	1
Variance Detects	1.479	Percent Non-Detects	66.67%
Mean Detects	1.04	SD Detects	1.216
Median Detects	1.04	CV Detects	1.169
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.536	SD of Logged Detects	1.666

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.467	KM Standard Error of Mean	0.37
KM SD	0.641	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.212	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.075	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.577	95% KM Chebyshev UCL	2.08
97.5% KM Chebyshev UCL	2.778	99% KM Chebyshev UCL	4.149

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.002	k star (bias corrected MLE)	N/A
Theta hat (MLE)	1.038	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	4.009	nu star (bias corrected)	N/A
Mean (detects)	1.04		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.467	SD (KM)	0.641
Variance (KM)	0.411	SE of Mean (KM)	0.37
k hat (KM)	0.53	k star (KM)	0.376
nu hat (KM)	6.36	nu star (KM)	4.513
theta hat (KM)	0.88	theta star (KM)	1.241
80% gamma percentile (KM)	0.747	90% gamma percentile (KM)	1.332
95% gamma percentile (KM)	1.98	99% gamma percentile (KM)	3.621

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (4.51, α)	0.934	Adjusted Chi Square Value (4.51, β)	0.48
95% Gamma Approximate KM-UCL (use when n>=50)	2.254	95% Gamma Adjusted KM-UCL (use when n<50)	4.387

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.497	Mean in Log Scale	-1.353
SD in Original Scale	0.701	SD in Log Scale	1.194
95% t UCL (assumes normality of ROS data)	1.074	95% Percentile Bootstrap UCL	1.022
95% BCA Bootstrap UCL	1.115	95% Bootstrap t UCL	3.838
95% H-UCL (Log ROS)	6.831		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.322	KM Geo Mean	0.267
KM SD (logged)	0.878	95% Critical H Value (KM-Log)	3.707
KM Standard Error of Mean (logged)	0.507	95% H-UCL (KM -Log)	1.681
KM SD (logged)	0.878	95% Critical H Value (KM-Log)	3.707
KM Standard Error of Mean (logged)	0.507		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.68	Mean in Log Scale	-0.641
SD in Original Scale	0.611	SD in Log Scale	0.75
95% t UCL (Assumes normality)	1.183	95% H-Stat UCL	2.124

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

975% KM (Chebyshev) UCL 2.778

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (bhc alpha_319-84-6_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	2
Number of Detects	1	Number of Non-Detects	5
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

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

The data set for variable result (bhc alpha_319-84-6_t) was not processed!

result (cadmium_7440-43-9_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	3
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.18	Minimum Non-Detect	1
Maximum Detect	0.88	Maximum Non-Detect	1
Variance Detects	0.245	Percent Non-Detects	66.67%
Mean Detects	0.53	SD Detects	0.495
Median Detects	0.53	CV Detects	0.934
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.921	SD of Logged Detects	1.122

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.53	KM Standard Error of Mean	0.35
KM SD	0.35	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.235	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.106	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.58	95% KM Chebyshev UCL	2.056
97.5% KM Chebyshev UCL	2.716	99% KM Chebyshev UCL	4.012

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.895	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.28	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	7.581	nu star (bias corrected)	N/A
Mean (detects)	0.53		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.53	SD (KM)	0.35
Variance (KM)	0.123	SE of Mean (KM)	0.35
k hat (KM)	2.293	k star (KM)	1.258
nu hat (KM)	27.52	nu star (KM)	15.09
theta hat (KM)	0.231	theta star (KM)	0.421
80% gamma percentile (KM)	0.835	90% gamma percentile (KM)	1.153
95% gamma percentile (KM)	1.466	99% gamma percentile (KM)	2.18

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (15.09, α)	7.325	Adjusted Chi Square Value (15.09, β)	5.489
95% Gamma Approximate KM-UCL (use when n>=50)	1.092	95% Gamma Adjusted KM-UCL (use when n<50)	1.457

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.651	Mean in Log Scale	-0.921
SD in Original Scale	0.672	SD in Log Scale	1.14
95% t UCL (assumes normality of ROS data)	1.203	95% Percentile Bootstrap UCL	1.107
95% BCA Bootstrap UCL	1.232	95% Bootstrap t UCL	1.982
95% H-UCL (Log ROS)	8.035		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.921	KM Geo Mean	0.398
KM SD (logged)	0.793	95% Critical H Value (KM-Log)	3.456
KM Standard Error of Mean (logged)	0.793	95% H-UCL (KM -Log)	1.859
KM SD (logged)	0.793	95% Critical H Value (KM-Log)	3.456
KM Standard Error of Mean (logged)	0.793		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.51	Mean in Log Scale	-0.769
SD in Original Scale	0.222	SD in Log Scale	0.515
95% t UCL (Assumes normality)	0.693	95% H-Stat UCL	0.981

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 2.056

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (calcium_7440-70-2_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	5750	Mean	10038
Maximum	16900	Median	8290
SD	4835	Std. Error of Mean	1974
Coefficient of Variation	0.482	Skewness	0.774

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.262	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	14015	95% Adjusted-CLT UCL (Chen-1995)	13951
		95% Modified-t UCL (Johnson-1978)	14119

Gamma GOF Test

A-D Test Statistic	0.467	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.223	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.541	k star (bias corrected MLE)	2.882
Theta hat (MLE)	1812	Theta star (bias corrected MLE)	3483
nu hat (MLE)	66.5	nu star (bias corrected)	34.58
MLE Mean (bias corrected)	10038	MLE Sd (bias corrected)	5913
		Approximate Chi Square Value (0.05)	22.13
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	18.62

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	15687	95% Adjusted Gamma UCL (use when n<50)	18644

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.875	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.657	Mean of logged Data	9.121
Maximum of Logged Data	9.735	SD of logged Data	0.466

Assuming Lognormal Distribution

95% H-UCL	17396	90% Chebyshev (MVUE) UCL	15714
95% Chebyshev (MVUE) UCL	18300	97.5% Chebyshev (MVUE) UCL	21890
99% Chebyshev (MVUE) UCL	28941		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13285	95% Jackknife UCL	14015
95% Standard Bootstrap UCL	13003	95% Bootstrap-t UCL	19799
95% Hall's Bootstrap UCL	40393	95% Percentile Bootstrap UCL	13145
95% BCA Bootstrap UCL	13227		
90% Chebyshev(Mean, Sd) UCL	15959	95% Chebyshev(Mean, Sd) UCL	18641
97.5% Chebyshev(Mean, Sd) UCL	22364	99% Chebyshev(Mean, Sd) UCL	29676

Suggested UCL to Use

95% Student's-t UCL	14015

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (calcium_7440-70-2_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	5720	Mean	10400
Maximum	16700	Median	8335
SD	5000	Std. Error of Mean	2041
Coefficient of Variation	0.481	Skewness	0.769

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.278	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	14513	95% Adjusted-CLT UCL (Chen-1995)	14442
		95% Modified-t UCL (Johnson-1978)	14620

Gamma GOF Test

A-D Test Statistic	0.547	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.245	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.591	k star (bias corrected MLE)	2.906
Theta hat (MLE)	1860	Theta star (bias corrected MLE)	3578
nu hat (MLE)	67.09	nu star (bias corrected)	34.88
MLE Mean (bias corrected)	10400	MLE Sd (bias corrected)	6100
		Approximate Chi Square Value (0.05)	22.37
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	18.84

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	16217	95% Adjusted Gamma UCL (use when n<50)	19257

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.864	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.222	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.652	Mean of logged Data	9.157
Maximum of Logged Data	9.723	SD of logged Data	0.463

Assuming Lognormal Distribution

95% H-UCL	17919	90% Chebyshev (MVUE) UCL	16234
95% Chebyshev (MVUE) UCL	18894	97.5% Chebyshev (MVUE) UCL	22587
99% Chebyshev (MVUE) UCL	29840		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13758	95% Jackknife UCL	14513
95% Standard Bootstrap UCL	13502	95% Bootstrap-t UCL	22838
95% Hall's Bootstrap UCL	42512	95% Percentile Bootstrap UCL	13583
95% BCA Bootstrap UCL	13732		
90% Chebyshev(Mean, Sd) UCL	16524	95% Chebyshev(Mean, Sd) UCL	19298
97.5% Chebyshev(Mean, Sd) UCL	23148	99% Chebyshev(Mean, Sd) UCL	30711

Suggested UCL to Use

95% Student's-t UCL	14513

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (chloroform_67-66-3_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	3
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.27	Minimum Non-Detect	0.5
Maximum Detect	0.34	Maximum Non-Detect	0.5
Variance Detects	0.00245	Percent Non-Detects	66.67%
Mean Detects	0.305	SD Detects	0.0495
Median Detects	0.305	CV Detects	0.162
Skewness Detects	N/A	Kurtosis Detects	N/A

Mean of Logged Detects	-1.194	SD of Logged Detects	0.163

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.305	KM Standard Error of Mean	0.035
KM SD	0.035	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.376	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.363	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.41	95% KM Chebyshev UCL	0.458
97.5% KM Chebyshev UCL	0.524	99% KM Chebyshev UCL	0.653

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	75.6	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.00403	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	302.4	nu star (bias corrected)	N/A
Mean (detects)	0.305		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.305	SD (KM)	0.035
Variance (KM)	0.00123	SE of Mean (KM)	0.035
k hat (KM)	75.94	k star (KM)	38.08
nu hat (KM)	911.3	nu star (KM)	457
theta hat (KM)	0.00402	theta star (KM)	0.00801
80% gamma percentile (KM)	0.346	90% gamma percentile (KM)	0.37
95% gamma percentile (KM)	0.391	99% gamma percentile (KM)	0.432

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (456.97, α)	408.4	Adjusted Chi Square Value (456.97, β)	391.7
95% Gamma Approximate KM-UCL (use when n>=50)	0.341	95% Gamma Adjusted KM-UCL (use when n<50)	0.356

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.306	Mean in Log Scale	-1.194
SD in Original Scale	0.0506	SD in Log Scale	0.166
95% t UCL (assumes normality of ROS data)	0.348	95% Percentile Bootstrap UCL	0.339
95% BCA Bootstrap UCL	0.341	95% Bootstrap t UCL	0.352
95% H-UCL (Log ROS)	0.357		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.194	KM Geo Mean	0.303
KM SD (logged)	0.115	95% Critical H Value (KM-Log)	1.959
KM Standard Error of Mean (logged)	0.115	95% H-UCL (KM -Log)	0.337
KM SD (logged)	0.115	95% Critical H Value (KM-Log)	1.959
KM Standard Error of Mean (logged)	0.115		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.268	Mean in Log Scale	-1.322
SD in Original Scale	0.036	SD in Log Scale	0.123
95% t UCL (Assumes normality)	0.298	95% H-Stat UCL	0.299

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.376	KM H-UCL	0.337
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (chromium (total)_7440-47-3_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	4
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	0.32	Minimum Non-Detect	2
Maximum Detect	0.35	Maximum Non-Detect	2
Variance Detects	1.5833E-4	Percent Non-Detects	33.33%
Mean Detects	0.333	SD Detects	0.0126
Median Detects	0.33	CV Detects	0.0378
Skewness Detects	1.129	Kurtosis Detects	2.227
Mean of Logged Detects	-1.102	SD of Logged Detects	0.0375

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.329	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.333	KM Standard Error of Mean	0.00629
KM SD	0.0109	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.345	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.343	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.351	95% KM Chebyshev UCL	0.36
97.5% KM Chebyshev UCL	0.372	99% KM Chebyshev UCL	0.395

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.413	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.338	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	943.6	k star (bias corrected MLE)	236.1
Theta hat (MLE)	3.5238E-4	Theta star (bias corrected MLE)	0.00141
nu hat (MLE)	7549	nu star (bias corrected)	1888
Mean (detects)	0.333		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.32	Mean	0.332
Maximum	0.35	Median	0.33
SD	0.0107	CV	0.0322
k hat (MLE)	1168	k star (bias corrected MLE)	584

Theta hat (MLE)	2.8474E-4	Theta star (bias corrected MLE)	5.6937E-4
nu hat (MLE)	14012	nu star (bias corrected)	7007
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (N/A, α)	6814	Adjusted Chi Square Value (N/A, β)	6744
95% Gamma Approximate UCL (use when n>=50)	0.342	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.333	SD (KM)	0.0109
Variance (KM)	1.1875E-4	SE of Mean (KM)	0.00629
k hat (KM)	931	k star (KM)	465.6
nu hat (KM)	11172	nu star (KM)	5587
theta hat (KM)	3.5714E-4	theta star (KM)	7.1412E-4
80% gamma percentile (KM)	0.345	90% gamma percentile (KM)	0.352
95% gamma percentile (KM)	0.358	99% gamma percentile (KM)	0.369

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	5415	Adjusted Chi Square Value (N/A, β)	5352
95% Gamma Approximate KM-UCL (use when n>=50)	0.343	95% Gamma Adjusted KM-UCL (use when n<50)	0.347

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.324	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.332	Mean in Log Scale	-1.102
SD in Original Scale	0.0107	SD in Log Scale	0.0319
95% t UCL (assumes normality of ROS data)	0.341	95% Percentile Bootstrap UCL	0.34
95% BCA Bootstrap UCL	0.34	95% Bootstrap t UCL	0.348
95% H-UCL (Log ROS)	N/A		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.102	KM Geo Mean	0.332
KM SD (logged)	0.0325	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	0.0187	95% H-UCL (KM -Log)	N/A
KM SD (logged)	0.0325	95% Critical H Value (KM-Log)	N/A
KM Standard Error of Mean (logged)	0.0187		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.555	Mean in Log Scale	-0.734
SD in Original Scale	0.345	SD in Log Scale	0.57
95% t UCL (Assumes normality)	0.839	95% H-Stat UCL	1.155

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.345

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (chromium (total)_7440-47-3_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.3	Minimum Non-Detect	2
Maximum Detect	14.8	Maximum Non-Detect	2
Variance Detects	40.63	Percent Non-Detects	16.67%
Mean Detects	3.406	SD Detects	6.374
Median Detects	0.49	CV Detects	1.871
Skewness Detects	2.228	Kurtosis Detects	4.97

Mean of Logged Detects	5.0266E-4	SD of Logged Detects	1.562

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.585	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.449	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.931	KM Standard Error of Mean	2.425
KM SD	5.313	95% KM (BCA) UCL	7.643
95% KM (t) UCL	7.818	95% KM (Percentile Bootstrap) UCL	7.612
95% KM (z) UCL	6.921	95% KM Bootstrap t UCL	139
90% KM Chebyshev UCL	10.21	95% KM Chebyshev UCL	13.5
97.5% KM Chebyshev UCL	18.08	99% KM Chebyshev UCL	27.06

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.894	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.71	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.403	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.371	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.516	k star (bias corrected MLE)	0.34
Theta hat (MLE)	6.601	Theta star (bias corrected MLE)	10.03
nu hat (MLE)	5.16	nu star (bias corrected)	3.397
Mean (detects)	3.406		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.235	Mean	2.877
Maximum	14.8	Median	0.485
SD	5.846	CV	2.032
k hat (MLE)	0.491	k star (bias corrected MLE)	0.357
Theta hat (MLE)	5.863	Theta star (bias corrected MLE)	8.071
nu hat (MLE)	5.889	nu star (bias corrected)	4.278
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (4.28, α)	0.835	Adjusted Chi Square Value (4.28, β)	0.419
95% Gamma Approximate UCL (use when n>=50)	14.75	95% Gamma Adjusted UCL (use when n<50)	29.39

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.931	SD (KM)	5.313
Variance (KM)	28.22	SE of Mean (KM)	2.425
k hat (KM)	0.304	k star (KM)	0.263
nu hat (KM)	3.653	nu star (KM)	3.16
theta hat (KM)	9.628	theta star (KM)	11.13
80% gamma percentile (KM)	4.333	90% gamma percentile (KM)	8.763
95% gamma percentile (KM)	13.97	99% gamma percentile (KM)	27.73

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.16, α)	0.421	Adjusted Chi Square Value (3.16, β)	0.19
95% Gamma Approximate KM-UCL (use when n>=50)	21.98	95% Gamma Adjusted KM-UCL (use when n<50)	48.68

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.78	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.311	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.942	Mean in Log Scale	-0.0792
SD in Original Scale	5.814	SD in Log Scale	1.411
95% t UCL (assumes normality of ROS data)	7.724	95% Percentile Bootstrap UCL	7.61
95% BCA Bootstrap UCL	7.823	95% Bootstrap t UCL	123.2
95% H-UCL (Log ROS)	83.34		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.112	KM Geo Mean	0.894
KM SD (logged)	1.311	95% Critical H Value (KM-Log)	5.204
KM Standard Error of Mean (logged)	0.605	95% H-UCL (KM -Log)	44.62
KM SD (logged)	1.311	95% Critical H Value (KM-Log)	5.204
KM Standard Error of Mean (logged)	0.605		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.005	Mean in Log Scale	4.1889E-4
SD in Original Scale	5.785	SD in Log Scale	1.397
95% t UCL (Assumes normality)	7.764	95% H-Stat UCL	83.05

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	18.08	99% KM (Chebyshev) UCL	27.06

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (cobalt_7440-48-4_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	3
Number of Detects	3	Number of Non-Detects	3
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	1.3	Minimum Non-Detect	1
Maximum Detect	1.7	Maximum Non-Detect	1
Variance Detects	0.0533	Percent Non-Detects	50%
Mean Detects	1.567	SD Detects	0.231
Median Detects	1.7	CV Detects	0.147
Skewness Detects	-1.732	Kurtosis Detects	N/A
Mean of Logged Detects	0.441	SD of Logged Detects	0.155

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.283	KM Standard Error of Mean	0.157
KM SD	0.313	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.599	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.541	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.753	95% KM Chebyshev UCL	1.966

97.5% KM Chebyshev UCL	2.261	99% KM Chebyshev UCL	2.841

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	64.74	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0242	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	388.4	nu star (bias corrected)	N/A
Mean (detects)	1.567		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.786	Mean	1.263
Maximum	1.7	Median	1.209
SD	0.378	CV	0.3
k hat (MLE)	13.03	k star (bias corrected MLE)	6.626
Theta hat (MLE)	0.0969	Theta star (bias corrected MLE)	0.191
nu hat (MLE)	156.4	nu star (bias corrected)	79.52
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (79.52, α)	59.97	Adjusted Chi Square Value (79.52, β)	53.88
95% Gamma Approximate UCL (use when n>=50)	1.674	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.283	SD (KM)	0.313
Variance (KM)	0.0981	SE of Mean (KM)	0.157
k hat (KM)	16.8	k star (KM)	8.509
nu hat (KM)	201.6	nu star (KM)	102.1
theta hat (KM)	0.0764	theta star (KM)	0.151
80% gamma percentile (KM)	1.632	90% gamma percentile (KM)	1.869
95% gamma percentile (KM)	2.082	99% gamma percentile (KM)	2.521

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (102.11, α)	79.79	Adjusted Chi Square Value (102.11, β)	72.69
95% Gamma Approximate KM-UCL (use when n>=50)	1.642	95% Gamma Adjusted KM-UCL (use when n<50)	1.803

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.289	Mean in Log Scale	0.223
SD in Original Scale	0.347	SD in Log Scale	0.27
95% t UCL (assumes normality of ROS data)	1.574	95% Percentile Bootstrap UCL	1.5
95% BCA Bootstrap UCL	1.497	95% Bootstrap t UCL	1.692
95% H-UCL (Log ROS)	1.687		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.221	KM Geo Mean	1.247
KM SD (logged)	0.238	95% Critical H Value (KM-Log)	2.125
KM Standard Error of Mean (logged)	0.119	95% H-UCL (KM -Log)	1.608
KM SD (logged)	0.238	95% Critical H Value (KM-Log)	2.125
KM Standard Error of Mean (logged)	0.119		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.033	Mean in Log Scale	-0.126
SD in Original Scale	0.602	SD in Log Scale	0.629
95% t UCL (Assumes normality)	1.529	95% H-Stat UCL	2.478

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 1.599

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (cobalt_7440-48-4_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.47	Minimum Non-Detect	1
Maximum Detect	11.6	Maximum Non-Detect	1
Variance Detects	25.21	Percent Non-Detects	33.33%
Mean Detects	4.193	SD Detects	5.021
Median Detects	2.35	CV Detects	1.198
Skewness Detects	1.799	Kurtosis Detects	3.427
Mean of Logged Detects	0.848	SD of Logged Detects	1.312

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.79	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.374	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.952	KM Standard Error of Mean	1.867
KM SD	3.961	95% KM (BCA) UCL	N/A
95% KM (t) UCL	6.714	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	6.023	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	8.553	95% KM Chebyshev UCL	11.09
97.5% KM Chebyshev UCL	14.61	99% KM Chebyshev UCL	21.53

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.313	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.667	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.286	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.403	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.988	k star (bias corrected MLE)	0.414
Theta hat (MLE)	4.243	Theta star (bias corrected MLE)	10.13
nu hat (MLE)	7.905	nu star (bias corrected)	3.31
Mean (detects)	4.193		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.798
Maximum	11.6	Median	1.285
SD	4.449	CV	1.59
k hat (MLE)	0.338	k star (bias corrected MLE)	0.28
Theta hat (MLE)	8.271	Theta star (bias corrected MLE)	9.984

nu hat (MLE)	4.06	nu star (bias corrected)	3.363
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (3.36, α)	0.488	Adjusted Chi Square Value (3.36, β)	0.223
95% Gamma Approximate UCL (use when n>=50)	19.3	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.952	SD (KM)	3.961
Variance (KM)	15.69	SE of Mean (KM)	1.867
k hat (KM)	0.555	k star (KM)	0.389
nu hat (KM)	6.665	nu star (KM)	4.666
theta hat (KM)	5.314	theta star (KM)	7.591
80% gamma percentile (KM)	4.747	90% gamma percentile (KM)	8.379
95% gamma percentile (KM)	12.38	99% gamma percentile (KM)	22.49

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.67, α)	1.001	Adjusted Chi Square Value (4.67, β)	0.522
95% Gamma Approximate KM-UCL (use when n>=50)	13.76	95% Gamma Adjusted KM-UCL (use when n<50)	26.39

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.218	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.942	Mean in Log Scale	0.262
SD in Original Scale	4.347	SD in Log Scale	1.392
95% t UCL (assumes normality of ROS data)	6.518	95% Percentile Bootstrap UCL	6.271
95% BCA Bootstrap UCL	6.71	95% Bootstrap t UCL	16.61
95% H-UCL (Log ROS)	104.4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.314	KM Geo Mean	1.369
KM SD (logged)	1.197	95% Critical H Value (KM-Log)	4.809
KM Standard Error of Mean (logged)	0.564	95% H-UCL (KM -Log)	36.71
KM SD (logged)	1.197	95% Critical H Value (KM-Log)	4.809
KM Standard Error of Mean (logged)	0.564		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.962	Mean in Log Scale	0.335
SD in Original Scale	4.332	SD in Log Scale	1.291
95% t UCL (Assumes normality)	6.525	95% H-Stat UCL	62.23

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	6.714

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (copper_7440-50-8_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.33	Minimum Non-Detect	2
Maximum Detect	0.48	Maximum Non-Detect	2
Variance Detects	0.0046	Percent Non-Detects	33.33%
Mean Detects	0.41	SD Detects	0.0678
Median Detects	0.415	CV Detects	0.165
Skewness Detects	-0.282	Kurtosis Detects	-2.734
Mean of Logged Detects	-0.902	SD of Logged Detects	0.169

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.41	KM Standard Error of Mean	0.0339
KM SD	0.0587	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.478	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.466	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.512	95% KM Chebyshev UCL	0.558
97.5% KM Chebyshev UCL	0.622	99% KM Chebyshev UCL	0.747

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.276	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.656	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.258	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	47.41	k star (bias corrected MLE)	12.02
Theta hat (MLE)	0.00865	Theta star (bias corrected MLE)	0.0341
nu hat (MLE)	379.3	nu star (bias corrected)	96.16
Mean (detects)	0.41		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.33	Mean	0.41
Maximum	0.48	Median	0.415
SD	0.0583	CV	0.142
k hat (MLE)	57.92	k star (bias corrected MLE)	29.07
Theta hat (MLE)	0.00707	Theta star (bias corrected MLE)	0.0141
nu hat (MLE)	695	nu star (bias corrected)	348.8
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (348.83, α)	306.6	Adjusted Chi Square Value (348.83, β)	292.1
95% Gamma Approximate UCL (use when n>=50)	0.466	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.41	SD (KM)	0.0587
Variance (KM)	0.00345	SE of Mean (KM)	0.0339
k hat (KM)	48.72	k star (KM)	24.47
nu hat (KM)	584.7	nu star (KM)	293.7
theta hat (KM)	0.00841	theta star (KM)	0.0168
80% gamma percentile (KM)	0.478	90% gamma percentile (KM)	0.519
95% gamma percentile (KM)	0.555	99% gamma percentile (KM)	0.627

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (293.68, α)	255	Adjusted Chi Square Value (293.68, β)	241.9
95% Gamma Approximate KM-UCL (use when n>=50)	0.472	95% Gamma Adjusted KM-UCL (use when n<50)	0.498

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.951	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.409	Mean in Log Scale	-0.902
SD in Original Scale	0.0585	SD in Log Scale	0.146
95% t UCL (assumes normality of ROS data)	0.457	95% Percentile Bootstrap UCL	0.446
95% BCA Bootstrap UCL	0.443	95% Bootstrap t UCL	0.456
95% H-UCL (Log ROS)	0.467		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.902	KM Geo Mean	0.406
KM SD (logged)	0.147	95% Critical H Value (KM-Log)	1.997
KM Standard Error of Mean (logged)	0.0846	95% H-UCL (KM -Log)	0.467
KM SD (logged)	0.147	95% Critical H Value (KM-Log)	1.997
KM Standard Error of Mean (logged)	0.0846		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.607	Mean in Log Scale	-0.601
SD in Original Scale	0.309	SD in Log Scale	0.484
95% t UCL (Assumes normality)	0.861	95% H-Stat UCL	1.082

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.478

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (copper_7440-50-8_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.43	Mean	3.95
Maximum	18.5	Median	0.515
SD	7.217	Std. Error of Mean	2.946
Coefficient of Variation	1.827	Skewness	2.324

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.594	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.369	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9.887	95% Adjusted-CLT UCL (Chen-1995)	11.78
		95% Modified-t UCL (Johnson-1978)	10.35

Gamma GOF Test

A-D Test Statistic	0.948	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.734	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.385	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.348	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.53	k star (bias corrected MLE)	0.376
Theta hat (MLE)	7.46	Theta star (bias corrected MLE)	10.51

nu hat (MLE)	6.354	nu star (bias corrected)	4.51
MLE Mean (bias corrected)	3.95	MLE Sd (bias corrected)	6.443
		Approximate Chi Square Value (0.05)	0.933
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.479

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	19.09	95% Adjusted Gamma UCL (use when n<50)	37.17

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.749	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.352	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.844	Mean of logged Data	0.185
Maximum of Logged Data	2.918	SD of logged Data	1.552

Assuming Lognormal Distribution

95% H-UCL	270	90% Chebyshev (MVUE) UCL	8.145
95% Chebyshev (MVUE) UCL	10.51	97.5% Chebyshev (MVUE) UCL	13.78
99% Chebyshev (MVUE) UCL	20.22		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	8.796	95% Jackknife UCL	9.887
95% Standard Bootstrap UCL	8.406	95% Bootstrap-t UCL	402.8
95% Hall's Bootstrap UCL	202.5	95% Percentile Bootstrap UCL	9.475
95% BCA Bootstrap UCL	9.972		
90% Chebyshev(Mean, Sd) UCL	12.79	95% Chebyshev(Mean, Sd) UCL	16.79
97.5% Chebyshev(Mean, Sd) UCL	22.35	99% Chebyshev(Mean, Sd) UCL	33.27

Suggested UCL to Use

95% Hall's Bootstrap UCL	202.5

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (cyanide_57-12-5_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	4
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	2.1	Minimum Non-Detect	10
Maximum Detect	3.3	Maximum Non-Detect	10
Variance Detects	0.323	Percent Non-Detects	33.33%
Mean Detects	2.95	SD Detects	0.569
Median Detects	3.2	CV Detects	0.193
Skewness Detects	-1.958	Kurtosis Detects	3.871
Mean of Logged Detects	1.066	SD of Logged Detects	0.216

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.701	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.42	**Lilliefors GOF Test**

5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.95	KM Standard Error of Mean	0.284
KM SD	0.492	95% KM (BCA) UCL	N/A
95% KM (t) UCL	3.523	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	3.418	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	3.803	95% KM Chebyshev UCL	4.189
97.5% KM Chebyshev UCL	4.726	99% KM Chebyshev UCL	5.779

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.822	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.657	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.448	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.394	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	30.91	k star (bias corrected MLE)	7.893
Theta hat (MLE)	0.0954	Theta star (bias corrected MLE)	0.374
nu hat (MLE)	247.3	nu star (bias corrected)	63.15
Mean (detects)	2.95		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	2.1	Mean	2.947
Maximum	3.3	Median	3.2
SD	0.474	CV	0.161
k hat (MLE)	40.77	k star (bias corrected MLE)	20.5
Theta hat (MLE)	0.0723	Theta star (bias corrected MLE)	0.144
nu hat (MLE)	489.2	nu star (bias corrected)	245.9
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (245.94, α)	210.6	Adjusted Chi Square Value (245.94, β)	198.8
95% Gamma Approximate UCL (use when n>=50)	3.441	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.95	SD (KM)	0.492
Variance (KM)	0.243	SE of Mean (KM)	0.284
k hat (KM)	35.89	k star (KM)	18.05
nu hat (KM)	430.6	nu star (KM)	216.7
theta hat (KM)	0.0822	theta star (KM)	0.163
80% gamma percentile (KM)	3.513	90% gamma percentile (KM)	3.867
95% gamma percentile (KM)	4.177	99% gamma percentile (KM)	4.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (216.65, α)	183.6	Adjusted Chi Square Value (216.65, β)	172.5
95% Gamma Approximate KM-UCL (use when n>=50)	3.481	95% Gamma Adjusted KM-UCL (use when n<50)	3.704

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.688	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.424	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.94	Mean in Log Scale	1.066
SD in Original Scale	0.482	SD in Log Scale	0.18
95% t UCL (assumes normality of ROS data)	3.336	95% Percentile Bootstrap UCL	3.226
95% BCA Bootstrap UCL	3.214	95% Bootstrap t UCL	3.207
95% H-UCL (Log ROS)	3.478		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.066	KM Geo Mean	2.902
KM SD (logged)	0.187	95% Critical H Value (KM-Log)	2.051

KM Standard Error of Mean (logged)	0.108	95% H-UCL (KM -Log)	3.507
KM SD (logged)	0.187	95% Critical H Value (KM-Log)	2.051
KM Standard Error of Mean (logged)	0.108		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	3.633	Mean in Log Scale	1.247
SD in Original Scale	1.147	SD in Log Scale	0.327
95% t UCL (Assumes normality)	4.577	95% H-Stat UCL	5.118

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	3.523	KM H-UCL	3.507
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (cyanide_57-12-5_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	1.9	Minimum Non-Detect	10
Maximum Detect	3.2	Maximum Non-Detect	10
Variance Detects	0.282	Percent Non-Detects	16.67%
Mean Detects	2.38	SD Detects	0.531
Median Detects	2.2	CV Detects	0.223
Skewness Detects	1.087	Kurtosis Detects	0.322
Mean of Logged Detects	0.848	SD of Logged Detects	0.213

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.38	KM Standard Error of Mean	0.237
KM SD	0.475	95% KM (BCA) UCL	2.75
95% KM (t) UCL	2.859	95% KM (Percentile Bootstrap) UCL	2.75
95% KM (z) UCL	2.771	95% KM Bootstrap t UCL	3.647
90% KM Chebyshev UCL	3.092	95% KM Chebyshev UCL	3.415
97.5% KM Chebyshev UCL	3.863	99% KM Chebyshev UCL	4.743

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.316	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.232	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	26.94	k star (bias corrected MLE)	10.91
Theta hat (MLE)	0.0884	Theta star (bias corrected MLE)	0.218
nu hat (MLE)	269.4	nu star (bias corrected)	109.1

Mean (detects)	2.38		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	1.9	Mean	2.377
Maximum	3.2	Median	2.28
SD	0.475	CV	0.2
k hat (MLE)	32.28	k star (bias corrected MLE)	16.25
Theta hat (MLE)	0.0736	Theta star (bias corrected MLE)	0.146
nu hat (MLE)	387.4	nu star (bias corrected)	195
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (195.03, α)	163.7	Adjusted Chi Square Value (195.03, β)	153.3
95% Gamma Approximate UCL (use when n>=50)	2.831	95% Gamma Adjusted UCL (use when n<50)	3.023

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.38	SD (KM)	0.475
Variance (KM)	0.226	SE of Mean (KM)	0.237
k hat (KM)	25.11	k star (KM)	12.67
nu hat (KM)	301.3	nu star (KM)	152
theta hat (KM)	0.0948	theta star (KM)	0.188
80% gamma percentile (KM)	2.917	90% gamma percentile (KM)	3.267
95% gamma percentile (KM)	3.576	99% gamma percentile (KM)	4.205

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (151.98, α)	124.5	Adjusted Chi Square Value (151.98, β)	115.5
95% Gamma Approximate KM-UCL (use when n>=50)	2.906	95% Gamma Adjusted KM-UCL (use when n<50)	3.132

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.373	Mean in Log Scale	0.848
SD in Original Scale	0.475	SD in Log Scale	0.19
95% t UCL (assumes normality of ROS data)	2.764	95% Percentile Bootstrap UCL	2.7
95% BCA Bootstrap UCL	2.717	95% Bootstrap t UCL	3.057
95% H-UCL (Log ROS)	2.833		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.848	KM Geo Mean	2.336
KM SD (logged)	0.19	95% Critical H Value (KM-Log)	2.055
KM Standard Error of Mean (logged)	0.0951	95% H-UCL (KM -Log)	2.833
KM SD (logged)	0.19	95% Critical H Value (KM-Log)	2.055
KM Standard Error of Mean (logged)	0.0951		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.817	Mean in Log Scale	0.975
SD in Original Scale	1.17	SD in Log Scale	0.364
95% t UCL (Assumes normality)	3.779	95% H-Stat UCL	4.151

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.859

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (endosulfan sulfate_1031-07-8_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	3
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	4.4000E-4	Minimum Non-Detect	0.0014
Maximum Detect	7.9000E-4	Maximum Non-Detect	0.0014
Variance Detects	6.1250E-8	Percent Non-Detects	66.67%
Mean Detects	6.1500E-4	SD Detects	2.4749E-4
Median Detects	6.1500E-4	CV Detects	0.402
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-7.436	SD of Logged Detects	0.414

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	6.1500E-4	KM Standard Error of Mean	1.7500E-4
KM SD	1.7500E-4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	9.6763E-4	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	9.0285E-4	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.00114	95% KM Chebyshev UCL	0.00138
97.5% KM Chebyshev UCL	0.00171	99% KM Chebyshev UCL	0.00236

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	12.01	k star (bias corrected MLE)	N/A
Theta hat (MLE)	5.1218E-5	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	48.03	nu star (bias corrected)	N/A
Mean (detects)	6.1500E-4		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	6.1500E-4	SD (KM)	1.7500E-4
Variance (KM)	3.0625E-8	SE of Mean (KM)	1.7500E-4
k hat (KM)	12.35	k star (KM)	6.286
nu hat (KM)	148.2	nu star (KM)	75.43
theta hat (KM)	4.9797E-5	theta star (KM)	9.7833E-5
80% gamma percentile (KM)	8.0635E-4	90% gamma percentile (KM)	9.4279E-4
95% gamma percentile (KM)	0.00107	99% gamma percentile (KM)	0.00132

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (75.43, α)	56.43	Adjusted Chi Square Value (75.43, β)	50.54
95% Gamma Approximate KM-UCL (use when n>=50)	8.2212E-4	95% Gamma Adjusted KM-UCL (use when n<50)	9.1797E-4

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	6.3398E-4	Mean in Log Scale	-7.436
SD in Original Scale	2.6247E-4	SD in Log Scale	0.421
95% t UCL (assumes normality of ROS data)	8.4989E-4	95% Percentile Bootstrap UCL	8.0151E-4
95% BCA Bootstrap UCL	8.2605E-4	95% Bootstrap t UCL	9.0050E-4
95% H-UCL (Log ROS)	0.00102		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.436	KM Geo Mean	5.8958E-4
KM SD (logged)	0.293	95% Critical H Value (KM-Log)	2.213

KM Standard Error of Mean (logged)	0.293	95% H-UCL (KM -Log)	8.2212E-4
KM SD (logged)	0.293	95% Critical H Value (KM-Log)	2.213
KM Standard Error of Mean (logged)	0.293		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	6.7167E-4	Mean in Log Scale	-7.322
SD in Original Scale	1.1907E-4	SD in Log Scale	0.205
95% t UCL (Assumes normality)	7.6961E-4	95% H-Stat UCL	8.1687E-4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	9.6763E-4	KM H-UCL	8.2212E-4
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (endrin_72-20-8_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	4
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	2
Minimum Detect	3.1000E-4	Minimum Non-Detect	0.0013
Maximum Detect	4.8000E-4	Maximum Non-Detect	0.0014
Variance Detects	1.4450E-8	Percent Non-Detects	66.67%
Mean Detects	3.9500E-4	SD Detects	1.2021E-4
Median Detects	3.9500E-4	CV Detects	0.304
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-7.86	SD of Logged Detects	0.309

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.9500E-4	KM Standard Error of Mean	8.5000E-5
KM SD	8.5000E-5	95% KM (BCA) UCL	N/A
95% KM (t) UCL	5.6628E-4	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	5.3481E-4	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	6.5000E-4	95% KM Chebyshev UCL	7.6551E-4
97.5% KM Chebyshev UCL	9.2582E-4	99% KM Chebyshev UCL	0.00124

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	21.26	k star (bias corrected MLE)	N/A
Theta hat (MLE)	1.8583E-5	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	85.03	nu star (bias corrected)	N/A
Mean (detects)	3.9500E-4		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.9500E-4	SD (KM)	8.5000E-5

Variance (KM)	7.2250E-9	SE of Mean (KM)	8.5000E-5
k hat (KM)	21.6	k star (KM)	10.91
nu hat (KM)	259.1	nu star (KM)	130.9
theta hat (KM)	1.8291E-5	theta star (KM)	3.6210E-5
80% gamma percentile (KM)	4.9056E-4	90% gamma percentile (KM)	5.5391E-4
95% gamma percentile (KM)	6.1006E-4	99% gamma percentile (KM)	7.2496E-4

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (130.90, α)	105.5	Adjusted Chi Square Value (130.90, β)	97.23
95% Gamma Approximate KM-UCL (use when n>=50)	4.9024E-4	95% Gamma Adjusted KM-UCL (use when n<50)	5.3180E-4

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.9644E-4	Mean in Log Scale	-7.86
SD in Original Scale	1.0123E-4	SD in Log Scale	0.257
95% t UCL (assumes normality of ROS data)	4.7971E-4	95% Percentile Bootstrap UCL	4.6155E-4
95% BCA Bootstrap UCL	4.5912E-4	95% Bootstrap t UCL	5.0553E-4
95% H-UCL (Log ROS)	5.1066E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-7.86	KM Geo Mean	3.8575E-4
KM SD (logged)	0.219	95% Critical H Value (KM-Log)	2.096
KM Standard Error of Mean (logged)	0.219	95% H-UCL (KM -Log)	4.8492E-4
KM SD (logged)	0.219	95% Critical H Value (KM-Log)	2.096
KM Standard Error of Mean (logged)	0.219		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.9000E-4	Mean in Log Scale	-7.475
SD in Original Scale	1.6149E-4	SD in Log Scale	0.33
95% t UCL (Assumes normality)	7.2285E-4	95% H-Stat UCL	8.3780E-4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	5.6628E-4	KM H-UCL	4.8492E-4
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (iron_7439-89-6_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	117	Mean	744.7
Maximum	2000	Median	435
SD	709.1	Std. Error of Mean	289.5
Coefficient of Variation	0.952	Skewness	1.403

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.33	**Lilliefors GOF Test**

5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level	

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1328	95% Adjusted-CLT UCL (Chen-1995)	1398
		95% Modified-t UCL (Johnson-1978)	1356

Gamma GOF Test

A-D Test Statistic	0.313	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.275	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.338	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.428	k star (bias corrected MLE)	0.825
Theta hat (MLE)	521.6	Theta star (bias corrected MLE)	902.7
nu hat (MLE)	17.13	nu star (bias corrected)	9.899
MLE Mean (bias corrected)	744.7	MLE Sd (bias corrected)	819.9
		Approximate Chi Square Value (0.05)	3.879
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	2.645

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1901	95% Adjusted Gamma UCL (use when n<50)	2787

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.217	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.762	Mean of logged Data	6.223
Maximum of Logged Data	7.601	SD of logged Data	0.998

Assuming Lognormal Distribution

95% H-UCL	5208	90% Chebyshev (MVUE) UCL	1645
95% Chebyshev (MVUE) UCL	2051	97.5% Chebyshev (MVUE) UCL	2616
99% Chebyshev (MVUE) UCL	3724		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1221	95% Jackknife UCL	1328
95% Standard Bootstrap UCL	1198	95% Bootstrap-t UCL	2919
95% Hall's Bootstrap UCL	5054	95% Percentile Bootstrap UCL	1181
95% BCA Bootstrap UCL	1266		
90% Chebyshev(Mean, Sd) UCL	1613	95% Chebyshev(Mean, Sd) UCL	2006
97.5% Chebyshev(Mean, Sd) UCL	2552	99% Chebyshev(Mean, Sd) UCL	3625

Suggested UCL to Use

95% Student's-t UCL	1328

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (iron_7439-89-6_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0

Minimum	196	Mean	6558
Maximum	32600	Median	1795
SD	12789	Std. Error of Mean	5221
Coefficient of Variation	1.95	Skewness	2.422

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.563	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.459	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	17079	95% Adjusted-CLT UCL (Chen-1995)	20664
		95% Modified-t UCL (Johnson-1978)	17940

Gamma GOF Test

A-D Test Statistic	0.635	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.361	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.35	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.474	k star (bias corrected MLE)	0.348
Theta hat (MLE)	13843	Theta star (bias corrected MLE)	18846
nu hat (MLE)	5.685	nu star (bias corrected)	4.176
MLE Mean (bias corrected)	6558	MLE Sd (bias corrected)	11117
		Approximate Chi Square Value (0.05)	0.792
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.394

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	34561	95% Adjusted Gamma UCL (use when n<50)	69592

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.248	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.278	Mean of logged Data	7.436
Maximum of Logged Data	10.39	SD of logged Data	1.742

Assuming Lognormal Distribution

95% H-UCL	1489576	90% Chebyshev (MVUE) UCL	14936
95% Chebyshev (MVUE) UCL	19404	97.5% Chebyshev (MVUE) UCL	25606
99% Chebyshev (MVUE) UCL	37789		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	15146	95% Jackknife UCL	17079
95% Standard Bootstrap UCL	14459	95% Bootstrap-t UCL	98525
95% Hall's Bootstrap UCL	90234	95% Percentile Bootstrap UCL	16780
95% BCA Bootstrap UCL	17159		
90% Chebyshev(Mean, Sd) UCL	22222	95% Chebyshev(Mean, Sd) UCL	29317
97.5% Chebyshev(Mean, Sd) UCL	39165	99% Chebyshev(Mean, Sd) UCL	58509

Suggested UCL to Use

95% Adjusted Gamma UCL	69592

Recommended UCL exceeds the maximum observation

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (lead_7439-92-1_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	2
Number of Detects	1	Number of Non-Detects	5
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

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

The data set for variable result (lead_7439-92-1_d) was not processed!

result (lead_7439-92-1_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.21	Mean	5.92
Maximum	29	Median	0.625
SD	11.44	Std. Error of Mean	4.672
Coefficient of Variation	1.933	Skewness	2.327

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.601	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.372	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15.33	95% Adjusted-CLT UCL (Chen-1995)	18.35
		95% Modified-t UCL (Johnson-1978)	16.07

Gamma GOF Test

A-D Test Statistic	0.66	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.307	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.353	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.403	k star (bias corrected MLE)	0.312
Theta hat (MLE)	14.7	Theta star (bias corrected MLE)	18.95
nu hat (MLE)	4.831	nu star (bias corrected)	3.749
MLE Mean (bias corrected)	5.92	MLE Sd (bias corrected)	10.59
		Approximate Chi Square Value (0.05)	0.625
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.297

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	35.51	95% Adjusted Gamma UCL (use when n<50)	74.75

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.23	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.561	Mean of logged Data	0.146
Maximum of Logged Data	3.367	SD of logged Data	1.951

Assuming Lognormal Distribution

95% H-UCL	5500	90% Chebyshev (MVUE) UCL	13.68
95% Chebyshev (MVUE) UCL	17.89	97.5% Chebyshev (MVUE) UCL	23.73
99% Chebyshev (MVUE) UCL	35.19		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13.6	95% Jackknife UCL	15.33
95% Standard Bootstrap UCL	12.8	95% Bootstrap-t UCL	223
95% Hall's Bootstrap UCL	122	95% Percentile Bootstrap UCL	14.73
95% BCA Bootstrap UCL	20.17		
90% Chebyshev(Mean, Sd) UCL	19.94	95% Chebyshev(Mean, Sd) UCL	26.28
97.5% Chebyshev(Mean, Sd) UCL	35.1	99% Chebyshev(Mean, Sd) UCL	52.41

Suggested UCL to Use

95% Adjusted Gamma UCL	74.75

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (magnesium_7439-95-4_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	2000	Mean	3167
Maximum	5370	Median	2630
SD	1386	Std. Error of Mean	565.8
Coefficient of Variation	0.438	Skewness	0.991

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.257	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4307	95% Adjusted-CLT UCL (Chen-1995)	4342
		95% Modified-t UCL (Johnson-1978)	4345

Gamma GOF Test

A-D Test Statistic	0.443	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.224	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.952	k star (bias corrected MLE)	3.587
Theta hat (MLE)	455.5	Theta star (bias corrected MLE)	882.8
nu hat (MLE)	83.42	nu star (bias corrected)	43.04
MLE Mean (bias corrected)	3167	MLE Sd (bias corrected)	1672
		Approximate Chi Square Value (0.05)	29
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	24.91

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4700	95% Adjusted Gamma UCL (use when n<50)	5471

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.884	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.601	Mean of logged Data	7.987
Maximum of Logged Data	8.589	SD of logged Data	0.411

Assuming Lognormal Distribution

95% H-UCL	5014	90% Chebyshev (MVUE) UCL	4743
95% Chebyshev (MVUE) UCL	5462	97.5% Chebyshev (MVUE) UCL	6461
99% Chebyshev (MVUE) UCL	8423		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4097	95% Jackknife UCL	4307
95% Standard Bootstrap UCL	3998	95% Bootstrap-t UCL	6086
95% Hall's Bootstrap UCL	10714	95% Percentile Bootstrap UCL	4077
95% BCA Bootstrap UCL	4218		
90% Chebyshev(Mean, Sd) UCL	4864	95% Chebyshev(Mean, Sd) UCL	5633
97.5% Chebyshev(Mean, Sd) UCL	6700	99% Chebyshev(Mean, Sd) UCL	8796

Suggested UCL to Use

95% Student's-t UCL	4307

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (magnesium_7439-95-4_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	2040	Mean	3328
Maximum	5320	Median	2715
SD	1448	Std. Error of Mean	591.3
Coefficient of Variation	0.435	Skewness	0.806

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4520	95% Adjusted-CLT UCL (Chen-1995)	4509
		95% Modified-t UCL (Johnson-1978)	4552

Gamma GOF Test

A-D Test Statistic	0.538	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.239	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.882	k star (bias corrected MLE)	3.552
Theta hat (MLE)	483.6	Theta star (bias corrected MLE)	937
nu hat (MLE)	82.58	nu star (bias corrected)	42.63
MLE Mean (bias corrected)	3328	MLE Sd (bias corrected)	1766
		Approximate Chi Square Value (0.05)	28.66
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	24.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4951	95% Adjusted Gamma UCL (use when n<50)	5768

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.211	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.621	Mean of logged Data	8.036
Maximum of Logged Data	8.579	SD of logged Data	0.415

Assuming Lognormal Distribution

95% H-UCL	5303	90% Chebyshev (MVUE) UCL	5002
95% Chebyshev (MVUE) UCL	5766	97.5% Chebyshev (MVUE) UCL	6825
99% Chebyshev (MVUE) UCL	8906		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4301	95% Jackknife UCL	4520
95% Standard Bootstrap UCL	4215	95% Bootstrap-t UCL	7227
95% Hall's Bootstrap UCL	5887	95% Percentile Bootstrap UCL	4265
95% BCA Bootstrap UCL	4338		
90% Chebyshev(Mean, Sd) UCL	5102	95% Chebyshev(Mean, Sd) UCL	5906
97.5% Chebyshev(Mean, Sd) UCL	7021	99% Chebyshev(Mean, Sd) UCL	9212

Suggested UCL to Use

95% Student's-t UCL 4520

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (manganese_7439-96-5_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	8.6	Mean	141.6
Maximum	552	Median	40.3
SD	213	Std. Error of Mean	86.95
Coefficient of Variation	1.505	Skewness	1.943

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use

guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.

For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.719	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.324	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	316.8	95% Adjusted-CLT UCL (Chen-1995)	358.3
		95% Modified-t UCL (Johnson-1978)	328.3

Gamma GOF Test

A-D Test Statistic	0.39	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.234	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.347	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.595	k star (bias corrected MLE)	0.409
Theta hat (MLE)	238	Theta star (bias corrected MLE)	346.5
nu hat (MLE)	7.138	nu star (bias corrected)	4.903
MLE Mean (bias corrected)	141.6	MLE Sd (bias corrected)	221.5
		Approximate Chi Square Value (0.05)	1.107
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.59

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	626.6	95% Adjusted Gamma UCL (use when n<50)	1176

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.152	Mean of logged Data	3.913
Maximum of Logged Data	6.314	SD of logged Data	1.627

Assuming Lognormal Distribution

95% H-UCL	18882	90% Chebyshev (MVUE) UCL	375.6
95% Chebyshev (MVUE) UCL	485.9	97.5% Chebyshev (MVUE) UCL	639
99% Chebyshev (MVUE) UCL	939.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	284.6	95% Jackknife UCL	316.8
95% Standard Bootstrap UCL	273.8	95% Bootstrap-t UCL	1533
95% Hall's Bootstrap UCL	1209	95% Percentile Bootstrap UCL	291.3
95% BCA Bootstrap UCL	343.4		
90% Chebyshev(Mean, Sd) UCL	402.4	95% Chebyshev(Mean, Sd) UCL	520.6
97.5% Chebyshev(Mean, Sd) UCL	684.6	99% Chebyshev(Mean, Sd) UCL	1007

Suggested UCL to Use

95% Student's-t UCL	316.8

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (manganese_7439-96-5_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	10.9	Mean	219.5
Maximum	708	Median	45.1
SD	301.3	Std. Error of Mean	123
Coefficient of Variation	1.373	Skewness	1.179

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.747	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.36	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	467.4	95% Adjusted-CLT UCL (Chen-1995)	485.2
		95% Modified-t UCL (Johnson-1978)	477.3

Gamma GOF Test

A-D Test Statistic	0.578	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.348	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.553	k star (bias corrected MLE)	0.388
Theta hat (MLE)	396.9	Theta star (bias corrected MLE)	566.3
nu hat (MLE)	6.636	nu star (bias corrected)	4.652
MLE Mean (bias corrected)	219.5	MLE Sd (bias corrected)	352.6
		Approximate Chi Square Value (0.05)	0.995
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.518

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1026	95% Adjusted Gamma UCL (use when n<50)	1971

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.243	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.389	Mean of logged Data	4.26
Maximum of Logged Data	6.562	SD of logged Data	1.742

Assuming Lognormal Distribution

95% H-UCL	62505	90% Chebyshev (MVUE) UCL	624.2
95% Chebyshev (MVUE) UCL	811	97.5% Chebyshev (MVUE) UCL	1070
99% Chebyshev (MVUE) UCL	1579		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	421.9	95% Jackknife UCL	467.4
95% Standard Bootstrap UCL	403.9	95% Bootstrap-t UCL	2565

95% Hall's Bootstrap UCL	2562	95% Percentile Bootstrap UCL	412.9
95% BCA Bootstrap UCL	449.9		
90% Chebyshev(Mean, Sd) UCL	588.6	95% Chebyshev(Mean, Sd) UCL	755.7
97.5% Chebyshev(Mean, Sd) UCL	987.8	99% Chebyshev(Mean, Sd) UCL	1444

Suggested UCL to Use

95% Adjusted Gamma UCL 1971

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (mercury_7439-97-6_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	2
Number of Detects	3	Number of Non-Detects	3
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

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

The data set for variable result (mercury_7439-97-6_d) was not processed!

result (mercury_7439-97-6_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	4
Number of Detects	3	Number of Non-Detects	3
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	0.25	Minimum Non-Detect	0.2
Maximum Detect	4	Maximum Non-Detect	0.2
Variance Detects	4.675	Percent Non-Detects	50%
Mean Detects	1.503	SD Detects	2.162
Median Detects	0.26	CV Detects	1.438
Skewness Detects	1.732	Kurtosis Detects	N/A
Mean of Logged Detects	-0.449	SD of Logged Detects	1.59

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.752	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.384	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.852	KM Standard Error of Mean	0.704
KM SD	1.408	95% KM (BCA) UCL	N/A
95% KM (t) UCL	2.27	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	2.01	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	2.964	95% KM Chebyshev UCL	3.921
97.5% KM Chebyshev UCL	5.249	99% KM Chebyshev UCL	7.857

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.705	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2.133	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	4.229	nu star (bias corrected)	N/A
Mean (detects)	1.503		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.757
Maximum	4	Median	0.13
SD	1.593	CV	2.106
k hat (MLE)	0.306	k star (bias corrected MLE)	0.264
Theta hat (MLE)	2.475	Theta star (bias corrected MLE)	2.866
nu hat (MLE)	3.669	nu star (bias corrected)	3.168
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (3.17, α)	0.424	Adjusted Chi Square Value (3.17, β)	0.191
95% Gamma Approximate UCL (use when n>=50)	5.655	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.852	SD (KM)	1.408
Variance (KM)	1.983	SE of Mean (KM)	0.704
k hat (KM)	0.366	k star (KM)	0.294
nu hat (KM)	4.389	nu star (KM)	3.528
theta hat (KM)	2.328	theta star (KM)	2.897
80% gamma percentile (KM)	1.299	90% gamma percentile (KM)	2.518
95% gamma percentile (KM)	3.921	99% gamma percentile (KM)	7.578

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.53, α)	0.545	Adjusted Chi Square Value (3.53, β)	0.253
95% Gamma Approximate KM-UCL (use when n>=50)	5.517	95% Gamma Adjusted KM-UCL (use when n<50)	11.87

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.761	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.381	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.756	Mean in Log Scale	-2.925
SD in Original Scale	1.594	SD in Log Scale	3.034
95% t UCL (assumes normality of ROS data)	2.067	95% Percentile Bootstrap UCL	2.009
95% BCA Bootstrap UCL	2.088	95% Bootstrap t UCL	12.04
95% H-UCL (Log ROS)	33070570		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.029	KM Geo Mean	0.357
KM SD (logged)	1.086	95% Critical H Value (KM-Log)	4.428
KM Standard Error of Mean (logged)	0.543	95% H-UCL (KM -Log)	5.531
KM SD (logged)	1.086	95% Critical H Value (KM-Log)	4.428
KM Standard Error of Mean (logged)	0.543		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.802	Mean in Log Scale	-1.376
SD in Original Scale	1.569	SD in Log Scale	1.429
95% t UCL (Assumes normality)	2.092	95% H-Stat UCL	25.49

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.27

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (nickel_7440-02-0_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.16	Mean	0.462
Maximum	0.94	Median	0.42
SD	0.301	Std. Error of Mean	0.123
Coefficient of Variation	0.652	Skewness	0.707

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.167	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.709	95% Adjusted-CLT UCL (Chen-1995)	0.702
		95% Modified-t UCL (Johnson-1978)	0.715

Gamma GOF Test

A-D Test Statistic	0.269	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.702	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.215	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.335	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.668	k star (bias corrected MLE)	1.445
Theta hat (MLE)	0.173	Theta star (bias corrected MLE)	0.319
nu hat (MLE)	32.02	nu star (bias corrected)	17.34
MLE Mean (bias corrected)	0.462	MLE Sd (bias corrected)	0.384
		Approximate Chi Square Value (0.05)	8.917
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	6.849

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.898	95% Adjusted Gamma UCL (use when n<50)	1.169

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.833	Mean of logged Data	-0.972
Maximum of Logged Data	-0.0619	SD of logged Data	0.716

Assuming Lognormal Distribution

95% H-UCL	1.372	90% Chebyshev (MVUE) UCL	0.872
95% Chebyshev (MVUE) UCL	1.056	97.5% Chebyshev (MVUE) UCL	1.312
99% Chebyshev (MVUE) UCL	1.814		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.664	95% Jackknife UCL	0.709
95% Standard Bootstrap UCL	0.65	95% Bootstrap-t UCL	0.807
95% Hall's Bootstrap UCL	0.834	95% Percentile Bootstrap UCL	0.653
95% BCA Bootstrap UCL	0.672		
90% Chebyshev(Mean, Sd) UCL	0.83	95% Chebyshev(Mean, Sd) UCL	0.997
97.5% Chebyshev(Mean, Sd) UCL	1.229	99% Chebyshev(Mean, Sd) UCL	1.684

Suggested UCL to Use

95% Student's-t UCL	0.709

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (nickel_7440-02-0_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.32	Mean	2.547
Maximum	11.9	Median	0.77
SD	4.591	Std. Error of Mean	1.874
Coefficient of Variation	1.803	Skewness	2.428

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.556	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.457	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.323	95% Adjusted-CLT UCL (Chen-1995)	7.615
		95% Modified-t UCL (Johnson-1978)	6.633

Gamma GOF Test

A-D Test Statistic	0.947	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.727	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.398	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.345	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.655	k star (bias corrected MLE)	0.439
Theta hat (MLE)	3.885	Theta star (bias corrected MLE)	5.803
nu hat (MLE)	7.866	nu star (bias corrected)	5.266
MLE Mean (bias corrected)	2.547	MLE Sd (bias corrected)	3.844
		Approximate Chi Square Value (0.05)	1.277
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.702

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	10.5	95% Adjusted Gamma UCL (use when n<50)	19.11

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.305	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.139	Mean of logged Data	0.0042
Maximum of Logged Data	2.477	SD of logged Data	1.294

Assuming Lognormal Distribution

95% H-UCL	45.55	90% Chebyshev (MVUE) UCL	4.807
95% Chebyshev (MVUE) UCL	6.122	97.5% Chebyshev (MVUE) UCL	7.946
99% Chebyshev (MVUE) UCL	11.53		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.63	95% Jackknife UCL	6.323
95% Standard Bootstrap UCL	5.298	95% Bootstrap-t UCL	45.07
95% Hall's Bootstrap UCL	30.43	95% Percentile Bootstrap UCL	6.227
95% BCA Bootstrap UCL	6.428		
90% Chebyshev(Mean, Sd) UCL	8.17	95% Chebyshev(Mean, Sd) UCL	10.72
97.5% Chebyshev(Mean, Sd) UCL	14.25	99% Chebyshev(Mean, Sd) UCL	21.2

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	10.72

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (potassium_7440-09-7_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	1030	Mean	1330
Maximum	1510	Median	1430
SD	213.3	Std. Error of Mean	87.06
Coefficient of Variation	0.16	Skewness	-0.877

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.799	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.295	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1505	95% Adjusted-CLT UCL (Chen-1995)	1440
		95% Modified-t UCL (Johnson-1978)	1500

Gamma GOF Test

A-D Test Statistic	0.723	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.697	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.319	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	43.3	k star (bias corrected MLE)	21.76
Theta hat (MLE)	30.71	Theta star (bias corrected MLE)	61.11
nu hat (MLE)	519.7	nu star (bias corrected)	261.2
MLE Mean (bias corrected)	1330	MLE Sd (bias corrected)	285.1
		Approximate Chi Square Value (0.05)	224.7
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	212.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1546	95% Adjusted Gamma UCL (use when n<50)	1635

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.788	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.311	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.937	Mean of logged Data	7.181
Maximum of Logged Data	7.32	SD of logged Data	0.17

Assuming Lognormal Distribution

95% H-UCL	1556	90% Chebyshev (MVUE) UCL	1608
95% Chebyshev (MVUE) UCL	1733	97.5% Chebyshev (MVUE) UCL	1907
99% Chebyshev (MVUE) UCL	2249		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1473	95% Jackknife UCL	1505
95% Standard Bootstrap UCL	1459	95% Bootstrap-t UCL	1470
95% Hall's Bootstrap UCL	1417	95% Percentile Bootstrap UCL	1463
95% BCA Bootstrap UCL	1428		
90% Chebyshev(Mean, Sd) UCL	1591	95% Chebyshev(Mean, Sd) UCL	1709
97.5% Chebyshev(Mean, Sd) UCL	1874	99% Chebyshev(Mean, Sd) UCL	2196

Suggested UCL to Use

95% Student's-t UCL	1505

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

result (potassium_7440-09-7_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	1020	Mean	1348
Maximum	1590	Median	1435
SD	235.6	Std. Error of Mean	96.17
Coefficient of Variation	0.175	Skewness	-0.663

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1542	95% Adjusted-CLT UCL (Chen-1995)	1479
		95% Modified-t UCL (Johnson-1978)	1538

Gamma GOF Test

A-D Test Statistic	0.504	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.262	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	36.76	k star (bias corrected MLE)	18.49
Theta hat (MLE)	36.68	Theta star (bias corrected MLE)	72.92
nu hat (MLE)	441.1	nu star (bias corrected)	221.9
MLE Mean (bias corrected)	1348	MLE Sd (bias corrected)	313.6
		Approximate Chi Square Value (0.05)	188.4
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	177.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1588	95% Adjusted Gamma UCL (use when n<50)	1688

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.861	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.243	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.928	Mean of logged Data	7.193
Maximum of Logged Data	7.371	SD of logged Data	0.184

Assuming Lognormal Distribution

95% H-UCL	1601	90% Chebyshev (MVUE) UCL	1653
95% Chebyshev (MVUE) UCL	1791	97.5% Chebyshev (MVUE) UCL	1983
99% Chebyshev (MVUE) UCL	2359		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1507	95% Jackknife UCL	1542
95% Standard Bootstrap UCL	1491	95% Bootstrap-t UCL	1501
95% Hall's Bootstrap UCL	1451	95% Percentile Bootstrap UCL	1493
95% BCA Bootstrap UCL	1477		
90% Chebyshev(Mean, Sd) UCL	1637	95% Chebyshev(Mean, Sd) UCL	1768
97.5% Chebyshev(Mean, Sd) UCL	1949	99% Chebyshev(Mean, Sd) UCL	2305

Suggested UCL to Use

95% Student's-t UCL 1542

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

result (selenium_7782-49-2_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	2
Number of Detects	1	Number of Non-Detects	5
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

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

The data set for variable result (selenium_7782-49-2_t) was not processed!

result (sodium_7440-23-5_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	3670	Mean	5740
Maximum	8480	Median	5140
SD	2164	Std. Error of Mean	883.5
Coefficient of Variation	0.377	Skewness	0.585

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7520	95% Adjusted-CLT UCL (Chen-1995)	7418
		95% Modified-t UCL (Johnson-1978)	7555

Gamma GOF Test

A-D Test Statistic	0.489	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.233	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.752	k star (bias corrected MLE)	4.487
Theta hat (MLE)	655.9	Theta star (bias corrected MLE)	1279
nu hat (MLE)	105	nu star (bias corrected)	53.84
MLE Mean (bias corrected)	5740	MLE Sd (bias corrected)	2710
		Approximate Chi Square Value (0.05)	37.98
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	33.24

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8136	95% Adjusted Gamma UCL (use when n<50)	9298

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.209	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.208	Mean of logged Data	8.597
Maximum of Logged Data	9.045	SD of logged Data	0.372

Assuming Lognormal Distribution

95% H-UCL	8590	90% Chebyshev (MVUE) UCL	8344
95% Chebyshev (MVUE) UCL	9526	97.5% Chebyshev (MVUE) UCL	11167
99% Chebyshev (MVUE) UCL	14390		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7193	95% Jackknife UCL	7520
95% Standard Bootstrap UCL	7080	95% Bootstrap-t UCL	9487
95% Hall's Bootstrap UCL	13499	95% Percentile Bootstrap UCL	7070
95% BCA Bootstrap UCL	7150		
90% Chebyshev(Mean, Sd) UCL	8390	95% Chebyshev(Mean, Sd) UCL	9591

97.5% Chebyshev(Mean, Sd) UCL	11257	99% Chebyshev(Mean, Sd) UCL	14531

Suggested UCL to Use

95% Student's-t UCL 7520

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (sodium_7440-23-5_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	3530	Mean	5370
Maximum	8310	Median	5250
SD	1764	Std. Error of Mean	720.2
Coefficient of Variation	0.329	Skewness	0.821

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6821	95% Adjusted-CLT UCL (Chen-1995)	6813
		95% Modified-t UCL (Johnson-1978)	6861

Gamma GOF Test

A-D Test Statistic	0.258	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.197	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	11.65	k star (bias corrected MLE)	5.937
Theta hat (MLE)	460.9	Theta star (bias corrected MLE)	904.5
nu hat (MLE)	139.8	nu star (bias corrected)	71.24
MLE Mean (bias corrected)	5370	MLE Sd (bias corrected)	2204
		Approximate Chi Square Value (0.05)	52.81
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	47.13

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7244	95% Adjusted Gamma UCL (use when n<50)	8118

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.169	Mean of logged Data	8.545
Maximum of Logged Data	9.025	SD of logged Data	0.322

Assuming Lognormal Distribution

95% H-UCL	7497	90% Chebyshev (MVUE) UCL	7479
95% Chebyshev (MVUE) UCL	8436	97.5% Chebyshev (MVUE) UCL	9764

99% Chebyshev (MVUE) UCL	12373

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6555	95% Jackknife UCL	6821
95% Standard Bootstrap UCL	6434	95% Bootstrap-t UCL	7108
95% Hall's Bootstrap UCL	7571	95% Percentile Bootstrap UCL	6550
95% BCA Bootstrap UCL	6620		
90% Chebyshev(Mean, Sd) UCL	7531	95% Chebyshev(Mean, Sd) UCL	8509
97.5% Chebyshev(Mean, Sd) UCL	9868	99% Chebyshev(Mean, Sd) UCL	12536

Suggested UCL to Use

95% Student's-t UCL	6821

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (vanadium_7440-62-2_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	2
Number of Detects	1	Number of Non-Detects	5
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

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

The data set for variable result (vanadium_7440-62-2_d) was not processed!

result (vanadium_7440-62-2_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	2.1	Mean	12.78
Maximum	62.4	Median	3.15
SD	24.32	Std. Error of Mean	9.928
Coefficient of Variation	1.902	Skewness	2.444

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.524	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.477	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	32.79	95% Adjusted-CLT UCL (Chen-1995)	39.7
		95% Modified-t UCL (Johnson-1978)	34.44

Gamma GOF Test

A-D Test Statistic	1.295	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.464	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.346	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.608	k star (bias corrected MLE)	0.415
Theta hat (MLE)	21.02	Theta star (bias corrected MLE)	30.79
nu hat (MLE)	7.296	nu star (bias corrected)	4.982
MLE Mean (bias corrected)	12.78	MLE Sd (bias corrected)	19.84
		Approximate Chi Square Value (0.05)	1.144
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.614

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	55.68	95% Adjusted Gamma UCL (use when n<50)	103.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.671	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.394	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.742	Mean of logged Data	1.534
Maximum of Logged Data	4.134	SD of logged Data	1.302

Assuming Lognormal Distribution

95% H-UCL	219.7	90% Chebyshev (MVUE) UCL	22.42
95% Chebyshev (MVUE) UCL	28.57	97.5% Chebyshev (MVUE) UCL	37.1
99% Chebyshev (MVUE) UCL	53.85		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	29.11	95% Jackknife UCL	32.79
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	42.57	95% Chebyshev(Mean, Sd) UCL	56.06
97.5% Chebyshev(Mean, Sd) UCL	74.79	99% Chebyshev(Mean, Sd) UCL	111.6

Suggested UCL to Use

Recommendation Provided only for 95% Confidence Coefficient

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (zinc_7440-66-6_d)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.37	Mean	1.305
Maximum	2.8	Median	1.05
SD	0.87	Std. Error of Mean	0.355
Coefficient of Variation	0.667	Skewness	1.114

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL **95% UCLs (Adjusted for Skewness)**

95% Student's-t UCL	2.021	95% Adjusted-CLT UCL (Chen-1995)	2.062
		95% Modified-t UCL (Johnson-1978)	2.048

Gamma GOF Test

A-D Test Statistic	0.194	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.702	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.195	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.335	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.757	k star (bias corrected MLE)	1.49
Theta hat (MLE)	0.473	Theta star (bias corrected MLE)	0.876
nu hat (MLE)	33.08	nu star (bias corrected)	17.87
MLE Mean (bias corrected)	1.305	MLE Sd (bias corrected)	1.069
		Approximate Chi Square Value (0.05)	9.3
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	7.179

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2.508	95% Adjusted Gamma UCL (use when n<50)	3.249

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.985	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.155	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.994	Mean of logged Data	0.074
Maximum of Logged Data	1.03	SD of logged Data	0.699

Assuming Lognormal Distribution

95% H-UCL	3.707	90% Chebyshev (MVUE) UCL	2.432
95% Chebyshev (MVUE) UCL	2.939	97.5% Chebyshev (MVUE) UCL	3.643
99% Chebyshev (MVUE) UCL	5.025		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.889	95% Jackknife UCL	2.021
95% Standard Bootstrap UCL	1.838	95% Bootstrap-t UCL	2.743
95% Hall's Bootstrap UCL	6.318	95% Percentile Bootstrap UCL	1.883
95% BCA Bootstrap UCL	1.945		
90% Chebyshev(Mean, Sd) UCL	2.371	95% Chebyshev(Mean, Sd) UCL	2.854
97.5% Chebyshev(Mean, Sd) UCL	3.524	99% Chebyshev(Mean, Sd) UCL	4.84

Suggested UCL to Use

95% Student's-t UCL	2.021

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

result (zinc_7440-66-6_t)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	1.3	Mean	16.35
Maximum	79	Median	2.75
SD	30.87	Std. Error of Mean	12.6
Coefficient of Variation	1.888	Skewness	2.39

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.575	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.411	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	41.74	95% Adjusted-CLT UCL (Chen-1995)	50.21
		95% Modified-t UCL (Johnson-1978)	43.79

Gamma GOF Test

A-D Test Statistic	0.838	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.734	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.351	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.348	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.532	k star (bias corrected MLE)	0.377
Theta hat (MLE)	30.72	Theta star (bias corrected MLE)	43.35
nu hat (MLE)	6.386	nu star (bias corrected)	4.526
MLE Mean (bias corrected)	16.35	MLE Sd (bias corrected)	26.62
		Approximate Chi Square Value (0.05)	0.94
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.484

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	78.73	95% Adjusted Gamma UCL (use when n<50)	153

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.262	Mean of logged Data	1.612
Maximum of Logged Data	4.369	SD of logged Data	1.519

Assuming Lognormal Distribution

95% H-UCL	903.2	90% Chebyshev (MVUE) UCL	32.46
95% Chebyshev (MVUE) UCL	41.81	97.5% Chebyshev (MVUE) UCL	54.79
99% Chebyshev (MVUE) UCL	80.28		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	37.08	95% Jackknife UCL	41.74
95% Standard Bootstrap UCL	35.86	95% Bootstrap-t UCL	705.5
95% Hall's Bootstrap UCL	313.7	95% Percentile Bootstrap UCL	40.58
95% BCA Bootstrap UCL	43.43		
90% Chebyshev(Mean, Sd) UCL	54.16	95% Chebyshev(Mean, Sd) UCL	71.28
97.5% Chebyshev(Mean, Sd) UCL	95.05	99% Chebyshev(Mean, Sd) UCL	141.7

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	141.7

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Attachment C

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Table C.3 Outlier Results for Surface Water Samples

Table C.4 Outlier Results for Sediment Samples

Table C.5 ProUCL Box Plots for Background Surface Water with Nondetects

Table C.6 ProUCL Box Plots for Background Sediment with Nondetects

Table C.7 ProUCL Output of Background Threshold Values for Surface Water

Table C.8 ProUCL Output of Background Threshold Values for Sediment

TABLE C.1
BACKGROUND THRESHOLD VALUES FOR SURFACE WATER & SEDIMENT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Medium	Fraction	COPC Group	COPC	CASRN	Units	Detect Count (before outliers removed)	Detect Count (after outliers removed)	Upper Simultaneous Limits				Final BTV	Comment	ProUCL Notes
								Normal	Gamma (Wilson Hilferty)	Lognormal	Non-parametric			
Sediment	T	INORGANIC	Arsenic	7440-38-2	mg/kg	10 / 10	10 / 10	2.8	3.001	3.196	2.8	2.8	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Barium	7440-39-3	mg/kg	10 / 10	10 / 10	28.14	29.35	30.37	28.3	28.14	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Beryllium	7440-41-7	mg/kg	8 / 10	8 / 10	1.432	2.466	2.45	1.3	1.432	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Cadmium	7440-43-9	mg/kg	7 / 10	7 / 10	0.222	0.313	0.303	0.21	0.222	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Chromium (Total)	7440-47-3	mg/kg	10 / 10	10 / 10	7.006	8.527	10.48	5.9	7.006	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Cobalt	7440-48-4	mg/kg	10 / 10	10 / 10	4.211	4.894	5.643	3.6	4.211	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Copper	7440-50-8	mg/kg	10 / 10	10 / 10	10.21	13.49	19.1	9.3	10.21	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Cyanide	57-12-5	mg/kg	1 / 10	0 / 9	--	--	--	--	0.098	ProUCL did not calculate; insufficient detects; applied maximum nondetect	c, g
Sediment	T	INORGANIC	Lead	7439-92-1	mg/kg	10 / 10	9 / 9	9.596	10.59	11.49	8.2	9.596	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Manganese	7439-96-5	mg/kg	10 / 10	10 / 10	327.8	409.2	532.7	293	327.8	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Nickel	7440-02-0	mg/kg	10 / 10	10 / 10	4.067	5.184	6.718	3.2	4.067	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Vanadium	7440-62-2	mg/kg	10 / 10	10 / 10	19.03	22.2	25.87	16.2	19.03	95% USL assuming normal distribution	
Sediment	T	INORGANIC	Zinc	7440-66-6	mg/kg	10 / 10	10 / 10	26.65	27.71	28.51	25.1	26.65	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Aluminum	7429-90-5	ug/L	9 / 10	8 / 9	432.7	714	926.3	450	450	95% USL assuming nonparametric	
Surface Water	T	INORGANIC	Arsenic	7440-38-2	ug/L	8 / 10	8 / 8	1.596	1.604	1.609	1.6	1.596	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Barium	7440-39-3	ug/L	7 / 10	5 / 8	18.69	15.32	15.28	13.7	18.69	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Calcium	7440-70-2	ug/L	10 / 10	9 / 9	9,228	9,391	9,492	8,630	9,228	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Chromium (Total)	7440-47-3	ug/L	2 / 10	0 / 8	--	--	--	--	0.28	ProUCL did not calculate; insufficient detects; applied maximum nondetect	c, g
Surface Water	T	INORGANIC	Cobalt	7440-48-4	ug/L	2 / 10	0 / 8	--	--	--	--	0.15	ProUCL did not calculate; insufficient detects; applied maximum nondetect	c, g
Surface Water	T	INORGANIC	Copper	7440-50-8	ug/L	8 / 10	7 / 9	1.391	2.555	2.307	1.5	1.391	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Cyanide	57-12-5	ug/L	2 / 10	0 / 8	--	--	--	--	1.7	ProUCL did not calculate; insufficient detects; applied maximum nondetect	c, g
Surface Water	T	INORGANIC	Iron	7439-89-6	ug/L	10 / 10	9 / 9	1,618	2,014	2,920	1,640	2,014	95% USL assuming gamma distribution	
Surface Water	T	INORGANIC	Lead	7439-92-1	ug/L	7 / 10	6 / 9	1.594	2.741	4.129	1.5	1.594	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Magnesium	7439-95-4	ug/L	10 / 10	9 / 9	3,861	4,031	4,155	3,660	3,861	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Manganese	7439-96-5	ug/L	10 / 10	8 / 8	65.09	78.67	98.1	58.4	65.09	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Mercury	7439-97-6	ug/L	3 / 10	3 / 10	0.321	0.287	0.284	0.27	0.321	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Nickel	7440-02-0	ug/L	7 / 10	6 / 9	0.961	1.766	1.641	0.83	0.961	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Potassium	7440-09-7	ug/L	10 / 10	9 / 9	1,244	1,259	1,268	1,230	1,244	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Sodium	7440-23-5	ug/L	10 / 10	9 / 9	4,875	4,887	4,894	4,690	4,875	95% USL assuming normal distribution	
Surface Water	T	INORGANIC	Vanadium	7440-62-2	ug/L	1 / 10	0 / 9	--	--	--	--	0.66	ProUCL did not calculate; insufficient detects; applied maximum nondetect	c, g
Surface Water	T	INORGANIC	Zinc	7440-66-6	ug/L	10 / 10	9 / 9	7.9	8.747	9.632	7.6	7.9	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Aluminum	7429-90-5	ug/L	1 / 10	0 / 9	--	--	--	--	2.5	ProUCL did not calculate; insufficient detects; applied maximum nondetect	c, g
Surface Water	D	INORGANIC	Arsenic	7440-38-2	ug/L	10 / 10	8 / 8	1.268	1.271	1.273	1.2	1.268	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Barium	7440-39-3	ug/L	10 / 10	9 / 9	19.2	20.02	20.73	19.4	19.2	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Calcium	7440-70-2	ug/L	10 / 10	9 / 9	8,749	8,907	9,004	8,150	8,749	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Chromium (Total)	7440-47-3	ug/L	2 / 10	0 / 8	--	--	--	--	0.28	ProUCL did not calculate; insufficient detects; applied maximum nondetect	c, g
Surface Water	D	INORGANIC	Cobalt	7440-48-4	ug/L	3 / 10	1 / 8	--	--	--	--	0.15	ProUCL did not calculate; insufficient detects; applied maximum nondetect even if there is one detect	d, g
Surface Water	D	INORGANIC	Copper	7440-50-8	ug/L	5 / 10	5 / 10	0.481	0.658	0.609	0.5	0.481	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Cyanide	57-12-5	ug/L	3 / 10	3 / 10	3.723	7.102	4.701	3.7	3.723	95% USL assuming normal distribution	f
Surface Water	D	INORGANIC	Iron	7439-89-6	ug/L	5 / 10	3 / 8	197.1	458.3	263.9	182	197.1	95% USL assuming normal distribution	f
Surface Water	D	INORGANIC	Lead	7439-92-1	ug/L	1 / 10	0 / 9	--	--	--	--	0.16	ProUCL did not calculate; insufficient detects; applied maximum nondetect	c, g
Surface Water	D	INORGANIC	Magnesium	7439-95-4	ug/L	10 / 10	9 / 9	3,744	3,939	4,085	3,490	3,744	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Manganese	7439-96-5	ug/L	10 / 10	8 / 8	44.54	59.27	108.8	47	44.54	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Mercury	7439-97-6	ug/L	4 / 10	4 / 10	0.335	0.504	0.514	0.27	0.335	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Nickel	7440-02-0	ug/L	7 / 10	6 / 9	0.448	0.523	0.558	0.37	0.448	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Potassium	7440-09-7	ug/L	10 / 10	9 / 9	1,142	1,153	1,160	1,070	1,142	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Sodium	7440-23-5	ug/L	10 / 10	9 / 9	5,168	5,189	5,200	5,010	5,168	95% USL assuming normal distribution	
Surface Water	D	INORGANIC	Zinc	7440-66-6	ug/L	9 / 10	8 / 9	4.071	5.078	5.406	4	4.071	95% USL assuming normal distribution	

Notes:
The chemical list is based on background data set having at least one detection. Outliers were removed prior to calculating the background threshold values, which resulted in data sets having only nondetect values.
The BTV defaulted to the 95% USL assuming normal distribution unless the ProUCL output indicated the data was not normally distributed at a 5% level of significance.
For data sets with one detected concentration, ProUCL will not calculate BTVs. The BTV defaulted to the maximum nondetect concentration per EPA 2011 (as opposed to the sole detect).

Abbreviations:
BTV -- Background threshold value
COPC -- Constituent of potential concern
Qual -- Qualifier
USL -- 95% Upper simultaneous limit

ProUCL Notes and Warnings:
c All data are non-detects.
d Data set has only 1 Distinct Detected Values.
e Data set has only 2 Detected Values.
f Data set has only 3 Detected Values.
g The data set was not processed.

References:

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EPA. 2015. ProUCL Version 5.1 User Guide. EPA/600/R-07/041. October. Available online: https://www.epa.gov/land-research/proucl-version-5100-documentation-downloads
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TABLE C.2
PROUCL DATA INPUT FOR BACKGROUND DATA
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:
The background data set provided here are for constituents with at least one detection in surface water or sediment to determine outliers and background threshold values using USEPA ProUCL software for the risk assessment.
The maximum of the field duplicate and parent sample results was applied. The detection limit is presented as the **method detection limit** for the statistical calculations. Refer to the Remedial Investigation Report for the complete data set.
Outliers were identified using the Dixon Outlier tests and box plots in ProUCL and removed prior to calculation background threshold values.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Dixon Outlier Test Results	Box Plot Results	Location	Sample ID	Sample Type	Sample Date	Analytical Method	Fraction	COPC Group	CASRN	Qualifier	Detection Limit	Unit	Method Detection Limit	Reporting Limit	Quantitation Limit
Sediment	SE_Arsenic_7440-38-2_T	1.3	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-38-2		0.13	mg/kg	0.13	0.56	0.5
Sediment	SE_Arsenic_7440-38-2_T	1.3	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-38-2	J	0.13	mg/kg	0.13	0.57	0.5
Sediment	SE_Arsenic_7440-38-2_T	1.1	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-38-2		0.13	mg/kg	0.13	0.61	0.5
Sediment	SE_Arsenic_7440-38-2_T	1.9	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-38-2		0.13	mg/kg	0.13	0.69	0.5
Sediment	SE_Arsenic_7440-38-2_T	2	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-38-2		0.13	mg/kg	0.13	0.58	0.5
Sediment	SE_Arsenic_7440-38-2_T	0.81	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-38-2		0.13	mg/kg	0.13	0.57	0.5
Sediment	SE_Arsenic_7440-38-2_T	2.8	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-38-2		0.13	mg/kg	0.13	0.73	0.5
Sediment	SE_Arsenic_7440-38-2_T	0.82	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-38-2		0.13	mg/kg	0.13	0.66	0.5
Sediment	SE_Arsenic_7440-38-2_T	0.89	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-38-2		0.13	mg/kg	0.13	0.55	0.5
Sediment	SE_Arsenic_7440-38-2_T	1.2	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-38-2		0.13	mg/kg	0.13	0.61	0.5
Sediment	SE_Barium_7440-39-3_T	20	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	5.5	5
Sediment	SE_Barium_7440-39-3_T	13.6	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	5.7	5
Sediment	SE_Barium_7440-39-3_T	14.8	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	6.9	5
Sediment	SE_Barium_7440-39-3_T	20.9	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	5.7	5
Sediment	SE_Barium_7440-39-3_T	17.1	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	12.1	5
Sediment	SE_Barium_7440-39-3_T	17.7	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	5.8	5
Sediment	SE_Barium_7440-39-3_T	28.3	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	5.6	5
Sediment	SE_Barium_7440-39-3_T	10.9	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	6.6	5
Sediment	SE_Barium_7440-39-3_T	12.1	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	6.1	5
Sediment	SE_Barium_7440-39-3_T	15.5	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-39-3		0.75	mg/kg	0.75	7.3	5
Sediment	SE_Beryllium_7440-41-7_T	0.098	0			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-41-7	U	0.098	mg/kg	0.098	0.55	0.5
Sediment	SE_Beryllium_7440-41-7_T	0.49	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-41-7	J	0.098	mg/kg	0.098	0.57	0.5
Sediment	SE_Beryllium_7440-41-7_T	1.3	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-41-7		0.098	mg/kg	0.098	0.57	0.5
Sediment	SE_Beryllium_7440-41-7_T	0.28	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-41-7	J	0.098	mg/kg	0.098	0.56	0.5
Sediment	SE_Beryllium_7440-41-7_T	0.82	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-41-7		0.098	mg/kg	0.098	0.58	0.5
Sediment	SE_Beryllium_7440-41-7_T	0.65	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-41-7		0.098	mg/kg	0.098	0.61	0.5
Sediment	SE_Beryllium_7440-41-7_T	0.098	0			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-41-7	U	0.098	mg/kg	0.098	0.69	0.5
Sediment	SE_Beryllium_7440-41-7_T	1	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-41-7		0.098	mg/kg	0.098	0.61	0.5
Sediment	SE_Beryllium_7440-41-7_T	0.89	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-41-7		0.098	mg/kg	0.098	0.73	0.5
Sediment	SE_Beryllium_7440-41-7_T	0.33	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-41-7	J	0.098	mg/kg	0.098	0.66	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.074	0			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-43-9	U	0.074	mg/kg	0.074	0.58	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.074	0			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-43-9	U	0.074	mg/kg	0.074	0.56	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.089	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-43-9	J	0.074	mg/kg	0.074	0.57	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.21	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-43-9	J	0.074	mg/kg	0.074	0.61	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.11	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-43-9	J	0.074	mg/kg	0.074	0.69	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.074	0			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-43-9	U	0.074	mg/kg	0.074	0.66	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.17	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-43-9	J	0.074	mg/kg	0.074	0.57	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.17	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-43-9	J	0.074	mg/kg	0.074	0.73	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.14	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-43-9	J	0.074	mg/kg	0.074	0.55	0.5
Sediment	SE_Cadmium_7440-43-9_T	0.099	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-43-9	J	0.074	mg/kg	0.074	0.61	0.5
Sediment	SE_Chromium (Total)_7440-47-3_T	3.8	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-47-3		0.14	mg/kg	0.14	1.1	1
Sediment	SE_Chromium (Total)_7440-47-3_T	1.2	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-47-3		0.14	mg/kg	0.14	1.1	1
Sediment	SE_Chromium (Total)_7440-47-3_T	1.8	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-47-3		0.14	mg/kg	0.14	1.2	1
Sediment	SE_Chromium (Total)_7440-47-3_T	2.9	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-47-3		0.14	mg/kg	0.14	1.2	1
Sediment	SE_Chromium (Total)_7440-47-3_T	5.2	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-47-3		0.14	mg/kg	0.14	1.5	1
Sediment	SE_Chromium (Total)_7440-47-3_T	1.2	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-47-3	J	0.14	mg/kg	0.14	1.3	1
Sediment	SE_Chromium (Total)_7440-47-3_T	2.8	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-47-3		0.14	mg/kg	0.14	1.2	1
Sediment	SE_Chromium (Total)_7440-47-3_T	5	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-47-3		0.14	mg/kg	0.14	1.1	1
Sediment	SE_Chromium (Total)_7440-47-3_T	5.9	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-47-3		0.14	mg/kg	0.14	1.4	1
Sediment	SE_Chromium (Total)_7440-47-3_T	1.2	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-47-3		0.14	mg/kg	0.14	1.1	1
Sediment	SE_Cobalt_7440-48-4_T	2.1	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.56	0.5
Sediment	SE_Cobalt_7440-48-4_T	2.4	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.69	0.5
Sediment	SE_Cobalt_7440-48-4_T	0.96	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.57	0.5
Sediment	SE_Cobalt_7440-48-4_T	2.6	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.61	0.5
Sediment	SE_Cobalt_7440-48-4_T	3.6	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.57	0.5
Sediment	SE_Cobalt_7440-48-4_T	3.3	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.58	0.5
Sediment	SE_Cobalt_7440-48-4_T	1	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.66	0.5
Sediment	SE_Cobalt_7440-48-4_T	1.9	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.55	0.5
Sediment	SE_Cobalt_7440-48-4_T	3	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.73	0.5
Sediment	SE_Cobalt_7440-48-4_T	1.9	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-48-4		0.084	mg/kg	0.084	0.61	0.5
Sediment	SE_Copper_7440-50-8_T	1.1	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-50-8		0.18	mg/kg	0.18	1.1	1
Sediment	SE_Copper_7440-50-8_T	6.2	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-50-8		0.18	mg/kg	0.18	1.1	1
Sediment	SE_Copper_7440-50-8_T	4.8	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-50-8		0.18	mg/kg	0.18	1.5	1
Sediment	SE_Copper_7440-50-8_T	3.6	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-50-8		0.18	mg/kg	0.18	1.1	1
Sediment	SE_Copper_7440-50-8_T	6.2	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-50-8		0.18	mg/kg	0.18	1.4	1
Sediment	SE_Copper_7440-50-8_T	9.3	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-50-8		0.18	mg/kg	0.18	1.2	1
Sediment	SE_Copper_7440-50-8_T	1.6	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-50-8		0.18	mg/kg	0.18	1.2	1
Sediment	SE_Copper_7440-50-8_T	1.3	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-50-8		0.18	mg/kg	0.18	1.1	1
Sediment	SE_Copper_7440-50-8_T	5.6	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-50-8		0.18	mg/kg	0.18	1.2	1
Sediment	SE_Copper_7440-50-8_T	0.98	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-50-8	J	0.18	mg/kg	0.18	1.3	1
Sediment	SE_Cyanide_57-12-5_T	0.098	0			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E335.2	T	INORGANIC	57-12-5	U	0.098	mg/kg	0.098	0.44	0.5

TABLE C.2
PROUCL DATA INPUT FOR BACKGROUND DATA
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:
The background data set provided here are for constituents with at least one detection in surface water or sediment to determine outliers and background threshold values using USEPA ProUCL software for the risk assessment.
The maximum of the field duplicate and parent sample results was applied. The detection limit is presented as the **method detection limit** for the statistical calculations. Refer to the Remedial Investigation Report for the complete data set.
Outliers were identified using the Dixon Outlier tests and box plots in ProUCL and removed prior to calculation background threshold values.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Dixon Outlier Test Results	Box Plot Results	Location	Sample ID	Sample Type	Sample Date	Analytical Method	Fraction	COPC Group	CASRN	Qualifier	Detection Limit	Unit	Method Detection Limit	Reporting Limit	Quantitation Limit
Sediment	SE_Cyanide_57-12-5_T	0.098	0			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E335.2	T	INORGANIC	57-12-5	U	0.098	mg/kg	0.098	0.69	0.5
Sediment	SE_Cyanide_57-12-5_T	0.13	1	Outlier	Outlier	TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E335.2	T	INORGANIC	57-12-5	J	0.098	mg/kg	0.098	0.51	0.5
Sediment	SE_Cyanide_57-12-5_T	0.098	0			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E335.2	T	INORGANIC	57-12-5	U	0.098	mg/kg	0.098	0.6	0.5
Sediment	SE_Cyanide_57-12-5_T	0.098	0			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E335.2	T	INORGANIC	57-12-5	U	0.098	mg/kg	0.098	0.58	0.5
Sediment	SE_Cyanide_57-12-5_T	0.098	0			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E335.2	T	INORGANIC	57-12-5	U	0.098	mg/kg	0.098	0.58	0.5
Sediment	SE_Cyanide_57-12-5_T	0.098	0			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E335.2	T	INORGANIC	57-12-5	U	0.098	mg/kg	0.098	0.64	0.5
Sediment	SE_Cyanide_57-12-5_T	0.098	0			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E335.2	T	INORGANIC	57-12-5	U	0.098	mg/kg	0.098	0.49	0.5
Sediment	SE_Cyanide_57-12-5_T	0.098	0			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E335.2	T	INORGANIC	57-12-5	U	0.098	mg/kg	0.098	0.56	0.5
Sediment	SE_Cyanide_57-12-5_T	0.098	0			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E335.2	T	INORGANIC	57-12-5	U	0.098	mg/kg	0.098	0.6	0.5
Sediment	SE_Lead_7439-92-1_T	4.9	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7439-92-1		0.13	mg/kg	0.13	0.61	0.5
Sediment	SE_Lead_7439-92-1_T	6.8	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7439-92-1		0.13	mg/kg	0.13	0.73	0.5
Sediment	SE_Lead_7439-92-1_T	8.2	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7439-92-1	J	0.13	mg/kg	0.13	0.57	0.5
Sediment	SE_Lead_7439-92-1_T	7	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7439-92-1		0.13	mg/kg	0.13	0.57	0.5
Sediment	SE_Lead_7439-92-1_T	4	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7439-92-1		0.13	mg/kg	0.13	0.56	0.5
Sediment	SE_Lead_7439-92-1_T	13.1	1	Outlier	Outlier	TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7439-92-1		0.13	mg/kg	0.13	0.61	0.5
Sediment	SE_Lead_7439-92-1_T	3.7	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7439-92-1		0.13	mg/kg	0.13	0.58	0.5
Sediment	SE_Lead_7439-92-1_T	2.7	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7439-92-1		0.13	mg/kg	0.13	0.66	0.5
Sediment	SE_Lead_7439-92-1_T	7.6	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7439-92-1		0.13	mg/kg	0.13	0.69	0.5
Sediment	SE_Lead_7439-92-1_T	4.5	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7439-92-1		0.13	mg/kg	0.13	0.55	0.5
Sediment	SE_Manganese_7439-96-5_T	96.8	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7439-96-5		0.084	mg/kg	0.084	0.73	0.5
Sediment	SE_Manganese_7439-96-5_T	98.1	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7439-96-5		0.084	mg/kg	0.084	0.61	0.5
Sediment	SE_Manganese_7439-96-5_T	54.3	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7439-96-5		0.084	mg/kg	0.084	0.69	0.5
Sediment	SE_Manganese_7439-96-5_T	31.4	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7439-96-5		0.084	mg/kg	0.084	0.57	0.5
Sediment	SE_Manganese_7439-96-5_T	51.4	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7439-96-5		0.084	mg/kg	0.084	0.66	0.5
Sediment	SE_Manganese_7439-96-5_T	194	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7439-96-5	J	0.084	mg/kg	0.084	0.57	0.5
Sediment	SE_Manganese_7439-96-5_T	293	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7439-96-5		0.084	mg/kg	0.084	1.1	0.5
Sediment	SE_Manganese_7439-96-5_T	225	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7439-96-5		0.084	mg/kg	0.084	0.55	0.5
Sediment	SE_Manganese_7439-96-5_T	67.6	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7439-96-5		0.084	mg/kg	0.084	0.61	0.5
Sediment	SE_Manganese_7439-96-5_T	206	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7439-96-5		0.084	mg/kg	0.084	0.58	0.5
Sediment	SE_Nickel_7440-02-0_T	3.2	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-02-0		0.094	mg/kg	0.094	0.57	0.5
Sediment	SE_Nickel_7440-02-0_T	2.1	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-02-0		0.094	mg/kg	0.094	0.56	0.5
Sediment	SE_Nickel_7440-02-0_T	0.62	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-02-0		0.094	mg/kg	0.094	0.57	0.5
Sediment	SE_Nickel_7440-02-0_T	3	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-02-0		0.094	mg/kg	0.094	0.61	0.5
Sediment	SE_Nickel_7440-02-0_T	0.6	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-02-0	J	0.094	mg/kg	0.094	0.66	0.5
Sediment	SE_Nickel_7440-02-0_T	0.88	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-02-0		0.094	mg/kg	0.094	0.58	0.5
Sediment	SE_Nickel_7440-02-0_T	2.6	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-02-0		0.094	mg/kg	0.094	0.69	0.5
Sediment	SE_Nickel_7440-02-0_T	2.4	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-02-0		0.094	mg/kg	0.094	0.61	0.5
Sediment	SE_Nickel_7440-02-0_T	1.3	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-02-0		0.094	mg/kg	0.094	0.55	0.5
Sediment	SE_Nickel_7440-02-0_T	2.5	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-02-0		0.094	mg/kg	0.094	0.73	0.5
Sediment	SE_Vanadium_7440-62-2_T	15.5	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-62-2		0.32	mg/kg	0.32	3.5	2.5
Sediment	SE_Vanadium_7440-62-2_T	4.4	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-62-2		0.32	mg/kg	0.32	2.8	2.5
Sediment	SE_Vanadium_7440-62-2_T	3.5	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-62-2		0.32	mg/kg	0.32	3.3	2.5
Sediment	SE_Vanadium_7440-62-2_T	4.4	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-62-2		0.32	mg/kg	0.32	2.7	2.5
Sediment	SE_Vanadium_7440-62-2_T	9.2	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-62-2		0.32	mg/kg	0.32	2.9	2.5
Sediment	SE_Vanadium_7440-62-2_T	5.5	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-62-2		0.32	mg/kg	0.32	2.8	2.5
Sediment	SE_Vanadium_7440-62-2_T	13	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-62-2	J	0.32	mg/kg	0.32	2.8	2.5
Sediment	SE_Vanadium_7440-62-2_T	8.9	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-62-2		0.32	mg/kg	0.32	3.1	2.5
Sediment	SE_Vanadium_7440-62-2_T	8.3	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-62-2		0.32	mg/kg	0.32	3	2.5
Sediment	SE_Vanadium_7440-62-2_T	16.2	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-62-2		0.32	mg/kg	0.32	3.6	2.5
Sediment	SE_Zinc_7440-66-6_T	11.7	1			TUSD0012	TUSD0012-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.3	1
Sediment	SE_Zinc_7440-66-6_T	16.5	1			TUSD0014	TUSD0014-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.2	1
Sediment	SE_Zinc_7440-66-6_T	14.5	1			TUSD0007	TUSD0007-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.4	1
Sediment	SE_Zinc_7440-66-6_T	23.4	1			TUSD0010	TUSD0010-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.2	1
Sediment	SE_Zinc_7440-66-6_T	17.3	1			TUSD0016	TUSD0016-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.1	1
Sediment	SE_Zinc_7440-66-6_T	25.1	1			TUSD0009	TUSD0009-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.5	1
Sediment	SE_Zinc_7440-66-6_T	17.7	1			TUSD0013	TUSD0013-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.1	1
Sediment	SE_Zinc_7440-66-6_T	15.3	1			TUSD0015	TUSD0015-SD-AA-AB-0	N	9/25/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.1	1
Sediment	SE_Zinc_7440-66-6_T	19.7	1			TUSD0011	TUSD0011-SD-AA-AB-0	N	9/21/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.1	1
Sediment	SE_Zinc_7440-66-6_T	18.1	1			TUSD0008	TUSD0008-SD-AA-AB-0	N	9/20/2017	E200.8	T	INORGANIC	7440-66-6		0.26	mg/kg	0.26	1.2	1
Surface Water	WS_Aluminum_7429-90-5_T	106	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7429-90-5		2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_T	317	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7429-90-5		2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_T	131	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7429-90-5		2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_T	450	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7429-90-5	J	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_T	66.7	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7429-90-5		2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_T	77.9	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7429-90-5		2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_T	1380	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7429-90-5		2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_T	2.5	0			TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_T	27.9	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7429-90-5		2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_T	51	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7429-90-5		2.5	ug/l	2.5	20	20
Surface Water	WS_Arsenic_7440-38-2_T	1.2	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_T	1.6	1			TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_T	1.2	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-38-2	J	0.15	ug/l	0.15	1	1

TABLE C.2
PROUCL DATA INPUT FOR BACKGROUND DATA
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:
The background data set provided here are for constituents with at least one detection in surface water or sediment to determine outliers and background threshold values using USEPA ProUCL software for the risk assessment.
The maximum of the field duplicate and parent sample results was applied. The detection limit is presented as the **method detection limit** for the statistical calculations. Refer to the Remedial Investigation Report for the complete data set.
Outliers were identified using the Dixon Outlier tests and box plots in ProUCL and removed prior to calculation background threshold values.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Dixon Outlier Test Results	Box Plot Results	Location	Sample ID	Sample Type	Sample Date	Analytical Method	Fraction	COPC Group	CASRN	Qualifier	Detection Limit	Unit	Method Detection Limit	Reporting Limit	Quantitation Limit
Surface Water	WS_Arsenic_7440-38-2_T	1.4	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_T	0.15	0		Outlier	TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-38-2	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_T	1.2	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-38-2	J	0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_T	0.15	0		Outlier	TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-38-2	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_T	1.2	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-38-2	J	0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_T	1.1	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_T	1.3	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-38-2	J	0.15	ug/l	0.15	1	1
Surface Water	WS_Barium_7440-39-3_T	1.3	0			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-39-3	U	1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_T	12.5	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_T	1.3	0			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-39-3	U	1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_T	13.7	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_T	10.6	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_T	11	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_T	40.1	1		Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_T	1.3	0			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-39-3	U	1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_T	12.3	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_T	46.3	1		Outlier	TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Calcium_7440-70-2_T	8630	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Calcium_7440-70-2_T	7730	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Calcium_7440-70-2_T	6510	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Calcium_7440-70-2_T	7900	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Calcium_7440-70-2_T	5980	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Calcium_7440-70-2_T	7820	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Calcium_7440-70-2_T	6220	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Calcium_7440-70-2_T	7940	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Calcium_7440-70-2_T	7140	1			TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Calcium_7440-70-2_T	27000	1	Outlier	Outlier	TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.7	T	INORGANIC	7440-70-2		1450	ug/l	1450	5000	5000
Surface Water	WS_Chromium (Total)_7440-47-3_T	0.28	0			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_T	0.28	0			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_T	0.31	1		Outlier	TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-47-3	J	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_T	0.28	0			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_T	0.28	0			TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_T	0.28	0			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_T	0.28	0			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_T	2.3	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-47-3		0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_T	0.28	0			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_T	0.28	0			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Cobalt_7440-48-4_T	0.15	0			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_T	2.9	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-48-4		0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_T	0.15	0			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_T	0.15	0			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_T	0.15	0			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_T	0.15	0			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_T	0.15	0			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_T	0.27	1		Outlier	TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-48-4	J	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_T	0.15	0			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_T	0.15	0			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Copper_7440-50-8_T	1.5	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_T	0.61	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_T	0.55	1			TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_T	0.33	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_T	0.32	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_T	0.3	0			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-50-8	U	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_T	3.7	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-50-8		0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_T	0.96	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_T	0.3	0			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-50-8	U	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_T	0.41	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Cyanide_57-12-5_T	2.1	1		Outlier	TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E335.2	T	INORGANIC	57-12-5	J	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_T	1.7	0			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E335.2	T	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_T	1.7	0			TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E335.2	T	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_T	1.7	0			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E335.2	T	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_T	1.7	0			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E335.2	T	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_T	1.7	0			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E335.2	T	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_T	1.7	0			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E335.2	T	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_T	2.5	1		Outlier	TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E335.2	T	INORGANIC	57-12-5	J	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_T	1.7	0			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E335.2	T	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_T	1.7	0			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E335.2	T	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Iron_7439-89-6_T	806	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-89-6		33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_T	224	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7439-89-6		33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_T	1640	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-89-6		33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_T	6110	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-89-6		33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_T	230	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-89-6		33.5	ug/l	33.5	200	200

TABLE C.2
PROUCL DATA INPUT FOR BACKGROUND DATA
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:
The background data set provided here are for constituents with at least one detection in surface water or sediment to determine outliers and background threshold values using USEPA ProUCL software for the risk assessment.
The maximum of the field duplicate and parent sample results was applied. The detection limit is presented as the **method detection limit** for the statistical calculations. Refer to the Remedial Investigation Report for the complete data set.
Outliers were identified using the Dixon Outlier tests and box plots in ProUCL and removed prior to calculation background threshold values.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Dixon Outlier Test Results	Box Plot Results	Location	Sample ID	Sample Type	Sample Date	Analytical Method	Fraction	COPC Group	CASRN	Qualifier	Detection Limit	Unit	Method Detection Limit	Reporting Limit	Quantitation Limit
Surface Water	WS_Iron_7439-89-6_T	129	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-89-6	J	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_T	63.2	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-89-6	J	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_T	169	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-89-6	J	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_T	364	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7439-89-6		33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_T	961	1			TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7439-89-6		33.5	ug/l	33.5	200	200
Surface Water	WS_Lead_7439-92-1_T	0.17	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7439-92-1	J	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_T	1.5	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-92-1		0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_T	0.16	0			TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_T	0.16	0			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_T	0.35	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-92-1	J	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_T	4	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-92-1		0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_T	0.16	0			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_T	0.4	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-92-1	J	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_T	1.4	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-92-1		0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_T	0.46	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-92-1	J	0.16	ug/l	0.16	1	1
Surface Water	WS_Magnesium_7439-95-4_T	2910	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.7	T	INORGANIC	7439-95-4	J	1320	ug/l	1320	5000	5000
Surface Water	WS_Magnesium_7439-95-4_T	1960	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.7	T	INORGANIC	7439-95-4	J	1320	ug/l	1320	5000	5000
Surface Water	WS_Magnesium_7439-95-4_T	2100	1			TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_T	8290	1	Outlier	Outlier	TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.7	T	INORGANIC	7439-95-4		1320	ug/l	1320	5000	5000
Surface Water	WS_Magnesium_7439-95-4_T	1830	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_T	2840	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.7	T	INORGANIC	7439-95-4	J	1320	ug/l	1320	5000	5000
Surface Water	WS_Magnesium_7439-95-4_T	3660	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_T	1890	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.7	T	INORGANIC	7439-95-4	J	1320	ug/l	1320	5000	5000
Surface Water	WS_Magnesium_7439-95-4_T	2870	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.7	T	INORGANIC	7439-95-4	J	1320	ug/l	1320	5000	5000
Surface Water	WS_Magnesium_7439-95-4_T	2820	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.7	T	INORGANIC	7439-95-4	J	1320	ug/l	1320	5000	5000
Surface Water	WS_Manganese_7439-96-5_T	12.2	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_T	37.3	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_T	58.4	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_T	7.5	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_T	20.8	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_T	8.5	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_T	330	1		Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_T	15.9	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_T	47.2	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_T	297	1		Outlier	TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Mercury_7439-97-6_T	0.042	0			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E245.2	T	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_T	0.042	0			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E245.2	T	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_T	0.042	0			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E245.2	T	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_T	0.25	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E245.2	T	INORGANIC	7439-97-6	J	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_T	0.25	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E245.2	T	INORGANIC	7439-97-6	J	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_T	0.042	0			TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E245.2	T	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_T	0.27	1			TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E245.2	T	INORGANIC	7439-97-6	J	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_T	0.042	0			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E245.2	T	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_T	0.042	0			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E245.2	T	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_T	0.042	0			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E245.2	T	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Nickel_7440-02-0_T	0.58	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_T	2.1	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-02-0		0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_T	0.13	0			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-02-0	U	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_T	0.13	0			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-02-0	U	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_T	0.3	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_T	0.83	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_T	0.13	0			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-02-0	U	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_T	0.26	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_T	0.34	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_T	0.83	1			TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Potassium_7440-09-7_T	1060	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_T	794	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_T	995	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_T	920	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_T	1050	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_T	939	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_T	1800	1	Outlier	Outlier	TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_T	883	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_T	1230	1			TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_T	969	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Sodium_7440-23-5_T	4690	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_T	16300	1	Outlier	Outlier	TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_T	4290	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_T	4520	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_T	4260	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_T	4510	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_T	4670	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500

TABLE C.2
PROUCL DATA INPUT FOR BACKGROUND DATA
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:
The background data set provided here are for constituents with at least one detection in surface water or sediment to determine outliers and background threshold values using USEPA ProUCL software for the risk assessment.
The maximum of the field duplicate and parent sample results was applied. The detection limit is presented as the **method detection limit** for the statistical calculations. Refer to the Remedial Investigation Report for the complete data set.
Outliers were identified using the Dixon Outlier tests and box plots in ProUCL and removed prior to calculation background threshold values.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Dixon Outlier Test Results	Box Plot Results	Location	Sample ID	Sample Type	Sample Date	Analytical Method	Fraction	COPC Group	CASRN	Qualifier	Detection Limit	Unit	Method Detection Limit	Reporting Limit	Quantitation Limit
Surface Water	WS_Sodium_7440-23-5_T	4140	1			TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_T	4430	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_T	4640	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Vanadium_7440-62-2_T	0.66	0			TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-62-2	U	0.66	ug/l	0.66	5	5
Surface Water	WS_Vanadium_7440-62-2_T	0.66	0			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-62-2	U	0.66	ug/l	0.66	5	5
Surface Water	WS_Vanadium_7440-62-2_T	0.66	0			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-62-2	U	0.66	ug/l	0.66	5	5
Surface Water	WS_Vanadium_7440-62-2_T	0.66	0			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-62-2	U	0.66	ug/l	0.66	5	5
Surface Water	WS_Vanadium_7440-62-2_T	0.66	0			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-62-2	U	0.66	ug/l	0.66	5	5
Surface Water	WS_Vanadium_7440-62-2_T	0.66	0			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-62-2	U	0.66	ug/l	0.66	5	5
Surface Water	WS_Vanadium_7440-62-2_T	0.66	0			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-62-2	U	0.66	ug/l	0.66	5	5
Surface Water	WS_Vanadium_7440-62-2_T	7.9	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-62-2		0.66	ug/l	0.66	5	5
Surface Water	WS_Vanadium_7440-62-2_T	0.66	0			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-62-2	U	0.66	ug/l	0.66	5	5
Surface Water	WS_Vanadium_7440-62-2_T	0.66	0			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-62-2	U	0.66	ug/l	0.66	5	5
Surface Water	WS_Zinc_7440-66-6_T	7.6	1			TUSW0009	TUSW0009-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_T	4.3	1			TUSW0004	TUSW0004-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_T	1.9	1			TUSW0010	TUSW0010-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-66-6	J	0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_T	15.3	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_T	5.8	1			TUSW0013	TUSW0013-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_T	2.4	1			TUSW0012	TUSW0012-SW-AA-0	N	9/25/2017	E200.8	T	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_T	3	1			TUSW0006	TUSW0006-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_T	1.9	1			TUSW0008	TUSW0008-SW-AA-0	N	9/21/2017	E200.8	T	INORGANIC	7440-66-6	J	0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_T	2.2	1			TUSW0005	TUSW0005-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_T	4.4	1			TUSW0007	TUSW0007-SW-AA-0	N	9/20/2017	E200.8	T	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Aluminum_7429-90-5_D	2.5	0			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_D	73.8	1	Outlier	Outlier	TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7429-90-5		2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_D	2.5	0			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_D	2.5	0			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_D	2.5	0			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_D	2.5	0			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_D	2.5	0			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_D	2.5	0			TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_D	2.5	0			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Aluminum_7429-90-5_D	2.5	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7429-90-5	U	2.5	ug/l	2.5	20	20
Surface Water	WS_Arsenic_7440-38-2_D	0.99	1	Outlier		TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-38-2	J	0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_D	1.2	1			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_D	1.1	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_D	1.4	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_D	1.2	1			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_D	1.2	1			TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_D	1.1	1			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_D	1.1	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_D	1.2	1			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Arsenic_7440-38-2_D	1.2	1			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-38-2		0.15	ug/l	0.15	1	1
Surface Water	WS_Barium_7440-39-3_D	12.8	1			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_D	8.5	1			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-39-3	J	1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_D	7.6	1			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-39-3	J	1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_D	19.4	1			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_D	7.3	1			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-39-3	J	1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_D	8	1			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-39-3	J	1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_D	45.7	1	Outlier	Outlier	TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_D	12.6	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_D	8.2	1			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-39-3	J	1.3	ug/l	1.3	10	10
Surface Water	WS_Barium_7440-39-3_D	12.7	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-39-3		1.3	ug/l	1.3	10	10
Surface Water	WS_Calcium_7440-70-2_D	7390	1			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Calcium_7440-70-2_D	5880	1			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Calcium_7440-70-2_D	5840	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Calcium_7440-70-2_D	7110	1			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Calcium_7440-70-2_D	8150	1			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Calcium_7440-70-2_D	24400	1	Outlier	Outlier	TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Calcium_7440-70-2_D	5810	1			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Calcium_7440-70-2_D	7460	1			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Calcium_7440-70-2_D	5810	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Calcium_7440-70-2_D	7550	1			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-70-2		58.7	ug/l	58.7	500	500
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.28	0			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.28	0			TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.28	0			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.33	1		Outlier	TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-47-3	J	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.28	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.28	0			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.29	1		Outlier	TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-47-3	J	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.28	0			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.28	0			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2

TABLE C.2
PROUCL DATA INPUT FOR BACKGROUND DATA
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:
The background data set provided here are for constituents with at least one detection in surface water or sediment to determine outliers and background threshold values using USEPA ProUCL software for the risk assessment.
The maximum of the field duplicate and parent sample results was applied. The detection limit is presented as the **method detection limit** for the statistical calculations. Refer to the Remedial Investigation Report for the complete data set.
Outliers were identified using the Dixon Outlier tests and box plots in ProUCL and removed prior to calculation background threshold values.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Dixon Outlier Test Results	Box Plot Results	Location	Sample ID	Sample Type	Sample Date	Analytical Method	Fraction	COPC Group	CASRN	Qualifier	Detection Limit	Unit	Method Detection Limit	Reporting Limit	Quantitation Limit
Surface Water	WS_Chromium (Total)_7440-47-3_D	0.28	0			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-47-3	U	0.28	ug/l	0.28	2	2
Surface Water	WS_Cobalt_7440-48-4_D	0.15	0			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_D	0.15	0			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_D	0.95	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-48-4	J	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_D	0.15	0			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_D	0.15	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_D	0.15	0			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_D	0.15	0			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_D	0.26	1		Outlier	TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-48-4	J	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_D	0.15	0			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-48-4	U	0.15	ug/l	0.15	1	1
Surface Water	WS_Cobalt_7440-48-4_D	0.15	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-48-4	J	0.15	ug/l	0.15	1	1
Surface Water	WS_Copper_7440-50-8_D	0.32	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_D	0.5	1			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_D	0.3	0			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-50-8	U	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_D	0.3	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-50-8	U	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_D	0.32	1			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_D	0.3	0			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-50-8	U	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_D	0.3	0			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-50-8	U	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_D	0.3	0			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-50-8	U	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_D	0.39	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Copper_7440-50-8_D	0.4	1			TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-50-8	J	0.3	ug/l	0.3	2	2
Surface Water	WS_Cyanide_57-12-5_D	1.7	0			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E335.2	D	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_D	2.7	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E335.2	D	INORGANIC	57-12-5	J	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_D	1.7	0			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E335.2	D	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_D	3.7	1			TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E335.2	D	INORGANIC	57-12-5	J	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_D	3.2	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E335.2	D	INORGANIC	57-12-5	J	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_D	1.7	0			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E335.2	D	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_D	1.7	0			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E335.2	D	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_D	1.7	0			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E335.2	D	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_D	1.7	0			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E335.2	D	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Cyanide_57-12-5_D	1.7	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E335.2	D	INORGANIC	57-12-5	U	1.7	ug/l	1.7	10	10
Surface Water	WS_Iron_7439-89-6_D	108	1			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-89-6	J	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_D	1580	1	Outlier	Outlier	TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-89-6		33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_D	33.5	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-89-6	U	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_D	33.5	0			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-89-6	U	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_D	608	1		Outlier	TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-89-6		33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_D	33.5	0			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-89-6	U	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_D	158	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-89-6	J	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_D	182	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-89-6	J	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_D	33.5	0			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-89-6	U	33.5	ug/l	33.5	200	200
Surface Water	WS_Iron_7439-89-6_D	33.5	0			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-89-6	U	33.5	ug/l	33.5	200	200
Surface Water	WS_Lead_7439-92-1_D	0.16	0			TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_D	0.16	0			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_D	0.16	0			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_D	0.55	1	Outlier	Outlier	TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-92-1	J	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_D	0.16	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_D	0.16	0			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_D	0.16	0			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_D	0.16	0			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_D	0.16	0			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Lead_7439-92-1_D	0.16	0			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-92-1	U	0.16	ug/l	0.16	1	1
Surface Water	WS_Magnesium_7439-95-4_D	7910	1	Outlier	Outlier	TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_D	2740	1			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_D	2770	1			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_D	2840	1			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_D	1830	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_D	1760	1			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_D	2650	1			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_D	1870	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_D	1680	1			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Magnesium_7439-95-4_D	3490	1			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-95-4		67.8	ug/l	67.8	500	500
Surface Water	WS_Manganese_7439-96-5_D	16.1	1			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_D	14	1			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_D	19.3	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_D	2.5	1			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_D	47	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_D	189	1		Outlier	TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_D	1.5	1			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_D	1.3	1			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_D	285	1		Outlier	TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Manganese_7439-96-5_D	9.7	1			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7439-96-5		0.17	ug/l	0.17	1	1
Surface Water	WS_Mercury_7439-97-6_D	0.042	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E245.2	D	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2

TABLE C.2
PROUCL DATA INPUT FOR BACKGROUND DATA
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Notes:
The background data set provided here are for constituents with at least one detection in surface water or sediment to determine outliers and background threshold values using USEPA ProUCL software for the risk assessment.
The maximum of the field duplicate and parent sample results was applied. The detection limit is presented as the **method detection limit** for the statistical calculations. Refer to the Remedial Investigation Report for the complete data set.
Outliers were identified using the Dixon Outlier tests and box plots in ProUCL and removed prior to calculation background threshold values.

Medium	ProUCL Group	ProUCL Result	ProUCL Flag	Dixon Outlier Test Results	Box Plot Results	Location	Sample ID	Sample Type	Sample Date	Analytical Method	Fraction	COPC Group	CASRN	Qualifier	Detection Limit	Unit	Method Detection Limit	Reporting Limit	Quantitation Limit
Surface Water	WS_Mercury_7439-97-6_D	0.042	0			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E245.2	D	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_D	0.27	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E245.2	D	INORGANIC	7439-97-6	J	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_D	0.042	0			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E245.2	D	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_D	0.27	1			TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E245.2	D	INORGANIC	7439-97-6	J	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_D	0.042	0			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E245.2	D	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_D	0.042	0			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E245.2	D	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_D	0.11	1			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E245.2	D	INORGANIC	7439-97-6	J	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_D	0.26	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E245.2	D	INORGANIC	7439-97-6	J	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Mercury_7439-97-6_D	0.042	0			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E245.2	D	INORGANIC	7439-97-6	U	0.042	ug/l	0.042	0.2	0.2
Surface Water	WS_Nickel_7440-02-0_D	0.13	0			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-02-0	U	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_D	0.13	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-02-0	U	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_D	0.3	1			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_D	0.13	0			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-02-0	U	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_D	0.36	1			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_D	0.17	1			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_D	0.69	1	Outlier		TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_D	0.33	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_D	0.27	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Nickel_7440-02-0_D	0.37	1			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-02-0	J	0.13	ug/l	0.13	1	1
Surface Water	WS_Potassium_7440-09-7_D	821	1			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_D	904	1			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_D	909	1			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_D	1030	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_D	971	1			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_D	1020	1			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_D	1840	1	Outlier	Outlier	TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_D	961	1			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_D	1050	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Potassium_7440-09-7_D	1070	1			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-09-7		72.3	ug/l	72.3	500	500
Surface Water	WS_Sodium_7440-23-5_D	16500	1	Outlier	Outlier	TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_D	4790	1			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_D	4300	1			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_D	5010	1			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_D	4810	1			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_D	4150	1			TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_D	4450	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_D	4700	1			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_D	4340	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Sodium_7440-23-5_D	4250	1			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-23-5		74.5	ug/l	74.5	500	500
Surface Water	WS_Zinc_7440-66-6_D	2.5	1			TUSW0011	TUSW0011-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_D	2.2	1			TUSW0010	TUSW0010-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_D	1	1			TUSW0012	TUSW0012-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-66-6	J	0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_D	4	1			TUSW0013	TUSW0013-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_D	4.7	1		Outlier	TUSW0007	TUSW0007-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_D	1.4	1			TUSW0008	TUSW0008-SW-AA-0-D	N	9/21/2017	E200.8	D	INORGANIC	7440-66-6	J	0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_D	2.5	1			TUSW0009	TUSW0009-SW-AA-0-D	N	9/25/2017	E200.8	D	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_D	1.9	1			TUSW0004	TUSW0004-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-66-6	J	0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_D	0.37	0			TUSW0005	TUSW0005-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-66-6	U	0.37	ug/l	0.37	2	2
Surface Water	WS_Zinc_7440-66-6_D	2.2	1			TUSW0006	TUSW0006-SW-AA-0-D	N	9/20/2017	E200.8	D	INORGANIC	7440-66-6		0.37	ug/l	0.37	2	2

TABLE C.3
OUTLIER RESULTS FOR BACKGROUND SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Outlier Tests for Selected Variables replacing nondetects with 1/2 the Detection Limit
User Selected Options

Date/Time of Computation	ProUCL 5.14/25/2018 10:47:22 AM
From File	WorkSheet.xls
Full Precision	OFF

Dixon's Outlier Test for result (ws_aluminum_7429-90-5_d)

Total N = 10
Number NDs = 9
Number Detects = 1
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 73.8 is a Potential Outlier (Upper Tail)?

Test Statistic: 1.000

For 10% significance level, 73.8 is an outlier.
For 5% significance level, 73.8 is an outlier.
For 1% significance level, 73.8 is an outlier.

2. Data Value 1.25 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 1.25 is an outlier.
For 5% significance level, 1.25 is an outlier.
For 1% significance level, 1.25 is an outlier.

Dixon's Outlier Test for result (ws_aluminum_7429-90-5_t)

Total N = 10
Number NDs = 1
Number Detects = 9
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 1380 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.688

For 10% significance level, 1380 is an outlier.
For 5% significance level, 1380 is an outlier.
For 1% significance level, 1380 is an outlier.

2. Data Value 1.25 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.059

For 10% significance level, 1.25 is not an outlier.
For 5% significance level, 1.25 is not an outlier.
For 1% significance level, 1.25 is not an outlier.

Dixon's Outlier Test for result (ws_arsenic_7440-38-2_d)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 1.4 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.667

For 10% significance level, 1.4 is an outlier.
For 5% significance level, 1.4 is an outlier.
For 1% significance level, 1.4 is an outlier.

2. Data Value 0.99 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.524

For 10% significance level, 0.99 is an outlier.
For 5% significance level, 0.99 is an outlier.
For 1% significance level, 0.99 is not an outlier.

Dixon's Outlier Test for result (ws_arsenic_7440-38-2_t)

Total N = 10
Number NDs = 2
Number Detects = 8
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 1.6 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.131

For 10% significance level, 1.6 is not an outlier.
For 5% significance level, 1.6 is not an outlier.

For 1% significance level, 1.6 is not an outlier.

2. Data Value 0.075 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.075 is not an outlier.
For 5% significance level, 0.075 is not an outlier.
For 1% significance level, 0.075 is not an outlier.

Dixon's Outlier Test for result (ws_barium_7440-39-3_d)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 45.7 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.690

For 10% significance level, 45.7 is an outlier.
For 5% significance level, 45.7 is an outlier.
For 1% significance level, 45.7 is an outlier.

2. Data Value 7.3 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.025

For 10% significance level, 7.3 is not an outlier.
For 5% significance level, 7.3 is not an outlier.
For 1% significance level, 7.3 is not an outlier.

Dixon's Outlier Test for result (ws_barium_7440-39-3_t)

Total N = 10
Number NDs = 3
Number Detects = 7
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 46.3 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.136

For 10% significance level, 46.3 is not an outlier.
For 5% significance level, 46.3 is not an outlier.
For 1% significance level, 46.3 is not an outlier.

2. Data Value 0.65 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.65 is not an outlier.
For 5% significance level, 0.65 is not an outlier.
For 1% significance level, 0.65 is not an outlier.

Dixon's Outlier Test for result (ws_calcium_7440-70-2_d)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 24400 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.874

For 10% significance level, 24400 is an outlier.
For 5% significance level, 24400 is an outlier.
For 1% significance level, 24400 is an outlier.

2. Data Value 5810 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 5810 is not an outlier.
For 5% significance level, 5810 is not an outlier.
For 1% significance level, 5810 is not an outlier.

Dixon's Outlier Test for result (ws_calcium_7440-70-2_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 27000 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.884

For 10% significance level, 27000 is an outlier.
For 5% significance level, 27000 is an outlier.
For 1% significance level, 27000 is an outlier.

2. Data Value 5980 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.091

For 10% significance level, 5980 is not an outlier.
For 5% significance level, 5980 is not an outlier.
For 1% significance level, 5980 is not an outlier.

Dixon's Outlier Test for result (ws_chromium (total)_7440-47-3_d)

Total N = 10
Number NDs = 8
Number Detects = 2
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.33 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.211

For 10% significance level, 0.33 is not an outlier.
For 5% significance level, 0.33 is not an outlier.
For 1% significance level, 0.33 is not an outlier.

2. Data Value 0.14 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.14 is not an outlier.
For 5% significance level, 0.14 is not an outlier.
For 1% significance level, 0.14 is not an outlier.

Dixon's Outlier Test for result (ws_chromium (total)_7440-47-3_t)

Total N = 10
Number NDs = 8
Number Detects = 2
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 2.3 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.921

For 10% significance level, 2.3 is an outlier.
For 5% significance level, 2.3 is an outlier.
For 1% significance level, 2.3 is an outlier.

2. Data Value 0.14 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.14 is not an outlier.
For 5% significance level, 0.14 is not an outlier.
For 1% significance level, 0.14 is not an outlier.

Dixon's Outlier Test for result (ws_cobalt_7440-48-4_d)

Total N = 10
Number NDs = 7
Number Detects = 3
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.95 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.789

For 10% significance level, 0.95 is an outlier.
For 5% significance level, 0.95 is an outlier.
For 1% significance level, 0.95 is an outlier.

2. Data Value 0.075 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.075 is not an outlier.
For 5% significance level, 0.075 is not an outlier.
For 1% significance level, 0.075 is not an outlier.

Dixon's Outlier Test for result (ws_cobalt_7440-48-4_t)

Total N = 10
Number NDs = 8
Number Detects = 2
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 2.9 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.931

For 10% significance level, 2.9 is an outlier.
For 5% significance level, 2.9 is an outlier.
For 1% significance level, 2.9 is an outlier.

2. Data Value 0.075 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.075 is not an outlier.
For 5% significance level, 0.075 is not an outlier.
For 1% significance level, 0.075 is not an outlier.

Dixon's Outlier Test for result (ws_copper_7440-50-8_d)

Total N = 10
Number NDs = 5
Number Detects = 5
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.5 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.286

For 10% significance level, 0.5 is not an outlier.
For 5% significance level, 0.5 is not an outlier.
For 1% significance level, 0.5 is not an outlier.

2. Data Value 0.15 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.15 is not an outlier.
For 5% significance level, 0.15 is not an outlier.
For 1% significance level, 0.15 is not an outlier.

Dixon's Outlier Test for result (ws_copper_7440-50-8_t)

Total N = 10
Number NDs = 2
Number Detects = 8
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 3.7 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.620

For 10% significance level, 3.7 is an outlier.
For 5% significance level, 3.7 is an outlier.
For 1% significance level, 3.7 is an outlier.

2. Data Value 0.15 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.15 is not an outlier.
For 5% significance level, 0.15 is not an outlier.
For 1% significance level, 0.15 is not an outlier.

Dixon's Outlier Test for result (ws_cyanide_57-12-5_d)

Total N = 10
Number NDs = 7
Number Detects = 3
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 3.7 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.175

For 10% significance level, 3.7 is not an outlier.
For 5% significance level, 3.7 is not an outlier.
For 1% significance level, 3.7 is not an outlier.

2. Data Value 0.85 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.85 is not an outlier.
For 5% significance level, 0.85 is not an outlier.
For 1% significance level, 0.85 is not an outlier.

Dixon's Outlier Test for result (ws_cyanide_57-12-5_t)

Total N = 10
Number NDs = 8
Number Detects = 2
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477

1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 2.5 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.242

For 10% significance level, 2.5 is not an outlier.
For 5% significance level, 2.5 is not an outlier.
For 1% significance level, 2.5 is not an outlier.

2. Data Value 0.85 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.85 is not an outlier.
For 5% significance level, 0.85 is not an outlier.
For 1% significance level, 0.85 is not an outlier.

Dixon's Outlier Test for result (ws_iron_7439-89-6_d)

Total N = 10
Number NDs = 5
Number Detects = 5
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 1580 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.622

For 10% significance level, 1580 is an outlier.
For 5% significance level, 1580 is an outlier.
For 1% significance level, 1580 is an outlier.

2. Data Value 16.75 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 16.75 is not an outlier.
For 5% significance level, 16.75 is not an outlier.
For 1% significance level, 16.75 is not an outlier.

Dixon's Outlier Test for result (ws_iron_7439-89-6_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 6110 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.747

For 10% significance level, 6110 is an outlier.
For 5% significance level, 6110 is an outlier.
For 1% significance level, 6110 is an outlier.

2. Data Value 63.2 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.042

For 10% significance level, 63.2 is not an outlier.
For 5% significance level, 63.2 is not an outlier.
For 1% significance level, 63.2 is not an outlier.

Dixon's Outlier Test for result (ws_lead_7439-92-1_d)

Total N = 10
Number NDs = 9
Number Detects = 1
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.55 is a Potential Outlier (Upper Tail)?

Test Statistic: 1.000

For 10% significance level, 0.55 is an outlier.
For 5% significance level, 0.55 is an outlier.
For 1% significance level, 0.55 is an outlier.

2. Data Value 0.08 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0.08 is an outlier.
For 5% significance level, 0.08 is an outlier.
For 1% significance level, 0.08 is an outlier.

Dixon's Outlier Test for result (ws_lead_7439-92-1_t)

Total N = 10
Number NDs = 3
Number Detects = 7
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 4 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.638

For 10% significance level, 4 is an outlier.
For 5% significance level, 4 is an outlier.
For 1% significance level, 4 is an outlier.

2. Data Value 0.08 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.08 is not an outlier.
For 5% significance level, 0.08 is not an outlier.
For 1% significance level, 0.08 is not an outlier.

Dixon's Outlier Test for result (ws_magnesium_7439-95-4_d)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 7910 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.719

For 10% significance level, 7910 is an outlier.
For 5% significance level, 7910 is an outlier.
For 1% significance level, 7910 is an outlier.

2. Data Value 1680 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.044

For 10% significance level, 1680 is not an outlier.
For 5% significance level, 1680 is not an outlier.
For 1% significance level, 1680 is not an outlier.

Dixon's Outlier Test for result (ws_magnesium_7439-95-4_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 8290 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.723

For 10% significance level, 8290 is an outlier.
For 5% significance level, 8290 is an outlier.
For 1% significance level, 8290 is an outlier.

2. Data Value 1830 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.033

For 10% significance level, 1830 is not an outlier.
For 5% significance level, 1830 is not an outlier.
For 1% significance level, 1830 is not an outlier.

Dixon's Outlier Test for result (ws_manganese_7439-96-5_d)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 285 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.339

For 10% significance level, 285 is not an outlier.
For 5% significance level, 285 is not an outlier.
For 1% significance level, 285 is not an outlier.

2. Data Value 1.3 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.001

For 10% significance level, 1.3 is not an outlier.
For 5% significance level, 1.3 is not an outlier.
For 1% significance level, 1.3 is not an outlier.

Dixon's Outlier Test for result (ws_manganese_7439-96-5_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 330 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.103

For 10% significance level, 330 is not an outlier.
For 5% significance level, 330 is not an outlier.
For 1% significance level, 330 is not an outlier.

2. Data Value 7.5 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.003

For 10% significance level, 7.5 is not an outlier.
For 5% significance level, 7.5 is not an outlier.
For 1% significance level, 7.5 is not an outlier.

Dixon's Outlier Test for result (ws_mercury_7439-97-6_d)

Total N = 10
Number NDs = 6
Number Detects = 4
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.27 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.000

For 10% significance level, 0.27 is not an outlier.
For 5% significance level, 0.27 is not an outlier.
For 1% significance level, 0.27 is not an outlier.

2. Data Value 0.021 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.021 is not an outlier.
For 5% significance level, 0.021 is not an outlier.
For 1% significance level, 0.021 is not an outlier.

Dixon's Outlier Test for result (ws_mercury_7439-97-6_t)

Total N = 10
Number NDs = 7
Number Detects = 3
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.27 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.080

For 10% significance level, 0.27 is not an outlier.
For 5% significance level, 0.27 is not an outlier.
For 1% significance level, 0.27 is not an outlier.

2. Data Value 0.021 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.021 is not an outlier.
For 5% significance level, 0.021 is not an outlier.
For 1% significance level, 0.021 is not an outlier.

Dixon's Outlier Test for result (ws_nickel_7440-02-0_d)

Total N = 10
Number NDs = 3
Number Detects = 7
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.69 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.512

For 10% significance level, 0.69 is an outlier.
For 5% significance level, 0.69 is an outlier.

For 1% significance level, 0.69 is not an outlier.

2. Data Value 0.065 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.065 is not an outlier.
For 5% significance level, 0.065 is not an outlier.
For 1% significance level, 0.065 is not an outlier.

Dixon's Outlier Test for result (ws_nickel_7440-02-0_t)

Total N = 10
Number NDs = 3
Number Detects = 7
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 2.1 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.624

For 10% significance level, 2.1 is an outlier.
For 5% significance level, 2.1 is an outlier.
For 1% significance level, 2.1 is an outlier.

2. Data Value 0.065 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.065 is not an outlier.
For 5% significance level, 0.065 is not an outlier.
For 1% significance level, 0.065 is not an outlier.

Dixon's Outlier Test for result (ws_potassium_7440-09-7_d)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 1840 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.823

For 10% significance level, 1840 is an outlier.
For 5% significance level, 1840 is an outlier.
For 1% significance level, 1840 is an outlier.

2. Data Value 821 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.333

For 10% significance level, 821 is not an outlier.
For 5% significance level, 821 is not an outlier.
For 1% significance level, 821 is not an outlier.

Dixon's Outlier Test for result (ws_potassium_7440-09-7_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 1800 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.622

For 10% significance level, 1800 is an outlier.
For 5% significance level, 1800 is an outlier.
For 1% significance level, 1800 is an outlier.

2. Data Value 794 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.204

For 10% significance level, 794 is not an outlier.
For 5% significance level, 794 is not an outlier.
For 1% significance level, 794 is not an outlier.

Dixon's Outlier Test for result (ws_sodium_7440-23-5_d)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 16500 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.938

For 10% significance level, 16500 is an outlier.
For 5% significance level, 16500 is an outlier.
For 1% significance level, 16500 is an outlier.

2. Data Value 4150 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.116

For 10% significance level, 4150 is not an outlier.
For 5% significance level, 4150 is not an outlier.
For 1% significance level, 4150 is not an outlier.

Dixon's Outlier Test for result (ws_sodium_7440-23-5_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 16300 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.964

For 10% significance level, 16300 is an outlier.
For 5% significance level, 16300 is an outlier.
For 1% significance level, 16300 is an outlier.

2. Data Value 4140 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.218

For 10% significance level, 4140 is not an outlier.
For 5% significance level, 4140 is not an outlier.
For 1% significance level, 4140 is not an outlier.

Dixon's Outlier Test for result (ws_vanadium_7440-62-2_t)

Total N = 10
Number NDs = 9
Number Detects = 1
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 7.9 is a Potential Outlier (Upper Tail)?

Test Statistic: 1.000

For 10% significance level, 7.9 is an outlier.
For 5% significance level, 7.9 is an outlier.
For 1% significance level, 7.9 is an outlier.

2. Data Value 0.33 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0.33 is an outlier.
For 5% significance level, 0.33 is an outlier.
For 1% significance level, 0.33 is an outlier.

Dixon's Outlier Test for result (ws_zinc_7440-66-6_d)

Total N = 10
Number NDs = 1
Number Detects = 9
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 4.7 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.189

For 10% significance level, 4.7 is not an outlier.
For 5% significance level, 4.7 is not an outlier.
For 1% significance level, 4.7 is not an outlier.

2. Data Value 0.185 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.214

For 10% significance level, 0.185 is not an outlier.
For 5% significance level, 0.185 is not an outlier.
For 1% significance level, 0.185 is not an outlier.

Dixon's Outlier Test for result (ws_zinc_7440-66-6_t)

Total N = 10
Number NDs = 0
Number Detects = 10

TABLE C.3
OUTLIER RESULTS FOR BACKGROUND SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 15.3 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.575

For 10% significance level, 15.3 is an outlier.
For 5% significance level, 15.3 is an outlier.
For 1% significance level, 15.3 is not an outlier.

2. Data Value 1.9 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 1.9 is not an outlier.
For 5% significance level, 1.9 is not an outlier.
For 1% significance level, 1.9 is not an outlier.

TABLE C.4
OUTLIER RESULTS FOR BACKGROUND SEDIMENT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Outlier Tests for Selected Variables replacing nondetects with 1/2 the Detection Limit
User Selected Options

Date/Time of Computation	ProUCL 5.14/25/2018 10:41:51 AM
From File	WorkSheet.xls
Full Precision	OFF

Dixon's Outlier Test for result (se_arsenic_7440-38-2_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 2.8 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.404

For 10% significance level, 2.8 is not an outlier.
For 5% significance level, 2.8 is not an outlier.
For 1% significance level, 2.8 is not an outlier.

2. Data Value 0.81 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.008

For 10% significance level, 0.81 is not an outlier.
For 5% significance level, 0.81 is not an outlier.
For 1% significance level, 0.81 is not an outlier.

Dixon's Outlier Test for result (se_barium_7440-39-3_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 28.3 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.457

For 10% significance level, 28.3 is an outlier.
For 5% significance level, 28.3 is not an outlier.

2. Data Value 10.9 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.120

For 10% significance level, 10.9 is not an outlier.
For 5% significance level, 10.9 is not an outlier.
For 1% significance level, 10.9 is not an outlier.

Dixon's Outlier Test for result (se_beryllium_7440-41-7_t)

Total N = 10
Number NDs = 2
Number Detects = 8
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 1.3 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.240

For 10% significance level, 1.3 is not an outlier.
For 5% significance level, 1.3 is not an outlier.
For 1% significance level, 1.3 is not an outlier.

2. Data Value 0.049 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.049 is not an outlier.
For 5% significance level, 0.049 is not an outlier.
For 1% significance level, 0.049 is not an outlier.

Dixon's Outlier Test for result (se_cadmium_7440-43-9_t)

Total N = 10
Number NDs = 3
Number Detects = 7
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.21 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.231

For 10% significance level, 0.21 is not an outlier.
For 5% significance level, 0.21 is not an outlier.
For 1% significance level, 0.21 is not an outlier.

2. Data Value 0.037 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 0.037 is not an outlier.
For 5% significance level, 0.037 is not an outlier.
For 1% significance level, 0.037 is not an outlier.

Dixon's Outlier Test for result (se_chromium (total)_7440-47-3_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 5.9 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.149

For 10% significance level, 5.9 is not an outlier.
For 5% significance level, 5.9 is not an outlier.
For 1% significance level, 5.9 is not an outlier.

2. Data Value 1.2 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 1.2 is not an outlier.
For 5% significance level, 1.2 is not an outlier.
For 1% significance level, 1.2 is not an outlier.

Dixon's Outlier Test for result (se_cobalt_7440-48-4_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 3.6 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.115

For 10% significance level, 3.6 is not an outlier.
For 5% significance level, 3.6 is not an outlier.
For 1% significance level, 3.6 is not an outlier.

2. Data Value 0.96 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.017

For 10% significance level, 0.96 is not an outlier.
For 5% significance level, 0.96 is not an outlier.
For 1% significance level, 0.96 is not an outlier.

Dixon's Outlier Test for result (se_copper_7440-50-8_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 9.3 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.378

For 10% significance level, 9.3 is not an outlier.
For 5% significance level, 9.3 is not an outlier.
For 1% significance level, 9.3 is not an outlier.

2. Data Value 0.98 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.023

For 10% significance level, 0.98 is not an outlier.
For 5% significance level, 0.98 is not an outlier.
For 1% significance level, 0.98 is not an outlier.

Dixon's Outlier Test for result (se_cyanide_57-12-5_t)

Total N = 10
Number NDs = 9
Number Detects = 1
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477

1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 0.13 is a Potential Outlier (Upper Tail)?

Test Statistic: 1.000

For 10% significance level, 0.13 is an outlier.
For 5% significance level, 0.13 is an outlier.
For 1% significance level, 0.13 is an outlier.

2. Data Value 0.049 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0.049 is an outlier.
For 5% significance level, 0.049 is an outlier.
For 1% significance level, 0.049 is an outlier.

Dixon's Outlier Test for result (se_lead_7439-92-1_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 13.1 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.521

For 10% significance level, 13.1 is an outlier.
For 5% significance level, 13.1 is an outlier.
For 1% significance level, 13.1 is not an outlier.

2. Data Value 2.7 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.182

For 10% significance level, 2.7 is not an outlier.
For 5% significance level, 2.7 is not an outlier.
For 1% significance level, 2.7 is not an outlier.

Dixon's Outlier Test for result (se_manganese_7439-96-5_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 293 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.281

For 10% significance level, 293 is not an outlier.
For 5% significance level, 293 is not an outlier.
For 1% significance level, 293 is not an outlier.

2. Data Value 31.4 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.103

For 10% significance level, 31.4 is not an outlier.
For 5% significance level, 31.4 is not an outlier.
For 1% significance level, 31.4 is not an outlier.

Dixon's Outlier Test for result (se_nickel_7440-02-0_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 3.2 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.078

For 10% significance level, 3.2 is not an outlier.
For 5% significance level, 3.2 is not an outlier.
For 1% significance level, 3.2 is not an outlier.

2. Data Value 0.6 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.008

For 10% significance level, 0.6 is not an outlier.
For 5% significance level, 0.6 is not an outlier.
For 1% significance level, 0.6 is not an outlier.

Dixon's Outlier Test for result (se_vanadium_7440-62-2_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 16.2 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.059

For 10% significance level, 16.2 is not an outlier.
For 5% significance level, 16.2 is not an outlier.
For 1% significance level, 16.2 is not an outlier.

2. Data Value 3.5 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.075

For 10% significance level, 3.5 is not an outlier.
For 5% significance level, 3.5 is not an outlier.
For 1% significance level, 3.5 is not an outlier.

Dixon's Outlier Test for result (se_zinc_7440-66-6_t)

Total N = 10
Number NDs = 0
Number Detects = 10
Number Data (n) = 10
10% critical value: 0.409
5% critical value: 0.477
1% critical value: 0.597
Note: NDs replaced by DL/2 in Outlier Test

1. Data Value 25.1 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.160

For 10% significance level, 25.1 is not an outlier.
For 5% significance level, 25.1 is not an outlier.
For 1% significance level, 25.1 is not an outlier.

2. Data Value 11.7 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.239

For 10% significance level, 11.7 is not an outlier.
For 5% significance level, 11.7 is not an outlier.
For 1% significance level, 11.7 is not an outlier.

TABLE C.5

PROUCL BOX PLOTS FOR BACKGROUND SURFACE WATER WITH NONDETECTS

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

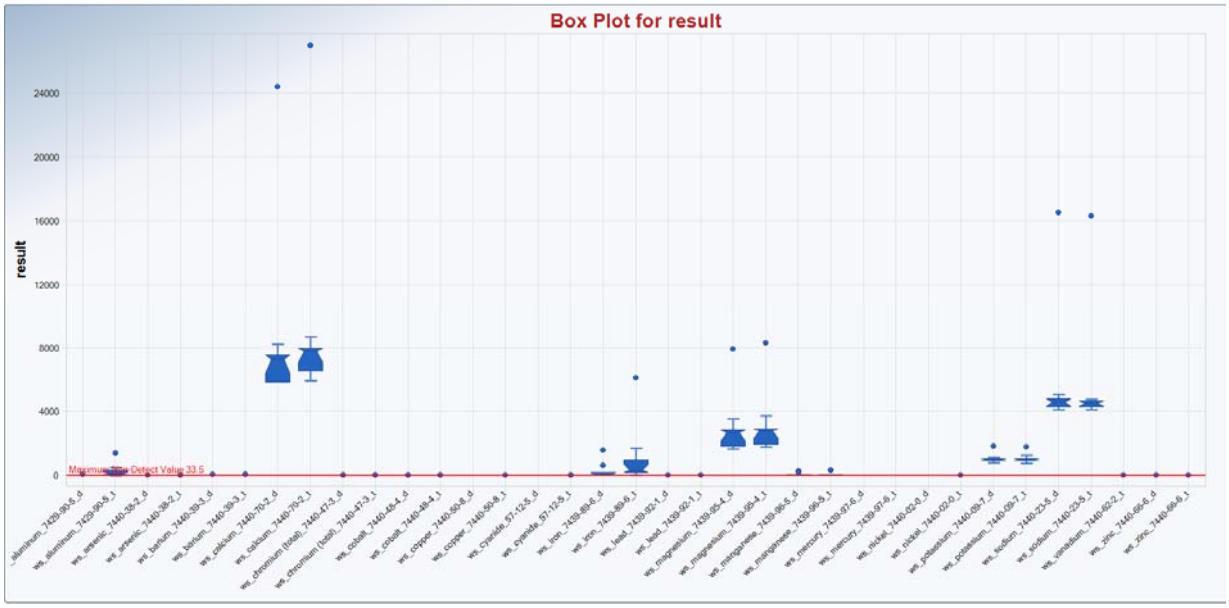

TABLE C.6

PROUCL BOX PLOTS FOR BACKGROUND SEDIMENT WITH NONDETECTS

COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2

CHESTER AND WASHINGTON TOWNSHIPS, NJ

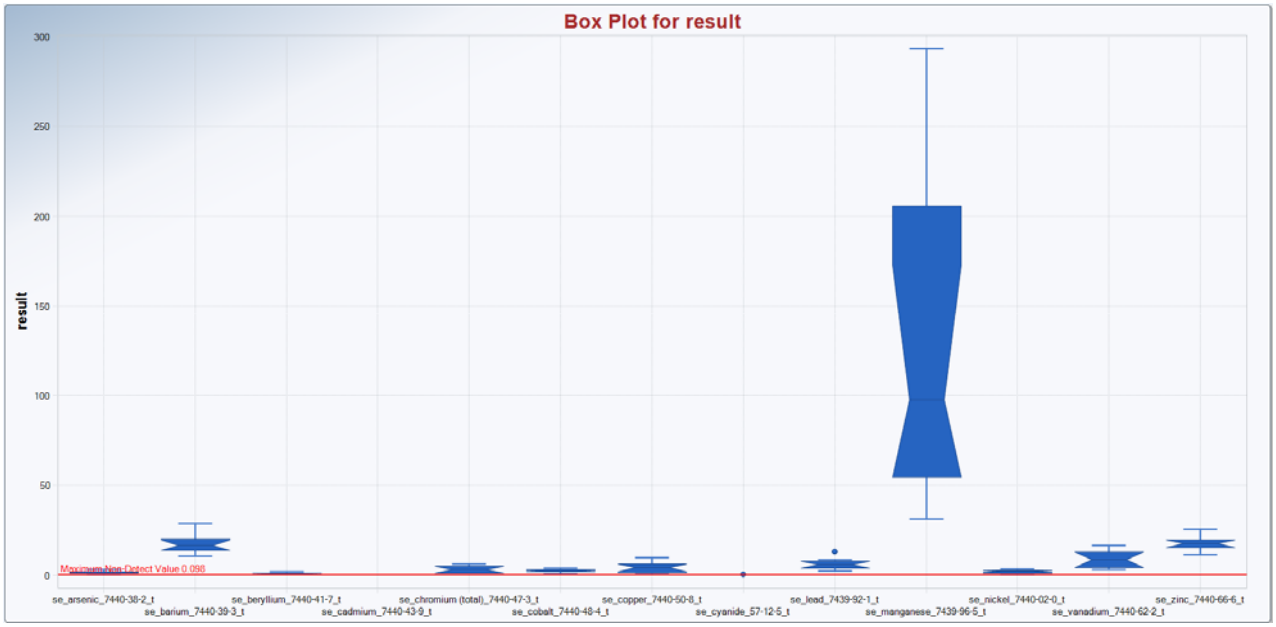

TABLE C.7
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Background Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.14/25/2018 4:26:03 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
Different or Future K Observations	1
Number of Bootstrap Operations	2000

result (ws_aluminum_7429-90-5_d)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	9
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	2.5
Maximum Detect	N/A	Maximum Non-Detect	2.5
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable result (ws_aluminum_7429-90-5_d) was not processed!

result (ws_aluminum_7429-90-5_t)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	9		
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	27.9	Minimum Non-Detect	2.5
Maximum Detect	450	Maximum Non-Detect	2.5
Variance Detected	22420	Percent Non-Detects	11.11%
Mean Detected	153.4	SD Detected	149.7
Mean of Detected Logged Data	4.653	SD of Detected Logged Data	0.923

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.791	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.31	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	136.7	KM SD	140.3
95% UTL95% Coverage	562	95% KM UPL (t)	411.7
90% KM Percentile (z)	316.5	95% KM Percentile (z)	367.5
99% KM Percentile (z)	463.1	95% KM USL	432.7

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	136.5	SD	149
95% UTL95% Coverage	588	95% UPL (t)	428.5
90% Percentile (z)	327.4	95% Percentile (z)	381.6
99% Percentile (z)	483.1	95% USL	450.8

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.394	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.212	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.459	k star (bias corrected MLE)	0.995
Theta hat (MLE)	105.2	Theta star (bias corrected MLE)	154.2
nu hat (MLE)	23.34	nu star (bias corrected)	15.92
MLE Mean (bias corrected)	153.4		
MLE Sd (bias corrected)	153.8	95% Percentile of Chisquare (2kstar)	5.972

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	136.4
Maximum	450	Median	77.9
SD	149.1	CV	1.093
k hat (MLE)	0.493	k star (bias corrected MLE)	0.403
Theta hat (MLE)	276.7	Theta star (bias corrected MLE)	338.7
nu hat (MLE)	8.873	nu star (bias corrected)	7.249
MLE Mean (bias corrected)	136.4	MLE Sd (bias corrected)	214.9
95% Percentile of Chisquare (2kstar)	3.339	90% Percentile	384.8
95% Percentile	565.4	99% Percentile	1019

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	1303	1978	95% Approx. Gamma UPL	639.7	821.9
95% Gamma USL	714	940.4			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	136.7	SD (KM)	140.3
Variance (KM)	19688	SE of Mean (KM)	50
k hat (KM)	0.949	k star (KM)	0.707

nu hat (KM)	17.08	nu star (KM)	12.72
theta hat (KM)	144.1	theta star (KM)	193.4
80% gamma percentile (KM)	224.6	90% gamma percentile (KM)	342.3
95% gamma percentile (KM)	463.6	99% gamma percentile (KM)	753

The following statistics are computed using gamma distribution and KM estimates

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	980.3	1204	95% Approx. Gamma UPL	516.4	570.7
95% KM Gamma Percentile	415.2	444.9	95% Gamma USL	569.6	638.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.155	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	137.6	Mean in Log Scale	4.398
SD in Original Scale	147.9	SD in Log Scale	1.153
95% UTL95% Coverage	2681	95% BCA UTL95% Coverage	450
95% Bootstrap (%) UTL95% Coverage	450	95% UPL (t)	779.6
90% Percentile (z)	356.4	95% Percentile (z)	541.9
99% Percentile (z)	1189	95% USL	926.3

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	4.238	95% KM UTL (Lognormal)95% Coverage	5261
KM SD of Logged Data	1.429	95% KM UPL (Lognormal)	1139
95% KM Percentile Lognormal (z)	726.1	95% KM USL (Lognormal)	1410

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	136.5	Mean in Log Scale	4.161
SD in Original Scale	149	SD in Log Scale	1.71
95% UTL95% Coverage	11439	95% UPL (t)	1832
90% Percentile (z)	574	95% Percentile (z)	1068
99% Percentile (z)	3427	95% USL	2366

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	9	95% UTL with95% Coverage	450
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
Approximate Sample Size needed to achieve specified CC	59	95% UPL	450
95% USL	450	95% KM Chebyshev UPL	781.4

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_arsenic_7440-38-2_d)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	2
Minimum	1.1	First Quartile	1.1
Second Largest	1.2	Median	1.2
Maximum	1.2	Third Quartile	1.2
Mean	1.163	SD	0.0518
Coefficient of Variation	0.0445	Skewness	-0.644
Mean of logged Data	0.15	SD of logged Data	0.045

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.187	d2max (for USL)	2.032

Normal GOF Test

Shapiro Wilk Test Statistic	0.641	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.391	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	1.327	90% Percentile (z)	1.229
95% UPL (t)	1.267	95% Percentile (z)	1.248
95% USL	1.268	99% Percentile (z)	1.283

Gamma GOF Test

A-D Test Statistic	1.557	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.715	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.406	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.294	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	568	k star (bias corrected MLE)	355.1
Theta hat (MLE)	0.00205	Theta star (bias corrected MLE)	0.00327
nu hat (MLE)	9088	nu star (bias corrected)	5681
MLE Mean (bias corrected)	1.163	MLE Sd (bias corrected)	0.0617

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	1.27	90% Percentile	1.242
95% Hawkins Wixley (HW) Approx. Gamma UPL	1.27	95% Percentile	1.266
95% WH Approx. Gamma UTL with 95% Coverage	1.336	99% Percentile	1.311
95% HW Approx. Gamma UTL with 95% Coverage	1.337		
95% WH USL	1.271	95% HW USL	1.271

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.641	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.391	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	1.341	90% Percentile (z)	1.23
95% UPL (t)	1.271	95% Percentile (z)	1.251
95% USL	1.273	99% Percentile (z)	1.29

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	8	95% UTL with 95% Coverage	1.2
Approx, f used to compute achieved CC	0.421	Approximate Actual Confidence Coefficient achieved by UTL	0.337
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	1.2	90% Percentile	1.2
90% Chebyshev UPL	1.327	95% Percentile	1.2
95% Chebyshev UPL	1.402	99% Percentile	1.2
95% USL	1.2		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_arsenic_7440-38-2_t)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	5
Minimum	1.1	First Quartile	1.2
Second Largest	1.4	Median	1.2
Maximum	1.6	Third Quartile	1.325
Mean	1.275	SD	0.158
Coefficient of Variation	0.124	Skewness	1.409
Mean of logged Data	0.237	SD of logged Data	0.118

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.187	d2max (for USL)	2.032

Normal GOF Test

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	1.779	90% Percentile (z)	1.478
95% UPL (t)	1.593	95% Percentile (z)	1.535
95% USL	1.596	99% Percentile (z)	1.643

Gamma GOF Test

A-D Test Statistic	0.663	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.715	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.316	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.294	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	79.95	k star (bias corrected MLE)	50.05
Theta hat (MLE)	0.0159	Theta star (bias corrected MLE)	0.0255
nu hat (MLE)	1279	nu star (bias corrected)	800.9
MLE Mean (bias corrected)	1.275	MLE Sd (bias corrected)	0.18

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	1.6	90% Percentile	1.511
95% Hawkins Wixley (HW) Approx. Gamma UPL	1.601	95% Percentile	1.585
95% WH Approx. Gamma UTL with 95% Coverage	1.818	99% Percentile	1.731
95% HW Approx. Gamma UTL with 95% Coverage	1.824		
95% WH USL	1.604	95% HW USL	1.605

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.303	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	1.843	90% Percentile (z)	1.473
95% UPL (t)	1.605	95% Percentile (z)	1.538
95% USL	1.609	99% Percentile (z)	1.666

Nonparametric Distribution Free Background Statistics
Data appear Approximate Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	8	95% UTL with 95% Coverage	1.6
Approx, f used to compute achieved CC	0.421	Approximate Actual Confidence Coefficient achieved by UTL	0.337
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	1.6	95% BCA Bootstrap UTL with 95% Coverage	1.6
95% UPL	1.6	90% Percentile	1.46
90% Chebyshev UPL	1.778	95% Percentile	1.53
95% Chebyshev UPL	2.006	99% Percentile	1.586
95% USL	1.6		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_barium_7440-39-3_d)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9

Minimum	7.3	First Quartile	8
Second Largest	12.8	Median	8.5
Maximum	19.4	Third Quartile	12.7
Mean	10.79	SD	3.987
Coefficient of Variation	0.37	Skewness	1.353
Mean of logged Data	2.326	SD of logged Data	0.335

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	22.87	90% Percentile (z)	15.9
95% UPL (t)	18.6	95% Percentile (z)	17.35
95% USL	19.2	99% Percentile (z)	20.06

Gamma GOF Test

A-D Test Statistic	0.696	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.282	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.598	k star (bias corrected MLE)	6.473
Theta hat (MLE)	1.124	Theta star (bias corrected MLE)	1.667
nu hat (MLE)	172.8	nu star (bias corrected)	116.5
MLE Mean (bias corrected)	10.79	MLE Sd (bias corrected)	4.241

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	19.2	90% Percentile	16.45
95% Hawkins Wixley (HW) Approx. Gamma UPL	19.31	95% Percentile	18.58
95% WH Approx. Gamma UTL with 95% Coverage	25.62	99% Percentile	23.01
95% HW Approx. Gamma UTL with 95% Coverage	26.15		
95% WH USL	20.02	95% HW USL	20.18

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.858	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.266	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	28.21	90% Percentile (z)	15.71
95% UPL (t)	19.72	95% Percentile (z)	17.74
95% USL	20.73	99% Percentile (z)	22.29

Nonparametric Distribution Free Background Statistics

Data appear Approximate Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	9	95% UTL with 95% Coverage	19.4
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	19.4	95% BCA Bootstrap UTL with 95% Coverage	19.4
95% UPL	19.4	90% Percentile	14.12
90% Chebyshev UPL	23.4	95% Percentile	16.76
95% Chebyshev UPL	29.11	99% Percentile	18.87
95% USL	19.4		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_barium_7440-39-3_t)

General Statistics

Total Number of Observations	8	Number of Missing Observations	0
Number of Distinct Observations	6		
Number of Detects	5	Number of Non-Detects	3
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	10.6	Minimum Non-Detect	1.3
Maximum Detect	13.7	Maximum Non-Detect	1.3
Variance Detected	1.547	Percent Non-Detects	37.5%
Mean Detected	12.02	SD Detected	1.244
Mean of Detected Logged Data	2.482	SD of Detected Logged Data	0.103

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.187	d2max (for USL)	2.032

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	8	KM SD	5.264
95% UTL95% Coverage	24.78	95% KM UPL (t)	18.58
90% KM Percentile (z)	14.75	95% KM Percentile (z)	16.66
99% KM Percentile (z)	20.25	95% KM USL	18.69

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	7.756	SD	5.959
95% UTL95% Coverage	26.75	95% UPL (t)	19.73
90% Percentile (z)	15.39	95% Percentile (z)	17.56

99% Percentile (z)	21.62	95% USL	19.86

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.28	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.22	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	117.1	k star (bias corrected MLE)	46.96
Theta hat (MLE)	0.103	Theta star (bias corrected MLE)	0.256
nu hat (MLE)	1171	nu star (bias corrected)	469.6
MLE Mean (bias corrected)	12.02		
MLE Sd (bias corrected)	1.754	95% Percentile of Chisquare (2kstar)	117.5

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.845	Mean	10.77
Maximum	13.7	Median	10.8
SD	2.012	CV	0.187
k hat (MLE)	31.88	k star (bias corrected MLE)	20.01
Theta hat (MLE)	0.338	Theta star (bias corrected MLE)	0.538
nu hat (MLE)	510.1	nu star (bias corrected)	320.1
MLE Mean (bias corrected)	10.77	MLE Sd (bias corrected)	2.407
95% Percentile of Chisquare (2kstar)	55.78	90% Percentile	13.95
95% Percentile	15.01	99% Percentile	17.14

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	18.5	18.73	95% Approx. Gamma UPL	15.27	15.34
95% Gamma USL	15.32	15.4			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8	SD (KM)	5.264
Variance (KM)	27.71	SE of Mean (KM)	2.081
k hat (KM)	2.31	k star (KM)	1.527
nu hat (KM)	36.96	nu star (KM)	24.43
theta hat (KM)	3.463	theta star (KM)	5.239
80% gamma percentile (KM)	12.35	90% gamma percentile (KM)	16.6
95% gamma percentile (KM)	20.72	99% gamma percentile (KM)	30

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	50.46	60.69	95% Approx. Gamma UPL	27.26	29.85
95% KM Gamma Percentile	21.89	23.3	95% Gamma USL	27.61	30.29

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.204	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	10.88	Mean in Log Scale	2.374
SD in Original Scale	1.869	SD in Log Scale	0.174
95% UTL95% Coverage	18.67	95% BCA UTL95% Coverage	13.7
95% Bootstrap (%) UTL95% Coverage	13.7	95% UPL (t)	15.22
90% Percentile (z)	13.41	95% Percentile (z)	14.28
99% Percentile (z)	16.08	95% USL	15.28

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	1.65	95% KM UTL (Lognormal)95% Coverage	161.2
KM SD of Logged Data	1.077	95% KM UPL (Lognormal)	45.35
95% KM Percentile Lognormal (z)	30.62	95% KM USL (Lognormal)	46.45

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	7.756	Mean in Log Scale	1.39
SD in Original Scale	5.959	SD in Log Scale	1.51
95% UTL95% Coverage	493.4	95% UPL (t)	83.4
90% Percentile (z)	27.79	95% Percentile (z)	48.09
99% Percentile (z)	134.6	95% USL	86.23

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	8	95% UTL with95% Coverage	13.7
Approx, f used to compute achieved CC	0.421	Approximate Actual Confidence Coefficient achieved by UTL	0.337
Approximate Sample Size needed to achieve specified CC	59	95% UPL	13.7
95% USL	13.7	95% KM Chebyshev UPL	32.34

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_calcium_7440-70-2_d)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Minimum	5810	First Quartile	5840
Second Largest	7550	Median	7110
Maximum	8150	Third Quartile	7460
Mean	6778	SD	934.6
Coefficient of Variation	0.138	Skewness	0.0525

Mean of logged Data	8.813	SD of logged Data	0.139

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with	95% Coverage	9611	90% Percentile (z)	7976
	95% UPL (t)	8610	95% Percentile (z)	8315
	95% USL	8749	99% Percentile (z)	8952

Gamma GOF Test

A-D Test Statistic	0.856	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.72	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.291	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	58.88	k star (bias corrected MLE)	39.33
Theta hat (MLE)	115.1	Theta star (bias corrected MLE)	172.3
nu hat (MLE)	1060	nu star (bias corrected)	707.9
MLE Mean (bias corrected)	6778	MLE Sd (bias corrected)	1081

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL		8740	90% Percentile 8195
95% Hawkins Wixley (HW) Approx. Gamma UPL		8759	95% Percentile 8648
95% WH Approx. Gamma UTL with	95% Coverage	9984	99% Percentile 9542
95% HW Approx. Gamma UTL with	95% Coverage	10041	
	95% WH USL	8907	95% HW USL 8930

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.816	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with	95% Coverage	10231	90% Percentile (z)	8027
	95% UPL (t)	8819	95% Percentile (z)	8442
	95% USL	9004	99% Percentile (z)	9278

Nonparametric Distribution Free Background Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r		9	95% UTL with 95% Coverage	8150
Approx, f used to compute achieved CC		0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
			Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with	95% Coverage	8150	95% BCA Bootstrap UTL with 95% Coverage	8150
	95% UPL	8150	90% Percentile	7670
	90% Chebyshev UPL	9733	95% Percentile	7910
	95% Chebyshev UPL	11072	99% Percentile	8102
	95% USL	8150		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_calcium_7440-70-2_t)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Minimum	5980	First Quartile	6510
Second Largest	7940	Median	7730
Maximum	8630	Third Quartile	7900
Mean	7319	SD	904.8
Coefficient of Variation	0.124	Skewness	-0.299
Mean of logged Data	8.891	SD of logged Data	0.127

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with	95% Coverage	10061	90% Percentile (z)	8478
	95% UPL (t)	9092	95% Percentile (z)	8807
	95% USL	9228	99% Percentile (z)	9424

Gamma GOF Test

A-D Test Statistic	0.462	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.249	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	71.52	k star (bias corrected MLE)	47.75
Theta hat (MLE)	102.3	Theta star (bias corrected MLE)	153.3
nu hat (MLE)	1287	nu star (bias corrected)	859.5
MLE Mean (bias corrected)	7319	MLE Sd (bias corrected)	1059

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	9230	90% Percentile	8705
95% Hawkins Wixley (HW) Approx. Gamma UPL	9250	95% Percentile	9144
95% WH Approx. Gamma UTL with 95% Coverage	10426	99% Percentile	10006
95% HW Approx. Gamma UTL with 95% Coverage	10482		
95% WH USL	9391	95% HW USL	9415

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.242	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	10666	90% Percentile (z)	8548
95% UPL (t)	9314	95% Percentile (z)	8950
95% USL	9492	99% Percentile (z)	9756

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	9	95% UTL with 95% Coverage	8630
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	8630	95% BCA Bootstrap UTL with 95% Coverage	8630
95% UPL	8630	90% Percentile	8078
90% Chebyshev UPL	10180	95% Percentile	8354
95% Chebyshev UPL	11476	99% Percentile	8575
95% USL	8630		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_chromium (total)_7440-47-3_d)

General Statistics

Total Number of Observations	8	Number of Missing Observations	0
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	8
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	0.28
Maximum Detect	N/A	Maximum Non-Detect	0.28
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable result (ws_chromium (total)_7440-47-3_d) was not processed!

result (ws_chromium (total)_7440-47-3_t)

General Statistics

Total Number of Observations	8	Number of Missing Observations	0
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	8
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	0.28
Maximum Detect	N/A	Maximum Non-Detect	0.28
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable result (ws_chromium (total)_7440-47-3_t) was not processed!

result (ws_cobalt_7440-48-4_d)

General Statistics

Total Number of Observations	8	Number of Missing Observations	0
Number of Distinct Observations	1		
Number of Detects	1	Number of Non-Detects	7
Number of Distinct Detects	1	Number of Distinct Non-Detects	1
Minimum Detect	0.15	Minimum Non-Detect	0.15
Maximum Detect	0.15	Maximum Non-Detect	0.15
Variance Detected	N/A	Percent Non-Detects	87.5%
Mean Detected	0.15	SD Detected	N/A
Mean of Detected Logged Data	-1.897	SD of Detected Logged Data	N/A

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

The data set for variable result (ws_cobalt_7440-48-4_d) was not processed!

result (ws_cobalt_7440-48-4_t)

General Statistics

Total Number of Observations	8	Number of Missing Observations	0
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	8
Number of Distinct Detects	0	Number of Distinct Non-Detects	1

Minimum Detect	N/A	Minimum Non-Detect	0.15
Maximum Detect	N/A	Maximum Non-Detect	0.15
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable result (ws_cobalt_7440-48-4_t) was not processed!

result (ws_copper_7440-50-8_d)

General Statistics

Total Number of Observations	10	Number of Missing Observations	0
Number of Distinct Observations	5		
Number of Detects	5	Number of Non-Detects	5
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.32	Minimum Non-Detect	0.3
Maximum Detect	0.5	Maximum Non-Detect	0.3
Variance Detected	0.00548	Percent Non-Detects	50%
Mean Detected	0.386	SD Detected	0.074
Mean of Detected Logged Data	-0.966	SD of Detected Logged Data	0.186

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.343	KM SD	0.0636
95% UTL95% Coverage	0.528	95% KM UPL (t)	0.465
90% KM Percentile (z)	0.424	95% KM Percentile (z)	0.448
99% KM Percentile (z)	0.491	95% KM USL	0.481

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.268	SD	0.134
95% UTL95% Coverage	0.658	95% UPL (t)	0.525
90% Percentile (z)	0.439	95% Percentile (z)	0.488
99% Percentile (z)	0.579	95% USL	0.559

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.388	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.249	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	35.71	k star (bias corrected MLE)	14.42
Theta hat (MLE)	0.0108	Theta star (bias corrected MLE)	0.0268
nu hat (MLE)	357.1	nu star (bias corrected)	144.2
MLE Mean (bias corrected)	0.386		
MLE Sd (bias corrected)	0.102	95% Percentile of Chisquare (2kstar)	42.36

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0928	Mean	0.281
Maximum	0.5	Median	0.283
SD	0.128	CV	0.454
k hat (MLE)	4.745	k star (bias corrected MLE)	3.388
Theta hat (MLE)	0.0592	Theta star (bias corrected MLE)	0.083
nu hat (MLE)	94.91	nu star (bias corrected)	67.77
MLE Mean (bias corrected)	0.281	MLE Sd (bias corrected)	0.153
95% Percentile of Chisquare (2kstar)	13.74	90% Percentile	0.486
95% Percentile	0.57	99% Percentile	0.751

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.851	0.901	95% Approx. Gamma UPL	0.599	0.616
95% Gamma USL	0.658	0.681			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.343	SD (KM)	0.0636
Variance (KM)	0.00404	SE of Mean (KM)	0.0225
k hat (KM)	29.11	k star (KM)	20.45
nu hat (KM)	582.3	nu star (KM)	408.9
theta hat (KM)	0.0118	theta star (KM)	0.0168
80% gamma percentile (KM)	0.405	90% gamma percentile (KM)	0.443
95% gamma percentile (KM)	0.477	99% gamma percentile (KM)	0.544

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.541	0.543	95% Approx. Gamma UPL	0.465	0.466
95% KM Gamma Percentile	0.446	0.445	95% Gamma USL	0.484	0.485

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

TABLE C.7
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.302	Mean in Log Scale	-1.253
SD in Original Scale	0.105	SD in Log Scale	0.348
95% UTL95% Coverage	0.787	95% BCA UTL95% Coverage	0.5
95% Bootstrap (%) UTL95% Coverage	0.5	95% UPL (t)	0.558
90% Percentile (z)	0.446	95% Percentile (z)	0.506
99% Percentile (z)	0.642	95% USL	0.609

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-1.085	95% KM UTL (Lognormal)95% Coverage	0.55
KM SD of Logged Data	0.167	95% KM UPL (Lognormal)	0.466
95% KM Percentile Lognormal (z)	0.445	95% KM USL (Lognormal)	0.486

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.268	Mean in Log Scale	-1.432
SD in Original Scale	0.134	SD in Log Scale	0.506
95% UTL95% Coverage	1.043	95% UPL (t)	0.632
90% Percentile (z)	0.457	95% Percentile (z)	0.549
99% Percentile (z)	0.776	95% USL	0.719

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	10	95% UTL with95% Coverage	0.5
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.5
95% USL	0.5	95% KM Chebyshev UPL	0.634

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_copper_7440-50-8_t)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	8		
Number of Detects	7	Number of Non-Detects	2
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.32	Minimum Non-Detect	0.3
Maximum Detect	1.5	Maximum Non-Detect	0.3
Variance Detected	0.183	Percent Non-Detects	22.22%
Mean Detected	0.669	SD Detected	0.428
Mean of Detected Logged Data	-0.552	SD of Detected Logged Data	0.571

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.831	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.269	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.587	KM SD	0.381
95% UTL95% Coverage	1.742	95% KM UPL (t)	1.334
90% KM Percentile (z)	1.075	95% KM Percentile (z)	1.214
99% KM Percentile (z)	1.474	95% KM USL	1.391

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.553	SD	0.435
95% UTL95% Coverage	1.872	95% UPL (t)	1.406
90% Percentile (z)	1.111	95% Percentile (z)	1.269
99% Percentile (z)	1.566	95% USL	1.471

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.38	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.711	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.21	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.495	k star (bias corrected MLE)	2.092
Theta hat (MLE)	0.191	Theta star (bias corrected MLE)	0.32
nu hat (MLE)	48.93	nu star (bias corrected)	29.29
MLE Mean (bias corrected)	0.669		
MLE Sd (bias corrected)	0.462	95% Percentile of Chisquare (2kstar)	9.785

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.522
Maximum	1.5	Median	0.41
SD	0.471	CV	0.901
k hat (MLE)	0.746	k star (bias corrected MLE)	0.571
Theta hat (MLE)	0.7	Theta star (bias corrected MLE)	0.914
nu hat (MLE)	13.42	nu star (bias corrected)	10.28
MLE Mean (bias corrected)	0.522	MLE Sd (bias corrected)	0.691
95% Percentile of Chisquare (2kstar)	4.184	90% Percentile	1.373
95% Percentile	1.913	99% Percentile	3.223

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	4.543	6.225	95% Approx. Gamma UPL	2.301	2.75
95% Gamma USL	2.555	3.115			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.587	SD (KM)	0.381
Variance (KM)	0.145	SE of Mean (KM)	0.137
k hat (KM)	2.368	k star (KM)	1.653
nu hat (KM)	42.63	nu star (KM)	29.75
theta hat (KM)	0.248	theta star (KM)	0.355
80% gamma percentile (KM)	0.898	90% gamma percentile (KM)	1.194
95% gamma percentile (KM)	1.48	99% gamma percentile (KM)	2.121

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	2.09	2.173	95% Approx. Gamma UPL	1.374	1.385
95% KM Gamma Percentile	1.2	1.2	95% Gamma USL	1.462	1.479

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.551	Mean in Log Scale	-0.872
SD in Original Scale	0.438	SD in Log Scale	0.81
95% UTL95% Coverage	4.865	95% BCA UTL95% Coverage	1.5
95% Bootstrap (%) UTL95% Coverage	1.5	95% UPL (t)	2.044
90% Percentile (z)	1.18	95% Percentile (z)	1.583
99% Percentile (z)	2.749	95% USL	2.307

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-0.697	95% KM UTL (Lognormal)95% Coverage	2.55
KM SD of Logged Data	0.539	95% KM UPL (Lognormal)	1.432
95% KM Percentile Lognormal (z)	1.208	95% KM USL (Lognormal)	1.552

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.553	Mean in Log Scale	-0.851
SD in Original Scale	0.435	SD in Log Scale	0.772
95% UTL95% Coverage	4.43	95% UPL (t)	1.938
90% Percentile (z)	1.148	95% Percentile (z)	1.519
99% Percentile (z)	2.571	95% USL	2.175

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	9	95% UTL with95% Coverage	1.5
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
Approximate Sample Size needed to achieve specified CC	59	95% UPL	1.5
95% USL	1.5	95% KM Chebyshev UPL	2.338

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_cyanide_57-12-5_d)

General Statistics

Total Number of Observations	10	Number of Missing Observations	0
Number of Distinct Observations	4		
Number of Detects	3	Number of Non-Detects	7
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	2.7	Minimum Non-Detect	1.7
Maximum Detect	3.7	Maximum Non-Detect	1.7
Variance Detected	0.25	Percent Non-Detects	70%
Mean Detected	3.2	SD Detected	0.5
Mean of Detected Logged Data	1.155	SD of Detected Logged Data	0.158

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	1	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	2.15	KM SD	0.723
95% UTL95% Coverage	4.254	95% KM UPL (t)	3.54
90% KM Percentile (z)	3.076	95% KM Percentile (z)	3.339
99% KM Percentile (z)	3.832	95% KM USL	3.723

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	1.555	SD	1.159
95% UTL95% Coverage	4.93	95% UPL (t)	3.784
90% Percentile (z)	3.041	95% Percentile (z)	3.462
99% Percentile (z)	4.252	95% USL	4.078

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	60.85	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0526	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	365.1	nu star (bias corrected)	N/A

MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0245	Mean	1.764
Maximum	3.7	Median	1.648
SD	1.178	CV	0.667
k hat (MLE)	1.191	k star (bias corrected MLE)	0.9
Theta hat (MLE)	1.482	Theta star (bias corrected MLE)	1.96
nu hat (MLE)	23.81	nu star (bias corrected)	18
MLE Mean (bias corrected)	1.764	MLE Sd (bias corrected)	1.86
95% Percentile of Chisquare (2kstar)	5.598	90% Percentile	4.169
95% Percentile	5.487	99% Percentile	8.571

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	10.56	13.52	95% Approx. Gamma UPL	6.113	7.081
95% Gamma USL	7.102	8.445			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.15	SD (KM)	0.723
Variance (KM)	0.523	SE of Mean (KM)	0.28
k hat (KM)	8.847	k star (KM)	6.259
nu hat (KM)	176.9	nu star (KM)	125.2
theta hat (KM)	0.243	theta star (KM)	0.343
80% gamma percentile (KM)	2.82	90% gamma percentile (KM)	3.298
95% gamma percentile (KM)	3.73	99% gamma percentile (KM)	4.634

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	4.576	4.632	95% Approx. Gamma UPL	3.581	3.588
95% KM Gamma Percentile	3.331	3.33	95% Gamma USL	3.821	3.837

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.998	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	2.105	Mean in Log Scale	0.671
SD in Original Scale	0.859	SD in Log Scale	0.403
95% UTL95% Coverage	6.321	95% BCA UTL95% Coverage	3.7
95% Bootstrap (%) UTL95% Coverage	3.7	95% UPL (t)	4.245
90% Percentile (z)	3.279	95% Percentile (z)	3.796
99% Percentile (z)	4.995	95% USL	4.701

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	0.718	95% KM UTL (Lognormal)95% Coverage	4.834
KM SD of Logged Data	0.295	95% KM UPL (Lognormal)	3.612
95% KM Percentile Lognormal (z)	3.329	95% KM USL (Lognormal)	3.893

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	1.555	Mean in Log Scale	0.233
SD in Original Scale	1.159	SD in Log Scale	0.641
95% UTL95% Coverage	8.148	95% UPL (t)	4.325
90% Percentile (z)	2.869	95% Percentile (z)	3.62
99% Percentile (z)	5.603	95% USL	5.088

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	10	95% UTL with95% Coverage	3.7
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
Approximate Sample Size needed to achieve specified CC	59	95% UPL	3.7
95% USL	3.7	95% KM Chebyshev UPL	5.455

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_cyanide_57-12-5_t)

General Statistics

Total Number of Observations	8	Number of Missing Observations	0
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	8
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	1.7
Maximum Detect	N/A	Maximum Non-Detect	1.7
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable result (ws_cyanide_57-12-5_t) was not processed!

result (ws_iron_7439-89-6_d)

TABLE C.7
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Total Number of Observations	8	Number of Missing Observations	0
Number of Distinct Observations	4		
Number of Detects	3	Number of Non-Detects	5
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	108	Minimum Non-Detect	33.5
Maximum Detect	182	Maximum Non-Detect	33.5
Variance Detected	1425	Percent Non-Detects	62.5%
Mean Detected	149.3	SD Detected	37.75
Mean of Detected Logged Data	4.983	SD of Detected Logged Data	0.27

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.187	d2max (for USL)	2.032

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.257	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	76.94	KM SD	59.17
95% UTL95% Coverage	265.5	95% KM UPL (t)	195.8
90% KM Percentile (z)	152.8	95% KM Percentile (z)	174.3
99% KM Percentile (z)	214.6	95% KM USL	197.1

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	66.47	SD	71.52
95% UTL95% Coverage	294.4	95% UPL (t)	210.2
90% Percentile (z)	158.1	95% Percentile (z)	184.1
99% Percentile (z)	232.9	95% USL	211.8

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	21.65	k star (bias corrected MLE)	N/A
Theta hat (MLE)	6.897	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	129.9	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	73.6
Maximum	182	Median	58.08
SD	69.7	CV	0.947
k hat (MLE)	0.315	k star (bias corrected MLE)	0.28
Theta hat (MLE)	233.5	Theta star (bias corrected MLE)	262.5
nu hat (MLE)	5.043	nu star (bias corrected)	4.486
MLE Mean (bias corrected)	73.6	MLE Sd (bias corrected)	139
95% Percentile of Chisquare (2kstar)	2.621	90% Percentile	218.7
95% Percentile	344	99% Percentile	672.4

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	1056	1925	95% Approx. Gamma UPL	449.9	647.9
95% Gamma USL	458.3	663.3			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	76.94	SD (KM)	59.17
Variance (KM)	3501	SE of Mean (KM)	25.62
k hat (KM)	1.691	k star (KM)	1.14
nu hat (KM)	27.05	nu star (KM)	18.24
theta hat (KM)	45.5	theta star (KM)	67.49
80% gamma percentile (KM)	122.4	90% gamma percentile (KM)	171.5
95% gamma percentile (KM)	220.1	99% gamma percentile (KM)	331.9

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	381.1	412.9	95% Approx. Gamma UPL	221.1	226.7
95% KM Gamma Percentile	182.7	184.5	95% Gamma USL	223.6	229.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.283	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	91.03	Mean in Log Scale	4.356
SD in Original Scale	54.18	SD in Log Scale	0.6
95% UTL95% Coverage	528.1	95% BCA UTL95% Coverage	182
95% Bootstrap (%) UTL95% Coverage	182	95% UPL (t)	260.4
90% Percentile (z)	168.2	95% Percentile (z)	209.2
99% Percentile (z)	315	95% USL	263.9

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	4.063	95% KM UTL (Lognormal)95% Coverage	586.3
KM SD of Logged Data	0.725	95% KM UPL (Lognormal)	249.7
95% KM Percentile Lognormal (z)	191.7	95% KM USL (Lognormal)	253.7

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	66.47	Mean in Log Scale	3.63
SD in Original Scale	71.52	SD in Log Scale	1.129

95% UTL95% Coverage	1380	95% UPL (t)	365
90% Percentile (z)	160.4	95% Percentile (z)	241.8
99% Percentile (z)	522	95% USL	374.2

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	8	95% UTL with95% Coverage	182
Approx, f used to compute achieved CC	0.421	Approximate Actual Confidence Coefficient achieved by UTL	0.337
Approximate Sample Size needed to achieve specified CC	59	95% UPL	182
95% USL	182	95% KM Chebyshev UPL	350.5

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_iron_7439-89-6_t)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Minimum	63.2	First Quartile	169
Second Largest	961	Median	230
Maximum	1640	Third Quartile	806
Mean	509.6	SD	525.7
Coefficient of Variation	1.032	Skewness	1.472
Mean of logged Data	5.761	SD of logged Data	1.052

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.809	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	2103	90% Percentile (z)	1183
95% UPL (t)	1540	95% Percentile (z)	1374
95% USL	1618	99% Percentile (z)	1732

Gamma GOF Test

A-D Test Statistic	0.368	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.286	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.196	k star (bias corrected MLE)	0.872
Theta hat (MLE)	426	Theta star (bias corrected MLE)	584.7
nu hat (MLE)	21.53	nu star (bias corrected)	15.69
MLE Mean (bias corrected)	509.6	MLE Sd (bias corrected)	545.8

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	1836	90% Percentile	1214
95% Hawkins Wixley (HW) Approx. Gamma UPL	1933	95% Percentile	1603
95% WH Approx. Gamma UTL with 95% Coverage	3373	99% Percentile	2517
95% HW Approx. Gamma UTL with 95% Coverage	3844		
95% WH USL	2014	95% HW USL	2143

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	7696	90% Percentile (z)	1222
95% UPL (t)	2495	95% Percentile (z)	1791
95% USL	2920	99% Percentile (z)	3668

Nonparametric Distribution Free Background Statistics

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	9	95% UTL with 95% Coverage	1640
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	1640	95% BCA Bootstrap UTL with 95% Coverage	1640
95% UPL	1640	90% Percentile	1097
90% Chebyshev UPL	2172	95% Percentile	1368
95% Chebyshev UPL	2925	99% Percentile	1586
95% USL	1640		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_lead_7439-92-1_d)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	9
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	0.16
Maximum Detect	N/A	Maximum Non-Detect	0.16

Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable result (ws_lead_7439-92-1_d) was not processed!

result (ws_lead_7439-92-1_t)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	7		
Number of Detects	6	Number of Non-Detects	3
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.17	Minimum Non-Detect	0.16
Maximum Detect	1.5	Maximum Non-Detect	0.16
Variance Detected	0.336	Percent Non-Detects	33.33%
Mean Detected	0.713	SD Detected	0.58
Mean of Detected Logged Data	-0.629	SD of Detected Logged Data	0.847

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.794	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.529	KM SD	0.505
95% UTL95% Coverage	2.059	95% KM UPL (t)	1.518
90% KM Percentile (z)	1.176	95% KM Percentile (z)	1.359
99% KM Percentile (z)	1.703	95% KM USL	1.594

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.502	SD	0.557
95% UTL95% Coverage	2.191	95% UPL (t)	1.594
90% Percentile (z)	1.216	95% Percentile (z)	1.418
99% Percentile (z)	1.798	95% USL	1.677

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.503	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.705	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.287	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.336	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.868	k star (bias corrected MLE)	1.045
Theta hat (MLE)	0.382	Theta star (bias corrected MLE)	0.683
nu hat (MLE)	22.41	nu star (bias corrected)	12.54
MLE Mean (bias corrected)	0.713		
MLE Sd (bias corrected)	0.698	95% Percentile of Chisquare (2kstar)	6.165

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.479
Maximum	1.5	Median	0.35
SD	0.578	CV	1.206
k hat (MLE)	0.519	k star (bias corrected MLE)	0.42
Theta hat (MLE)	0.923	Theta star (bias corrected MLE)	1.141
nu hat (MLE)	9.335	nu star (bias corrected)	7.556
MLE Mean (bias corrected)	0.479	MLE Sd (bias corrected)	0.739
95% Percentile of Chisquare (2kstar)	3.43	90% Percentile	1.341
95% Percentile	1.957	99% Percentile	3.497

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	5.225	7.187	95% Approx. Gamma UPL	2.433	2.867
95% Gamma USL	2.741	3.303			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.529	SD (KM)	0.505
Variance (KM)	0.255	SE of Mean (KM)	0.184
k hat (KM)	1.098	k star (KM)	0.806
nu hat (KM)	19.77	nu star (KM)	14.51
theta hat (KM)	0.482	theta star (KM)	0.656
80% gamma percentile (KM)	0.864	90% gamma percentile (KM)	1.284
95% gamma percentile (KM)	1.711	99% gamma percentile (KM)	2.719

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	2.898	3.152	95% Approx. Gamma UPL	1.657	1.696
95% KM Gamma Percentile	1.375	1.386	95% Gamma USL	1.803	1.861

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.497	Mean in Log Scale	-1.366

SD in Original Scale	0.562	SD in Log Scale	1.32
95% UTL95% Coverage	13.94	95% BCA UTL95% Coverage	1.5
95% Bootstrap (%) UTL95% Coverage	1.5	95% UPL (t)	3.39
90% Percentile (z)	1.384	95% Percentile (z)	2.236
99% Percentile (z)	5.498	95% USL	4.129

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-1.03	95% KM UTL (Lognormal)95% Coverage	4.681
KM SD of Logged Data	0.849	95% KM UPL (Lognormal)	1.886
95% KM Percentile Lognormal (z)	1.443	95% KM USL (Lognormal)	2.141

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.502	Mean in Log Scale	-1.261
SD in Original Scale	0.557	SD in Log Scale	1.161
95% UTL95% Coverage	9.568	95% UPL (t)	2.759
90% Percentile (z)	1.255	95% Percentile (z)	1.913
99% Percentile (z)	4.222	95% USL	3.282

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	9	95% UTL with95% Coverage	1.5
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
Approximate Sample Size needed to achieve specified CC	59	95% UPL	1.5
95% USL	1.5	95% KM Chebyshev UPL	2.848

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_magnesium_7439-95-4_d)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Minimum	1680	First Quartile	1830
Second Largest	2840	Median	2650
Maximum	3490	Third Quartile	2770
Mean	2403	SD	635.5
Coefficient of Variation	0.264	Skewness	0.303
Mean of logged Data	7.753	SD of logged Data	0.266

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	4329	90% Percentile (z)	3218
95% UPL (t)	3649	95% Percentile (z)	3449
95% USL	3744	99% Percentile (z)	3882

Gamma GOF Test

A-D Test Statistic	0.648	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.255	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	16.11	k star (bias corrected MLE)	10.81
Theta hat (MLE)	149.2	Theta star (bias corrected MLE)	222.3
nu hat (MLE)	289.9	nu star (bias corrected)	194.6
MLE Mean (bias corrected)	2403	MLE Sd (bias corrected)	730.9

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	3809	90% Percentile	3375
95% Hawkins Wixley (HW) Approx. Gamma UPL	3835	95% Percentile	3718
95% WH Approx. Gamma UTL with 95% Coverage	4811	99% Percentile	4421
95% HW Approx. Gamma UTL with 95% Coverage	4898		
95% WH USL	3939	95% HW USL	3972

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.873	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.242	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	5222	90% Percentile (z)	3277
95% UPL (t)	3926	95% Percentile (z)	3610
95% USL	4085	99% Percentile (z)	4328

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	9	95% UTL with 95% Coverage	3490
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	3490	95% BCA Bootstrap UTL with 95% Coverage	3490
95% UPL	3490	90% Percentile	2970
90% Chebyshev UPL	4413	95% Percentile	3230
95% Chebyshev UPL	5323	99% Percentile	3438
95% USL	3490		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.

Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_magnesium_7439-95-4_t)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Minimum	1830	First Quartile	1960
Second Largest	2910	Median	2820
Maximum	3660	Third Quartile	2870
Mean	2542	SD	625
Coefficient of Variation	0.246	Skewness	0.399
Mean of logged Data	7.814	SD of logged Data	0.246

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	4437	90% Percentile (z)	3343
95% UPL (t)	3767	95% Percentile (z)	3570
95% USL	3861	99% Percentile (z)	3996

Gamma GOF Test

A-D Test Statistic	0.612	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.259	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	18.83	k star (bias corrected MLE)	12.63
Theta hat (MLE)	135	Theta star (bias corrected MLE)	201.3
nu hat (MLE)	338.9	nu star (bias corrected)	227.3
MLE Mean (bias corrected)	2542	MLE Sd (bias corrected)	715.4

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	3906	90% Percentile	3491
95% Hawkins Wixley (HW) Approx. Gamma UPL	3928	95% Percentile	3822
95% WH Approx. Gamma UTL with 95% Coverage	4861	99% Percentile	4495
95% HW Approx. Gamma UTL with 95% Coverage	4936		
95% WH USL	4031	95% HW USL	4059

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	5210	90% Percentile (z)	3390
95% UPL (t)	4005	95% Percentile (z)	3707
95% USL	4155	99% Percentile (z)	4382

Nonparametric Distribution Free Background Statistics
Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	9	95% UTL with 95% Coverage	3660
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	3660	95% BCA Bootstrap UTL with 95% Coverage	3660
95% UPL	3660	90% Percentile	3060
90% Chebyshev UPL	4519	95% Percentile	3360
95% Chebyshev UPL	5414	99% Percentile	3600
95% USL	3660		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_manganese_7439-96-5_d)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Minimum	1.3	First Quartile	2.25
Second Largest	19.3	Median	11.85
Maximum	47	Third Quartile	16.9
Mean	13.93	SD	15.07
Coefficient of Variation	1.082	Skewness	1.717
Mean of logged Data	2.011	SD of logged Data	1.319

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.187	d2max (for USL)	2.032

Normal GOF Test

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	61.95	90% Percentile (z)	33.24
95% UPL (t)	44.21	95% Percentile (z)	38.71

95% USL	44.54	99% Percentile (z)	48.98

Gamma GOF Test

A-D Test Statistic	0.342	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.738	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.302	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.934	k star (bias corrected MLE)	0.667
Theta hat (MLE)	14.91	Theta star (bias corrected MLE)	20.88
nu hat (MLE)	14.94	nu star (bias corrected)	10.67
MLE Mean (bias corrected)	13.93	MLE Sd (bias corrected)	17.05

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	58.39	90% Percentile	35.35
95% Hawkins Wixley (HW) Approx. Gamma UPL	64.08	95% Percentile	48.23
95% WH Approx. Gamma UTL with 95% Coverage	118.4	99% Percentile	79.1
95% HW Approx. Gamma UTL with 95% Coverage	145.5		
95% WH USL	59.27	95% HW USL	65.19

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.204	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	499	90% Percentile (z)	40.46
95% UPL (t)	105.6	95% Percentile (z)	65.32
95% USL	108.8	99% Percentile (z)	160.4

Nonparametric Distribution Free Background Statistics

Data appear Approximate Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	8	95% UTL with 95% Coverage	47
Approx, f used to compute achieved CC	0.421	Approximate Actual Confidence Coefficient achieved by UTL	0.337
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	47	95% BCA Bootstrap UTL with 95% Coverage	47
95% UPL	47	90% Percentile	27.61
90% Chebyshev UPL	61.88	95% Percentile	37.31
95% Chebyshev UPL	83.6	99% Percentile	45.06
95% USL	47		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_manganese_7439-96-5_t)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Minimum	7.5	First Quartile	11.28
Second Largest	47.2	Median	18.35
Maximum	58.4	Third Quartile	39.78
Mean	25.98	SD	19.25
Coefficient of Variation	0.741	Skewness	0.792
Mean of logged Data	3	SD of logged Data	0.781

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.187	d2max (for USL)	2.032

Normal GOF Test

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	87.34	90% Percentile (z)	50.65
95% UPL (t)	64.66	95% Percentile (z)	57.64
95% USL	65.09	99% Percentile (z)	70.77

Gamma GOF Test

A-D Test Statistic	0.336	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.161	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.094	k star (bias corrected MLE)	1.392
Theta hat (MLE)	12.4	Theta star (bias corrected MLE)	18.66
nu hat (MLE)	33.51	nu star (bias corrected)	22.28
MLE Mean (bias corrected)	25.98	MLE Sd (bias corrected)	22.01

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	77.78	90% Percentile	55.12
95% Hawkins Wixley (HW) Approx. Gamma UPL	81.05	95% Percentile	69.38
95% WH Approx. Gamma UTL with 95% Coverage	135	99% Percentile	101.7
95% HW Approx. Gamma UTL with 95% Coverage	149.6		
95% WH USL	78.67	95% HW USL	82.07

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.161	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

TABLE C.7
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	241.8	90% Percentile (z)	54.62
95% UPL (t)	96.41	95% Percentile (z)	72.53
95% USL	98.1	99% Percentile (z)	123.5

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	8	95% UTL with 95% Coverage	58.4
Approx, f used to compute achieved CC	0.421	Approximate Actual Confidence Coefficient achieved by UTL	0.337
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	58.4	95% BCA Bootstrap UTL with 95% Coverage	58.4
95% UPL	58.4	90% Percentile	50.56
90% Chebyshev UPL	87.24	95% Percentile	54.48
95% Chebyshev UPL	115	99% Percentile	57.62
95% USL	58.4		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_mercury_7439-97-6_d)

General Statistics

Total Number of Observations	10	Number of Missing Observations	0
Number of Distinct Observations	4		
Number of Detects	4	Number of Non-Detects	6
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	0.11	Minimum Non-Detect	0.042
Maximum Detect	0.27	Maximum Non-Detect	0.042
Variance Detected	0.00616	Percent Non-Detects	60%
Mean Detected	0.228	SD Detected	0.0785
Mean of Detected Logged Data	-1.543	SD of Detected Logged Data	0.443

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.674	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.411	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.116	KM SD	0.101
95% UTL95% Coverage	0.409	95% KM UPL (t)	0.309
90% KM Percentile (z)	0.245	95% KM Percentile (z)	0.282
99% KM Percentile (z)	0.35	95% KM USL	0.335

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.104	SD	0.116
95% UTL95% Coverage	0.441	95% UPL (t)	0.326
90% Percentile (z)	0.252	95% Percentile (z)	0.294
99% Percentile (z)	0.373	95% USL	0.356

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.872	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.658	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.443	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	8.144	k star (bias corrected MLE)	2.203
Theta hat (MLE)	0.0279	Theta star (bias corrected MLE)	0.103
nu hat (MLE)	65.15	nu star (bias corrected)	17.62
MLE Mean (bias corrected)	0.228		
MLE Sd (bias corrected)	0.153	95% Percentile of Chisquare (2kstar)	10.14

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.126
Maximum	0.27	Median	0.102
SD	0.103	CV	0.815
k hat (MLE)	1.283	k star (bias corrected MLE)	0.964
Theta hat (MLE)	0.0986	Theta star (bias corrected MLE)	0.131
nu hat (MLE)	25.65	nu star (bias corrected)	19.29
MLE Mean (bias corrected)	0.126	MLE Sd (bias corrected)	0.129
95% Percentile of Chisquare (2kstar)	5.853	90% Percentile	0.294
95% Percentile	0.384	99% Percentile	0.593

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.752	0.885	95% Approx. Gamma UPL	0.434	0.471
95% Gamma USL	0.504	0.559			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.116	SD (KM)	0.101
Variance (KM)	0.0101	SE of Mean (KM)	0.0367
k hat (KM)	1.336	k star (KM)	1.002
nu hat (KM)	26.72	nu star (KM)	20.04
theta hat (KM)	0.087	theta star (KM)	0.116
80% gamma percentile (KM)	0.187	90% gamma percentile (KM)	0.267
95% gamma percentile (KM)	0.348	99% gamma percentile (KM)	0.535

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

TABLE C.7
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.584	0.634	95% Approx. Gamma UPL	0.35	0.359
95% KM Gamma Percentile	0.298	0.302	95% Gamma USL	0.403	0.419

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.66	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.421	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.133	Mean in Log Scale	-2.251
SD in Original Scale	0.0951	SD in Log Scale	0.728
95% UTL95% Coverage	0.878	95% BCA UTL95% Coverage	0.27
95% Bootstrap (%) UTL95% Coverage	0.27	95% UPL (t)	0.427
90% Percentile (z)	0.268	95% Percentile (z)	0.349
99% Percentile (z)	0.573	95% USL	0.514

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-2.519	95% KM UTL (Lognormal)95% Coverage	0.91
KM SD of Logged Data	0.833	95% KM UPL (Lognormal)	0.399
95% KM Percentile Lognormal (z)	0.317	95% KM USL (Lognormal)	0.493

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.104	Mean in Log Scale	-2.935
SD in Original Scale	0.116	SD in Log Scale	1.225
95% UTL95% Coverage	1.879	95% UPL (t)	0.56
90% Percentile (z)	0.255	95% Percentile (z)	0.398
99% Percentile (z)	0.918	95% USL	0.764

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	10	95% UTL with95% Coverage	0.27
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.27
95% USL	0.27	95% KM Chebyshev UPL	0.576

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_mercury_7439-97-6_t)

General Statistics

Total Number of Observations	10	Number of Missing Observations	0
Number of Distinct Observations	3		
Number of Detects	3	Number of Non-Detects	7
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.25	Minimum Non-Detect	0.042
Maximum Detect	0.27	Maximum Non-Detect	0.042
Variance Detected	1.3333E-4	Percent Non-Detects	70%
Mean Detected	0.257	SD Detected	0.0115
Mean of Detected Logged Data	-1.361	SD of Detected Logged Data	0.0444

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.106	KM SD	0.0985
95% UTL95% Coverage	0.393	95% KM UPL (t)	0.296
90% KM Percentile (z)	0.233	95% KM Percentile (z)	0.268
99% KM Percentile (z)	0.336	95% KM USL	0.321

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.0917	SD	0.114
95% UTL95% Coverage	0.423	95% UPL (t)	0.311
90% Percentile (z)	0.238	95% Percentile (z)	0.279
99% Percentile (z)	0.357	95% USL	0.34

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	753.6	k star (bias corrected MLE)	N/A
Theta hat (MLE)	3.4059E-4	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	4522	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.184	Mean	0.225
Maximum	0.27	Median	0.223
SD	0.0266	CV	0.119

k hat (MLE)	79.13	k star (bias corrected MLE)	55.46
Theta hat (MLE)	0.00284	Theta star (bias corrected MLE)	0.00405
nu hat (MLE)	1583	nu star (bias corrected)	1109
MLE Mean (bias corrected)	0.225	MLE Sd (bias corrected)	0.0302
95% Percentile of Chisquare (2kstar)	136.5	90% Percentile	0.264
95% Percentile	0.276	99% Percentile	0.301

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.31	0.311	95% Approx. Gamma UPL	0.279	0.279
95% Gamma USL	0.287	0.287			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.106	SD (KM)	0.0985
Variance (KM)	0.0097	SE of Mean (KM)	0.0382
k hat (KM)	1.167	k star (KM)	0.883
nu hat (KM)	23.33	nu star (KM)	17.67
theta hat (KM)	0.0912	theta star (KM)	0.12
80% gamma percentile (KM)	0.173	90% gamma percentile (KM)	0.253
95% gamma percentile (KM)	0.333	99% gamma percentile (KM)	0.522

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.548	0.589	95% Approx. Gamma UPL	0.325	0.331
95% KM Gamma Percentile	0.276	0.277	95% Gamma USL	0.375	0.387

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.227	Mean in Log Scale	-1.486
SD in Original Scale	0.024	SD in Log Scale	0.105
95% UTL95% Coverage	0.307	95% BCA UTL95% Coverage	0.27
95% Bootstrap (%) UTL95% Coverage	0.27	95% UPL (t)	0.277
90% Percentile (z)	0.259	95% Percentile (z)	0.269
99% Percentile (z)	0.289	95% USL	0.284

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-2.627	95% KM UTL (Lognormal)95% Coverage	0.808
KM SD of Logged Data	0.829	95% KM UPL (Lognormal)	0.356
95% KM Percentile Lognormal (z)	0.283	95% KM USL (Lognormal)	0.439

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.0917	Mean in Log Scale	-3.112
SD in Original Scale	0.114	SD in Log Scale	1.209
95% UTL95% Coverage	1.502	95% UPL (t)	0.455
90% Percentile (z)	0.21	95% Percentile (z)	0.325
99% Percentile (z)	0.741	95% USL	0.618

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	10	95% UTL with95% Coverage	0.27
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.27
95% USL	0.27	95% KM Chebyshev UPL	0.557

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_nickel_7440-02-0_d)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	7		
Number of Detects	6	Number of Non-Detects	3
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.17	Minimum Non-Detect	0.13
Maximum Detect	0.37	Maximum Non-Detect	0.13
Variance Detected	0.00544	Percent Non-Detects	33.33%
Mean Detected	0.3	SD Detected	0.0738
Mean of Detected Logged Data	-1.235	SD of Detected Logged Data	0.288

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.243	KM SD	0.0972
95% UTL95% Coverage	0.538	95% KM UPL (t)	0.434
90% KM Percentile (z)	0.368	95% KM Percentile (z)	0.403
99% KM Percentile (z)	0.469	95% KM USL	0.448

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.222	SD	0.131
95% UTL95% Coverage	0.619	95% UPL (t)	0.479
90% Percentile (z)	0.39	95% Percentile (z)	0.437
99% Percentile (z)	0.527	95% USL	0.498

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

TABLE C.7
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.453	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.202	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	16.29	k star (bias corrected MLE)	8.258
Theta hat (MLE)	0.0184	Theta star (bias corrected MLE)	0.0363
nu hat (MLE)	195.5	nu star (bias corrected)	99.1
MLE Mean (bias corrected)	0.3		
MLE Sd (bias corrected)	0.104	95% Percentile of Chisquare (2kstar)	26.96

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.107	Mean	0.247
Maximum	0.37	Median	0.27
SD	0.0999	CV	0.405
k hat (MLE)	6.104	k star (bias corrected MLE)	4.143
Theta hat (MLE)	0.0405	Theta star (bias corrected MLE)	0.0596
nu hat (MLE)	109.9	nu star (bias corrected)	74.58
MLE Mean (bias corrected)	0.247	MLE Sd (bias corrected)	0.121
95% Percentile of Chisquare (2kstar)	15.91	90% Percentile	0.41
95% Percentile	0.474	99% Percentile	0.612

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.702	0.737	95% Approx. Gamma UPL	0.498	0.508
95% Gamma USL	0.523	0.536			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.243	SD (KM)	0.0972
Variance (KM)	0.00944	SE of Mean (KM)	0.0355
k hat (KM)	6.269	k star (KM)	4.254
nu hat (KM)	112.8	nu star (KM)	76.57
theta hat (KM)	0.0388	theta star (KM)	0.0572
80% gamma percentile (KM)	0.333	90% gamma percentile (KM)	0.401
95% gamma percentile (KM)	0.464	99% gamma percentile (KM)	0.598

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.674	0.704	95% Approx. Gamma UPL	0.48	0.489
95% KM Gamma Percentile	0.432	0.437	95% Gamma USL	0.505	0.516

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.838	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.25	Mean in Log Scale	-1.46
SD in Original Scale	0.0961	SD in Log Scale	0.415
95% UTL95% Coverage	0.818	95% BCA UTL95% Coverage	0.37
95% Bootstrap (%) UTL95% Coverage	0.37	95% UPL (t)	0.524
90% Percentile (z)	0.395	95% Percentile (z)	0.46
99% Percentile (z)	0.61	95% USL	0.558

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-1.503	95% KM UTL (Lognormal)95% Coverage	0.834
KM SD of Logged Data	0.436	95% KM UPL (Lognormal)	0.523
95% KM Percentile Lognormal (z)	0.456	95% KM USL (Lognormal)	0.558

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.222	Mean in Log Scale	-1.734
SD in Original Scale	0.131	SD in Log Scale	0.783
95% UTL95% Coverage	1.894	95% UPL (t)	0.819
90% Percentile (z)	0.481	95% Percentile (z)	0.64
99% Percentile (z)	1.091	95% USL	0.921

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	9	95% UTL with95% Coverage	0.37
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.37
95% USL	0.37	95% KM Chebyshev UPL	0.69

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_nickel_7440-02-0_t)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	6		
Number of Detects	6	Number of Non-Detects	3
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.26	Minimum Non-Detect	0.13
Maximum Detect	0.83	Maximum Non-Detect	0.13
Variance Detected	0.0688	Percent Non-Detects	33.33%
Mean Detected	0.523	SD Detected	0.262
Mean of Detected Logged Data	-0.758	SD of Detected Logged Data	0.519

TABLE C.7
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.836	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.392	KM SD	0.269
95% UTL95% Coverage	1.209	95% KM UPL (t)	0.92
90% KM Percentile (z)	0.738	95% KM Percentile (z)	0.835
99% KM Percentile (z)	1.019	95% KM USL	0.961

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.371	SD	0.309
95% UTL95% Coverage	1.307	95% UPL (t)	0.976
90% Percentile (z)	0.767	95% Percentile (z)	0.879
99% Percentile (z)	1.09	95% USL	1.023

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.498	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.699	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.262	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.692	k star (bias corrected MLE)	2.457
Theta hat (MLE)	0.112	Theta star (bias corrected MLE)	0.213
nu hat (MLE)	56.3	nu star (bias corrected)	29.48
MLE Mean (bias corrected)	0.523		
MLE Sd (bias corrected)	0.334	95% Percentile of Chisquare (2kstar)	10.94

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.36
Maximum	0.83	Median	0.3
SD	0.322	CV	0.895
k hat (MLE)	0.756	k star (bias corrected MLE)	0.578
Theta hat (MLE)	0.476	Theta star (bias corrected MLE)	0.622
nu hat (MLE)	13.61	nu star (bias corrected)	10.41
MLE Mean (bias corrected)	0.36	MLE Sd (bias corrected)	0.473
95% Percentile of Chisquare (2kstar)	4.216	90% Percentile	0.943
95% Percentile	1.312	99% Percentile	2.206

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	3.152	4.212	95% Approx. Gamma UPL	1.59	1.862
95% Gamma USL	1.766	2.109			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.392	SD (KM)	0.269
Variance (KM)	0.0726	SE of Mean (KM)	0.0984
k hat (KM)	2.118	k star (KM)	1.486
nu hat (KM)	38.13	nu star (KM)	26.76
theta hat (KM)	0.185	theta star (KM)	0.264
80% gamma percentile (KM)	0.607	90% gamma percentile (KM)	0.819
95% gamma percentile (KM)	1.025	99% gamma percentile (KM)	1.49

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	1.719	1.865	95% Approx. Gamma UPL	1.06	1.094
95% KM Gamma Percentile	0.904	0.921	95% Gamma USL	1.139	1.184

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.863	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.391	Mean in Log Scale	-1.209
SD in Original Scale	0.288	SD in Log Scale	0.808
95% UTL95% Coverage	3.454	95% BCA UTL95% Coverage	0.83
95% Bootstrap (%) UTL95% Coverage	0.83	95% UPL (t)	1.454
90% Percentile (z)	0.84	95% Percentile (z)	1.127
99% Percentile (z)	1.955	95% USL	1.641

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-1.185	95% KM UTL (Lognormal)95% Coverage	2.692
KM SD of Logged Data	0.718	95% KM UPL (Lognormal)	1.248
95% KM Percentile Lognormal (z)	0.995	95% KM USL (Lognormal)	1.389

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.371	Mean in Log Scale	-1.416
SD in Original Scale	0.309	SD in Log Scale	1.07
95% UTL95% Coverage	6.207	95% UPL (t)	1.974
90% Percentile (z)	0.955	95% Percentile (z)	1.409
99% Percentile (z)	2.921	95% USL	2.317

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	9	95% UTL with95% Coverage	0.83

Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.83
95% USL	0.83	95% KM Chebyshev UPL	1.63

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_potassium_7440-09-7_d)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Minimum	821	First Quartile	909
Second Largest	1050	Median	971
Maximum	1070	Third Quartile	1030
Mean	970.7	SD	81.28
Coefficient of Variation	0.0837	Skewness	-0.621
Mean of logged Data	6.875	SD of logged Data	0.0859

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with	95% Coverage	1217	90% Percentile (z)	1075
		1130	95% Percentile (z)	1104
	95% USL	1142	99% Percentile (z)	1160

Gamma GOF Test

A-D Test Statistic	0.298	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	155.2	k star (bias corrected MLE)	103.6
Theta hat (MLE)	6.253	Theta star (bias corrected MLE)	9.372
nu hat (MLE)	2794	nu star (bias corrected)	1864
MLE Mean (bias corrected)	970.7	MLE Sd (bias corrected)	95.38

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	1140	90% Percentile	1095
95% Hawkins Wixley (HW) Approx. Gamma UPL	1141	95% Percentile	1133
95% WH Approx. Gamma UTL with 95% Coverage	1241	99% Percentile	1206
95% HW Approx. Gamma UTL with 95% Coverage	1244		
95% WH USL	1153	95% HW USL	1155

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with	95% Coverage	1255	90% Percentile (z)	1080
	95% UPL (t)	1145	95% Percentile (z)	1114
	95% USL	1160	99% Percentile (z)	1182

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r		9	95% UTL with 95% Coverage	1070
Approx, f used to compute achieved CC		0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
			Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with	95% Coverage	1070	95% BCA Bootstrap UTL with 95% Coverage	1070
	95% UPL	1070	90% Percentile	1054
	90% Chebyshev UPL	1228	95% Percentile	1062
	95% Chebyshev UPL	1344	99% Percentile	1068
	95% USL	1070		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_potassium_7440-09-7_t)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Minimum	794	First Quartile	920
Second Largest	1060	Median	969
Maximum	1230	Third Quartile	1050
Mean	982.2	SD	124.2
Coefficient of Variation	0.126	Skewness	0.673
Mean of logged Data	6.883	SD of logged Data	0.124

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with	95% Coverage	1359	90% Percentile (z)	1141
	95% UPL (t)	1226	95% Percentile (z)	1186
	95% USL	1244	99% Percentile (z)	1271

Gamma GOF Test

A-D Test Statistic	0.187	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.132	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	72.27	k star (bias corrected MLE)	48.25
Theta hat (MLE)	13.59	Theta star (bias corrected MLE)	20.36
nu hat (MLE)	1301	nu star (bias corrected)	868.5
MLE Mean (bias corrected)	982.2	MLE Sd (bias corrected)	141.4

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	1237	90% Percentile	1167
95% Hawkins Wixley (HW) Approx. Gamma UPL	1239	95% Percentile	1226
95% WH Approx. Gamma UTL with 95% Coverage	1397	99% Percentile	1341
95% HW Approx. Gamma UTL with 95% Coverage	1403		
95% WH USL	1259	95% HW USL	1261

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.141	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with	95% Coverage	1422	90% Percentile (z)	1144
	95% UPL (t)	1245	95% Percentile (z)	1197
	95% USL	1268	99% Percentile (z)	1303

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r		9	95% UTL with 95% Coverage	1230
Approx, f used to compute achieved CC		0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
			Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with	95% Coverage	1230	95% BCA Bootstrap UTL with 95% Coverage	1230
	95% UPL	1230	90% Percentile	1094
	90% Chebyshev UPL	1375	95% Percentile	1162
	95% Chebyshev UPL	1553	99% Percentile	1216
	95% USL	1230		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_sodium_7440-23-5_d)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Minimum	4150	First Quartile	4300
Second Largest	4810	Median	4450
Maximum	5010	Third Quartile	4790
Mean	4533	SD	300.7
Coefficient of Variation	0.0663	Skewness	0.304
Mean of logged Data	8.417	SD of logged Data	0.066

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with	95% Coverage	5445	90% Percentile (z)	4919
	95% UPL (t)	5123	95% Percentile (z)	5028
	95% USL	5168	99% Percentile (z)	5233

Gamma GOF Test

A-D Test Statistic	0.387	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	257.7	k star (bias corrected MLE)	171.9
Theta hat (MLE)	17.59	Theta star (bias corrected MLE)	26.37
nu hat (MLE)	4639	nu star (bias corrected)	3094
MLE Mean (bias corrected)	4533	MLE Sd (bias corrected)	345.8

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	5140	90% Percentile	4982
95% Hawkins Wixley (HW) Approx. Gamma UPL	5142	95% Percentile	5117
95% WH Approx. Gamma UTL with 95% Coverage	5496	99% Percentile	5376
95% HW Approx. Gamma UTL with 95% Coverage	5504		
95% WH USL	5189	95% HW USL	5191

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk Lognormal GOF Test**

5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.181	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with	95% Coverage	5526	90% Percentile (z)	4924
	95% UPL (t)	5149	95% Percentile (z)	5043
	95% USL	5200	99% Percentile (z)	5275

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	9	95% UTL with	95% Coverage	5010
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL		0.37
		Approximate Sample Size needed to achieve specified CC		59
95% Percentile Bootstrap UTL with	95% Coverage	5010	95% BCA Bootstrap UTL with 95% Coverage	5010
	95% UPL	5010	90% Percentile	4850
	90% Chebyshev UPL	5484	95% Percentile	4930
	95% Chebyshev UPL	5915	99% Percentile	4994
	95% USL	5010		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_sodium_7440-23-5_t)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Minimum	4140	First Quartile	4290
Second Largest	4670	Median	4510
Maximum	4690	Third Quartile	4640
Mean	4461	SD	196.1
Coefficient of Variation	0.044	Skewness	-0.408
Mean of logged Data	8.402	SD of logged Data	0.0443

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.154	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with	95% Coverage	5056	90% Percentile (z)	4712
	95% UPL (t)	4846	95% Percentile (z)	4784
	95% USL	4875	99% Percentile (z)	4917

Gamma GOF Test

A-D Test Statistic	0.337	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.166	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	576	k star (bias corrected MLE)	384.1
Theta hat (MLE)	7.745	Theta star (bias corrected MLE)	11.61
nu hat (MLE)	10369	nu star (bias corrected)	6914
MLE Mean (bias corrected)	4461	MLE Sd (bias corrected)	227.6

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	4856	90% Percentile	4755
95% Hawkins Wixley (HW) Approx. Gamma UPL	4857	95% Percentile	4842
95% WH Approx. Gamma UTL with 95% Coverage	5083	99% Percentile	5008
95% HW Approx. Gamma UTL with 95% Coverage	5087		
95% WH USL	4887	95% HW USL	4889

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.16	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with	95% Coverage	5098	90% Percentile (z)	4718
	95% UPL (t)	4862	95% Percentile (z)	4794
	95% USL	4894	99% Percentile (z)	4941

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	9	95% UTL with	95% Coverage	4690
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL		0.37
		Approximate Sample Size needed to achieve specified CC		59
95% Percentile Bootstrap UTL with	95% Coverage	4690	95% BCA Bootstrap UTL with 95% Coverage	4690
	95% UPL	4690	90% Percentile	4674
	90% Chebyshev UPL	5081	95% Percentile	4682
	95% Chebyshev UPL	5362	99% Percentile	4688
	95% USL	4690		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_vanadium_7440-62-2_t)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	9
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	0.66
Maximum Detect	N/A	Maximum Non-Detect	0.66
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable result (ws_vanadium_7440-62-2_t) was not processed!

result (ws_zinc_7440-66-6_d)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	7		
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	1	Minimum Non-Detect	0.37
Maximum Detect	4	Maximum Non-Detect	0.37
Variance Detected	0.798	Percent Non-Detects	11.11%
Mean Detected	2.213	SD Detected	0.894
Mean of Detected Logged Data	0.722	SD of Detected Logged Data	0.414

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.921	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.249	Lilliefors GOF Test
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	2.008	KM SD	0.978
95% UTL95% Coverage	4.972	95% KM UPL (t)	3.925
90% KM Percentile (z)	3.261	95% KM Percentile (z)	3.616
99% KM Percentile (z)	4.283	95% KM USL	4.071

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	1.987	SD	1.075
95% UTL95% Coverage	5.245	95% UPL (t)	4.094
90% Percentile (z)	3.365	95% Percentile (z)	3.755
99% Percentile (z)	4.488	95% USL	4.255

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.303	Anderson-Darling GOF Test
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.073	k star (bias corrected MLE)	4.504
Theta hat (MLE)	0.313	Theta star (bias corrected MLE)	0.491
nu hat (MLE)	113.2	nu star (bias corrected)	72.06
MLE Mean (bias corrected)	2.213		
MLE Sd (bias corrected)	1.043	95% Percentile of Chisquare (2kstar)	16.93

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.481	Mean	2.02
Maximum	4	Median	2.2
SD	1.016	CV	0.503
k hat (MLE)	3.657	k star (bias corrected MLE)	2.512
Theta hat (MLE)	0.552	Theta star (bias corrected MLE)	0.804
nu hat (MLE)	65.83	nu star (bias corrected)	45.22
MLE Mean (bias corrected)	2.02	MLE Sd (bias corrected)	1.275
95% Percentile of Chisquare (2kstar)	11.11	90% Percentile	3.728
95% Percentile	4.466	99% Percentile	6.083

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	7.229	7.857	95% Approx. Gamma UPL	4.776	4.973
95% Gamma USL	5.078	5.318			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.008	SD (KM)	0.978
Variance (KM)	0.956	SE of Mean (KM)	0.348
k hat (KM)	4.216	k star (KM)	2.884
nu hat (KM)	75.88	nu star (KM)	51.92
theta hat (KM)	0.476	theta star (KM)	0.696
80% gamma percentile (KM)	2.877	90% gamma percentile (KM)	3.593
95% gamma percentile (KM)	4.262	99% gamma percentile (KM)	5.714

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	7.21	7.91	95% Approx. Gamma UPL	4.744	4.969
95% KM Gamma Percentile	4.144	4.287	95% Gamma USL	5.048	5.32

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	2.051	Mean in Log Scale	0.611
SD in Original Scale	0.966	SD in Log Scale	0.51
95% UTL95% Coverage	8.651	95% BCA UTL95% Coverage	4
95% Bootstrap (%) UTL95% Coverage	4	95% UPL (t)	5.009
90% Percentile (z)	3.543	95% Percentile (z)	4.265
99% Percentile (z)	6.039	95% USL	5.406

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	0.531	95% KM UTL (Lognormal)95% Coverage	12.25
KM SD of Logged Data	0.651	95% KM UPL (Lognormal)	6.098
95% KM Percentile Lognormal (z)	4.966	95% KM USL (Lognormal)	6.722

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	1.987	Mean in Log Scale	0.454
SD in Original Scale	1.075	SD in Log Scale	0.892
95% UTL95% Coverage	23.5	95% UPL (t)	9.043
90% Percentile (z)	4.937	95% Percentile (z)	6.826
99% Percentile (z)	12.53	95% USL	10.33

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	9	95% UTL with95% Coverage	4
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
Approximate Sample Size needed to achieve specified CC	59	95% UPL	4
95% USL	4	95% KM Chebyshev UPL	6.501

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

result (ws_zinc_7440-66-6_t)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
Minimum	1.9	First Quartile	2.2
Second Largest	5.8	Median	3
Maximum	7.6	Third Quartile	4.4
Mean	3.722	SD	1.98
Coefficient of Variation	0.532	Skewness	1.024
Mean of logged Data	1.197	SD of logged Data	0.506

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	9.725	90% Percentile (z)	6.26
95% UPL (t)	7.604	95% Percentile (z)	6.98
95% USL	7.9	99% Percentile (z)	8.329

Gamma GOF Test

A-D Test Statistic	0.402	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.201	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.42	k star (bias corrected MLE)	3.02
Theta hat (MLE)	0.842	Theta star (bias corrected MLE)	1.232
nu hat (MLE)	79.55	nu star (bias corrected)	54.37
MLE Mean (bias corrected)	3.722	MLE Sd (bias corrected)	2.142

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	8.259	90% Percentile	6.594
95% Hawkins Wixley (HW) Approx. Gamma UPL	8.395	95% Percentile	7.796
95% WH Approx. Gamma UTL with 95% Coverage	12.18	99% Percentile	10.4
95% HW Approx. Gamma UTL with 95% Coverage	12.76		
95% WH USL	8.747	95% HW USL	8.924

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.182	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	15.36	90% Percentile (z)	6.334
95% UPL (t)	8.93	95% Percentile (z)	7.613
95% USL	9.632	99% Percentile (z)	10.75

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	9	95% UTL with 95% Coverage	7.6

TABLE C.7
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SURFACE WATER
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Approx, f used to compute achieved CC		0.474	Approximate Actual Confidence Coefficient achieved by UTL		0.37
			Approximate Sample Size needed to achieve specified CC		59
95% Percentile Bootstrap UTL with	95% Coverage	7.6	95% BCA Bootstrap UTL with	95% Coverage	7.6
	95% UPL	7.6		90% Percentile	6.16
	90% Chebyshev UPL	9.985		95% Percentile	6.88
	95% Chebyshev UPL	12.82		99% Percentile	7.456
	95% USL	7.6			

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

TABLE C.8
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SEDIMENT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Background Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.14/25/2018 4:23:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
Different or Future K Observations	1
Number of Bootstrap Operations	2000

result (se_arsenic_7440-38-2_t)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
Minimum	0.81	First Quartile	0.943
Second Largest	2	Median	1.25
Maximum	2.8	Third Quartile	1.75
Mean	1.412	SD	0.638
Coefficient of Variation	0.452	Skewness	1.275
Mean of logged Data	0.264	SD of logged Data	0.413

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	3.269	90% Percentile (z)	2.23
95% UPL (t)	2.639	95% Percentile (z)	2.461
95% USL	2.8	99% Percentile (z)	2.896

Gamma GOF Test

A-D Test Statistic	0.419	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.229	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.344	k star (bias corrected MLE)	4.507
Theta hat (MLE)	0.223	Theta star (bias corrected MLE)	0.313
nu hat (MLE)	126.9	nu star (bias corrected)	90.15
MLE Mean (bias corrected)	1.412	MLE Sd (bias corrected)	0.665

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	2.76	90% Percentile	2.303
95% Hawkins Wixley (HW) Approx. Gamma UPL	2.785	95% Percentile	2.653
95% WH Approx. Gamma UTL with 95% Coverage	3.778	99% Percentile	3.397
95% HW Approx. Gamma UTL with 95% Coverage	3.886		
95% WH USL	3.001	95% HW USL	3.041

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	4.329	90% Percentile (z)	2.21
95% UPL (t)	2.879	95% Percentile (z)	2.567
95% USL	3.196	99% Percentile (z)	3.401

Data appear Approximate Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	2.8
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	2.8	95% BCA Bootstrap UTL with 95% Coverage	2.8
95% UPL	2.8	90% Percentile	2.08
90% Chebyshev UPL	3.419	95% Percentile	2.44
95% Chebyshev UPL	4.329	99% Percentile	2.728
95% USL	2.8		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_barium_7440-39-3_t)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Minimum	10.9	First Quartile	13.9
Second Largest	20.9	Median	16.3
Maximum	28.3	Third Quartile	19.43
Mean	17.09	SD	5.079
Coefficient of Variation	0.297	Skewness	1.133
Mean of logged Data	2.802	SD of logged Data	0.281

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	31.88	90% Percentile (z)	23.6
95% UPL (t)	26.86	95% Percentile (z)	25.44
95% USL	28.14	99% Percentile (z)	28.91

Gamma GOF Test

A-D Test Statistic	0.178	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.113	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.81	k star (bias corrected MLE)	9.733
Theta hat (MLE)	1.238	Theta star (bias corrected MLE)	1.756
nu hat (MLE)	276.2	nu star (bias corrected)	194.7
MLE Mean (bias corrected)	17.09	MLE Sd (bias corrected)	5.478

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	27.63	90% Percentile	24.38
95% Hawkins Wixley (HW) Approx. Gamma UPL	27.77	95% Percentile	26.98
95% WH Approx. Gamma UTL with 95% Coverage	34.77	99% Percentile	32.34
95% HW Approx. Gamma UTL with 95% Coverage	35.31		
95% WH USL	29.35	95% HW USL	29.58

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0993	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	37.35	90% Percentile (z)	23.62
95% UPL (t)	28.29	95% Percentile (z)	26.16
95% USL	30.37	99% Percentile (z)	31.69

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	28.3
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	28.3	95% BCA Bootstrap UTL with 95% Coverage	28.3
95% UPL	28.3	90% Percentile	21.64
90% Chebyshev UPL	33.07	95% Percentile	24.97
95% Chebyshev UPL	40.31	99% Percentile	27.63
95% USL	28.3		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_beryllium_7440-41-7_t)

General Statistics

Total Number of Observations	10	Number of Missing Observations	0
Number of Distinct Observations	9		
Number of Detects	8	Number of Non-Detects	2
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	0.28	Minimum Non-Detect	0.098
Maximum Detect	1.3	Maximum Non-Detect	0.098
Variance Detected	0.122	Percent Non-Detects	20%
Mean Detected	0.72	SD Detected	0.35
Mean of Detected Logged Data	-0.447	SD of Detected Logged Data	0.543

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.119	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.596	KM SD	0.384
95% UTL95% Coverage	1.714	95% KM UPL (t)	1.334
90% KM Percentile (z)	1.088	95% KM Percentile (z)	1.228
99% KM Percentile (z)	1.489	95% KM USL	1.432

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.586	SD	0.419
95% UTL95% Coverage	1.805	95% UPL (t)	1.391
90% Percentile (z)	1.122	95% Percentile (z)	1.274
99% Percentile (z)	1.56	95% USL	1.497

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.23	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.169	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.369	k star (bias corrected MLE)	2.814
Theta hat (MLE)	0.165	Theta star (bias corrected MLE)	0.256
nu hat (MLE)	69.9	nu star (bias corrected)	45.02
MLE Mean (bias corrected)	0.72		

MLE Sd (bias corrected)	0.429	95% Percentile of Chisquare (2kstar)	12.03

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.587
Maximum	1.3	Median	0.57
SD	0.417	CV	0.71
k hat (MLE)	1.112	k star (bias corrected MLE)	0.845
Theta hat (MLE)	0.528	Theta star (bias corrected MLE)	0.695
nu hat (MLE)	22.24	nu star (bias corrected)	16.9
MLE Mean (bias corrected)	0.587	MLE Sd (bias corrected)	0.639
95% Percentile of Chisquare (2kstar)	5.377	90% Percentile	1.409
95% Percentile	1.868	99% Percentile	2.947

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	3.71	4.721	95% Approx. Gamma UPL	2.112	2.429
95% Gamma USL	2.466	2.911			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.596	SD (KM)	0.384
Variance (KM)	0.148	SE of Mean (KM)	0.13
k hat (KM)	2.403	k star (KM)	1.749
nu hat (KM)	48.06	nu star (KM)	34.98
theta hat (KM)	0.248	theta star (KM)	0.341
80% gamma percentile (KM)	0.906	90% gamma percentile (KM)	1.196
95% gamma percentile (KM)	1.475	99% gamma percentile (KM)	2.099

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	2.739	3.091	95% Approx. Gamma UPL	1.697	1.802
95% KM Gamma Percentile	1.461	1.526	95% Gamma USL	1.933	2.084

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.177	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.611	Mean in Log Scale	-0.712
SD in Original Scale	0.386	SD in Log Scale	0.739
95% UTL95% Coverage	4.217	95% BCA UTL95% Coverage	1.3
95% Bootstrap (%) UTL95% Coverage	1.3	95% UPL (t)	2.031
90% Percentile (z)	1.265	95% Percentile (z)	1.655
99% Percentile (z)	2.738	95% USL	2.45

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-0.822	95% KM UTL (Lognormal)95% Coverage	5.646
KM SD of Logged Data	0.877	95% KM UPL (Lognormal)	2.372
95% KM Percentile Lognormal (z)	1.86	95% KM USL (Lognormal)	2.963

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.586	Mean in Log Scale	-0.961
SD in Original Scale	0.419	SD in Log Scale	1.184
95% UTL95% Coverage	12.02	95% UPL (t)	3.728
90% Percentile (z)	1.745	95% Percentile (z)	2.683
99% Percentile (z)	6.013	95% USL	5.033

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	10	95% UTL with95% Coverage	1.3
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
Approximate Sample Size needed to achieve specified CC	59	95% UPL	1.3
95% USL	1.3	95% KM Chebyshev UPL	2.352

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_cadmium_7440-43-9_t)

General Statistics

Total Number of Observations	10	Number of Missing Observations	0
Number of Distinct Observations	7		
Number of Detects	7	Number of Non-Detects	3
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.089	Minimum Non-Detect	0.074
Maximum Detect	0.21	Maximum Non-Detect	0.074
Variance Detected	0.00198	Percent Non-Detects	30%
Mean Detected	0.141	SD Detected	0.0445
Mean of Detected Logged Data	-2.001	SD of Detected Logged Data	0.32

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.121	KM SD	0.0462

95% UTL95% Coverage	0.255	95% KM UPL (t)	0.21
90% KM Percentile (z)	0.18	95% KM Percentile (z)	0.197
99% KM Percentile (z)	0.228	95% KM USL	0.222

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.11	SD	0.062
95% UTL95% Coverage	0.291	95% UPL (t)	0.229
90% Percentile (z)	0.189	95% Percentile (z)	0.212
99% Percentile (z)	0.254	95% USL	0.245

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.303	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.203	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	11.68	k star (bias corrected MLE)	6.772
Theta hat (MLE)	0.0121	Theta star (bias corrected MLE)	0.0208
nu hat (MLE)	163.6	nu star (bias corrected)	94.81
MLE Mean (bias corrected)	0.141		
MLE Sd (bias corrected)	0.0542	95% Percentile of Chisquare (2kstar)	23.08

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0223	Mean	0.111
Maximum	0.21	Median	0.105
SD	0.0608	CV	0.547
k hat (MLE)	2.906	k star (bias corrected MLE)	2.101
Theta hat (MLE)	0.0383	Theta star (bias corrected MLE)	0.053
nu hat (MLE)	58.12	nu star (bias corrected)	42.02
MLE Mean (bias corrected)	0.111	MLE Sd (bias corrected)	0.0768
95% Percentile of Chisquare (2kstar)	9.813	90% Percentile	0.214
95% Percentile	0.26	99% Percentile	0.362

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.424	0.465	95% Approx. Gamma UPL	0.279	0.292
95% Gamma USL	0.313	0.331			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.121	SD (KM)	0.0462
Variance (KM)	0.00213	SE of Mean (KM)	0.0158
k hat (KM)	6.861	k star (KM)	4.869
nu hat (KM)	137.2	nu star (KM)	97.38
theta hat (KM)	0.0176	theta star (KM)	0.0248
80% gamma percentile (KM)	0.163	90% gamma percentile (KM)	0.194
95% gamma percentile (KM)	0.223	99% gamma percentile (KM)	0.283

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.294	0.302	95% Approx. Gamma UPL	0.221	0.223
95% KM Gamma Percentile	0.203	0.204	95% Gamma USL	0.238	0.241

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.117	Mean in Log Scale	-2.25
SD in Original Scale	0.0538	SD in Log Scale	0.486
95% UTL95% Coverage	0.433	95% BCA UTL95% Coverage	0.21
95% Bootstrap (%) UTL95% Coverage	0.21	95% UPL (t)	0.268
90% Percentile (z)	0.196	95% Percentile (z)	0.234
99% Percentile (z)	0.326	95% USL	0.303

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-2.182	95% KM UTL (Lognormal)95% Coverage	0.332
KM SD of Logged Data	0.371	95% KM UPL (Lognormal)	0.23
95% KM Percentile Lognormal (z)	0.208	95% KM USL (Lognormal)	0.253

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.11	Mean in Log Scale	-2.39
SD in Original Scale	0.062	SD in Log Scale	0.678
95% UTL95% Coverage	0.66	95% UPL (t)	0.337
90% Percentile (z)	0.219	95% Percentile (z)	0.28
99% Percentile (z)	0.444	95% USL	0.401

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	10	95% UTL with95% Coverage	0.21
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.21
95% USL	0.21	95% KM Chebyshev UPL	0.332

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_carbon disulfide_75-15-0_t)

General Statistics

Total Number of Observations	8	Number of Missing Observations	0
Number of Distinct Observations	6		
Number of Detects	0	Number of Non-Detects	8
Number of Distinct Detects	0	Number of Distinct Non-Detects	6
Minimum Detect	N/A	Minimum Non-Detect	3.2000E-4
Maximum Detect	N/A	Maximum Non-Detect	3.8000E-4
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable result (se_carbon disulfide_75-15-0_t) was not processed!

result (se_chromium (total)_7440-47-3_t)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	8
Minimum	1.2	First Quartile	1.35
Second Largest	5.2	Median	2.85
Maximum	5.9	Third Quartile	4.7
Mean	3.1	SD	1.795
Coefficient of Variation	0.579	Skewness	0.375
Mean of logged Data	0.96	SD of logged Data	0.639

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.889	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	8.325	90% Percentile (z)	5.4
95% UPL (t)	6.551	95% Percentile (z)	6.053
95% USL	7.006	99% Percentile (z)	7.276

Gamma GOF Test

A-D Test Statistic	0.483	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.191	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.069	k star (bias corrected MLE)	2.215
Theta hat (MLE)	1.01	Theta star (bias corrected MLE)	1.4
nu hat (MLE)	61.38	nu star (bias corrected)	44.3
MLE Mean (bias corrected)	3.1	MLE Sd (bias corrected)	2.083

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	7.63	90% Percentile	5.887
95% Hawkins Wixley (HW) Approx. Gamma UPL	7.872	95% Percentile	7.122
95% WH Approx. Gamma UTL with 95% Coverage	11.52	99% Percentile	9.844
95% HW Approx. Gamma UTL with 95% Coverage	12.36		
95% WH USL	8.527	95% HW USL	8.882

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	16.75	90% Percentile (z)	5.918
95% UPL (t)	8.912	95% Percentile (z)	7.463
95% USL	10.48	99% Percentile (z)	11.53

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	5.9
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	5.9	95% BCA Bootstrap UTL with 95% Coverage	5.9
95% UPL	5.9	90% Percentile	5.27
90% Chebyshev UPL	8.748	95% Percentile	5.585
95% Chebyshev UPL	11.31	99% Percentile	5.837
95% USL	5.9		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_cobalt_7440-48-4_t)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
Minimum	0.96	First Quartile	1.9
Second Largest	3.3	Median	2.25
Maximum	3.6	Third Quartile	2.9
Mean	2.276	SD	0.889
Coefficient of Variation	0.391	Skewness	-0.13

Mean of logged Data	0.739	SD of logged Data	0.456

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.136	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	4.865	90% Percentile (z)	3.416
95% UPL (t)	3.986	95% Percentile (z)	3.739
95% USL	4.211	99% Percentile (z)	4.345

Gamma GOF Test

A-D Test Statistic	0.364	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.183	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.15	k star (bias corrected MLE)	4.372
Theta hat (MLE)	0.37	Theta star (bias corrected MLE)	0.521
nu hat (MLE)	123	nu star (bias corrected)	87.44
MLE Mean (bias corrected)	2.276	MLE Sd (bias corrected)	1.089

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	4.497	90% Percentile	3.734
95% Hawkins Wixley (HW) Approx. Gamma UPL	4.602	95% Percentile	4.31
95% WH Approx. Gamma UTL with 95% Coverage	6.177	99% Percentile	5.535
95% HW Approx. Gamma UTL with 95% Coverage	6.485		
95% WH USL	4.894	95% HW USL	5.04

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	7.888	90% Percentile (z)	3.754
95% UPL (t)	5.028	95% Percentile (z)	4.43
95% USL	5.643	99% Percentile (z)	6.043

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	3.6
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	3.6	95% BCA Bootstrap UTL with 95% Coverage	3.6
95% UPL	3.6	90% Percentile	3.33
90% Chebyshev UPL	5.075	95% Percentile	3.465
95% Chebyshev UPL	6.342	99% Percentile	3.573
95% USL	3.6		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_copper_7440-50-8_t)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
Minimum	0.98	First Quartile	1.375
Second Largest	6.2	Median	4.2
Maximum	9.3	Third Quartile	6.05
Mean	4.068	SD	2.822
Coefficient of Variation	0.694	Skewness	0.461
Mean of logged Data	1.126	SD of logged Data	0.838

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.209	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	12.28	90% Percentile (z)	7.684
95% UPL (t)	9.493	95% Percentile (z)	8.709
95% USL	10.21	99% Percentile (z)	10.63

Gamma GOF Test

A-D Test Statistic	0.539	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.209	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.27	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.954	k star (bias corrected MLE)	1.434
Theta hat (MLE)	2.082	Theta star (bias corrected MLE)	2.836
nu hat (MLE)	39.07	nu star (bias corrected)	28.68
MLE Mean (bias corrected)	4.068	MLE Sd (bias corrected)	3.397

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	11.83	90% Percentile	8.57
95% Hawkins Wixley (HW) Approx. Gamma UPL	12.44	95% Percentile	10.76
95% WH Approx. Gamma UTL with 95% Coverage	19.16	99% Percentile	15.71
95% HW Approx. Gamma UTL with 95% Coverage	21.34		
95% WH USL	13.49	95% HW USL	14.39

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.201	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	35.37	90% Percentile (z)	9.026
95% UPL (t)	15.45	95% Percentile (z)	12.24
95% USL	19.1	99% Percentile (z)	21.67

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	9.3
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	9.3	95% BCA Bootstrap UTL with 95% Coverage	9.3
95% UPL	9.3	90% Percentile	6.51
90% Chebyshev UPL	12.95	95% Percentile	7.905
95% Chebyshev UPL	16.97	99% Percentile	9.021
95% USL	9.3		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_cyanide_57-12-5_t)

General Statistics

Total Number of Observations	9	Number of Missing Observations	0
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	9
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	0.098
Maximum Detect	N/A	Maximum Non-Detect	0.098
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable result (se_cyanide_57-12-5_t) was not processed!

result (se_lead_7439-92-1_t)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
Minimum	2.7	First Quartile	4
Second Largest	7.6	Median	4.9
Maximum	8.2	Third Quartile	7
Mean	5.489	SD	1.947
Coefficient of Variation	0.355	Skewness	0.0686
Mean of logged Data	1.642	SD of logged Data	0.379

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.031	d2max (for USL)	2.11

Normal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	11.39	90% Percentile (z)	7.984
95% UPL (t)	9.305	95% Percentile (z)	8.692
95% USL	9.596	99% Percentile (z)	10.02

Gamma GOF Test

A-D Test Statistic	0.338	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.22	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.371	k star (bias corrected MLE)	5.655
Theta hat (MLE)	0.656	Theta star (bias corrected MLE)	0.971
nu hat (MLE)	150.7	nu star (bias corrected)	101.8
MLE Mean (bias corrected)	5.489	MLE Sd (bias corrected)	2.308

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	10.13	90% Percentile	8.576
95% Hawkins Wixley (HW) Approx. Gamma UPL	10.28	95% Percentile	9.753
95% WH Approx. Gamma UTL with 95% Coverage	13.73	99% Percentile	12.22
95% HW Approx. Gamma UTL with 95% Coverage	14.23		
95% WH USL	10.59	95% HW USL	10.78

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.21	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	16.3	90% Percentile (z)	8.396
95% UPL (t)	10.86	95% Percentile (z)	9.635
95% USL	11.49	99% Percentile (z)	12.48

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	9	95% UTL with 95% Coverage	8.2
Approx, f used to compute achieved CC	0.474	Approximate Actual Confidence Coefficient achieved by UTL	0.37
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	8.2	95% BCA Bootstrap UTL with 95% Coverage	8.2
95% UPL	8.2	90% Percentile	7.72
90% Chebyshev UPL	11.65	95% Percentile	7.96
95% Chebyshev UPL	14.44	99% Percentile	8.152
95% USL	8.2		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_manganese_7439-96-5_t)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Minimum	31.4	First Quartile	57.63
Second Largest	225	Median	97.45
Maximum	293	Third Quartile	203
Mean	131.8	SD	90.11
Coefficient of Variation	0.684	Skewness	0.629
Mean of logged Data	4.645	SD of logged Data	0.751

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	394.1	90% Percentile (z)	247.2
95% UPL (t)	305	95% Percentile (z)	280
95% USL	327.8	99% Percentile (z)	341.4

Gamma GOF Test

A-D Test Statistic	0.394	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.199	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.269	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.267	k star (bias corrected MLE)	1.654
Theta hat (MLE)	58.12	Theta star (bias corrected MLE)	79.68
nu hat (MLE)	45.34	nu star (bias corrected)	33.07
MLE Mean (bias corrected)	131.8	MLE Sd (bias corrected)	102.5

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	361.3	90% Percentile	268.1
95% Hawkins Wixley (HW) Approx. Gamma UPL	375.3	95% Percentile	332.3
95% WH Approx. Gamma UTL with 95% Coverage	571.4	99% Percentile	476.3
95% HW Approx. Gamma UTL with 95% Coverage	623.2		
95% WH USL	409.2	95% HW USL	430.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.197	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	924.9	90% Percentile (z)	272.2
95% UPL (t)	440.4	95% Percentile (z)	357.5
95% USL	532.7	99% Percentile (z)	596.4

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	293
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	293	95% BCA Bootstrap UTL with 95% Coverage	293
95% UPL	293	90% Percentile	231.8
90% Chebyshev UPL	415.3	95% Percentile	262.4
95% Chebyshev UPL	543.7	99% Percentile	286.9
95% USL	293		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_nickel_7440-02-0_t)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Minimum	0.6	First Quartile	0.985
Second Largest	3	Median	2.25
Maximum	3.2	Third Quartile	2.575
Mean	1.92	SD	0.987
Coefficient of Variation	0.514	Skewness	-0.271
Mean of logged Data	0.49	SD of logged Data	0.65

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	4.793	90% Percentile (z)	3.185
95% UPL (t)	3.817	95% Percentile (z)	3.543
95% USL	4.067	99% Percentile (z)	4.216

Gamma GOF Test

A-D Test Statistic	0.636	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.231	k star (bias corrected MLE)	2.328
Theta hat (MLE)	0.594	Theta star (bias corrected MLE)	0.825
nu hat (MLE)	64.62	nu star (bias corrected)	46.57
MLE Mean (bias corrected)	1.92	MLE Sd (bias corrected)	1.258

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	4.65	90% Percentile	3.605
95% Hawkins Wixley (HW) Approx. Gamma UPL	4.841	95% Percentile	4.344
95% WH Approx. Gamma UTL with 95% Coverage	6.963	99% Percentile	5.969
95% HW Approx. Gamma UTL with 95% Coverage	7.56		
95% WH USL	5.184	95% HW USL	5.454

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.848	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	10.83	90% Percentile (z)	3.755
95% UPL (t)	5.697	95% Percentile (z)	4.756
95% USL	6.718	99% Percentile (z)	7.408

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	3.2
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	3.2	95% BCA Bootstrap UTL with 95% Coverage	3.2
95% UPL	3.2	90% Percentile	3.02
90% Chebyshev UPL	5.025	95% Percentile	3.11
95% Chebyshev UPL	6.432	99% Percentile	3.182
95% USL	3.2		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_vanadium_7440-62-2_t)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
Minimum	3.5	First Quartile	4.675
Second Largest	15.5	Median	8.6
Maximum	16.2	Third Quartile	12.05
Mean	8.89	SD	4.659
Coefficient of Variation	0.524	Skewness	0.511
Mean of logged Data	2.053	SD of logged Data	0.551

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	22.45	90% Percentile (z)	14.86
95% UPL (t)	17.85	95% Percentile (z)	16.55
95% USL	19.03	99% Percentile (z)	19.73

Gamma GOF Test

A-D Test Statistic	0.363	**Anderson-Darling Gamma GOF Test**

5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.161	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.958	k star (bias corrected MLE)	2.837
Theta hat (MLE)	2.246	Theta star (bias corrected MLE)	3.134
nu hat (MLE)	79.15	nu star (bias corrected)	56.74
MLE Mean (bias corrected)	8.89	MLE Sd (bias corrected)	5.278

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	20.07	90% Percentile	15.97
95% Hawkins Wixley (HW) Approx. Gamma UPL	20.55	95% Percentile	18.96
95% WH Approx. Gamma UTL with 95% Coverage	29.22	99% Percentile	25.47
95% HW Approx. Gamma UTL with 95% Coverage	30.88		
95% WH USL	22.2	95% HW USL	22.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.15	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	38.78	90% Percentile (z)	15.8
95% UPL (t)	22.49	95% Percentile (z)	19.3
95% USL	25.87	99% Percentile (z)	28.1

Nonparametric Distribution Free Background Statistics

Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	16.2
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	16.2	95% BCA Bootstrap UTL with 95% Coverage	16.2
95% UPL	16.2	90% Percentile	15.57
90% Chebyshev UPL	23.55	95% Percentile	15.89
95% Chebyshev UPL	30.19	99% Percentile	16.14
95% USL	16.2		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

result (se_zinc_7440-66-6_t)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Minimum	11.7	First Quartile	15.6
Second Largest	23.4	Median	17.5
Maximum	25.1	Third Quartile	19.3
Mean	17.93	SD	4.007
Coefficient of Variation	0.223	Skewness	0.506
Mean of logged Data	2.864	SD of logged Data	0.223

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	29.59	90% Percentile (z)	23.06
95% UPL (t)	25.63	95% Percentile (z)	24.52
95% USL	26.65	99% Percentile (z)	27.25

Gamma GOF Test

A-D Test Statistic	0.213	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.154	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	22.55	k star (bias corrected MLE)	15.85
Theta hat (MLE)	0.795	Theta star (bias corrected MLE)	1.131
nu hat (MLE)	450.9	nu star (bias corrected)	317
MLE Mean (bias corrected)	17.93	MLE Sd (bias corrected)	4.504

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	26.38	90% Percentile	23.89
95% Hawkins Wixley (HW) Approx. Gamma UPL	26.5	95% Percentile	25.92
95% WH Approx. Gamma UTL with 95% Coverage	31.8	99% Percentile	30.03
95% HW Approx. Gamma UTL with 95% Coverage	32.19		
95% WH USL	27.71	95% HW USL	27.88

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.143	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	33.59	90% Percentile (z)	23.34
	26.94	95% Percentile (z)	25.32
95% USL	28.51	99% Percentile (z)	29.48

TABLE C.8
PROUCL OUTPUT OF BACKGROUND THRESHOLD VALUES FOR SEDIMENT
COMBE FILL SOUTH LANDFILL SITE OPERABLE UNIT 2
CHESTER AND WASHINGTON TOWNSHIPS, NJ

Nonparametric Distribution Free Background Statistics
Data appear Normal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	10	95% UTL with 95% Coverage	25.1
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	25.1	95% BCA Bootstrap UTL with 95% Coverage	25.1
95% UPL	25.1	90% Percentile	23.57
90% Chebyshev UPL	30.54	95% Percentile	24.34
95% Chebyshev UPL	36.25	99% Percentile	24.95
95% USL	25.1		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
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and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Attachment D

TSCA Work Plan Chemical Problem Formulation and Initial Assessment
1,4-Dioxane, CASRN: 123-91-1
EPA Document # 740-R1-5003
Office of Chemical Safety and Pollution Prevention
April 2015 Final

Available online: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPPT-2015-0078-0002

Tables D.1 and D.2 attached.

Table D-1: Aquatic Toxicity Data for 1,4-Dioxane - Acute Toxicity.

Test Species	Fresh/ Salt Water	Duration	End-point	Conc. (mg/L)	Test Analysis	Effect	References
Fish							
Bluegill sunfish (*Lepomis macrochirus*)	Fresh	96-hour	LC_{50}	>1,000	Nominal	Mortality	Dawson et al. (1977) as cited in Verschueren, (2010)
Fathead minnow (*Pimphales promelas*)	Fresh	96-hour	LC_{50}	1,080 to 9,850	Measured	Mortality	Geiger, et al. (1990)
Fathead minnow (*Pimphales promelas*)	Fresh	96-hour	LC_{50}	9,872	Measured	Mortality	Brooke (1987)
Fathead minnow (*Pimphales promelas*)	Fresh	96-hour	LC_{50}	12,326	Nominal	Mortality	Brooke (1987)
Fathead minnow (*Pimphales promelas*)	Fresh	96-hour	LC_{50}	>100	Nominal	Mortality	Dow (1991) as cited in the EU RAR (2002)
Inland Silversides (*Menidia beryllina*)	Salt	96-hour	LC_{50}	67,000	Nominal	Mortality	Dawson et al. (1977)
Aquatic Invertebrates							
Water flea (*Daphnia magna*)	Fresh	48-hour	EC_{50}	>1,000	Nominal	Immobilization	ECHA Assessment Report (2014)
Water flea (*Ceridodaphnia dubia*)	Fresh	48-hour	EC_{50}	>299	Nominal	Immobilization	Dow (1989) as cited in the 2002 EU RAR

Table D-2: Aquatic Toxicity Data for 1,4-Dioxane - Chronic Toxicity.

Test Species	Fresh/ Salt Water	Duration	End-point	Conc. (mg/L)	Test Analysis	Effect	References
Aquatic Plants							
Green algae (*Pseudokirchnerella subcapitata*)	Fresh	72-hour	EC_{50}	580	unspecified	growth	ECHA Assessment Report, 2014
				1,000		biomass	
Aquatic Invertebrates							
Water flea (*Daphnia magna*)	Fresh	21-day	NOEC	>1,000	Unspecified	Reproduction	ECHA Assessment Report, 2014
Fish							
Medaka (*Oryzias latipes*)	Fresh	28-day	NOEC	565	Measured	Not Reported	Johnson et al. (1993) as cited in EPA's Ecotox Database, 2014
Fathead minnow (*Pimphales promelas*)	Fresh	32-day	MATC	145	Measured	Development, Hatching, Survival	TSCATS, (1989) as cited in the EU RAR (2002)

Attachment E

Wildlife Technical Memorandum

Combe Fill South Landfill Superfund Site,
Operable Unit 2
Remedial Investigation/Feasibility Study

EPA Work Assignment Number 018-RICO-0256,
EPA Contract Number EP-W-09-009

Chester and Washington Townships,
Morris County, New Jersey
December 9, 2015

Prepared for:
U.S. Environmental Protection Agency
Region 2
New York, NY

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Figure 4 ..... Delineated Wetlands within Combe Fill South OU2 Study Area

ABBREVIATIONS AND ACRONYMS

DGPS	Differential Global Positioning System
E	Endangered
ETS	Endangered and threatened species
HDR	Henningson, Durham and Richardson Architecture and Engineering, P.C., in association with HDR Engineering, Inc.
IPAC	Information, Planning, and Conservation System
LULC	Land use/land cover
NHP	Natural Heritage Program
NJDEP	New Jersey Department of Environmental Protection
OU	Operable unit
PEM	Palustrine emergent wetland
PFO	Palustrine forested wetland
PSS	Palustrine scrub/shrub
RI	Remedial Investigation
ROW	Right-of-way
S	Stable species
SLERA	Screening Level Ecological Risk Assessment
SCS	Special concern species
T	Threatened
UNT	Unnamed tributary
USFWS	U.S. Fish and Wildlife Service

1 Introduction

The wildlife data discussed herein was collected in 2010 and 2011 to identify species that utilize habitats that may be disturbed by site work needed to access drilling locations and install monitoring wells for the collection of groundwater data as part of the Remedial Investigation (RI). The information gathered to prepare this report will also be used to inform the Screening Level Ecological Risk Assessment (SLERA). The focus of this wildlife study, in order of importance, was on federal- and state-listed wildlife (endangered and threatened species [ETS]); New Jersey special concern species (SCS), stable species (S) and non-listed or common wildlife.

The wildlife surveys were conducted within the boundaries of the Operable Unit 2 (OU2) study area which is bounded to the north by residential parcels on both sides of Schoolhouse Lane, to the east by Parker Road, and to the south and west by individual tax lots adjacent to the landfill (Figure 1).

2 Existing Habitats

The study area is located in the Skylands region “which combines two of New Jersey’s physiographic regions, the Ridge and Valley and the Highlands. It encompasses all or parts of Sussex, Warren, Hunterdon, Somerset, Passaic, Essex, Bergen, and Morris counties. The region contains extensive tracts of contiguous upland and wetland forests that support diverse animal populations.”

Existing habitats within the study area are defined on the New Jersey Department of Environmental Protection’s (NJDEP) Natural Heritage Program (NHP) Landscape Project Skylands Habitat Maps (Figure 2). “The Landscape Project combines documented wildlife locations with NJDEP aerial photo-based 2007 Land Use/Land Cover (LULC) to delineate imperiled and special concern species habitat within New Jersey. Many species occurrence locations cannot be published because they may represent nest sites, roost sites, dens and other sites used by species that are vulnerable to human disturbance and, in some cases, susceptible to illegal collection. At the same time, wildlife moves, as individual animals use various habitat features within the landscape to fulfill their foraging, sheltering and breeding needs. Therefore, protecting individual occurrences or the area used by one individual is generally not sufficient to protect the local population. Landscape Project maps address these issues by displaying habitat patches that animals use and that are required to support local populations, rather than pinpointing exact locations of the most sensitive wildlife sites or simply protecting points where species happened to be observed at one point in time. Prior to combining species occurrence data with LULC data to form the habitat patches that make up the Species-Based Habitat layer, each dataset was generated according to a specific data development process” (NJDEP 2012). Each individual species-based habitat patch is ranked (Figure 3). Landscape Project Skylands habitats, acreage and associated species within the OU2 study area are listed in Table 1.

Table 1. Habitats, Acreage and Potential Listed Species within the Combe Fill South OU2 Study Area

Habitat	Acreage	Federally-Listed Species*/ State-Listed Species
Upland Habitats		
Cropland and Pastureland	20.2	Indiana bat*, bobcat, Maine snaketail
Deciduous Brush/Shrubland	28.2	Indiana bat*, bobcat, veery, Maine snaketail
Deciduous Forest (>50% Crown Closure)	80.2	Indiana bat*, bobcat, veery, red-shouldered hawk, barred owl
Deciduous Forest (10-50% Crown Closure)	4.7	Indiana bat*, bobcat, veery
Mixed Deciduous/Coniferous Brush/Shrubland	4.7	Indiana bat*, bobcat, veery
Mixed Forest (>50% Coniferous with >50% Crown Closure)	3.6	Indiana bat*, bobcat, veery, Maine snaketail
Mixed Forest (>50% Deciduous with >50% Crown Closure)	6.8	Indiana bat*, bobcat, veery, Maine snaketail
Mixed Forest (>50% Deciduous with 10-50% Crown Closure)	1.1	Indiana bat*, bobcat, veery
Old Field (< 25% Brush Covered)	2.4	Indiana bat*, bobcat, Maine snaketail
Plantation (Planted pine and spruce stands)	36.1	Indiana bat*, bobcat
Upland Rights-of-Way (Undeveloped)	10.6	Indiana bat*, bobcat, veery, Maine snaketail
Wetland Habitats		
Agricultural Wetlands (Modified)	8.6	None
Deciduous Wooded Wetlands	65.4	Indiana bat*, bobcat, veery, great blue heron, Maine snaketail
Disturbed Wetlands (Modified)	1.6	None
Wetland Rights-of-Way (Modified)	2.2	Indiana bat*, bobcat, veery, Maine snaketail
Open Water		
Artificial Lakes	0.4	Indiana bat*, great blue heron, Maine snaketail
Natural Lakes	0.2	Indiana bat*, great blue heron, Maine snaketail
Note: Documented occurrence of habitat use according to NJDEP NHP Landscape Project.		

In addition to the mapped Landscape Project habitat patches within the OU2 study area, other habitats where abundant species were observed are portions of the Combe Fill South landfill (82-acre area excluding assigned Landscape Project habitat patch areas), perennial streams (1.45 miles), ponds and ditches (areas included in wetlands and open water habitats).

Based on field observations during the wildlife surveys and for purposes of discussion in this report, habitats within the OU2 study area were generalized into five categories: deciduous wooded wetlands (with small areas of emergent/shrub vegetation); streams, ponds and ditches; brush/shrubland and forest edge; upland forests (includes coniferous

and deciduous communities with varying crown closure percentages); and landfill and landfill edge.

2.1 Deciduous Wooded Wetlands

The majority of wetlands within the OU2 study area fall under the Landscape Project category of deciduous wooded wetlands encompassing approximately 84 percent of wetland habitat and the second largest in total habitat acreage to deciduous forest (>50% crown closure). The *Wetland Delineation Report and Wetland Functions and Values Assessment* is provided as Appendix Q in the RI report. Wetlands were delineated, however boundaries were not confirmed by state or federal representatives.

Wetland WA is the largest deciduous wooded wetland stretching across two watersheds (the headwaters of the west unnamed tributary (UNT) to Trout Brook to the south, and an UNT to Tanners Brook to the north covering about 49.9 acres (Figure 4). Its large and relatively undisturbed acreage (as it is bordered by the limited access landfill property and private lands) results in the highest wetland function value compared to other wetlands within the study area. Wetland WA is a palustrine forested wetland (PFO) with a diverse composition of trees. The canopy is primarily red maple (*Acer rubrum*) with yellow birch (*Betula alleghaniensis*) which co-dominates the canopy throughout the wetland. Other co-dominants include swamp white oak (*Quercus bicolor*) and black tupelo (*Nyssa sylvatica*). Mid-story trees include river birch (*Betula nigra*) and American hornbeam (*Carpinus caroliniana*). The shrub layer is dominated by spicebush (*Lindera benzoin*), highbush blueberry (*Vaccinium corymbosum*), and nannyberry (Viburnum lentago). The herbaceous layer is quite diverse and is dominated by a mixture of ferns including sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*) and marsh fern (*Thelypteris palustris*) along with sedges, rushes, mosses, and grasses.

Wetland WB (8.1 acres) is a seasonally-flooded red maple swamp community within a sub-watershed to Trout Brook. It occurs in poorly-drained depressions and along both sides of the Trout Brook UNT. Red maple was the dominant tree and slippery elm (*Ulmus rubra*), pin oak (*Quercus palustris*) and white ash (*Fraxinus americana*) were common and scattered throughout the wetland. Wetland WB contained a healthy shrub layer including northern spicebush (*Lindera benzoin*), gray dogwood (*Cornus racemosa*) and American witch-hazel (*Hamamelis virginiana*). Some small areas had evidence of past clearing and disturbance as indicated by invasive plants such as multiflora rose (Rosa multiflora) and common buckthorn (*Rhamnus catharitica*). Numerous emergents form the herbaceous stratum such as skunk-cabbage (*Symplocarpus foetidus*), swamp jack-in-the-pulpit (*Arisaema triphyllum*), sensitive fern (*Onoclea sensibilis*) and cinnamon fern.

Wetlands WC (2.3 acres), WD (1.4 acres), WE (1.4 acres), WF (0.2 acres), WG (0.06 acres), WH (1.6 acres), and WI (1.3 acres) are within one wetland complex (approximately 8.26 acres) in the Lamington (Black) River watershed and are located on both sides of Schoolhouse Lane. This wetland community is slightly drier then Wetlands WA and WB, and would be classified as a temporarily-flooded, red maple swamp community. This wetland complex has been fragmented into small pieces by historical land use practices, primarily development with single-family residential homes. The wetlands are dominated by red maples mixed with gray birch (*Betula populifolia*) along

with scattered upland trees such as tulip poplar (*Liriodendron tulipifera*) and black birch (*Betula lenta*). The shrub layer consists of highbush blueberry and red maple saplings. Non-native invasive plants such as multiflora rose, Japanese barberry (*Berberis thunbergii)* and Tatarian honeysuckle (*Lonicera tatarica*) are common. Skunk cabbage and cinnamon fern dominate the herbaceous stratum. Vine species including poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), summer grape (*Vitus aestivalis*) and cat briar (*Smilax glauca*) are common.

Small patches of emergent wetlands occur within the deciduous wooded wetlands in the study area, however only Wetland WJ (0.44 acres) was large enough to be delineated and classified as a palustrine emergent wetland (PEM). Wetland WJ would best be described as a shallow emergent marsh that is seasonally-flooded. The water depths appear to range from a few inches to a few feet during flood events but the water level drops by mid- to late-summer exposing the substrate. Wetland WJ likely resulted from past disturbance from adjacent landfill closure activities and installation and maintenance of the utility right-of-way on which it is located. The vegetation is predominantly hydrophytic; however, the soils do not display the normal hydric soil characteristics that would be expected. The soil profile is more homogeneous than expected and the soil color indicates the area has been filled. The hydrology appears to be the result of wetland WJ's location in a valley and stormwater run-off from the landfill perimeter road. This run-off appears to be very sporadic resulting in a tussock-type vegetation growth pattern. During a site visit on May 13, 2011, the area was saturated but did not hold standing water. Ten days later, the area had standing water. The central part of the marsh is dominated by wool grass (Scirpus cyperinus) and prairie dogbane (*Apocynum sibiricum*) - both plants can tolerate fluctuating water levels. Shrubs are scattered in clumps, surround the area and include silky dogwood (*Cornus amomum*), northern arrow-wood (*Viburnum recognitum*) and stiff dogwood (*Cornus foemina*). Areas with greater than 50% shrub cover are classified as shrub swamps. A small fringe within Wetland WJ could be classified as palustrine scrub/shrub (PSS). Wetland WJ could theoretically drain into the headwaters of the Lamington (Black) River watershed via overland flow although its distance from the nearest UNT is approximately 1,000 feet.

2.2 Streams, Ponds and Ditches

This category covers the headwaters of most of the streams in the study area; the best examples are streams in Wetland WA including Trout Brook and the tributary to Tanners Brook. These aquatic communities consist of small, marshy, perennial brooks with very low gradients and flow rates and cool to warm water that generally flows through a marsh, fen or swamp where a stream system originates. These streams have clearly distinguished meanders/high sinuosity and are in unconfined watersheds (Edinger et. al, 2002). Ditches and ponds are also present. Wetlands WE and WI are small ponds constructed on residential property. These ponds appeared to be somewhat eutrophic and filling with sediments and detrital vegetation.

2.3 Brush/Shrubland and Forest Edge

Forest edges are present along the utility right-of-way (ROW) that bisects the study area, roads, agricultural fields and surrounding the landfill. They include the edges of both

forested uplands and deciduous wooded wetlands. Common trees include ironwood (*Ostrya virginiana* or *Carpinus caroliniana*), sassafras (*Sassafras albidum),* red maple, white ash, black tupelo, yellow birch, black birch, hickories (*Carya sp.),* and several species of oak (*Quercus sp.).* Shrubs, herbaceous vegetation, and vines include witch hazel, Japanese barberry, Oriental bittersweet (*Celastrus orbiculatus*), swamp jack-in-the-pulpit, spicebush, New York fern (*Thelypteris noveboracensis*) and poison ivy.

2.4 Upland Forests

Upland forests are mostly deciduous and include large trees up to 30 inches in diameter at breast height (dbh), including red oak (*Quercus rubra*), black oak (*Quercus velutina*), white oak (*Quercus alba*), hickories, tulip-poplar, white ash, American elm (*Ulmus americana*) and maples (*Acer sp*). Plantation habitat (planted pine and spruce stands) are also present. Common sub-canopy trees include ironwood, sassafras, red maple, white ash, black tupelo, yellow birch and black birch. The shrubs, herbaceous vegetation and vines include witch hazel, Japanese barberry, Oriental bittersweet, swamp jack-in-the-pulpit, spicebush, black haw (*Viburnum prunifolium*), New York fern and poison ivy.

2.5 Landfill and Landfill Edge

Landfill and landfill edge habitat includes the landfill, landfill perimeter road and adjacent open uplands including shrublands. The landfill vegetation included planted fescues (*Festuca sp.*), Kentucky bluegrass (*Poa pratensis*), perennial ryegrass (*Lolium perenne*), red top (*Agrostis gigantea*), and white clover (*Trifolium repens*) and successional grasses and forbs.

3 Wildlife Observations

3.1 Summary of Research Information on Listed Species

HDR obtained the initial rare species information in May of 2010 through written correspondence with the NHP prior to conducting RI field work. New Jersey provides two listing designations for bird species; the first for breeding-nesting populations, and the second separated by a backslash (e.g. E/T), for non-breeding, non-nesting populations. For species other than birds, there is only one listing designation. The five ETS identified in 2010 consisted of four bird species: barred owl (*Strix varia*), NJ T/T; red-shouldered hawk (*Buteo lineatus*), NJ E/SC; Cooper's hawk (*Accipiter cooperii*), NJ T/SC; and Savannah sparrow (*Passerculus sandwichensis*), NJ E/SC; and one mammal: bobcat (*Felis rufus*), NJ E. Two of the 2010 NHP listed species, Cooper’s hawk and Savannah sparrow, were eliminated from the recent (version 3.1) Landscape Project data as species known to occur in or near the study area.

HDR conducted an updated file search in 2015 prior to completion of the RI field work using NJDEP’s on-line interactive mapping application NJ GeoWeb which uses the NHP

Landscape Project version 3.1 data.[1] The 2015 information indicated that there are seven listed species within the study area: Indiana bat (*Myotis sodalis*), US and NJ E; bobcat, NJ E; barred owl, NJ T/T; red-shouldered hawk, NJ E/SC; veery (*Catharus fuscescens*), NJ SC/S; great blue heron (*Ardea herodias*), NJ SC/S; and Maine snaketail (*Ophiogomphus mainensis*), NJ SC. Table 2 presents the Landscape Project species-based habitat patches found at each of the wildlife survey stations, the rank of each habitat patch and a list of species identified in association with each patch.

A U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System (IPaC) on-line inquiry performed on February 23, 2015 generated a Trust Resources List with four species in the study area on the Endangered Species Act Species List.[2] Indiana bat and northern long-eared bat (*Myotis septentrionalis*) are found in Morris County, New Jersey where both species are known to hibernate, roost, and form maternity colonies. Only the Indiana bat is known to hibernate, roost and form maternity colonies in Chester Township where Combe Fill South is located. The northern long-eared bat currently has a threatened status, but is proposed to be listed as endangered. The Small Whorled pogonia (*Isotria medeoloides*) is a plant with a threatened status, and the bog turtle (*Clemmys muhlenbergii*) also has a threatened status.

Several mammal species that could potentially use the study area have been recommended for state listing in New Jersey by the Endangered and Nongame Species Advisory Committee.[3] The eastern small-footed myotis (*Myotis leibii*), little brown bat (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), and tricolored bat (*Perimyotis subflavus*) are recommended to be listed as state-endangered. All of these overwinter in New Jersey. Four bats recommended for state listing as special concern species - hoary bat (Lasiurus cinereus), red bat (Lasiurus borealis), and silver-haired bat (*Lasionycteris noctivagans*) - are migratory bats, and another, the big brown bat (*Eptesicus fuscus*), overwinter in New Jersey. It is possible that some of these bats utilize habitats in the study area for roosting and foraging. The meadow jumping mouse (*Zapus hudsonius*) has also been recommended to be listed as a New Jersey SCS and it could also occur in the study area. These species are not discussed further due to their pending status.[4]

Table 3 provides habitat requirements, habitat use and sighting information on each ETS and SCS observed within the study area. Table 4 provides the same information for species that were not observed but have the potential to or are likely to use the study area.

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[1] "NJ-GeoWeb." NJ-GeoWeb. NJDEP, 6 Apr. 2015. Web. 13 July 2015. <http://www.nj.gov/dep/gis/geowebsplash.htm>.

[2] "Trust Resources List." (n.d.): n. pag. *USFWS Information, Planning, and Conservation System (IPAC)* Version 1.4. Web. 23 Feb. 2015.

[3] "NJ Endangered and Nongame Species Program." (n.d.): n. pag. 2 Dec. 2013. Web. 13 July 2015.

[4] Recommended Special Concern or Endangered status listing by the Endangered and Nongame Species Advisory Committee; no formal rule proposal filed to date.

Table 2. Landscape Project Habitat and Potential Species by Wildlife Survey Station

Wildlife Survey Station/Rank	Landscape Project-Designated Habitat	Landscape Project Identified Species
CFS-01/None	None identified by Landscape Project (landfill habitat)	None identified by Landscape Project
CFS-02/5	Upland rights-of-way (undeveloped)	Indiana bat, bobcat, veery
CFS-03/None	None identified by Landscape Project (landfill habitat)	None identified by Landscape Project
CFS-04/None	None identified by Landscape Project (landfill habitat)	None identified by Landscape Project
CFS-05/None	None identified by Landscape Project (landfill habitat)	None identified by Landscape Project
CFS-06/None	None identified by Landscape Project (landfill habitat)	None identified by Landscape Project
CFS-07/5	At border between deciduous wooded wetlands/upland rights-of-way (undeveloped)	Indiana bat, bobcat, veery, great blue heron, Maine snaketail
CFS-08/5	Deciduous forest (>50% crown closure)	Indiana bat, bobcat, veery, barred owl, red-shouldered hawk
CFS-09/5	Plantation (planted pine and spruce stands)	Indiana bat, bobcat
CFS-10/5	Deciduous forest (>50% crown closure)	Indiana bat, bobcat
CFS-11/5	Deciduous forest (>50% crown closure)	Indiana bat, bobcat, veery, barred owl, red-shouldered hawk
CFS-12/5	Upland rights-of-way (Undeveloped)	Indiana bat, bobcat, veery, Maine snaketail
CFS-13/5	Deciduous forest (>50% crown closure)	Indiana bat, bobcat, veery, Maine snaketail
CFS-14/None	None identified by Landscape Project (landfill habitat)	None identified by Landscape Project
CFS-15/5	Deciduous wooded wetlands	Indiana bat, bobcat, veery, great blue heron, Maine snaketail
CFS-16/5	Deciduous wooded wetlands	Indiana bat, bobcat, veery, great blue heron, Maine snaketail
CFS-17/5	Deciduous wooded wetlands	Indiana bat, bobcat, veery
CFS-18/5	Mixed deciduous/coniferous brush/shrubland	Indiana bat, bobcat, veery
CFS-19/5	At border of deciduous forest (10-50% crown closure)/deciduous brush/shrubland	Indiana bat, bobcat, veery
CFS-20/5	Deciduous forest (>50% crown closure)	Indiana bat, bobcat, veery
CFS-21/5	Plantation (planted pine and spruce stands)	Indiana bat, bobcat
CFS-22/5	Deciduous wooded wetlands	Indiana bat, bobcat, veery
CFS-23/5	Deciduous wooded wetlands	Indiana bat, bobcat, veery, great blue heron, Maine snaketail

3.2 Wildlife Survey Methodology

Wildlife were identified during seven site visits in 2010 and four in 2011 with the intent to identify habitat usage by ETS and SC species and other common wildlife that may be disturbed by RI activities (e.g. clearing access routes, well drilling and sampling).

HDR conducted wildlife surveys within the study area in 2010 on four days during summer and three days during fall. Twenty-three point count stations were set up and sampled on June 22 and 30, and July 1 and 8, 2010, and were surveyed a second time on September 23 and 29, and October 6, 2010. The point count surveys tallied the number of species observed and/or heard over a five minute period at a station; recording the direction and distance of the sighting and/or sound when possible on field data sheets. Incidental observations resulted in additional counts of birds, amphibians, reptiles and mammals at the point count stations before and after the five minute point count period, while moving between stations, and while moving through various habitat types.

Eight scent stations with hair snares, smoked aluminum track plates (16 in. x 22 in.) and a visual attractant (aluminum pie plate suspended by string near the station) were used to survey potential bobcat use of the study area during the fall 2010 survey period. Two commercially available scents that attract bobcat were used to entice bobcat into five-inch rubbing squares of plywood covered with carpet with exposed carpet nails and Velcro® patches to facilitate snaring bobcat hairs. Stations were set on September 23, 2010 and pulled on September 29, 2010 after six days.

Spring surveys conducted on April 15, May 12 and June 1, 2011, used play-back recordings of raptors (barred owl, red-shouldered hawk, Cooper's hawk and great horned owl [*Bubo virginianus*]) each played for five minutes with a two minute silent period between each species while moving around the study area. Spring surveys conducted on June 1 and June 22, 2011 used play-back recordings of grassland bird species (bobolink (*Dolichonyx oryzivorus*), grasshopper sparrow (*Ammodramus savannarum*), eastern meadowlark [*Sturnella magna*] and vesper sparrow [*Pooecetes gramineus*]) while moving around the landfill and adjacent habitats within the study area. Opportunistic surveys of stream, pond and wetland habitats were conducted during the wildlife surveys, particularly for amphibians breeding in wetlands and ephemeral and intermittent pools as evidenced by the presence of eggs, amphibian larvae and recent metamorphs, juveniles and adults. No fish, benthic or aquatic invertebrate surveys were conducted.

The point count and incidental observations data were entered in a Microsoft Access database and reduced to tables providing information on the species and numbers observed for all stations and by habitat type.

3.3 Wildlife Survey Results

Over 1200 mammal, bird, reptile, and amphibian observations representing 117 species were collected in the study area (Table 5). The survey results consist of 89 species of birds, 15 species of mammals, 10 species of amphibians, and three species of reptiles. State-listed species observed in the study area consisted of 16 bird species and one reptile species (Table 3). Of the 17 state-listed species observed, two were endangered

species, five were threatened species, and 10 were special concern species. The state-listed endangered and threatened species were all birds. All of the state-listed special concern species were birds except for the eastern box turtle (*Terrapene c. carolina*), a reptile. No federally-listed species were observed.

3.3.1 Endangered, Threatened and Special Concern Species

STATE-LISTED SPECIES

The following New Jersey-listed species were observed in the study area during the 2010-2011 wildlife surveys. Table 3 provides additional information including a list of the state-listed species observed during the wildlife survey, their habitat requirements and sighting information within the study area.

1. Northern harrier (*Circus cyaneus*) are listed as endangered for breeding/nesting and special concern for non-breeding/nesting populations (NJ E/SC). One individual flew over the landfill on October 6, 2010 while the survey was being conducted. It was likely migrating through the area as it was flying high over the landfill. There was no evidence of breeding/nesting in the study area.
2. Vesper sparrow are listed as endangered for breeding/nesting and special concern for non-breeding/nesting populations (NJ E/SC). One individual was observed at the edge of the landfill. The survey crew did not observe evidence of nesting during either the 2010 or 2011 field surveys.
3. American kestrel (*Falco sparverius*) are listed as threatened for both breeding/nesting and non-breeding/nesting populations (NJ T/T). Four American kestrel were observed foraging on the landfill and landfill edge.
4. Grasshopper sparrow are listed as threatened for breeding/nesting populations and special concern for non-breeding/nesting populations (NJ T/SC). The survey crew observed five grasshopper sparrows breeding and nesting on the landfill. The nesting areas were located in the north central and northwest portions of the landfill.
5. Bobolink are listed as threatened for breeding/nesting populations and special concern for non-breeding/nesting populations (NJ T/SC). The survey crew observed numerous bobolinks breeding and nesting on the northwest section of the landfill. Because NJDEP had scheduled routine grass mowing at the landfill, the survey crew mapped the primary bobolink nesting area using a differential Global Positioning System (DGPS) on June 1, 2011. Mowing was delayed in this area to reduce disturbance during the primary nesting period thereby reducing potential impacts to nesting bobolink and also grasshopper sparrow.
6. Savannah sparrow are listed as threatened for breeding/nesting populations and stable for non-breeding/nesting populations (NJ T/S). Savannah sparrows were observed on the landfill and in shrubland adjacent to the landfill and could potentially breed/nest on the landfill and adjacent grass/shrub areas.
7. Osprey (*Pandion haliaetus*) are threatened for breeding/nesting populations and stable for non-breeding/nesting populations (NJ T/S). One individual was observed flying high over the landfill on September 29, 2010 and was likely

migrating. The habitats around the landfill are not suitable for Osprey foraging or nesting.

8. Eastern meadowlark are listed as special concern for breeding/nesting populations and for non-breeding/nesting populations (NJ SC/SC). Four eastern meadowlarks were observed on the landfill and are likely to nest on the landfill.
9. Sharp-shinned hawk (*Accipiter straitus*) are listed as special concern for breeding/nesting populations and for non-breeding/nesting populations (NJ SC/SC). One individual was observed at the landfill edge on the north side.
10. Cooper's hawk are listed as special concern for breeding/nesting populations and stable for non-breeding/nesting populations (NJ SC/S). The survey crew observed two individuals at the landfill edge on the south side.
11. Great Blue Heron are listed as special concern for breeding/nesting populations and stable for non-breeding/nesting populations (NJ SC/S). The survey crew observed one individual at the landfill edge on the south side.
12. Black-billed cuckoo (*Coccyzus erythropthalmus*) are listed as special concern for breeding/nesting populations and stable for non-breeding/nesting populations (NJ SC/S).
13. Veery (*Catharus fuscescens*) are listed as special concern for breeding/nesting populations and stable for non-breeding/nesting populations (NJ SC/S). Eleven individuals were observed at eight different point count stations. The habitats at these stations are mostly landfill and landfill edge, with two upland forest locations.
14. Wood thrush are listed as special concern for breeding/nesting populations and stable for non-breeding/nesting populations (NJ SC/S). The survey crew observed two individuals near the landfill/landfill edge and one in an upland forest northeast of the landfill.
15. Black-throated blue warbler (*Dendroica caerulescens*) are listed as special concern for breeding/nesting populations and stable for non-breeding/nesting populations (NJ SC/S). One individual was observed in an upland forest north of the landfill near the northern end of the study area.
16. Black-throated green warbler (*Dendroica virens*) are listed as special concern for breeding/nesting populations and as stable for non-breeding/nesting populations (NJ SC/S). The survey crew observed two individuals in an upland forest north of the landfill near the northern end of the study area.
17. Eastern box turtle is listed as a special concern species. This species was observed along the landfill edge and in a deciduous wooded wetland.

The 2010 and 2011 field observations found 17 state-listed species within the study area – 16 bird and one reptile species. No state-listed mammals or amphibians were observed within the study area. Three bird species - osprey, northern harrier and vesper sparrow - were observed flying over the landfill. It is unlikely that the osprey would use the site because of unsuitable habitat. The northern harrier is not expected to nest in the study area, however northern harriers could forage on and adjacent to the landfill. The vesper sparrow was likely in migration and would not be anticipated to breed or nest in the study

area. Specific to the study area, the status of several of the state-listed bird species would drop from breeding/nesting to non-breeding/non-nesting because although they were observed within the study area, they were not breeding or nesting on the site.

Though the bobcat, red-shouldered hawk, and barred owl could occur in the study area, specific field activities directed at identifying these species found no evidence of them in the study area. No evidence of bobcat including tracks, droppings/scratches, or hairs was found.

FEDERALLY LISTED SPECIES

No federally-listed species were observed during the wildlife surveys. However, as discussed in Section 3.1, two federally-listed bat species may occur within the study area. Table 4 provides additional information on federally- and state-listed species with the potential to occur within the study area.

Indiana Bat

The Indiana bat is an endangered species (since 1967) that over-winters in caves and mines from October to April (Beth Hartmaier and Bruce E. Beans, pages 1-7 in Beans and Niles 2003). During the summer, they roost in trees and females form maternity roosts generally in riparian and flood plain forests under the loose bark and cavities of living and dead trees. They forage on flying aquatic and terrestrial insects (including moths, beetles, and dragonflies).

The Indiana bat has four distinct life history phases: hibernation, spring staging and autumn swarming, spring and autumn migration, and summer roosting (USFWS, 2007). From approximately September to April Indiana bats hibernate in caves or abandoned mines. In April through May, bats emerge from their hibernacula and migrate to their summer roosting locations. Although some males and non-reproductive females may stay within the vicinity of the hibernacula, the majority of females migrate, in some cases up to several hundred miles (Winhold and Kurta, 2006), to their summer habitat. In the northeast, migration distances tend to be shorter (Britzke et al., 2006).

At the summer habitat, males disperse and remain solitary until mating season at the end of the summer. Pregnant females form maternity colonies where gestation, birth, nursing/ lactation, and rearing young occur. Maternity roosts and general roosting sites are usually under loose, exfoliating bark or in the crevices of trees. Indiana bat roosting sites have been documented in numerous species of deciduous trees. Tree availability, diameter, altitude, bark characteristics, condition/damage, and solar exposure appear to be more important factors than tree species for roost site selection (USFWS, 2007).

Some species of mature, live trees may provide suitable bark characteristics for roosting including shagbark hickory (*Carya ovata*), sugar maple (*Acer saccharum*), black locust (*Robinia pseudoacacia*) and white oak (USFWS, 2007). However, most tree species must be damaged and/or dying before bark separation occurs and suitable crevices develop. In addition to suitable crevices, the amount of solar exposure needed to warm exfoliating bark and crevices is important. Indiana bats often roost near forest gaps or edges where trees receive direct sunlight for much of the day. A tree survey was not conducted in the study area; however, it is anticipated that there are potential roost trees

along the forested edges, and in trees around forest openings and open wetlands that could be used by Indiana bats.

Summer foraging habitat includes riparian, wetland, bottomland/floodplain, and fragmented upland forests with openings, as well as agricultural areas (Gardner et al. 1991, Miller et al. 2002, Carter 2003). Within the study area, potential foraging habitat exists along the forest edges, wetland fringes, and stream segments.

Although not observed within the study area, the Indiana bat is known to hibernate, roost and form maternity colonies in Chester Township where Combe Fill South is located.

Northern Long-eared Bat (Myotis septentrionalis)

The northern long-eared bat is a threatened species that was proposed to be listed as endangered in 2013. Similar to the Indiana bat, hibernacula of the northern long-eared bat includes mines and caves, where they hibernate from September/October to March/April when they emerge to forage and begin their dispersal to summer habitat (USFWS, 2014). Foraging habitat includes mature forested areas primarily under the canopy, with occasional foraging taking place over clearings and water, and along roads from sunset to five to eight hours after sunset (Kunz, 1973).

Breeding season is from late summer to early fall and breeding occurs near the hibernacula (Kurta, 1980). Females store sperm over winter, exhibiting a delayed fertilization strategy, eventually giving birth in late May or early June to a single pup in a maternity colony. Maternity colony selection, in terms of canopy and tree height, is dependent on reproductive stage relative to pre- and post-lactation periods (Kunz, 1973). Lactating northern long-eared bats have been shown to roost higher in tall trees situated in areas of relatively less canopy cover and tree density than Indiana bats.

The northern long-eared bat is comparable to the Indiana bat in terms of summer roost selection, but appears to be more opportunistic, often using live trees and sometimes manmade structures for roosting habitat (USFWS, 2014a). In areas where both species occur, there may be a small amount of roost-selection overlap or competition for roost sites (Foster and Kurta, 1999; Timpone et. al., 2010).

In the study area, there are potential roosting and maternity trees that occur along the forested edges, and in trees around forest openings and open wetlands that could be used by northern long-eared bats.

Forested uplands and wetlands as well as open areas along utility ROWs, roads and clearings in forested areas provide potential foraging habitat for northern long-eared bats.

Although not observed within the study area, the northern long-eared bat is documented in Morris County where Combe Fill South is located.

3.3.2 Non-Listed Species

During the point count surveys, over 1200 bird observations (89 species) were identified in habitats within the study area with the American crow (*Corvus brachyrhynchos*; n = 149) and European starling (*Sturnus vulgaris*; n = 148) the most common followed by American robin (*Turdus migratorius*; n = 110), blue jay (*Cyanocitta cristata*; n = 87), gray catbird (*Dumetella carolinensis*; n = 70), common raven (*Corvus corax*; n = 56), and

American goldfinch (*Carduelis tristis*; n = 53). Other commonly observed birds consisted of the tufted titmouse (*Parus bicolor*), eastern towhee (*Pipilo erythrophthalmus*), common yellowthroat (*Geothlypis trichas*), black-capped chickadee (*Parus atricapillus*), tree swallow (*Tachycineta bicolor*), red-bellied woodpecker (*Melanerpes carolinus*), and song sparrow (*Melospiza melodia*) ranging from 41 to 22 individuals in the order listed above.

Birds utilized a variety of habitats within the study area, however the landfill and landfill edge, and brush/shrubland (724 bird observations consisting of 56 species) had the greatest species diversity and highest abundance of birds compared to the upland forest (239 bird observations consisting of 35 species), upland forest edge (125 bird observations consisting of 26 species), and deciduous wooded wetland habitats (119 bird observations consisting of 28 species). The greater number of birds and species observed on the landfill is likely the result of greater visibility and easier detection of species in the open compared to forested habitats.

Incidental observations consisted of 106 species; 78 birds as well as 15 mammals, three reptiles, and 10 amphibians. The total number of species observed during the point count surveys and incidental observations combined consisted of 117 species (15 mammals, 89 birds, three reptiles, and 10 amphibians). The bobolink was the most common species observed. Bobolink observations were followed by the European starling, gray catbird, red-winged blackbird (*Agelaius phoeniceus*), American crow, American goldfinch, American robin, blue jay, barn swallow (*Hirundo rustica*), and common yellowthroat (Table 5).

Incidental observations included amphibians and reptiles found primarily in stream, pond and wetland habitats as well as numerous birds and a few mammals found throughout the study area. The majority of amphibians were observed in or adjacent to aquatic habitats (ponds and streams) generally near or in wetland habitats. Painted turtles (*Chrysemys picta*) were observed in pond habitats and the eastern box turtles used the deciduous wooded wetlands and adjacent upland/landfill edge habitats. Mammals and birds were observed throughout the site in various habitats.

Ten species of amphibians were observed. Aquatic species (green frog [*Lithobates clamitans],* American bullfrog [Lithobates catebeianus], red-spotted newt [*Notophthalmus viridescens*], and northern two-lined salamander [*Eurycea b. bislineata*]) were associated primarily with streams and ponds. Terrestrial amphibians observed consisted of American toads (*Anaxyrus americanus*), northern gray tree frogs (*Hyla versicolor*), wood frogs (*Lithobates sylvaticus*), spotted salamanders (*Ambystoma maculatum*), eastern red-backed salamanders (Plethodon c. cinereus), slimy salamanders (*Plethodon g. glutinosus*) and red-spotted newts.

Reptiles observed were the eastern box turtle, painted turtle, and northern watersnake (*Nerodia s. sipedon*).

Evidence or observations of 15 mammals found using the study area consisted of northern short-tailed shrew (*Blarina brevicauda*), eastern mole (*Scalopus aquaticus*), white-footed mouse (*Peromyscus leucopus*), eastern chipmunk (*Tamias straitus*), red squirrel (*Tamiasciurus hudsonicus*), gray squirrel (*Sciurus carolinensis*), woodchuck (*Marmota monax*), meadow vole (*Microtus pennsylvanicus*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata)*,

eastern cottontail (*Sylvilagus floridanus*), black bear (*Ursus americanus*) and white-tailed deer (*Odocoileus virginianus*; Table 5).

4 Conclusions

The Combe Fill South OU2 study area contains a variety of habitats that are well-suited for use by a diversity of species. The research and field observations confirmed this species diversity. Prior to mobilizing for RI field activities, the HDR biologist that led the wildlife surveys reviewed the proposed deep monitoring well locations to make certain that no species were present at these locations that could be adversely impacted by vegetation clearing and drilling activities. The information developed for preparation of this report was also used by the ecological risk assessors to prepare the Screening Level Ecological Risk Assessment.

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Tables

Table 3. Status, habitat requirements and sighting information on New Jersey State-listed endangered, threatened and special concern species observed within the Combe Fill South Landfill OU2 study area.

Common name (*Scientific name*)	**Status[1]**	**Habitat requirements**	**Habitat use/sighting information for the study area**
Northern harrier (*Circus cyaneus*)	NJ E/SC	Northern harrier is a medium- to large-sized hawk that is state-listed as endangered for breeding/nesting and special concern for non-breeding/nesting populations. At the Federal level, it is a Migratory Nongame Bird of Management Concern according to the USFWS's Office of Migratory Bird Management. Northern harrier nest on the ground in open habitat including tidal marshes, emergent wetlands, fallow fields, grasslands, meadows, airports, and agricultural areas (Sherry Liguori. Northern harrier. pages 73-79 in Beans and Niles 2003) including marshes and grasslands of coastal New Jersey (Walsh et. al. 1999). They forage over marshes, fields, and other areas of low vegetation primarily on vertebrates including small mammals, birds, reptiles, and amphibians. Fledgling birds and small mammals are important prey during the nesting season.	• One individual was observed flying south over the landfill on October 6, 2010. It was flying high and probably migrating/moving through the area. • Nesting on and adjacent to the landfill is unlikely to occur. • Potential foraging habitat is present on the landfill and nearby open fields, therefore overwintering and migrating northern harriers could forage on the landfill and adjacent early successional habitats including those nesting locally within normal daily movements of the landfill.
Vesper sparrow *(Pooecetes gramineus)*	NJ E/SC	Vesper sparrows are listed as endangered for breeding/nesting populations and special concern for non-breeding/nesting populations. They use dry grasslands, grassy/weedy fields, meadows and pastures (Walsh et al. 1999) preferring open areas with sparsely vegetated habitats with patches of bare ground and scattered shrubs and trees that are typically dry and well drained (Sherry Liguori. Vesper sparrow. pages 171-175 in Beans and Niles 2003). Vesper sparrows forage on invertebrates including beetles, grasshoppers, weevils, caterpillars, bees and wasps, ants, and insect larvae during the summer nesting season, and seeds supplement their diet when available.	• One individual was observed by the landfill edge. • Vesper sparrows were not observed nesting during the 2010 and 2011 surveys. • Vesper sparrows could use the study area during migrations.
American kestrel (*Falco sparverius*)	NJ T/T	The American kestrel is the smallest and most widely distributed falcon in North America (Smallwood & Bird 2002, Hawk Mountain n.d.). American kestrel are state-listed as threatened for both breeding/nesting and non-breeding/nesting populations. They nest in cavities near open habitats (Walsh et al. 1999). They feed on insects (terrestrial arthropods) and small birds and mammals. American kestrel may become prey to larger hawks and owls, therefore they provide pathways between landfill plants, terrestrial/flying invertebrates, small birds and mammals and larger predators including hawks and owls.	• Several individuals were observed foraging on and over the landfill during the fall. • None were observed nesting in tree cavities near or adjacent to the landfill but may nest in these areas. • American kestrel may use the landfill and adjacent early successional habitats during migration and some may overwinter in the landfill area.

Table 3. Status, habitat requirements and sighting information on New Jersey State-listed endangered, threatened and special concern species observed within the Combe Fill South Landfill OU2 study area.

Common name (*Scientific name*)	**Status[1]**	**Habitat requirements**	**Habitat use/sighting information for the study area**
Grasshopper sparrow *(Ammodramus savannarum)*	NJ T/SC	Grasshopper sparrows are listed as threatened for breeding/nesting populations and special concern for non-breeding/nesting populations. They nest in grasslands and some open small areas (Walsh et al. 1999). Open nesting areas include grasslands, upland meadows, pastures, hay fields, and old field habitat (Sherry Liguori. Grasshopper sparrow. pages 164-167 in Beans and Niles 2003). Grasshopper sparrows forage on invertebrates including beetles, grasshoppers, weevils, caterpillars, bees and wasps, ants, and insect larvae during the summer nesting season, and grains and seeds supplement their diet when available.	• Nesting was confirmed on the north-central portion of the landfill in 2010. • Grasshopper sparrows are likely to use the landfill during migrations, with some remaining to court, breed and nest. • Nesting on the landfill may not occur every year. • Foraging occurred on the landfill and may extend to adjacent early successional habitats.
Bobolink (*Dolichonyx oryzivorus*)	NJ T/SC	Bobolink, sparrow-sized and a member of the blackbird family, are listed as threatened for breeding/nesting populations and special concern for non-breeding/nesting populations. Their nesting habitat includes hayfields, grassy meadows, open pastures, and other open habitat (Walsh et al. 1999) including old fields with forbs and wildflowers preferring areas with high, dense vegetation (Sherry Liguori. Bobolink. pages 156-160 in Beans and Niles 2003). They forage on invertebrates including beetles, grasshoppers, weevils, caterpillars, centipedes, bees and wasps, ants, and insect larvae during the summer nesting season; and grains and seeds supplement their diet when available.	• Bobolink were observed staging for migration in early successional habitat adjacent the landfill in 2010. • Nesting was confirmed on the landfill in 2011. • Primary bobolink landfill nesting territory was mapped in 2011 in order to modify landfill mowing operations allowing bobolink to nest successfully. • Foraging was primarily on the landfill but also extended to adjacent early successional habitats.
Savannah Sparrow (*Passerculus sandwichensis*)	NJ T/S	Savannah Sparrows are listed as threatened for breeding/nesting populations and stable for non-breeding/nesting populations. Habitat includes open fields, meadows, pastures, hay fields, salt marshes, and vegetated landfills dominated by grasses and forbs (Sherry Liguori. Savannah Sparrow. pages 160-164 in Beans and Niles 2003). They forage on invertebrates including beetles, grasshoppers, weevils, caterpillars, centipedes, dragonflies, bees and wasps, ants, and insect larvae during the summer nesting season, and grains and seeds supplement their diet when available.	• Savannah sparrows were observed in early successional habitat adjacent to the landfill. • None were observed nesting in habitat near or adjacent to the landfill. • Savannah sparrows likely use early successional habitat near and adjacent to the landfill during migration stop-overs.

Table 3. Status, habitat requirements and sighting information on New Jersey State-listed endangered, threatened and special concern species observed within the Combe Fill South Landfill OU2 study area.

Common name (*Scientific name*)	**Status[1]**	**Habitat requirements**	**Habitat use/sighting information for the study area**
Osprey (*Pandion haliaetus*)	NJ T/S	Osprey are listed as threatened for breeding/nesting populations and stable for non-breeding/nesting populations. Osprey nest near open water with high fish densities including coastal rivers, marshes, inlets and bays as well as inland rivers, lakes and reservoirs. They build stick nests on live and dead trees, artificial nest platforms, channel markers, and abandoned structures (Sherry Liguori. Osprey. pages 80-86 in Beans and Niles 2003). They forage exclusively on fish.	• One osprey was observed flying over the landfill and was likely migrating. • Osprey would not be expected to use the landfill or adjacent areas as there is no potential nesting or foraging habitat for this species in the study area.
Cooper's hawk (*Accipiter cooperii*)	NJ SC/S (Previously NJ T/S)	Cooper's Hawk were a state threatened species when the wildlife surveys were undertaken in 2010-2011, but since that time, due to increasing numbers they are now listed as special concern for breeding/nesting and stable for non-breeding/nesting populations in New Jersey. Cooper's hawk forage, nest, and roost in deciduous forest, often near an open edge. They also nest in coniferous and mixed woodlands frequently near wet woods and water (Walsh et al. 1999). Nests are generally located in deciduous trees 20 to 60 feet above the ground. Cooper's hawk primarily forage on small to medium sized birds such as thrush, jays, blackbirds, doves, starlings, and woodpeckers (Sherry Liguori. Cooper's Hawk. pages 56-61 in Beans and Niles 2003).	• Cooper's hawk were confirmed in the study area. • None were observed nesting in habitat near or adjacent to the study area, however nesting in the area is likely. • Cooper's hawks likely forage in early successional habitats and forest edges and forested habitats near and adjacent to the landfill study area. Usage may be during migration and overwintering and as summer breeding/nesting residents.
Sharp-shinned hawk (*Accipiter striatus*)	NJ SC/SC	Sharp-shinned hawk is listed as special concern for both breeding/nesting and non-breeding/non-nesting. It nests in forested habitat of mixed woodlands with dense canopy of young coniferous and deciduous trees (Walsh et al. 1999). They prey primarily on small to medium-sized birds, but will also feed on small mammals and large insects.	• Sharp-shinned hawk were confirmed in the study area. • None were observed nesting in habitat near or adjacent to the study area. They may nest in the forested habitats within the study area. • Sharp-shinned hawks likely forage in early successional habitats and forest edges and forested habitats near and adjacent to the landfill study area. Primary usage may be during migration.
Great blue heron *(Ardea herodias)*	NJ SC/S	Great blue heron is the largest wading bird in North America. It is listed as special concern for breeding/nesting populations and stable for non-breeding/non-nesting. Great blue heron nest in trees over water (Walsh et al. 1999). They prey on small fish, frogs, salamanders, snakes, and invertebrates such as crayfish, grasshoppers, dragonflies, and aquatic insects Terres 1980).	• Great blue heron were confirmed in the study area. • Unlikely to nest in the study area as forested habitats are too dense and lack extensive open water, streams and marshes for foraging.

Table 3. Status, habitat requirements and sighting information on New Jersey State-listed endangered, threatened and special concern species observed within the Combe Fill South Landfill OU2 study area.

Common name (*Scientific name*)	**Status[1]**	**Habitat requirements**	**Habitat use/sighting information for the study area**
Eastern meadowlark *(Sturnella magna)*	NJ SC/SC	Eastern meadowlark is listed as special concern for both breeding/nesting and non-breeding/non-nesting. It nests in grassy areas of meadows, pastures and other open habitats (Walsh et al. 1999). They forage on invertebrates including beetles, grasshoppers, crickets, cutworms, weevils, caterpillars, spiders, bees and wasps, ants, and scale insect, and grains and seeds supplement their diet when available (Terres 1980).	• Eastern meadowlark were identified on the landfill. • Eastern meadowlark are likely to nest on the landfill although this was not confirmed.
Black-billed cuckoo *(Coccyzus erythropthalmus)*	NJ SC/S	Black-billed cuckoo is listed as special concern for breeding/nesting and stable for non-breeding/non-nesting. It nests along woodland edges in shrubby thickets and second growth woodlands (Walsh et al. 1999). Black-billed cuckoo forage on insects including beetles, caterpillars, grasshoppers, crickets and also forage on small mollusks, small fish and berries of various species (Bent, 1940 in Terres 1980). The black-billed cuckoo is also a USFWS Trust (Bird of Conservation Concern) species.	• Black-billed cuckoo were confirmed in the study area. • They could nest in the forested habitats adjacent the landfill and utility ROWs within or adjacent to the study area.
Veery *(Catharus fuscescens)*	NJ SC/S	Veery is listed as special concern for breeding/nesting and stable for non-breeding/non-nesting. It nests in the understory of moist deciduous woodlands and forested wetlands (Walsh et al. 1999). Veery forage on the forest floor eating insects including beetles, wood borers, caterpillars, spiders, earthworms and snails; about half its diet is fruits and berries of various species (Bent 1949 in Terres 1980). The veery is also a USFWS Trust (Bird of Conservation Concern) species.	• Veery were confirmed in the study area.
Wood thrush *(Hylocichla mustelina)*	NJ SC/S	Wood thrush is listed as special concern for breeding/nesting and stable for non-breeding/non-nesting. It nests in the understory of deciduous woodlands with a preference for moist woods (Walsh et al. 1999). They forage on insects including beetles, ants, caterpillars, moths, grasshoppers, flies, bugs, spiders, myriapods, snails, earthworms and also forage on berries of various species (Terres 1980). The wood thrush is also a USFWS Trust (Bird of Conservation Concern) species.	• Wood thrush were confirmed in the study area.
Black-throated green warbler *(Dendroica virens)*	NJ SC/S	Black-throated green warbler is listed as special concern for breeding/nesting and stable for non-breeding/non-nesting. It nests in trees in coniferous and mixed woodlands often near hemlock and spruce (Walsh et al. 1999). They forage on insects including beetles, caterpillars, moths, flies, bugs, and also forage on berries of various species (Bent, 1953 in Terres 1980).	• The black-throated green warbler observed was likely a migrant stopping over and probably doesn't nest in the area due to limited and marginal potential nesting habitat.
Black-throated blue warbler *(Dendroica caerulescens)*	NJ SC/S	Black-throated blue warbler is listed as special concern for breeding/nesting and stable for non-breeding/non-nesting. It nests close to ground in deciduous and mixed woodlands with a dense understory (Walsh et al. 1999). They forage on insects including beetles, caterpillars, moths, flies, and also forage on seeds and fruit (Terres 1980).	• The black-throated blue warbler observed was likely a migrant stopping over and is unlikely to nest in the area due to limited and marginal potential nesting habitat.

Table 3. Status, habitat requirements and sighting information on New Jersey State-listed endangered, threatened and special concern species observed within the Combe Fill South Landfill OU2 study area.

Common name (*Scientific name*)	**Status[1]**	**Habitat requirements**	**Habitat use/sighting information for the study area**
Eastern box turtle *(Terrapene carolina carolina)*	NJ SC	Eastern box turtle are state-listed as special concern. It is a habitat generalist with a small (few to several acres) home range in forested wetlands, moist woodlands and upland habitats. Eastern box turtle prefer open second growth woodland meadows, pastures, old fields and cut ROW often in sandy soils and near ponds and/or streams (Gibbs et al. 2007). They are omnivores and forage on slugs, earthworms, mushrooms, berries and fruits.	• Eastern box turtle were confirmed along the landfill edge and in the forested wetland.

[1] NJ State Status Descriptions: E – Endangered. T – Threatened. SC – Special Concern. S – Stable. Status for birds separated by a slash (/) indicates dual status; with the first status refers to the species breeding/nesting population and the second status refers to the species non-breeding/nesting (migratory or winter) population.

Table 4. Status, habitat requirements, and information on federally-listed and New Jersey state-listed endangered, threatened and special concern species that have the potential to occur within the Combe Fill South Landfill OU2 study area.

Common name (*Scientific name*)	**Status[1]**	**Habitat requirements**	**Habitat use/sighting information for the study area**
Indiana Bat (*Myotis sodalis*)	US & NJ E	Indiana bats are federally- and state-listed as endangered. Indiana bat over-winter in caves and mines from October to April (Beth Hartmaier and Bruce E. Beans, pages 1-7 in Beans and Niles 2003). During the summer, females may occupy maternity roosts with up to 100 females in riparian and floodplain forests under the loose bark of dead or dying trees (Beth Hartmaier and Bruce E. Beans. Indiana Bat. pages 1-7 in Beans and Niles 2003) as well as live trees with loose bark, scaly bark, deeply furrowed bark, fractured limbs, cavities and crevices. Indiana bat forage on flying and terrestrial insects some of which have aquatic egg and larval stages leading to flying adults (dragonflies, mosquitoes, etc.). Though not observed in the study area, they are expected to occur in suitable habitat for roosting/maternity roosts and foraging; there were no potential hibernacula on the site. Maternity colonies have been confirmed by the NJDEP/USFWS in Chester and Washington townships and hibernation records include Chester Township (IPaC January 2014). The landfill may provide foraging habitat and nearby forested habitats could provide foraging and roosting habitat for Indiana bats. Therefore, Indiana bats could occur in the study area from May through October.	• Indiana bats could forage within the study area. • Roosting/maternity colonies on and adjacent to the study area are also possible. • No potential hibernacula are known to be present on the site. • Mitigation would include limiting tree cutting to winter.
Northern Long-eared Bat (*Myotis septentrionalis*)	US T NJ E	Northern long-eared bats are federally-listed as threatened and state-listed as endangered. They roost in trees including dead, dying, and live trees with loose bark, scaly bark, deeply furrowed bark, fractured limbs, cavities, and crevices, and forage on flying insects including some that have aquatic egg and larval stages leading to flying adults (dragonflies, mosquitoes, etc.). Though not observed in the study area, they are expected to occur in suitable habitat for roosting/maternity roosts and foraging; there were no potential hibernacula on the site. Maternity colonies and hibernation records have been confirmed by the NJDEP/USFWS for Morris County but not for Chester and Washington townships (IPaC January 2014) where the landfill is located. The landfill may provide foraging habitat and nearby forested habitats could provide foraging and roosting habitat for northern long-eared bats. Northern long-eared bats could occur in the study area from May through October.	• Northern long-eared bats could forage within the study area. • Roosting/maternity colonies on and adjacent to the study area are also possible. • No potential hibernacula are known to be present on the site. • Mitigation would include limiting tree cutting to winter.

Table 4. Status, habitat requirements, and information on federally-listed and New Jersey state-listed endangered, threatened and special concern species that have the potential to occur within the Combe Fill South Landfill OU2 study area.

Common name (*Scientific name*)	**Status[1]**	**Habitat requirements**	**Habitat use/sighting information for the study area**
Bobcat *(Felis rufus)*	NJ E	Bobcat use a variety of habitats including deciduous and mixed forests, and forested areas mixed with agriculture and rural areas (Kris Schantz and Michael Valent. Bobcat. pages 23-29 in Beans and Niles 2003). They seem to prefer rough broken habitat with a mix of early and late successional stages with a dense understory for cover and protection. Bobcat often use areas with rock outcrops, caves, and ledges as denning areas and where rocky outcrops are not present, they use swamps, bogs, and areas of dense mountain laurel, rhododendron, or conifer stands. They are opportunistic feeders preferring rabbits, but also eat other small mammals including squirrels, chipmunks, mice, voles, shrews, and woodrats. They may also prey on small and injured deer and deer carrion. Bobcat may move through the study area, but are not likely to den in the study area.	• Bobcat were not observed in or near the study area. • Bobcat could use the study area as part of a larger home range or could disperse through the study area.
Red-shouldered Hawk (*Buteo lineatus*)	NJ E/SC	Red-shouldered hawk are listed as endangered for breeding/nesting populations and special concern for non-breeding/nesting populations. Red-shouldered hawk nest in extensive hardwood swamps (Walsh et al. 1999). Habitat includes mature wet woods deciduous, coniferous, or mixed woodlands (Sherry Liguori. Red-shouldered hawk. pages 61-67 in Beans and Niles 2003). During the nesting season they are found in deciduous, coniferous, and mixed wetland and upland forests where they forage primarily on frogs, salamanders, snakes, small turtles, crayfish, snails, grasshoppers, beetles, spiders, and to a lesser extent small birds and mammals (Sherry Liguori. Red-shouldered hawk. pages 61-67 in Beans and Niles 2003). Due to the forested wetland habitat near the landfill, the red-shouldered hawk would be considered a potential nesting species near the landfill. The existing habitat (forested wetlands) would be better suited for red-shouldered hawk if there were more open wetland areas and ponds.	• Red-shouldered hawk were not observed in or near the study area. • Nesting in forested habitat near or adjacent to the landfill is possible. • Red-shouldered hawk could use forested habitats within or near the study area during migration and potentially as overwintering habitat.
Barred Owl (Strix varia)	NJ T/T	Barred Owl are listed as threatened for both breeding/nesting populations and for non-breeding/nesting populations. Barred owl nest in cavities preferring large forested wetlands with mature trees (Walsh et al. 1999). They prefer an open understory for foraging where they may forage on small mammals including mice, voles, shrews, squirrels, rabbits, moles, rats, and chipmunks. They also consume frogs, small snakes, salamanders, spiders, crayfish, snails, slugs, insects, fish, opossums, bats, and small birds. Due to the forested wetland habitat near the landfill, the barred owl would be considered a potential nesting species near the landfill. The existing habitat (forested wetlands with large trees) is well suited for barred owl.	• Barred owl were not observed in or near the study area. • Barred owl could nest in the forested wetlands on and near the study area.

Table 4. Status, habitat requirements, and information on federally-listed and New Jersey state-listed endangered, threatened and special concern species that have the potential to occur within the Combe Fill South Landfill OU2 study area.

Common name (*Scientific name*)	**Status[1]**	**Habitat requirements**	**Habitat use/sighting information for the study area**
Maine snaketail *(Ophiogomphus mainensis)*	NJ SC	This is a dragonfly that prefers clear water with moderate rapids over rocky substrates flowing through forested habitats. They feed in fields/open habitats on other invertebrates. Maine snaketail are only found in two watersheds within New Jersey.	• Maine snaketail were not observed in or near the study area. • Maine snaketail may feed in the study area if they had suitable aquatic habitat nearby. However, it is unlikely suitable aquatic habitat is available within daily movement range.
Bog turtle (Clemmys muhlenbergii)	US T NJ E	They are found in wet grassy areas, mossy bogs, and plant meadows that are divided by clear, unpolluted spring-fed streams that flow throughout the year. They like open areas for basking in the sun and nesting. Bog turtle forage on seeds, berries, shoots, and invertebrates. They also eat insects and their larvae, crayfish, mollusks, worms, snails, slugs, amphibians, nestling rodents, nestling birds, and carrion.[1]	• Bog turtle were not observed in the study area.
Small Whorled pogonia (Isotria medeoloides)	US T	Small Whorled pogonia is an orchid that grows in older hardwood stands of beech, birch, maple, oak, and hickory that have an open understory. Sometimes it grows in stands of softwoods such as hemlock. It prefers acidic soils with a thick layer of dead leaves, often on slopes near small streams.[2] Small whorled pogonia is currently documented in Sussex and Passaic Counties, New Jersey.[3]	• Small whorled pogonia were not observed in the study area. • There are no documented locations of Small whorled pogonia in Morris County where the study area is located.

[1] Species Status Descriptions: US – federal. NJ – New Jersey state. E – Endangered. T – Threatened. SC – Special Concern. Status for animals separated by a slash (/) indicates dual status; with the first status refers to the species breeding/nesting population and the second status refers to the species non-breeding/nesting (migratory or winter) population.

[1] Conserve Wildlife Foundation of New Jersey, New Jersey Endangered and Threatened Species Field Guide.
[2] U.S. Fish and Wildlife Service, Threatened and Endangered Species, Small Whorled Pogonia, January 2008.
[3] U.S. Fish and Wildlife Service, New Jersey Field Office Northeast Region, Small Whorled Pogonia, January 28, 2014.

Table 5. Wildlife Species Observed and/or Heard During the 2010-2011 Combe Fill South OU2 Wildlife Surveys					
Scientific Name	**Common Name**	**Rank/Abundance Point Count**	**Rank/Abundance Incidental**	**NJ Status**	**NJ Resident Status**
	Mammals				
Blarina brevicauda	Northern Short-tailed Shrew	NA	Present	S	Year-round
Scalopus aquaticus	Eastern Mole	NA	Present	S	Year-round
Slyvilagus floridanus	Eastern Cottontail	NA	Present	S	Year-round
Tamias striatus	Eastern Chipmunk	NA	Present	S	Year-round
Marmota monax	Woodchuck	NA	Present	S	Year-round
Sciurus carolinensis	Eastern Gray Squirrel	NA	Common	S	Year-round
Tamiasciurus hudsonicus	Red Squirrel	NA	Common	S	Year-round
Peromyscus leucopus	White-footed Mouse	NA	Present	S	Year-round
Microtus pennsylvanicus	Meadow Vole	NA	Common	S	Year-round
Canis latrans	Coyote	NA	Present	S	Year-round
Vulpes vulpes	Red Fox*	NA	Present	S	Year-round
Ursus americanus	American Black Bear*	NA	Present	INC	Year-round
Procyon lotor	Northern Raccoon	NA	Present	S	Year-round
Mustela frenata	Long-tailed Weasel	NA	Present	S	Year-round
Odocoileus virginianus	White-tailed Deer	NA	Common	D	Year-round
Sub-total Mammal Species	**15**		**15**		
	Birds				
Empidonax alnorum	Alder Flycatcher	Uncommon	Uncommon	INC	bm
Corvus brachyrhynchos	American Crow	1/Common	5/Common	S	bmw
Carduelis tristis	American Goldfinch	7/Common	6/Common	INC	bmw
Falco sparverius	American Kestrel	Uncommon	Uncommon	SC	bmw
Setophaga ruticilla	American Redstart	Absent	Uncommon	INC	bm
Turdus migratorius	American Robin	3/Common	7/Common	S	bmw
Spizella arborea	American tree Sparrow	Absent	Uncommon	U	mw
Icterus galbula	Baltimore Oriole	Absent	Uncommon	RP	bm
Hirundo rustica	Barn Swallow	Common	9/Common	S	bm
Coragyps atratus	Black Vulture	Uncommon	Uncommon	INC	bmw
Miniotilta varia	Black-and-white Warbler	Uncommon	Uncommon	RP	bm
Coccyzus erythropthalmus	Black-billed Cuckoo	Absent	Uncommon	RP	bm
Paurs atricapillus	Black-capped Chickadee	10/Common	Uncommon	S	bmw

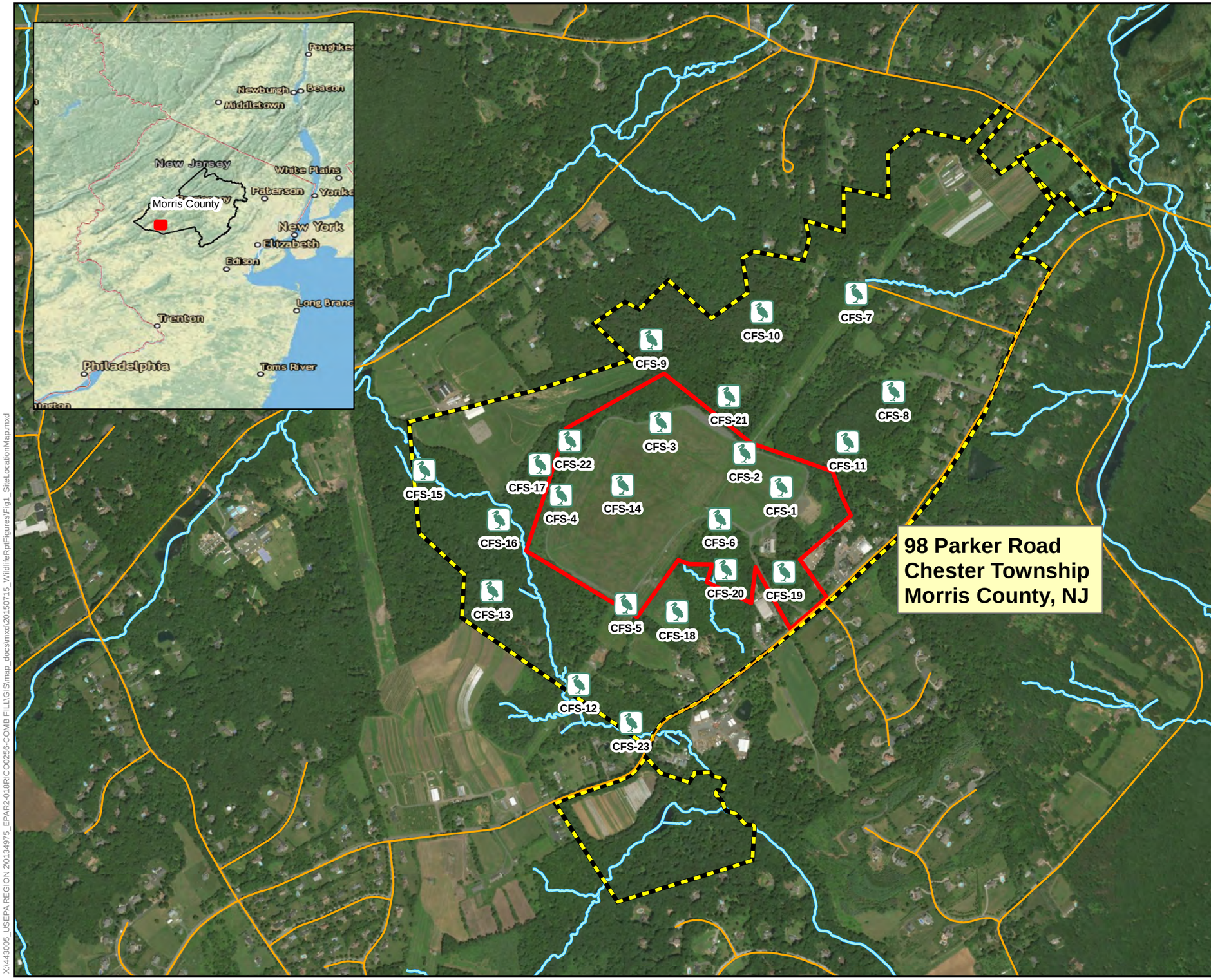
Table 5. Wildlife Species Observed and/or Heard During the 2010-2011 Combe Fill South OU2 Wildlife Surveys					
Scientific Name	**Common Name**	**Rank/Abundance Point Count**	**Rank/Abundance Incidental**	**NJ Status**	**NJ Resident Status**
Dendroica caerulescens	Black-throated Blue Warbler	Uncommon	Absent	RP	bm
Dendroica virens	Black-throated Green Warbler	Uncommon	Absent	SC	bm
Cyanocitta cristata	Blue Jay	4/Common	8/Common	D	bmw
Vermivora pinus	Blue-winged Warbler	Uncommon	Uncommon	RP	bm
Dolichonyx oryzivorus	Bobolink	Common	1/Common	T	bm
Molothrus ater	Brown-headed Cowbird	Uncommon	Uncommon	S	bmw
Branta canadensis	Canada Goose	Uncommon	Common	INC	bmw
Thryothorus ludovicianus	Carolina Wren	Uncommon	Uncommon	INC	bw
Bombycilla cedrorum	Cedar Waxwing	Common	Uncommon	SC	bm
Dendroica pensylvanica	Chestnut-sided Warbler	Uncommon	Uncommon	S	bm
Spizella passerina	Chipping Sparrow	Uncommon	Uncommon	S	bmw
Quiscalus quiscula	Common Grackle	Uncommon	Uncommon	D	bmw
Corvus corax	Common Raven	6/Common	Absent	INC	bmw
Geothlypis trichas	Common Yellowthroat	Common	10/Common	D	bm
Accipiter cooperii	Cooper's Hawk	Uncommon	Uncommon	SC/S	bmw
Picoides pubescens	Downy Woodpecker	Uncommon	Uncommon	S	bw
Sialia sialis	Eastern Bluebird	Uncommon	Absent	INC	bmw
Tyrannus Tyrannus	Eastern Kingbird	Uncommon	Uncommon	RP	bm
Sturnella magna	Eastern Meadowlark	Uncommon	Uncommon	SC	bmw
Sayornis phoebe	Eastern Phoebe	Common	Uncommon	S	bm
Otus asio	Eastern Screech Owl	Absent	Uncommon	RP	bw
Pipilo erythrophthalmus	Eastern Towhee	9/Common	11/Common	RP	bmw
Meleagris gallopavo	Eastern Wild Turkey*	Absent	Present	INC	bw
Contopus virens	Eastern Wood Pewee	Uncommon	Absent	RP	bm
Sturnus vulgaris	European Starling	2/Common	2/Common	I	bmw
Spizella pusilla	Field Sparrow	Common	Common	RP	bmw
Ammodramus savannarum	Grasshopper Sparrow	Uncommon	Uncommon	T	bm
Dumetella carolinensis	Gray Catbird	5/Common	3/Common	RP	bmw
Ardea herodias	Great Blue Heron	Uncommon	Absent	SC	bmw
Myiarchus crinitus	Great Crested Flycatcher	Uncommon	Uncommon	RP	bm
Picoides villosus	Hairy Woodpecker	Uncommon	Uncommon	D	bw

Table 5. Wildlife Species Observed and/or Heard During the 2010-2011 Combe Fill South OU2 Wildlife Surveys					
Scientific Name	**Common Name**	**Rank/Abundance Point Count**	**Rank/Abundance Incidental**	**NJ Status**	**NJ Resident Status**
Catharus guttatus	Hermit Thrush	Absent	Uncommon	D	bmw
Troglogytes aedon	House Wren	Uncommon	Uncommon	S	bm
Passerina cyanea	Indigo Bunting	Common	12/Common	RP	bm
Charadrius vociferus	Killdeer	Absent	Uncommon	S	bmw
Melospiza lincolnii	Lincoln's Sparrow	Uncommon	Uncommon	INC	m
Dendroica magnolia	Magnolia Warbler	Absent	Uncommon	INC	bm
Zenaida macroura	Mourning Dove	Uncommon	Common	S	bmw
Cardinalis cardinalis	Northern Cardinal	Uncommon	Common	INC	bw
Colaptes auratus	Northern Flicker	Common	Uncommon	RP	bmw
Mimus polyglottos	Northern Mockingbird	Uncommon	Uncommon	D	bmw
Seiurus noveboracensis	Northern Waterthrush	Absent	Uncommon	S	bm
Pandion haliaetus	Osprey	Uncommon	Absent	T	bm
Seiurus aurocapillus	Ovenbird	Uncommon	Common	D	bm
Dendroica palmarum	Palm Warbler	Absent	Uncommon	INC	m
Dryocopus pileatus	Pileated Woodpecker	Absent	Uncommon	D	bw
Dendroica pinus	Pine Warbler	Absent	Uncommon	RP	bm
Dendroica discolor	Prairie Warbler	Absent	Uncommon	RP	bm
Melanerpes carolinus	Red-bellied Woodpecker	Common	13/Common	INC	bw
Sitta canadensis	Red-breasted Nuthatch	Uncommon	Absent	S	bmw
Vireo olivaceus	Red-eyed Vireo	Uncommon	Uncommon	S	bm
Buteo jamaicensis	Red-tailed Hawk	Uncommon	Common	INC	bmw
Agelaius phoeniceus	Red-winged Blackbird	Common	4/Common	S	bmw
Columba livia	Rock Dove	Absent	Uncommon	I	bmw
Stelgidopteryx serripennis	Rough-winged swallow	Absent	Uncommon	S	bm
Regulus calendula	Ruby-crowned kinglet	Absent	Uncommon	D	mw
Archilochus colubris	Ruby-throated hummingbird	Absent	Uncommon	D	bm
Passerculus sandwichensis	Savannah Sparrow	Uncommon	Uncommon	T	bmw
Piranga olivacea	Scarlet Tanager	Uncommon	Uncommon	RP	bm
Accipiter striatus	Sharp-shinned Hawk	Uncommon	Uncommon	SC/S	bmw
Melospiza melodia	Song Sparrow	Common	Common	D	bmw
Melospiza georgiana	Swamp Sparrow	Uncommon	Uncommon	D	bmw

Table 5. Wildlife Species Observed and/or Heard During the 2010-2011 Combe Fill South OU2 Wildlife Surveys					
Scientific Name	**Common Name**	**Rank/Abundance Point Count**	**Rank/Abundance Incidental**	**NJ Status**	**NJ Resident Status**
Tachycineta bicolor	Tree Swallow	Common	Common	INC	bm
Parus bicolor	Tufted Titmouse	8/Common	Uncommon	INC	bw
Cathartes aura	Turkey Vulture	Common	Uncommon	INC	bmw
Catharus fuscescens	Veery	Common	Uncommon	SC	bm
Pooecetes gramineus	Vesper Sparrow	Absent	Common	E/SC	bmw
Vireo gilvus	Warbling Vireo	Uncommon	Absent	S	bm
Sitta carolinensis	White-breasted Nuthatch	Common	Common	INC	bw
Zonotrichia leucophrys	White-crowned Sparrow	Uncommon	Absent	D	mw
Zonotrichia albicollis	White-throated Sparrow	Common	Common	D	bmw
Aix sponsa	Wood Duck	Absent	Common	RP	bmw
Hylocichla mustelina	Wood Thrush	Uncommon	Absent	RP	bm
Dendroica petechia	Yellow Warbler	Uncommon	Common	S	bm
Sphyrapicus varius	Yellow-bellied Sapsucker	Absent	Uncommon	U	mw
Dendroica coronata	Yellow-rumped Warbler	Absent	Uncommon	INC	bmw
Sub-total Bird Species	**89**	**67**	**78**		
	Reptiles				
Terrapene carolina	Eastern Box Turtle	NA	Common	SC	Year-round
Chrysemys picta	Eastern Painted Turtle	NA	Present	S	Year-round
Nerodia sipedon	Northern Watersnake	NA	Present	S	Year-round
Sub-total Reptile Species	**3**		**3**		
	Amphibians				
Ambystoma maculatum	Spotted Salamander	NA	Common	S	Year-round
Notophthalmus v. viridescens	Red Spotted Newt	NA	Present	S	Year-round
Plethodon c. cinereus	Eastern Red-backed Salamander	NA	Common	S	Year-round
P. g. glutinosus	Northern Slimy Salamander	NA	Present	S	Year-round
Eurycea b. bislineata	Northern Two-lined Salamander	NA	Present	S	Year-round
Anaxyrus americanus	American Toad	NA	Present	S	Year-round
Hyla versicolor	Northern Gray Tree Frog	NA	Present	S	Year-round
Lithobates catesbeianus	American Bullfrog	NA	Present	S	Year-round

Table 5. Wildlife Species Observed and/or Heard During the 2010-2011 Combe Fill South OU2 Wildlife Surveys					
Scientific Name	**Common Name**	**Rank/Abundance Point Count**	**Rank/Abundance Incidental**	**NJ Status**	**NJ Resident Status**
Lithobates clamitans	Green Frog	NA	Common	S	Year-round
Lithobates sylvaticus	Wood Frog	NA	Common	S	Year-round
Sub-total Amphibian Species	**10**		**10**		
Total of All Species	**117**	**67**	**106**		
E- Endangered	S-Stable	INC-Increasing	P-Peripheral	b-breeding/summer	
T-Threatened	U-Undetermined	SC-Special Concern	RP-Regional Priority	m-migrant	
D-Decreasing	I-Introduced	NA-Not Applicable	Year-round Resident	w-winters	

Figures



Combe Fill South Landfill
Superfund Site OU2 RI/FS

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community
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Coordinates in New Jersey State Plane
(NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary
- Highlands Streams
- Wildlife Point Count Stations

0 500 1,000 2,000 Feet

Site Location Map

Figure 1
April 30, 2018

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Legend

Habitat

- AGRICULTURAL WETLANDS (MODIFIED)
- ALTERED LANDS
- ARTIFICIAL LAKES
- CONIFEROUS FOREST (10-50% CROWN CLOSURE)
- CONIFEROUS FOREST (>50% CROWN CLOSURE)
- CONIFEROUS WOODED WETLANDS
- CROPLAND AND PASTURELAND
- DECIDUOUS BRUSH/SHRUBLAND
- DECIDUOUS FOREST (10-50% CROWN CLOSURE)
- DECIDUOUS FOREST (>50% CROWN CLOSURE)
- DECIDUOUS SCRUB/SHRUB WETLANDS
- DECIDUOUS WOODED WETLANDS
- DISTURBED WETLANDS (MODIFIED)
- HERBACEOUS WETLANDS
- MANAGED WETLAND IN MAINTAINED LAWN GREENSPACE
- MIXED DECIDUOUS/CONIFEROUS BRUSH/SHRUBLAND
- MIXED FOREST (>50% CONIFEROUS WITH 10%-50% CROWN CLOSURE)
- MIXED FOREST (>50% CONIFEROUS WITH >50% CROWN CLOSURE)
- MIXED FOREST (>50% DECIDUOUS WITH 10-50% CROWN CLOSURE)
- MIXED FOREST (>50% DECIDUOUS WITH >50% CROWN CLOSURE)
- NATURAL LAKES
- OLD FIELD (< 25% BRUSH COVERED)
- OTHER AGRICULTURE
- PLANTATION
- UPLAND RIGHTS-OF-WAY (DEVELOPED)
- UPLAND RIGHTS-OF-WAY (UNDEVELOPED)
- WETLAND RIGHTS-OF-WAY (MODIFIED)
- OU2 Investigation Area
- Wildlife Point Count Stations

NJDEP Landscape Project Species-Based Habitat Patches Ranks

0 1,000 Feet

Job No.	Date	Figure No.
134975	4/30/2018	2

Legend

OU2 Investigation Area

Wildlife Point Count Stations

Species-Based Habitat - Skylands

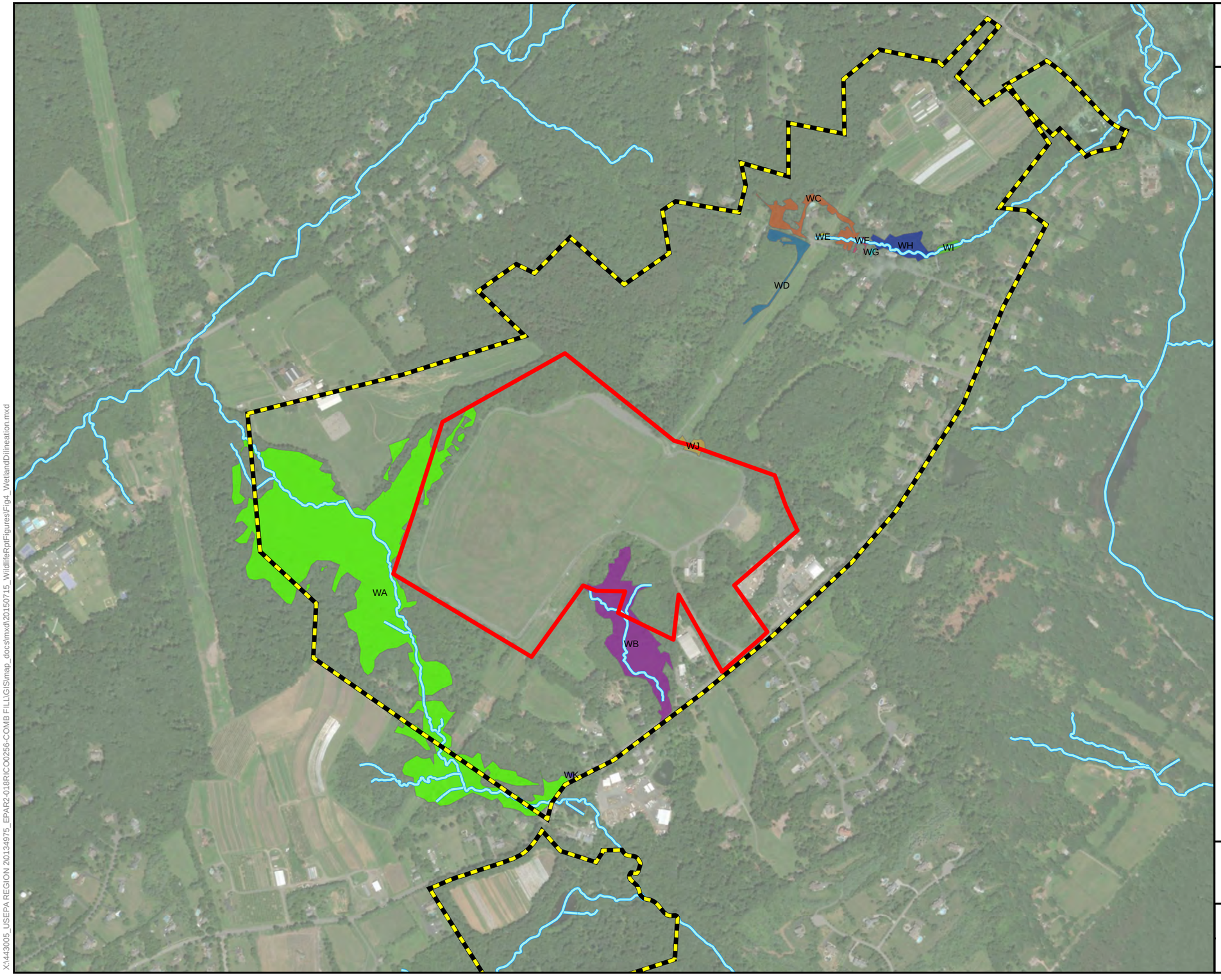
RANK

- Rank 1 - Habitat specific requirements
- Rank 2 - Special Concern
- Rank 3 - State Threatened
- Rank 4 - State Endangered
- Rank 5 - Federal Listed

NJDEP Landscape Project Species-Based Habitat Patches Ranks

0 1,000 Feet

Job No.	Date	Figure No.
134975	4/30/2018	3



Combe Fill South Landfill
Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinates in New Jersey State Plane
(NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary

Delineated Wetlands

Wetland Name

- WA
- WB
- WC
- WD
- WE
- WF
- WG
- WH
- WI
- WJ
- WK
- Highlands Streams

0 400 800 1,600 Feet

Delineated Wetlands Map

Figure 4
April 30, 2018

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Attachment F

Wetland Technical Memorandum

Wetland Delineation Report and Wetlands Functions and Values Assessment

Combe Fill South Landfill Superfund Site,
Operable Unit 2
Remedial Investigation/Feasibility Study

EPA Work Assignment Number 018-RICO-0256,
EPA Contract Number EP-W-09-009

Chester and Washington Townships,
Morris County, New Jersey
December 9, 2015

Prepared for:
U.S. Environmental Protection Agency
Region 2
New York, NY

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Figure 3 ..... NWI Wetland Map
Figure 4 ..... Highlands Wetlands, Streams and Groundwater Recharge
Figure 5 ..... USAD Soils and Highland Hydric Soils Map
Figure 6 ..... Delineated Wetlands
Figure 7 ..... Streams and Their Watersheds
Figure 8 ..... NJDEP Watershed Map
Figure 9 ..... FEMA Flood Map
Figure 10 ..... NJDEP Landscape Project Habitat Suitability Map

Attachments

Attachment A ..... USDA NRCS Custom Soil Survey Report
Attachment B ..... Wetland Delineation Data Sheets
Attachment C ..... Site Photograph Log
Attachment D ..... Wetland Functional Assessment Forms

ABBREVIATIONS AND ACRONYMS

DGPS	Differential Global Positioning System
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
HDR	Henningson, Durham and Richardson Architecture and Engineering, P.C., in association with HDR Engineering, Inc.
HUC	Hydrologic unit code
NJDEP	New Jersey Department of Environmental Protection
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
OU	Operable unit
PEM	Palustrine emergent wetland
PFO	Palustrine forested wetland
PSS	Palustrine scrub/shrub
RI	Remedial Investigation
UNT	Unnamed tributary
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geologic Survey

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1 Project Description

The Environmental Protection Agency Region 2 (EPA Region 2) proposes to identify and select viable remediation alternatives to eliminate, reduce, or control risks to human health and the environment at the Combe Fill South Landfill Operable Unit 2 (OU2) Superfund site located in Chester and Washington Townships, Morris County, NJ (Figure 1). As part of that effort, HDR conducted a wetland delineation, functional assessment and a habitat and wildlife survey prior to undertaking intrusive activities as part of the Remedial Investigation (RI). This report provides a description of the wetland delineation and wetland functional assessment, within the Combe Fill South OU2 study area. A description of the wildlife and habitats within the Combe Fill South OU2 study area are provided in the *Wildlife Technical Memorandum* in Appendix P.

1.1 Project Location

Combe Fill South is located at 98 Parker Road, Chester Township, Morris County, NJ (Figure 2). The property is about 115 acres and extends into portions of Washington and Chester Townships. This inactive municipal landfill consists of three separate fill areas, which were capped and closed in the mid-1990s. The final cap area is about 65 acres with about another 20 acres occupied by the treatment facility, drainage ditches, site roads, and detention basins.

This report addresses wetlands and waters of the United States within the overall study area (labeled OU2 Boundary in Figure 1 and subsequent figures). The OU2 study area is generally bounded to the north by residential parcels on both sides of Schoolhouse Lane, to the east by Parker Road, and to the south and west by individual tax lots adjacent to the landfill. Several agricultural operations are located to the south, north and east of the study area. Forested areas are interspersed with the residential and agricultural areas located to the west and north of the study area.

2 Wetland Delineation

2.1 Methods

Prior to initiation of the field work, HDR conducted a desktop review of available data sources in order to focus the field efforts. Data sources consulted for the wetland delineation included the following:

- National Wetland Inventory (NWI) maps published by the US Fish and Wildlife Service (USFWS) (Figure 3)
- Highlands Wetlands, Streams and Groundwater Recharge areas (Figure 4)
- U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Custom Soil Resource Report (Attachment A) and Highland Hydric Soils (Figure 5)
- Federal Emergency Management Agency (FEMA) Flood Map (Figure 9)

Wetlands within the boundaries of the Combe Fill South OU2 study area were delineated on May 9 through 12, and May 16 through 17, 2011 in accordance with the protocol described in the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands Intermediate-Level Onsite Determination Methods (Federal Interagency Committee for Wetland Delineation 1989). Each distinct wetland was given its own letter designation and was marked in the field with consecutively numbered orange fluorescent flagging tape (e.g. “WA-1”, “WA-2”, “WB-1”, etc.). Observation points were also flagged in the field and labeled (e.g. “OPA-01”, and “OPA-02”, etc.) Field indicators of hydrophytic vegetation, hydric soil, and wetland hydrology were recorded on field data forms at several observation points located along a line perpendicular to the wetlands boundary. Observation points were collected on both sides of the wetland boundary (i.e. on the wetland and upland sides of the boundary), and were used to make the determination of where to locate the wetland line. For areas where soil data was not obtained, the USDA soil series description was used to fill in the soil horizons on the datasheets. Copies of field data forms are provided in Attachment B. The wetlands were classified based on existing information and field assessment results according to the standard USFWS cover type classification (Cowardin, 1985).

Wetland flags and observation points were surveyed in the field using a Trimble Differential Global Positioning System (GPS) with sub-meter accuracy. GPS data were post-processed using Trimble Pathfinder Office software and plotted using ESRI® ArcGIS® Geographic Information System (GIS) software. A list of flags and locations were forwarded to Borbas Surveying and Mapping (Borbas), a NJ-licensed land surveyor, in support of the ground survey effort. Borbas subsequently located the boundary flags and observation points (Attachment C). The surveyed wetland boundaries were imported into the GIS and are shown on Figure 6.

2.2 Findings

A desktop review of existing available information and a field investigation were conducted in support of the wetland delineation at the project site. The results of the desktop review and the field investigation are provided below.

2.2.1 Wetland Desktop Review

The NWI maps indicate three wetland types within the OU2 boundary: within the west side of the site there is a PFO1B (palustrine forested/broadleaved deciduous/non-tidal, saturated) and on the east side there is a PSS1B (palustrine scrub-shrub/broadleaved deciduous, saturated) and a PSS1A (palustrine scrub-shrub/broadleaved deciduous, temporary flooded) (Figure 3). NJ Highlands wetlands maps (Figure 4) also show wetlands on the west and east sides of the site and a small wetland in the center portion of the site, on the northern edge of the landfill cap that is not shown on the NWI maps. The wetland in the center of the site appears to be isolated, whereas all the other wetlands appear to be associated with streams. The Custom Soil Resource Report (Attachment A) and Highlands hydric soils data (Figure 5) indicate several hydric soil map units on the site (Annandale gravelly loam, 3 to 8 percent slopes (AnoB), Califon loam, 0 to 3 and 3 to 8 percent slopes (CakA and CakB), Cokesbury gravelly loam, 0 to 3 and 3 to 8 percent slopes (CobA and CobB) and Cokesbury loam, 0 to 8 percent slopes (CoaBc)) (Figure 5). These areas were field checked for potential wetland areas.

2.2.2 Wetland Delineation

Four distinct wetland areas were delineated and five watercourses were identified within the OU2 study area. The delineated wetlands correspond to the four wetland areas depicted on the NJ Highlands wetlands map. Three of the wetlands (WA, WB, and the WC complex) were classified in the field as PFO1B (palustrine forested/broadleaved deciduous/non-tidal, saturated). One wetland (WJ), which corresponds with the small wetland area in the center of the site on the NJ Highlands wetland maps, was classified in the field as EM1C (emergent, persistent, seasonally flooded). The soils observed in the field are consistent with the USDA NRCS soils map (Attachment A, Figure 5).

Wetlands

Wetland WA is the largest wetland delineated within the study area, stretching across two New Jersey Department of Environmental Protection (NJDEP) hydrologic unit codes (HUC), 14 watersheds and covering about 48.6 acres (Photographs 1 through 10 in Attachment C). The wetland is located within the headwaters of the unnamed tributary (UNT) to Trout Brook in the south and an UNT to Tanners Brook to the north, within the western portion of the project site. Wetland WA is a forested wetland (PFO) dominated by a very diverse mixture of trees. The upper canopy is dominated with red maple (*Acer rubrum*), but other trees are intermixed and in some cases appear as co-dominants. Yellow birch (*Betula alleghaniensis*) is the prime associate of red maple and co-dominates the canopy throughout the wetland. Other co-dominants are both swamp white oak (*Quercus bicolor*) and sourgum (*Nyssa sylvatica*). Mid-story trees include river birch (*Betula nigra*) and American hornbeam (Carpinus caroliniana). The shrub layer is dominated by spice bush (*Lindera benzoin*), highbush blueberry (*Vaccinium corymbosum*), and nannyberry (*Viburnum lentago*). The herbaceous layer is quite diverse and is dominated by a mixture of ferns including sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*) and marsh fern (*Thelyperis palustis*) along with other assorted sedges and grasses. At the drainage divide between the watersheds, there is a large flat area with a dense understory of skunk cabbage (*Symplocarpus foetidus*) mixed with ferns and sedges.

Within each watershed, Wetland WA parallels each stream and occurs in the low lying inner floodplain of these watercourses. There is a gradual moisture gradient as you move from the outer edge of the wetland to the edge of the streams from a temporary flooded hydrology to a wetter seasonally flooded community along the stream.

Wetland WB is a seasonally flooded red maple swamp community associated with an UNT to Trout Brook covering about 8.1 acres (Photographs 11 through 14, Attachment C). It occurs in poorly drained depressions and along both sides of the stream. Red maple was by far the dominant tree but slippery elm (*Ulmus rubra*), pin oak (*Quercus palustris*) and white ash (*Fraxinus 3mergent3*) are scattered throughout. Wetland WB contained a healthy shrub layer including northern spicebush (*Lindera benzoin*), gray dogwood (*Cornus racemosa*) and American witchhazel (*Hamamelis virginiana*). Some small areas had been cleared and showed evidence of past disturbance (Photograph 11) along with some invasive plants such as multiflora rose (*Rosa multiflora*) and common buckthorn (*Rhamnus catharitica*). Numerous 3mergent form the herbaceous stratum such as skunk-cabbage (*Symplocarpus foetida*), swamp jack-in-the-pulpit (*Arisaema*

triphyllum) (Photograph 12), sensitive fern (Onoclea sensibilis) and cinnamon fern (*Osmunda cinnamomea*).

Wetlands WC, WD, WE, WF, WG, WH, and WI are all part of one wetland complex bordering an UNT to the Lamington (Black) River on both sides of Schoolhouse Lane. This community is slightly drier then Wetlands WA and WB, and would be classified as a temporarily flooded, red maple swamp community. Unlike the other two wetlands that have large continuous areas, this wetland complex has been divided up into small pieces by historical land use practices, particularly from single family residential subdivisions. Wetland WC (2.1 acres), WD (1.1 acres), WE (0.1 acres), WF (0.2 acres), WG (0.1 acres), WH (1.6 acres), and WI (0.3 acres) total about 5.5 acres. Wetlands WE and WI are small ponds constructed on residential property. They appeared to be somewhat eutrophic and perhaps stocked for local recreational use. The remaining wetlands are dominated by red maples but mixed with gray birch (*Betula populifolia*) along with scattered upland trees such as tulip poplar (*Liriodendron tulipifera*) and black birch (*Betula lenta*). The shrub layer consists of highbush blueberry (*Vaccinium ccorymbosum*) and red maple saplings. There is a significant amount of non-native invasive plants such as multi-flora rose, Japanese barberry (*Berberis thunbergii*) and tartarian honeysuckle (*Lonicera tatarica*). Skunk cabbage and cinnamon fern dominate the herbaceous stratum. There are significant numbers of vine species, another sign of disturbance, including poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia),* summer grape (Vitus aestivalis) and cat briar (*Smilax glauca*).

Wetland WJ is an isolated palustrine emergent wetland (PEM), i.e., freshwater marshes dominated by persistent and non-persistent grasses, that is located within the watershed of an UNT to the Lamington River (South) (Figure 7). Wetland WJ would best be described as a shallow emergent marsh that is seasonally flooded. The water depths appear to range from a few inches to a few feet during flood events but the water level drops by mid to late summer exposing the substrate. Wetland WJ appears to be the result of disturbed conditions; likely a result of proximate landfill capping activities and/or maintenance of the utility easement on which it is located. The vegetation is predominantly hydrophytic. However, the soils do not display the normal hydric soil characteristics that would be expected. The soil profile is more homogeneous than expected and the soil color indicates the area has been filled. The hydrology appears to be the result of stormwater run-off from the landfill perimeter road being directed to this area. This run-off appears to be very sporadic resulting in a tussock-type vegetation growth pattern (Photographs 29 and 30). During a site visit on May 13, 2011, the area was saturated but did not hold standing water. Ten days later (Photographs 31 and 32), the area had standing water. The central part of the marsh is dominated by wool-grass (*Scirpus cyperinus*) and prairie dogbane (*Apocynum sibiricum*) – both plants can tolerate fluctuating water levels. Shrubs are scattered in clumps, surround the area and include silky dogwood (*Cornus amomum*), northern arrow-wood (*Viburnum recognitum*) and stiff dogwood (*Cornus foemina*). Areas with greater than 50% shrub cover are classified as shrub swamps. A small fringe within Wetland WJ could be classified as palustrine scrub-shrub (PSS).

Watercourses

Five watercourses were identified within the OU2 study area. These waters consist of the headwaters of Trout Brook and a number of UNTs that flow into Trout Brook, Tanners Brook, and the Lamington River (Figure 7). The discrete watersheds for each of the streams are depicted on Figure 7. These surface water bodies are part of the Lamington River (HUC-11 Code: 02030105050) watershed and two Lamington River sub-watersheds (HUC-14 Codes: 02030105050030 and 02060105050040) (see Figure 8). Figure 9 depicts FEMA flood zones and surface water bodies within the vicinity of the study area.

Trout Brook is a low-gradient headwater creek that flows to the south, where it discharges into the Lamington River in Hacklebarney State Park to the south of the study area. One UNT to Trout Brook was identified within the southern portion of the study area and is associated with Wetland WB. An UNT to Tanners Brook originates west of the landfill and flows north. Tanners Brook is located to the northwest, outside of the study area, and flows northeast into the Lamington River, which at that juncture flows south. Drainage from the southeastern portion of the site flows east and southeast into an UNT of the Lamington River (South). Another UNT to the Lamington River (North), associated with the Wetland WC complex, generally flows alongside Schoolhouse Lane and Parker Road and eventually drains to the Lamington River to the northeast of the study area (Figure 7). According to field observations, the applicable Cowardin classification for both Trout Brook and the Lamington River is R3SB3 (riverine, upper perennial, streambed mud substrate).

Based on field observations, most of these streams have an ecological community classification of a marsh headwater stream. The best examples are streams in Wetland WA, Trout Brook and the UNT to Tanners Brook. These aquatic communities consist of small marshy perennial brooks with very low gradients, slow flow rate (<35 ft/sec) and cool to warm water that flows through a marsh, fen or swamp where a stream system originates. These streams have clearly distinguished meanders or high sinuosity, and are in unconfined watersheds (Edinger et. al, 2002).

All tributaries have relatively small local watersheds and are headwater streams with moderate relief tributaries. These would be characterized as Rosgen “B” type streams, moderately entrenched systems with channel gradients of 2 to 4 percent. Based on the grain size data collected as part of the RI sediment sampling effort, the channel bed morphology is dominated by sand-sized materials most likely classifying these as B4 streams. They are characterized as a series of rapids and irregularly spaced scour pools. Bankfull channel width varies from 10 to 18 feet. Field classification would be required for an accurate assessment of stream type and substrate evaluation. Table 1 lists the sub-watershed of each stream originating in the study area and the characteristics of each watershed (Figure 7).

Table 1. Watershed Characteristics for Streams Identified On-site

Stream and Designated Sub-Watershed	Associated Wetlands	Area (sq. mi.)	Bankfull Flow (ft^3/sec)	Slope	
				(ft./mi.)	(%)
Tanners Brook UNT	(Wetland WA)	0.0392	7.21	186	3.52
Trout Brook	(Wetland WA)	0.42	35.1	263	4.98
Trout Brook UNT	(Wetland WB)	0.13	17.3	114	2.20
Lamington River (North) UNT	(Wetland WC Complex and Wetland WJ)	0.23	25.8	121	2.29
Lamington River (South) UNT	(Wetland WI)	0.15	19.9	180	3.41
Note: Values are approximate and derived from StreamStats.					

3 Wildlife Observations

3.1 Methods

For the analysis of wetland functions and values, HDR utilized the “Highway Methodology” method used by the New England Division of the U.S. Army Corps of Engineers (USACE). This functional analysis methodology utilizes a “Descriptive Approach” to wetland functions and values and incorporates both wetland science and our best professional judgment to determine which functions and/or values are applicable to each wetland.

Wetlands and adjacent water bodies are legally protected because of the functions they perform and the perceived value that these functions provide to society. Wetland functions are the physical, chemical, and biological processes that characterize wetland ecosystems, such as flooding, denitrification, provision of habitat for organisms, and support of aquatic life that allow a wetland ecosystem to be self-sustaining in the absence of society. The value of a wetland is a measure of the societal importance or worth derived from a wetland function or a combination thereof (USACE 1999). Wetland functions and values examined consisted of the following:

1. Groundwater recharge/discharge
2. Flood flow alteration (storage and desynchronization)
3. Fish and shellfish habitat
4. Sediment/toxicant/pathogen retention
5. Nutrient removal/retention/transformation
6. Production export (nutrient)
7. Sediment/shoreline stabilization
8. Wildlife habitat

9. Recreation (consumptive and non-consumptive)
10. Educational/scientific value
11. Uniqueness/heritage
12. Visual quality/aesthetics
13. Threatened or endangered species habitat

The two major objectives of this functional assessment include: 1.) identification of the functions and values provided by the existing wetlands and watercourses within the study area; and 2.) assistance in the characterization of these habitats in support of the wildlife assessment. In order to complete the assessment a desktop review of available information was completed, followed by a field assessment. Data sources consulted for the desktop review included the following:

- US Geological Survey (USGS) Topographic Map (Figure 1)
- Aerial Photograph (Figure 2)
- Watershed maps (Figures 7 and 8)
- FEMA Flood Insurance Rate Map (Figure 9)
- NJDEP Landscape Project Habitat Suitability map (Figure 10)

3.2 Findings

As part of this functional assessment, a set of wetland functions have been identified that exist within the study area along with the extent to which these functions provide services and value beyond the limits of the site. Included in this assessment are the stream and watershed functions and values that are provided. (See Attachment D for the Wetland Function Value Evaluation Forms).

1. Groundwater Recharge/Discharge - This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area. This function was identified as being present and is a principal function of Wetlands WA and WB, and a secondary function for the other wetlands. The areas are expected to function primarily as groundwater discharge points as observed since the wetlands are associated with a perennial watercourse at the headwaters of these streams. The one wetland that serves as groundwater recharge is Wetland WJ. This isolated wetland is in a low-lying area that receives stormwater run-off from the landfill perimeter road. Accumulated run-off percolates into the groundwater regime. In addition the topography immediately surrounding the wetland is relatively flat and underlain by sands and gravels. Figure 4 shows a large recharge area adjacent to the location of Wetland WJ.
2. Floodflow Alteration - This function considers the effectiveness of the wetland in reducing flood damage by water retention for prolonged periods following precipitation events and the gradual release of floodwaters. This function was identified as being present in all wetlands within the study area. For Wetlands WA and WD, the area is large relative to its watershed (268+42=310 acres watershed to +49 acres Wetland WA; and 83 acres watershed to +8 acres

Wetland WB). This indicates the wetlands have a large influence on the stream and flooding hydrology. These wetlands receive and retain overland or sheet flow runoff from surrounding uplands. Since these are headwater wetlands, the flood storage function is reduced and therefore not a primary function. This function is primary for Wetlands WC, WD, WE, WF, WG, WH, WI and is closely tied to the presence/extent of the pond dams (Wetlands WE and WI); without the dams the flood storage/assimilation potential of the wetlands would be reduced. These areas retain higher volumes of water during flood events than under normal or average rainfall conditions.

3. Fish and Shellfish Habitat - This function considers the effectiveness of seasonal or permanent watercourses associated with the wetlands for fish and shellfish habitat. This function was identified as being present in Wetlands WA through WI although not a primary function. There may be some fish habitat value associated with the ponded areas created and maintained by the two constructed dams.
4. Sediment/Toxicant/Pathogen Retention - This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens in runoff water from surrounding uplands, or upstream eroding wetland areas. This function was identified as being present in all wetlands within the study area. There have been existing sources of toxicants or pathogens identified in the watershed above the wetlands as a result of the landfill activities. There is ample opportunity for sediment trapping or slow moving water or in some cases deep water habitat (Wetland WE and WI) that has a long duration water retention time.
5. Nutrient Removal/Retention/Transformation - This function considers the effectiveness of the wetland as a trap for nutrients in runoff from surrounding uplands or contiguous wetlands, and the ability of the wetland to process these nutrients into other forms of trophic levels. There are nutrients from the former landfill and thus there is the potential for this function to take place but limited evidence of this function is presently occurring. The physical configuration of the Lamington River UNT wetlands, such as the presence of the ponds and dams, gives this wetland complex high potential to trap nutrients. The ponded areas created by the dams and resultant slowing of stream velocity facilitate settling and sequestering of nutrients, and their uptake by the wetland plant community. However, since the landfill has been capped for some time and the watershed is relatively undeveloped, it is most likely serving this function at a minimal level.
6. Production/Export - This function evaluates the effectiveness of the wetland to produce food or usable products for man or other living organisms. This function was deemed to be present in Wetlands WA and WB and to a limited extent Wetlands WC through WI, due to the diverse plant community and numerous sources of food for wildlife.
7. Sediment/Shoreline Stabilization - This function considers the effectiveness of a wetland to stabilize stream banks and shorelines against erosion. This function was deemed to be present in Wetlands WA through WI; the very wide wetlands

(>10') bordering the watercourses and ponds indicates these wetlands have the capacity to slow runoff velocities and stabilize shorelines.

8. Recreation - This value considers the suitability of the wetland and associated watercourses to provide recreational opportunities such as hiking, canoeing, boating, fishing, hunting or other passive or active recreational activities. This function was deemed not to be present in Wetlands WA, WB and WJ due to the lack of access points and closed (fenced and posted) nature of the watershed. Wetlands WC through WI are accessible to the local residents and provide some passive recreational opportunities.
9. Wildlife Habitat - This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge. This function was deemed to be present in all wetlands within the study area and a principal function of the wetlands. The relatively undisturbed nature of the watershed (after the landfill was closed) and multiple vegetative communities (open water, herbaceous, scrub-shrub, and forested) within the wetlands provide diverse habitat and cover for wildlife. (See *Wildlife Technical Memorandum* in Appendix P for details).
10. Educational/Scientific Value - This value considers the suitability of the wetland as a site for an "outdoor classroom" or as a location for scientific study or research. This function was deemed not to exist for Wetlands WA, WB and WJ due to lack of access. The Lamington River UNT wetlands could have limited educational value to the adjacent homes. The area is private property and not available for use by local schools or environmental education facilities, so the potential for education or scientific uses in general is negligible.
11. Uniqueness/Heritage - This value considers the effectiveness of the wetland or its associated water bodies to provide certain special values. These may include archaeo-logical sites, unusual aesthetic quality, historical events, or unique plants, animals and geologic features. Based on the results of the file review and field surveys none of the other attributes are present and this function was deemed not to exist.
12. Visual Quality/Aesthetics – This value considers the visual and aesthetic quality of the wetland. This function was deemed not to exist due to the lack of access and/or viewing points around most wetlands. There may be some limited value to the wetlands around Schoolhouse Lane.
13. Endangered Species Habitat - This value considers the suitability of the wetland to support threatened or endangered species. Based on the field surveys, the study area wetlands do not provide habitat for any state or Federally-listed endangered or threatened species, thus this function was deemed not to exist.

Both the size and the relatively undisturbed condition of Wetland WA give it the highest functions and values of the wetlands within the study area.

4 Conclusions

Four freshwater wetland areas were delineated within the study area. These four areas generally correspond to wetlands mapped by the NJ Highlands Council. Two of the four areas (Wetlands WA and WB) consist of contiguous wetlands. Wetland WA, the largest at 48.62 acres, is associated with the headwaters of Trout Brook and an UNT to Tanners Brook. Wetland WA is located west and south of the landfill and extends to Parker Road. Wetland WB, the second largest at 8.25 acres, is associated with the headwaters of an UNT of Trout Brook. This wetland is located east-southeast of the landfill and also extends to Parker Road. Wetland WB receives effluent from the landfill groundwater treatment plant. The Wetland WC complex is a group of small wetlands along an UNT of the Lamington River segmented by residential development along Schoolhouse Lane to the north of the landfill. These wetlands total 5.48 acres. Wetland WJ is a small (0.44 acre) depressed area along the utility easement to the north of the landfill. This wetland appears isolated and is located over 1,000 ft. from the nearest delineated wetland and nearly 2,000 ft. from the UNT to Lamington River (North).

The findings of the wetland functions and values assessment indicate that many principle functions and values are provided by the wetlands within the study area. The principle wetland function and values provided by the wetlands are wildlife habitat and sediment/toxicant retention. The wildlife habitat function is provided by all wetlands as most are buffered from development and are connected to other aquatic habitats and resources. In addition, the wetlands provide sediment and toxicant retention as they receive flows from adjacent streams and upland areas, and the microtopographical relief allows for sediments and toxicants to settle out.

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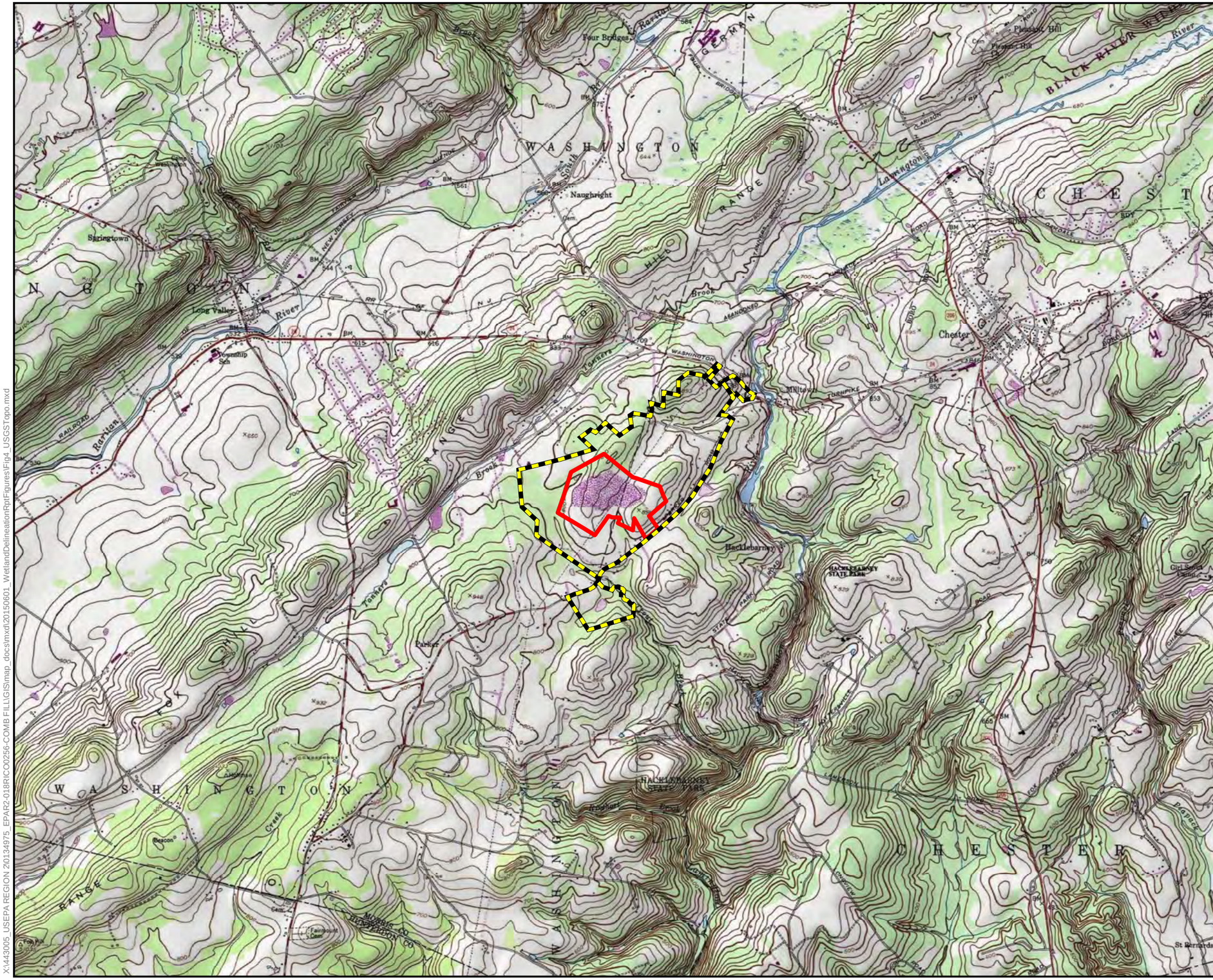
Wetland Memorandum Figures



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Combe Fill South Landfill
Superfund Site OU2 RI/FS

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

Coordinates in New Jersey State Plane
(NAD 1983, survey foot)

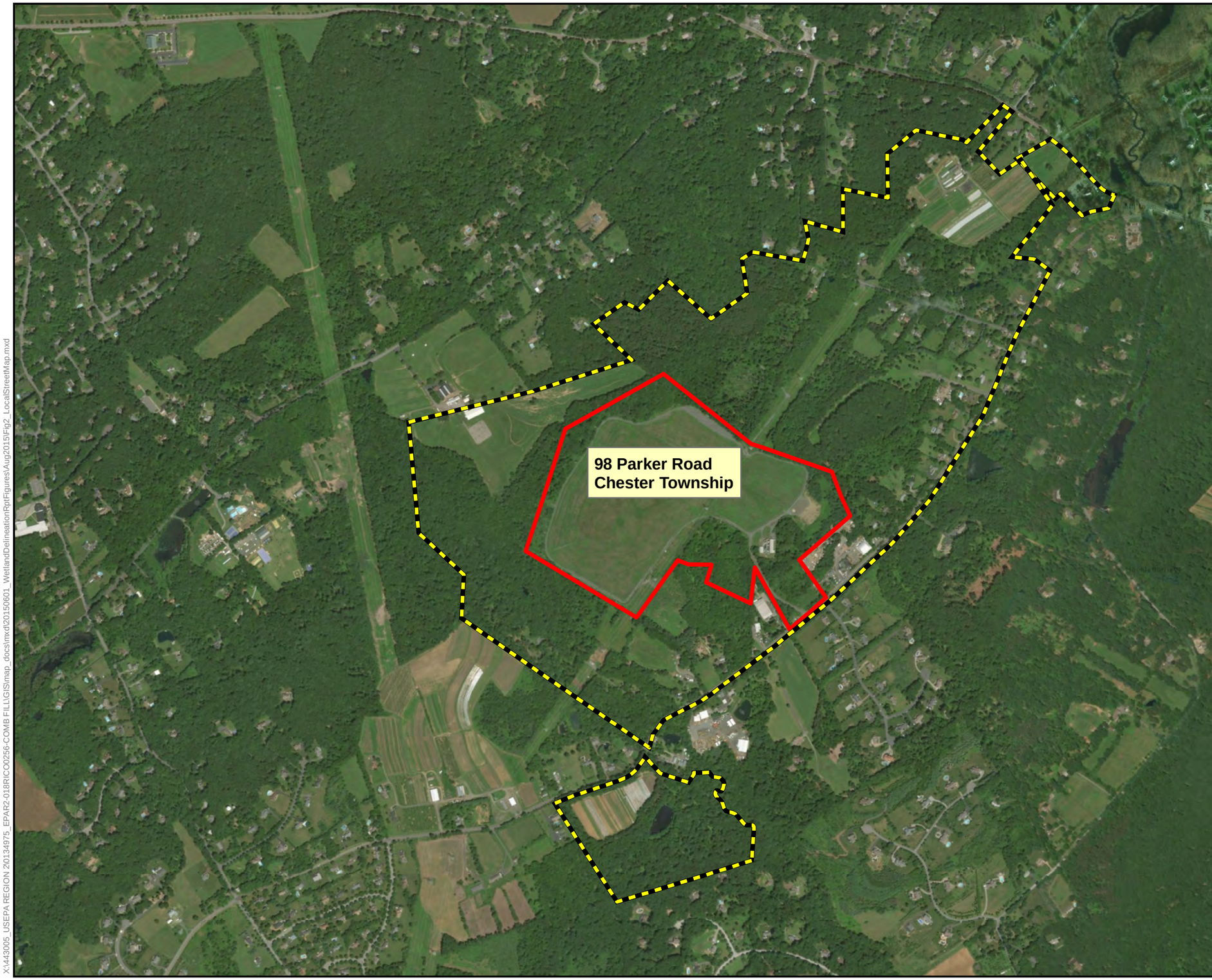
Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary

0 1,500 3,000 6,000 Feet

USGS Topographic Map

Figure 1
April 27, 2018



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Superfund Site OU2 RI/FS

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS

Coordinates in New Jersey State Plane
(NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary

0 500 1,000 2,000 Feet

Local Street Map

Figure 2
April 27, 2018

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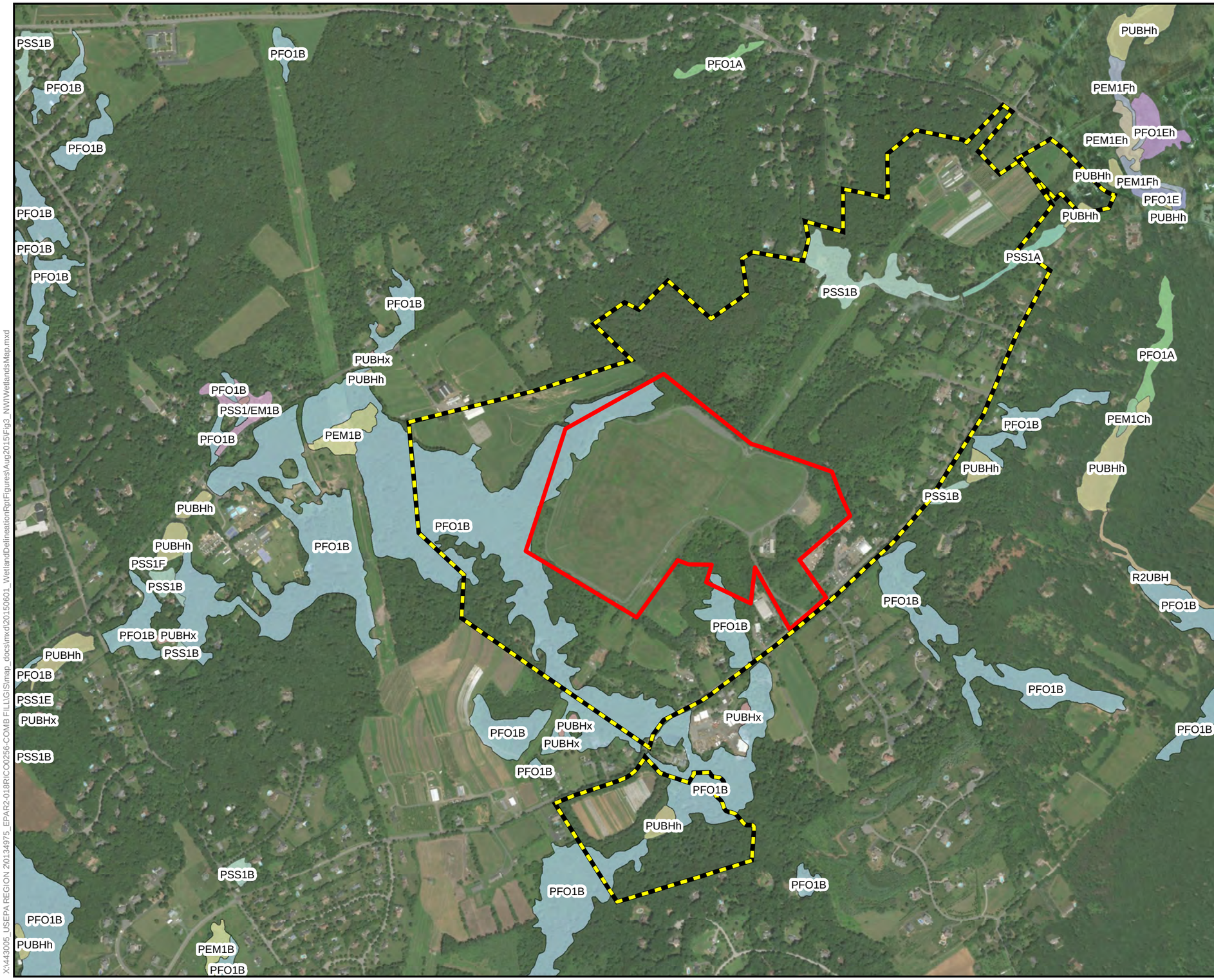

Combe Fill South Landfill Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,

Sources: USFWS National Wetland Inventory, 2015

Coordinates in New Jersey State Plane (NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary

National Wetlands Inventory

- PEM1B
- PEM1Ch
- PEM1Eh
- PEM1Fh
- PFO1A
- PFO1B
- PFO1E
- PFO1Eh
- PSS1/EM1B
- PSS1A
- PSS1B
- PUBHh
- PUBHx
- R2UBH

0 500 1,000 2,000 Feet

NWI Wetlands Map

Figure 3
April 27, 2018

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Coordinates in New Jersey State Plane (NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary
- Highlands Streams
- Highlands Wetlands
- Highlands Groundwater Recharge Areas

0 400 800 1,600 Feet

Highlands Wetlands, Streams, and Groundwater Recharge

Figure 4
April 27, 2018

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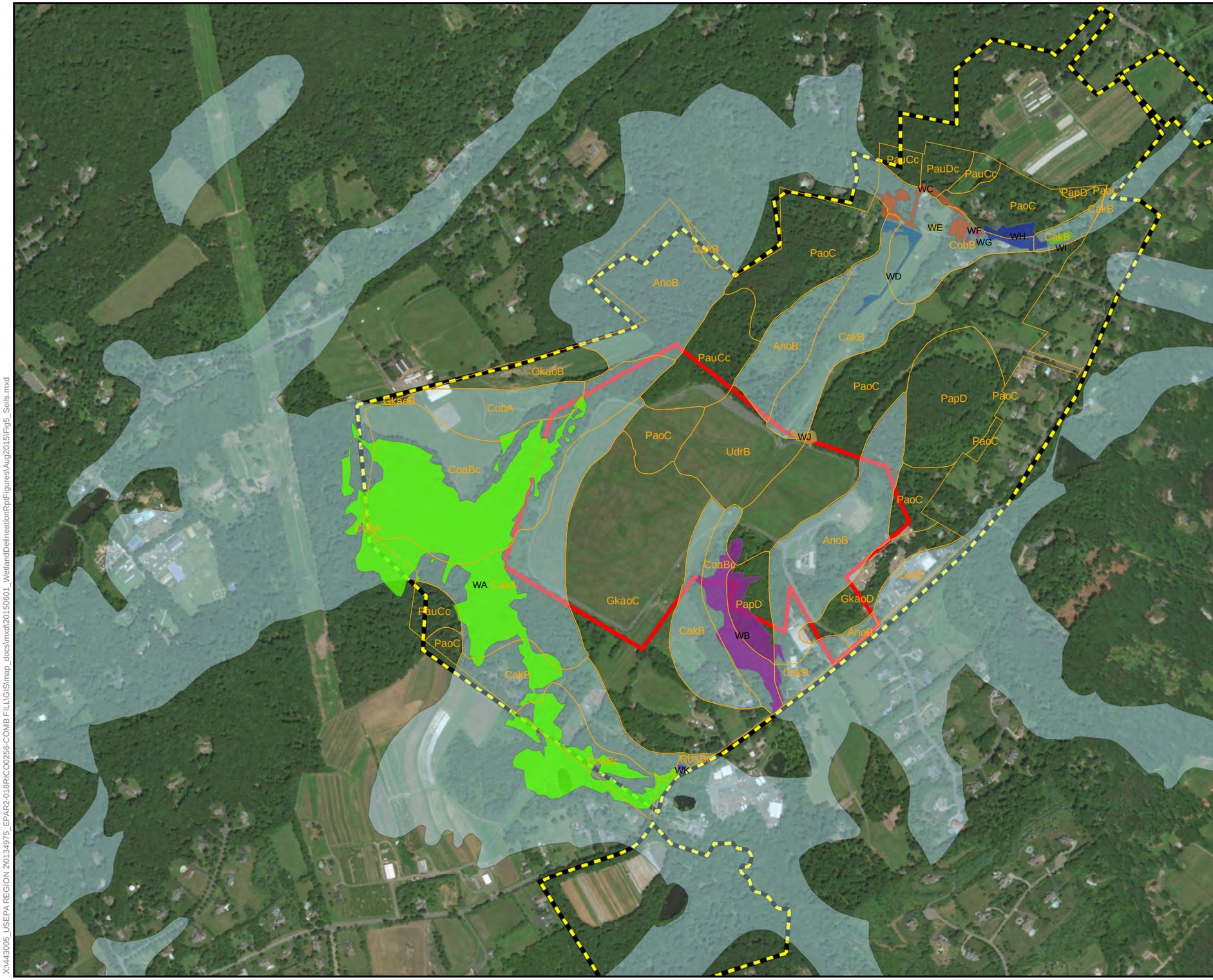

Combe Fill South Landfill
Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinates in New Jersey State Plane
(NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary
- Highlands Hydric Soils
- USDA Soils

Delineated Wetlands

- WA
- WB
- WC
- WD
- WE
- WF
- WG
- WH
- WI
- WJ
- WK

0 400 800 1,600 Feet

USDA Soils and Highlands Hydric Soils

Figure 5
April 27, 2018

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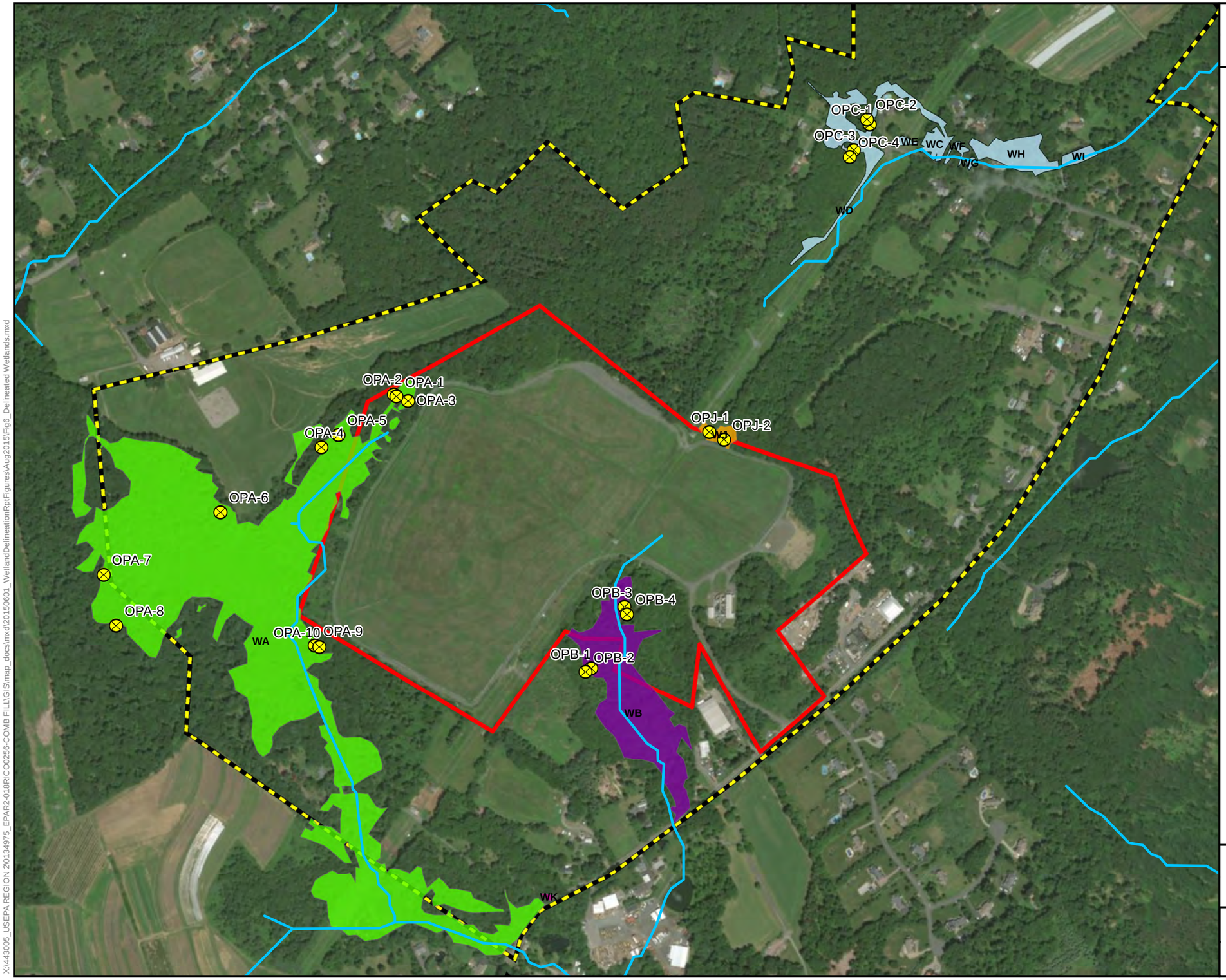


Combe Fill South Landfill Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: Stream data obtained from USGS StreamStats Beta Version 3 for the State of NJ

Coordinates in New Jersey State Plane (NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1- Landfill Property Boundary
- Observation Points
- Streams

Delineated Wetlands

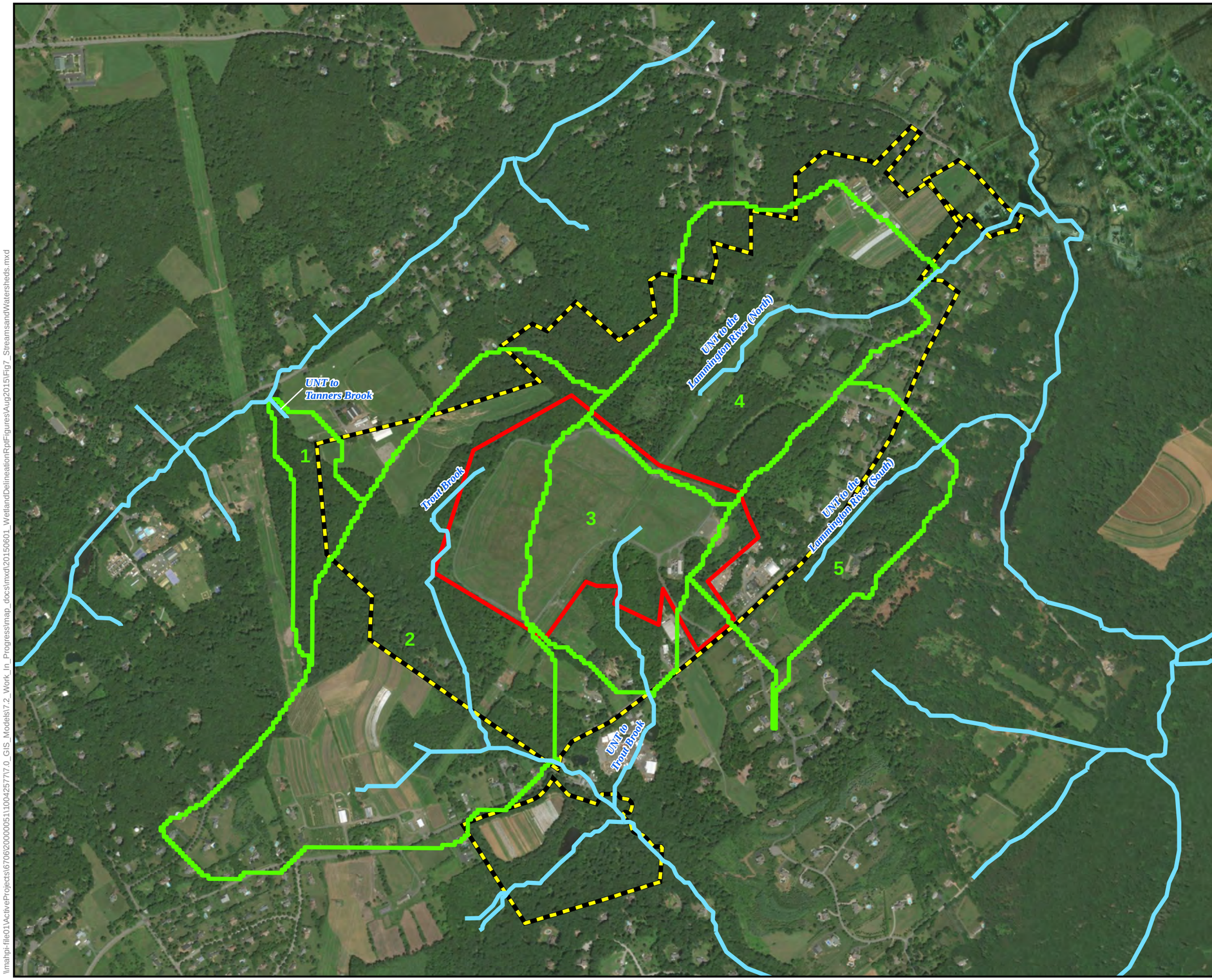
- Wetland A
- Wetland B
- Wetland C Complex
- Wetland J
- Wetland K

0 250 500 1,000 Feet

Delineated Wetlands

Figure 6
April 27, 2018

X:\443005_USEPA REGION 2\0134975_EPAR2-018RICO0256-COMB FILL\GIS\map_docs\mxd\20150601_WetlandDelineationRptFigures\Aug2015\Fig6_Delineated Wetlands.mxd



Combe Fill South Landfill Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

USGS StreamStats and Local Watershed data was derived from USGS StreamStats Version 3 Beta Application for the the State of New Jersey

Coordinates in New Jersey State Plane (NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary
- USGS StreamStats Data
- Local Watershed
  - 1 UNT to Tanners Brook
  - 2 Trout Brook
  - 3 UNT to Trout Brook
  - 4 UNT to Lammington River (North)
  - 5 UNT to Lammington River (South)

0 500 1,000 2,000 Feet

Streams and Watersheds **Figure 7**

April 27, 2018

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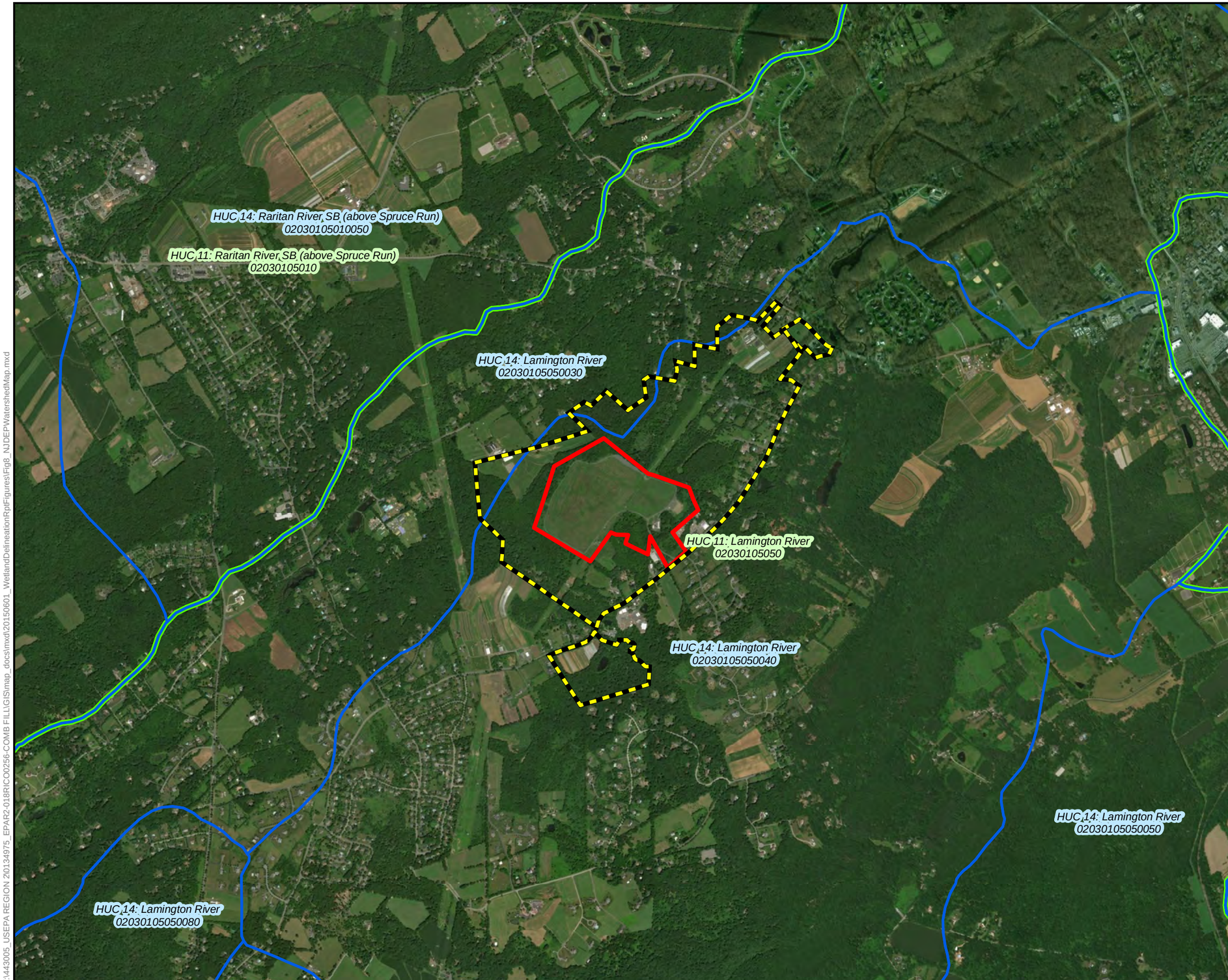

Combe Fill South Landfill Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Coordinates in New Jersey State Plane (NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary
- NJDEP HUC 14
- NJDEP HUC 11

0 1,000 2,000 4,000 Feet

NJDEP Watershed Map

Figure 8
April 27, 2018

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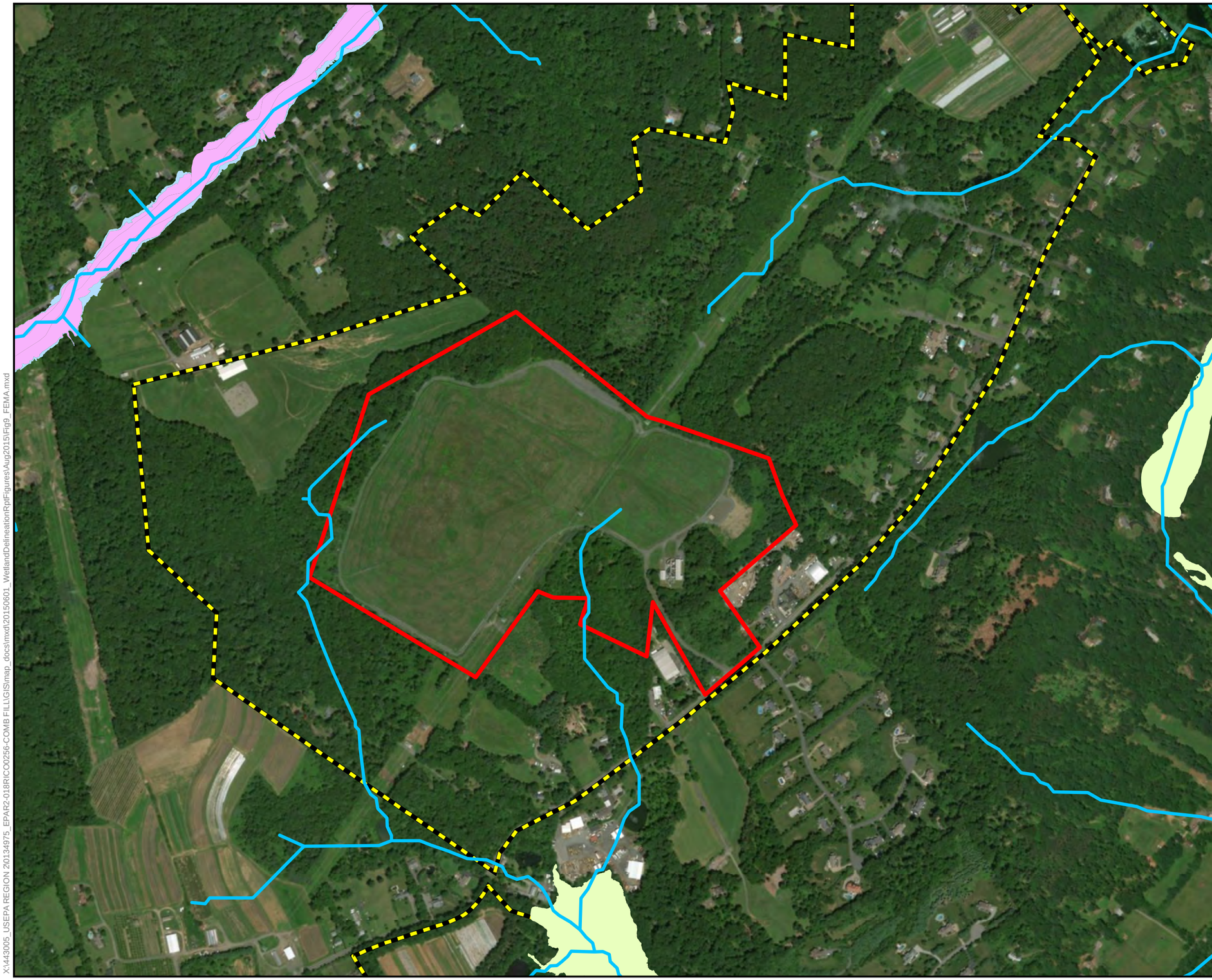

Combe Fill South Landfill Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Flood Zone Source: FEMA Preliminary Digital FIRM, April 2010.

Stream Data Source: USGS StreamStats Version 3 Beta Application for the the State of New Jersey

Coordinates in New Jersey State Plane (NAD 1983, survey foot)

Legend

- OU2 Investigation Area
- OU1 - Landfill Property Boundary
- Streams

FEMA Flood Zone

- 0.2 PCT Annual Chance Flood Hazard
- A
- AE

0 250 500 1,000 Feet

FEMA Flood Map

Figure 9
April 27, 2018

X:\443005_USEPA REGION 2\0134975_EPAR2-018RICO0256-COMB FILL\GIS\map_docs\mxd\20150601_WetlandDelineationRptFigures\Aug2015\Fig9_FEMA.mxd

Combe Fill South Landfill Superfund Site OU2 RI/FS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Source: NJDEP Landscape Project Version 3.1

Coordinates in New Jersey State Plane (NAD 1983, survey foot)

Legend

- OU2 Investigation
- OU1 - Landfill Property Boundary

NJDEP Landscape Project

- Arrowhead Spiketail
- Black-billed Cuckoo
- Blackburnian Warbler
- Brown Thrasher
- Golden-winged Warbler
- Great Blue Heron
- Jefferson Salamander
- Marbled Salamander
- Northern Copperhead
- Veery
- Wood Thrush
- Wood Turtle

0 500 1,000 2,000 Feet

NJDEP Landscape Project

Figure 10
April 30, 2018

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USDA NRCS
Custom Soil Survey Report

United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Morris County, New Jersey

Combe Fill South Landfill Operable Unit 2

August 11, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Morris County, New Jersey
Survey Area Data: Version 9, Sep 24, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 26, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Morris County, New Jersey (NJ027)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AnoB	Annandale gravelly loam, 3 to 8 percent slopes	52.5	12.7%
CakA	Califon loam, 0 to 3 percent slopes	27.9	6.8%
CakB	Califon loam, 3 to 8 percent slopes	49.9	12.1%
CoaBc	Cokesbury loam, 0 to 8 percent slopes, extremely stony	58.8	14.3%
CobA	Cokesbury gravelly loam, 0 to 3 percent slopes	10.2	2.5%
CobB	Cokesbury gravelly loam, 3 to 8 percent slopes	14.1	3.4%
GkaoB	Gladstone gravelly loam, 3 to 8 percent slopes	6.3	1.5%
GkaoC	Gladstone gravelly loam, 8 to 15 percent slopes	49.7	12.0%
GkaoD	Gladstone gravelly loam, 15 to 25 percent slopes	7.7	1.9%
PaoC	Parker gravelly sandy loam, 3 to 15 percent slopes	78.3	19.0%
PapD	Parker very gravelly sandy loam, 15 to 25 percent slopes	22.6	5.5%
PauCc	Parker-Gladstone complex, 0 to 15 percent slopes, extremely stony	18.0	4.4%
PauDc	Parker-Gladstone complex, 15 to 25 percent slopes, extremely stony	3.1	0.7%
UdrB	Udorthents, refuse substratum, 0 to 8 percent slopes	13.3	3.2%
Totals for Area of Interest		**412.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability

of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and

relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Morris County, New Jersey

AnoB—Annandale gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: b0l7
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Annandale and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Annandale

Setting

Landform: Ground moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy deeply weathered granitic gneiss and/or old glacial till

Typical profile

Ap - 0 to 11 inches: gravelly loam
BA - 11 to 17 inches: loam
Bt - 17 to 32 inches: loam
Bx - 32 to 44 inches: sandy loam
C - 44 to 76 inches: gravelly sandy loam
R - 76 to 80 inches: weathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 24 to 36 inches to fragipan; 72 to 80 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Gladstone

Percent of map unit: 5 percent
Landform: Colluvial aprons
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

Parker

Percent of map unit: 5 percent
Landform: Knobs
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope
Down-slope shape: Convex
Across-slope shape: Linear

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

CakA—Califon loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: b0lj
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Califon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Califon

Setting

Landform: Flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Till derived from gneiss and/or colluvium derived from gneiss

Typical profile

Ap - 0 to 9 inches: loam
Bt - 9 to 23 inches: clay loam
Bx - 23 to 38 inches: sandy loam
Cx - 38 to 57 inches: sandy loam
2C - 57 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C

Minor Components

Gladstone

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

Annandale

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

Cokesbury

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

CakB—Califon loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: b0lk
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Califon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Califon

Setting

Landform: Flats
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Till derived from gneiss and/or colluvium derived from gneiss

Typical profile

Ap - 0 to 9 inches: loam
Bt - 9 to 23 inches: clay loam
Bx - 23 to 38 inches: sandy loam
Cx - 38 to 57 inches: sandy loam
2C - 57 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Gladstone

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

Annandale

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

Cokesbury

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave

CoaBc—Cokesbury loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: b0ls
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Cokesbury, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cokesbury, Extremely Stony

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Till derived from gneiss and/or colluvium derived from gneiss

Typical profile

Ap - 0 to 9 inches: loam
BA - 9 to 15 inches: loam
Bt - 15 to 25 inches: gravelly clay loam
Bx - 25 to 35 inches: loam
C - 35 to 60 inches: gravelly loam

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D

Minor Components

Gladstone

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

Annandale

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

CobA—Cokesbury gravelly loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: b0lt
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Cokesbury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cokesbury

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Till derived from gneiss and/or colluvium derived from gneiss

Typical profile

Ap - 0 to 9 inches: gravelly loam
BA - 9 to 15 inches: loam
Bt - 15 to 25 inches: gravelly clay loam
Bx - 25 to 35 inches: loam
C - 35 to 60 inches: gravelly loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D

Minor Components

Gladstone

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Annandale

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

CobB—Cokesbury gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: b0lv
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Cokesbury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cokesbury

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Till derived from gneiss and/or colluvium derived from gneiss

Typical profile

Ap - 0 to 9 inches: gravelly loam
BA - 9 to 15 inches: loam
Bt - 15 to 25 inches: gravelly clay loam
Bx - 25 to 35 inches: loam
C - 35 to 60 inches: gravelly loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 30 inches to fragipan
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D

Minor Components

Gladstone

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Annandale

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

GkaoB—Gladstone gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 13pvd
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Gladstone and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gladstone

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 10 inches: gravelly loam
Bt - 10 to 22 inches: sandy clay loam
BC - 22 to 37 inches: sandy loam
C - 37 to 96 inches: sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Parker

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear

Annandale

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

GkaoC—Gladstone gravelly loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 13pvf
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Gladstone and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gladstone

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

Parent material: Loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 10 inches: gravelly loam
Bt - 10 to 22 inches: sandy clay loam
BC - 22 to 37 inches: sandy loam
C - 37 to 96 inches: sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

Minor Components

Parker

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear

Annandale, eroded

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

GkaoD—Gladstone gravelly loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 13pvg
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Gladstone and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gladstone

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 10 inches: gravelly loam
Bt - 10 to 22 inches: sandy clay loam
BC - 22 to 37 inches: sandy loam
C - 37 to 96 inches: sandy loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B

Minor Components

Parker

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear

Annandale, eroded

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

PaoC—Parker gravelly sandy loam, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: b0mp
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Parker and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parker

Setting

Landform: Knobs
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from granite and gneiss

Typical profile

A - 0 to 5 inches: very gravelly sandy loam
Bw1 - 5 to 20 inches: very gravelly sandy loam
Bw2 - 20 to 31 inches: very gravelly sandy loam
C - 31 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

Minor Components

Gladstone

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

Annandale

Percent of map unit: 5 percent
Landform: Ground moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Califon

Percent of map unit: 3 percent
Landform: Flats
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Califon, friable subsoil

Percent of map unit: 2 percent
Landform: Drainageways, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Concave

PapD—Parker very gravelly sandy loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: b0mq
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Parker and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parker

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from granite and gneiss

Typical profile

A - 0 to 5 inches: very gravelly sandy loam
Bw1 - 5 to 20 inches: very gravelly loam
Bw2 - 20 to 31 inches: very gravelly sandy loam
C - 31 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B

Minor Components

Gladstone, very stony

Percent of map unit: 5 percent

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex

Califon, friable subsoil
Percent of map unit: 5 percent
Landform: Drainageways, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Concave

PauCc—Parker-Gladstone complex, 0 to 15 percent slopes, extremely stony

Map Unit Setting
National map unit symbol: 1lpc4
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition
Parker, extremely stony, and similar soils: 55 percent
Gladstone, extremely stony, and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parker, Extremely Stony

Setting
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from granite and gneiss

Typical profile
A - 0 to 5 inches: very gravelly sandy loam
Bw1 - 5 to 20 inches: very gravelly loam
Bw2 - 20 to 31 inches: very gravelly sandy loam
C - 31 to 60 inches: very gravelly sandy loam

Properties and qualities
Slope: 0 to 15 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B

Description of Gladstone, Extremely Stony

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 10 inches: gravelly sandy loam
B - 10 to 22 inches: gravelly sandy clay loam
BC - 22 to 37 inches: sandy loam
C - 37 to 96 inches: sandy loam

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B

Minor Components

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Califon, friable subsoil

Percent of map unit: 5 percent
Landform: Drainageways, hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Concave

PauDc—Parker-Gladstone complex, 15 to 25 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 1lpc5
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Parker, extremely stony, and similar soils: 55 percent
Gladstone, extremely stony, and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parker, Extremely Stony

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from granite and gneiss

Typical profile

A - 0 to 5 inches: very gravelly sandy loam
Bw1 - 5 to 20 inches: very gravelly loam
Bw2 - 20 to 31 inches: very gravelly sandy loam
C - 31 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 15 to 25 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B

Description of Gladstone, Extremely Stony

Setting
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss

Typical profile
Ap - 0 to 10 inches: gravelly sandy loam
Bt - 10 to 22 inches: gravelly sandy clay loam
BC - 22 to 37 inches: gravelly sandy loam
C - 37 to 96 inches: sandy loam

Properties and qualities
Slope: 15 to 25 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B

Minor Components

Califon
Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Califon, friable subsoil
Percent of map unit: 5 percent
Landform: Drainageways, hillslopes

Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Concave

UdrB—Udorthents, refuse substratum, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 1kgn4
Elevation: 0 to 260 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, refuse substratum, and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Refuse Substratum

Setting

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy human-transported material over refuse

Typical profile

^A - 0 to 5 inches: loam
^Cu1 - 5 to 21 inches: gravelly loam
^Cu2 - 21 to 80 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.01 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Land Classifications

Land Classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Hydric Rating by Map Unit

This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit.

The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components, 66 to 99 percent hydric components, 33 to 65 percent hydric components, 1 to 32 percent hydric components, and less than one percent hydric components.

In Web Soil Survey, the Summary by Map Unit table that is displayed below the map pane contains a column named 'Rating'. In this column the percentage of each map unit that is classified as hydric is displayed.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

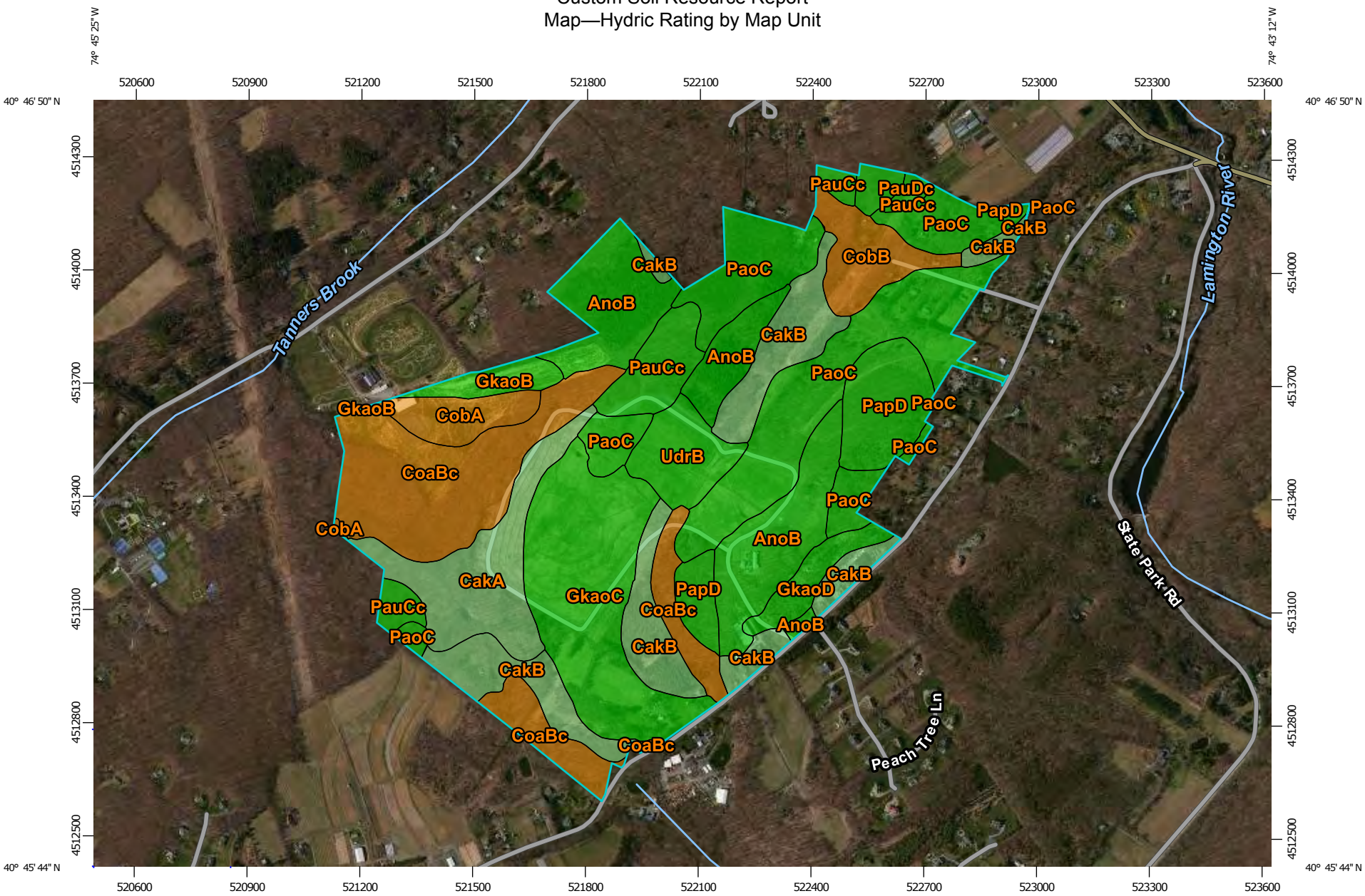
Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Map—Hydric Rating by Map Unit



Map Scale: 1:14,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Hydric (100%)

Hydric (66 to 99%)

Hydric (33 to 65%)

Hydric (1 to 32%)

Not Hydric (0%)

Not rated or not available

Soil Rating Lines

Hydric (100%)

Hydric (66 to 99%)

Hydric (33 to 65%)

Hydric (1 to 32%)

Not Hydric (0%)

Not rated or not available

Soil Rating Points

Hydric (100%)

Hydric (66 to 99%)

Hydric (33 to 65%)

Hydric (1 to 32%)

Not Hydric (0%)

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Morris County, New Jersey
Survey Area Data: Version 9, Sep 24, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 26, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydric Rating by Map Unit

Hydric Rating by Map Unit— Summary by Map Unit — Morris County, New Jersey (NJ027)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AnoB	Annandale gravelly loam, 3 to 8 percent slopes	0	52.5	12.7%
CakA	Califon loam, 0 to 3 percent slopes	5	27.9	6.8%
CakB	Califon loam, 3 to 8 percent slopes	5	49.9	12.1%
CoaBc	Cokesbury loam, 0 to 8 percent slopes, extremely stony	85	58.8	14.3%
CobA	Cokesbury gravelly loam, 0 to 3 percent slopes	85	10.2	2.5%
CobB	Cokesbury gravelly loam, 3 to 8 percent slopes	85	14.1	3.4%
GkaoB	Gladstone gravelly loam, 3 to 8 percent slopes	0	6.3	1.5%
GkaoC	Gladstone gravelly loam, 8 to 15 percent slopes	0	49.7	12.0%
GkaoD	Gladstone gravelly loam, 15 to 25 percent slopes	0	7.7	1.9%
PaoC	Parker gravelly sandy loam, 3 to 15 percent slopes	0	78.3	19.0%
PapD	Parker very gravelly sandy loam, 15 to 25 percent slopes	0	22.6	5.5%
PauCc	Parker-Gladstone complex, 0 to 15 percent slopes, extremely stony	0	18.0	4.4%
PauDc	Parker-Gladstone complex, 15 to 25 percent slopes, extremely stony	0	3.1	0.7%
UdrB	Udorthents, refuse substratum, 0 to 8 percent slopes	0	13.3	3.2%
Totals for Area of Interest			**412.3**	**100.0%**

Rating Options—Hydric Rating by Map Unit

Aggregation Method: Percent Present

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

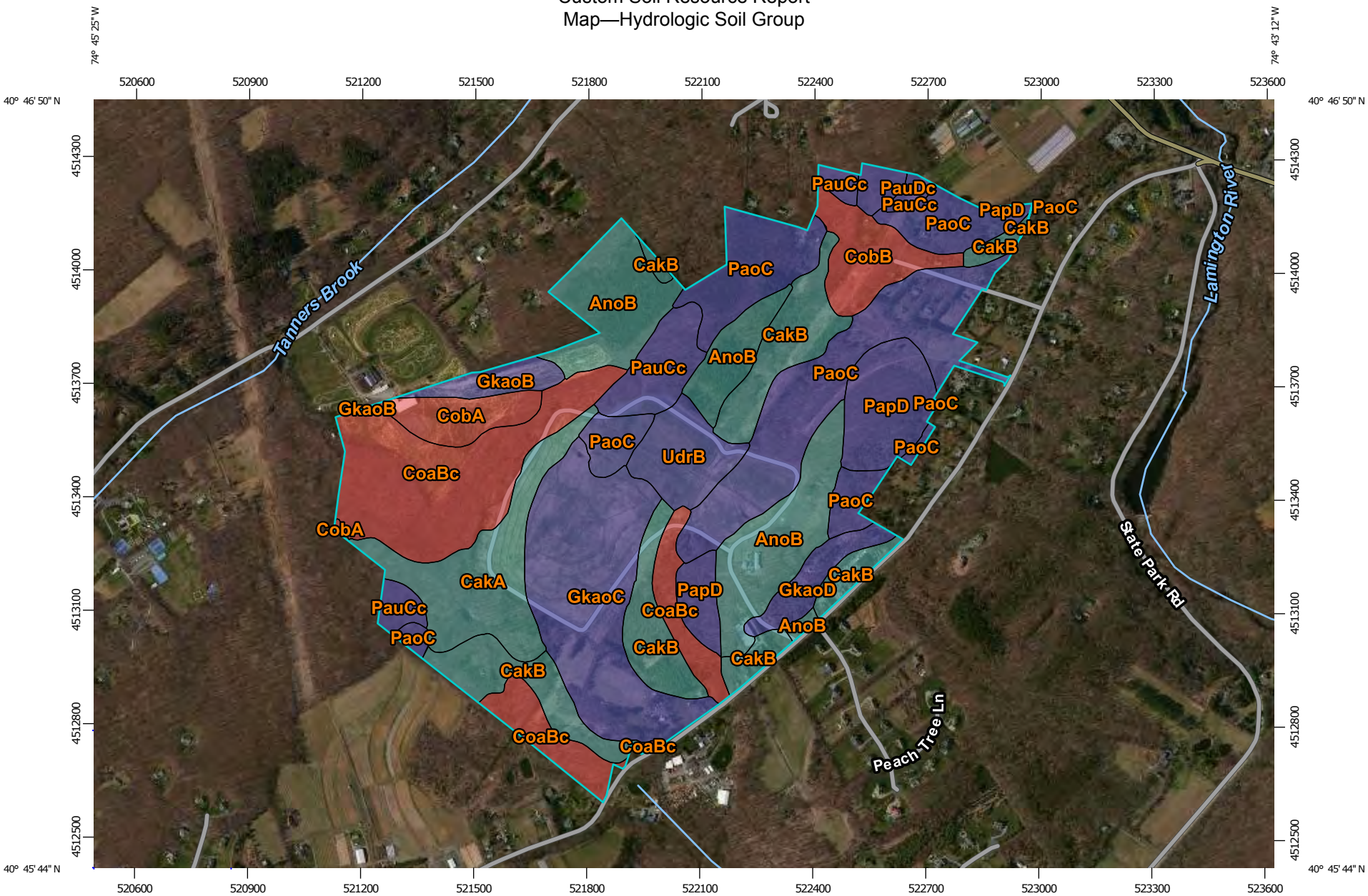
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the

surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Map—Hydrologic Soil Group



Map Scale: 1:14,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Morris County, New Jersey
Survey Area Data: Version 9, Sep 24, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 26, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Morris County, New Jersey (NJ027)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AnoB	Annandale gravelly loam, 3 to 8 percent slopes	C	52.5	12.7%
CakA	Califon loam, 0 to 3 percent slopes	C	27.9	6.8%
CakB	Califon loam, 3 to 8 percent slopes	C	49.9	12.1%
CoaBc	Cokesbury loam, 0 to 8 percent slopes, extremely stony	D	58.8	14.3%
CobA	Cokesbury gravelly loam, 0 to 3 percent slopes	D	10.2	2.5%
CobB	Cokesbury gravelly loam, 3 to 8 percent slopes	D	14.1	3.4%
GkaoB	Gladstone gravelly loam, 3 to 8 percent slopes	B	6.3	1.5%
GkaoC	Gladstone gravelly loam, 8 to 15 percent slopes	B	49.7	12.0%
GkaoD	Gladstone gravelly loam, 15 to 25 percent slopes	B	7.7	1.9%
PaoC	Parker gravelly sandy loam, 3 to 15 percent slopes	B	78.3	19.0%
PapD	Parker very gravelly sandy loam, 15 to 25 percent slopes	B	22.6	5.5%
PauCc	Parker-Gladstone complex, 0 to 15 percent slopes, extremely stony	B	18.0	4.4%
PauDc	Parker-Gladstone complex, 15 to 25 percent slopes, extremely stony	B	3.1	0.7%
UdrB	Udorthents, refuse substratum, 0 to 8 percent slopes	B	13.3	3.2%
Totals for Area of Interest			**412.3**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

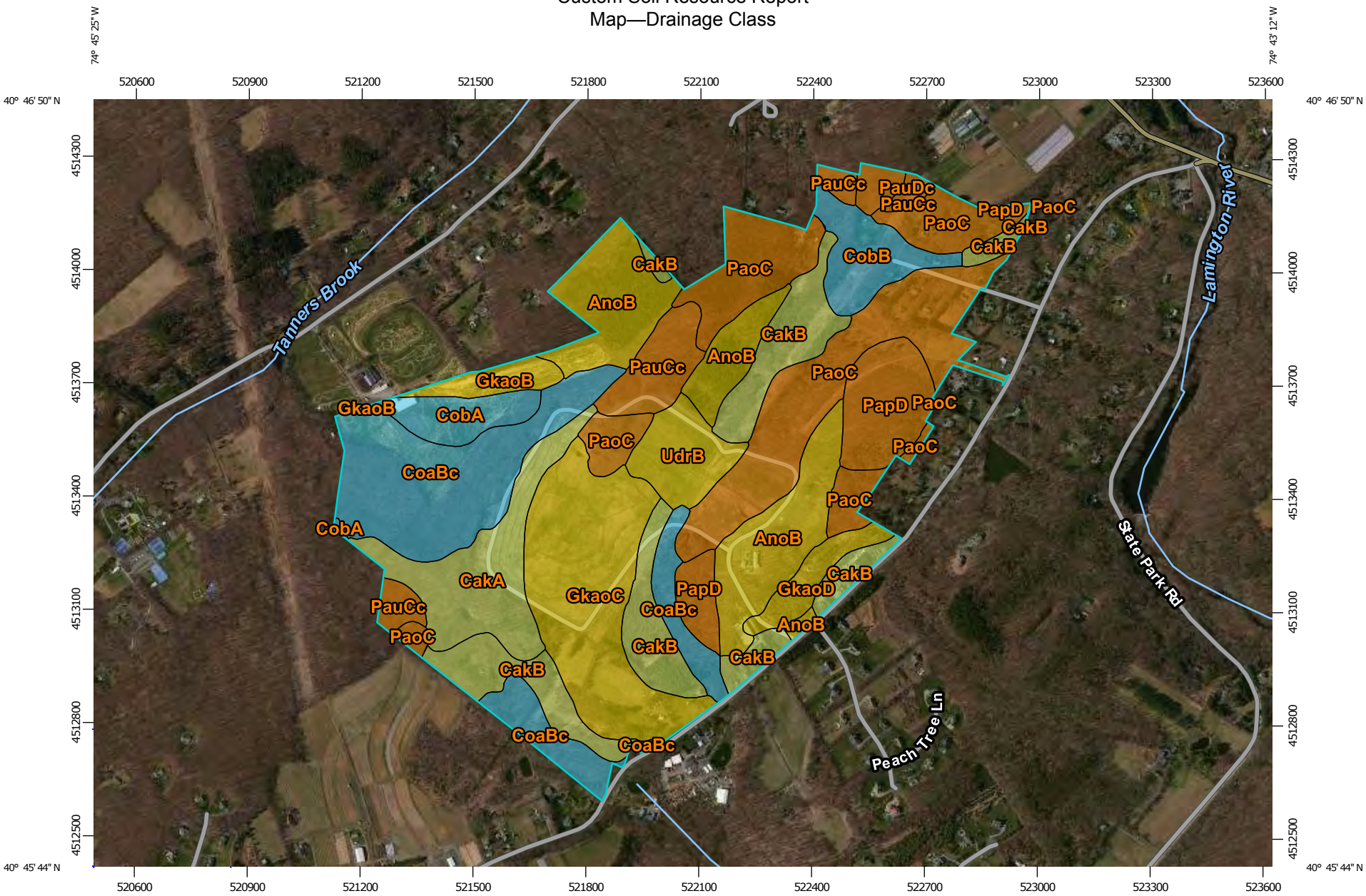
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Drainage Class

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Map—Drainage Class



Map Scale: 1:14,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Excessively drained

Somewhat excessively drained

Well drained

Moderately well drained

Somewhat poorly drained

Poorly drained

Very poorly drained

Subaqueous

Not rated or not available

Soil Rating Lines

Excessively drained

Somewhat excessively drained

Well drained

Moderately well drained

Somewhat poorly drained

Poorly drained

Very poorly drained

Subaqueous

Not rated or not available

Soil Rating Points

Excessively drained

Somewhat excessively drained

Well drained

Moderately well drained

Somewhat poorly drained

Poorly drained

Very poorly drained

Subaqueous

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Morris County, New Jersey
Survey Area Data: Version 9, Sep 24, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 26, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Drainage Class

Drainage Class— Summary by Map Unit — Morris County, New Jersey (NJ027)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AnoB	Annandale gravelly loam, 3 to 8 percent slopes	Well drained	52.5	12.7%
CakA	Califon loam, 0 to 3 percent slopes	Moderately well drained	27.9	6.8%
CakB	Califon loam, 3 to 8 percent slopes	Moderately well drained	49.9	12.1%
CoaBc	Cokesbury loam, 0 to 8 percent slopes, extremely stony	Poorly drained	58.8	14.3%
CobA	Cokesbury gravelly loam, 0 to 3 percent slopes	Poorly drained	10.2	2.5%
CobB	Cokesbury gravelly loam, 3 to 8 percent slopes	Poorly drained	14.1	3.4%
GkaoB	Gladstone gravelly loam, 3 to 8 percent slopes	Well drained	6.3	1.5%
GkaoC	Gladstone gravelly loam, 8 to 15 percent slopes	Well drained	49.7	12.0%
GkaoD	Gladstone gravelly loam, 15 to 25 percent slopes	Well drained	7.7	1.9%
PaoC	Parker gravelly sandy loam, 3 to 15 percent slopes	Somewhat excessively drained	78.3	19.0%
PapD	Parker very gravelly sandy loam, 15 to 25 percent slopes	Somewhat excessively drained	22.6	5.5%
PauCc	Parker-Gladstone complex, 0 to 15 percent slopes, extremely stony	Somewhat excessively drained	18.0	4.4%
PauDc	Parker-Gladstone complex, 15 to 25 percent slopes, extremely stony	Somewhat excessively drained	3.1	0.7%
UdrB	Udorthents, refuse substratum, 0 to 8 percent slopes	Well drained	13.3	3.2%
Totals for Area of Interest			**412.3**	**100.0%**

Rating Options—Drainage Class

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Water Features

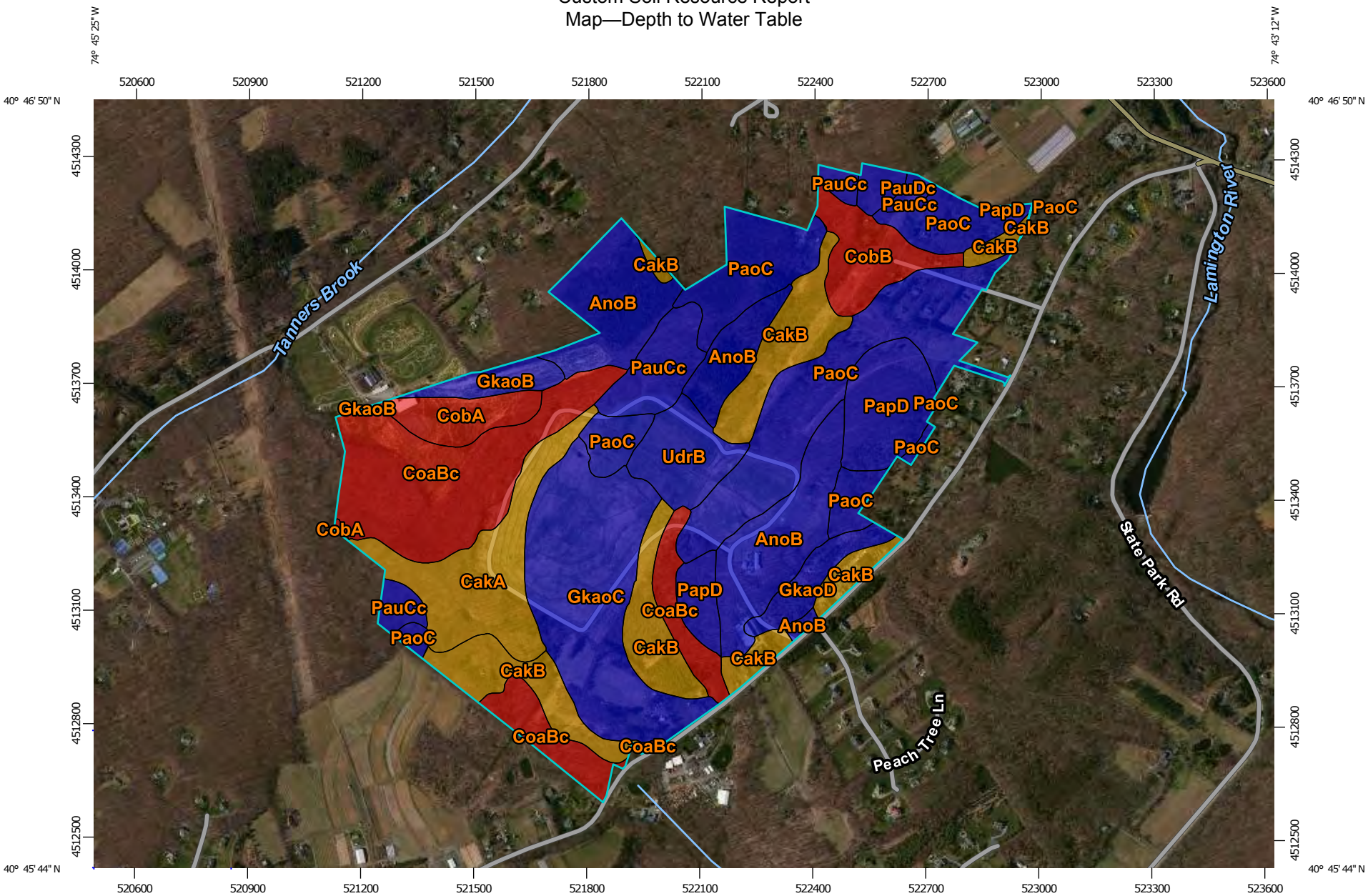
Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Map—Depth to Water Table



Map Scale: 1:14,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

0 - 25

25 - 50

50 - 100

100 - 150

150 - 200

> 200

Not rated or not available

Soil Rating Lines

0 - 25

25 - 50

50 - 100

100 - 150

150 - 200

> 200

Not rated or not available

Soil Rating Points

0 - 25

25 - 50

50 - 100

100 - 150

150 - 200

> 200

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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Date(s) aerial images were photographed: Mar 26, 2011—May 1, 2011

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Table—Depth to Water Table

Depth to Water Table— Summary by Map Unit — Morris County, New Jersey (NJ027)				
Map unit symbol	**Map unit name**	**Rating (centimeters)**	**Acres in AOI**	**Percent of AOI**
AnoB	Annandale gravelly loam, 3 to 8 percent slopes	>200	52.5	12.7%
CakA	Califon loam, 0 to 3 percent slopes	46	27.9	6.8%
CakB	Califon loam, 3 to 8 percent slopes	46	49.9	12.1%
CoaBc	Cokesbury loam, 0 to 8 percent slopes, extremely stony	15	58.8	14.3%
CobA	Cokesbury gravelly loam, 0 to 3 percent slopes	15	10.2	2.5%
CobB	Cokesbury gravelly loam, 3 to 8 percent slopes	15	14.1	3.4%
GkaoB	Gladstone gravelly loam, 3 to 8 percent slopes	>200	6.3	1.5%
GkaoC	Gladstone gravelly loam, 8 to 15 percent slopes	>200	49.7	12.0%
GkaoD	Gladstone gravelly loam, 15 to 25 percent slopes	>200	7.7	1.9%
PaoC	Parker gravelly sandy loam, 3 to 15 percent slopes	>200	78.3	19.0%
PapD	Parker very gravelly sandy loam, 15 to 25 percent slopes	>200	22.6	5.5%
PauCc	Parker-Gladstone complex, 0 to 15 percent slopes, extremely stony	>200	18.0	4.4%
PauDc	Parker-Gladstone complex, 15 to 25 percent slopes, extremely stony	>200	3.1	0.7%
UdrB	Udorthents, refuse substratum, 0 to 8 percent slopes	>200	13.3	3.2%
Totals for Area of Interest			**412.3**	**100.0%**

Rating Options—Depth to Water Table

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

Flooding Frequency Class

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent.

"None" means that flooding is not probable. The chance of flooding is nearly 0 percent in any year. Flooding occurs less than once in 500 years.

"Very rare" means that flooding is very unlikely but possible under extremely unusual weather conditions. The chance of flooding is less than 1 percent in any year.

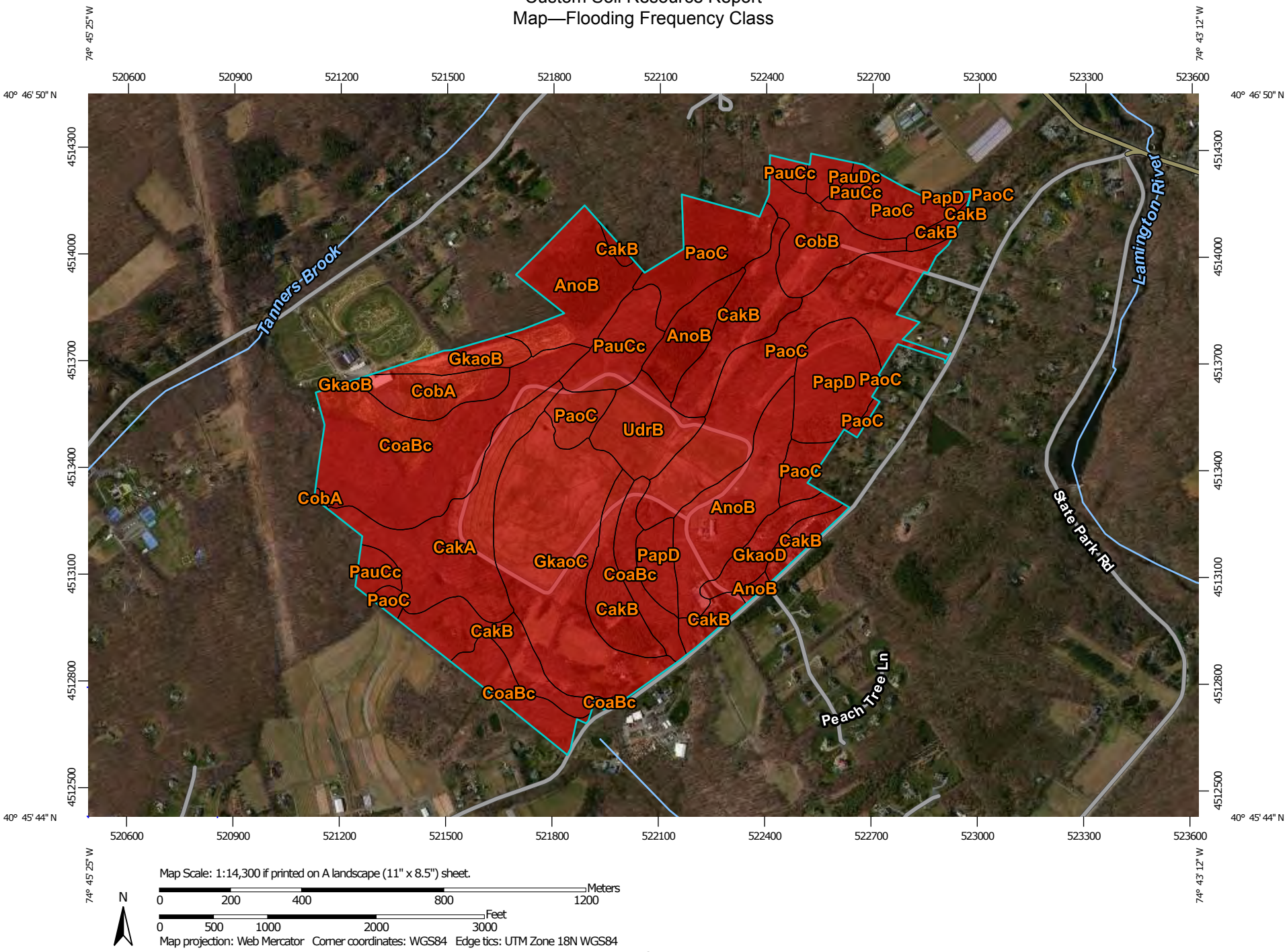
"Rare" means that flooding is unlikely but possible under unusual weather conditions. The chance of flooding is 1 to 5 percent in any year.

"Occasional" means that flooding occurs infrequently under normal weather conditions. The chance of flooding is 5 to 50 percent in any year.

"Frequent" means that flooding is likely to occur often under normal weather conditions. The chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year.

"Very frequent" means that flooding is likely to occur very often under normal weather conditions. The chance of flooding is more than 50 percent in all months of any year.

Map—Flooding Frequency Class



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- None
- Very Rare
- Rare
- Occasional
- Frequent
- Very Frequent
- Not rated or not available

Soil Rating Lines

- None
- Very Rare
- Rare
- Occasional
- Frequent
- Very Frequent
- Not rated or not available

Soil Rating Points

- None
- Very Rare
- Rare
- Occasional
- Frequent
- Very Frequent
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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Date(s) aerial images were photographed: Mar 26, 2011—May 1, 2011

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Table—Flooding Frequency Class

Flooding Frequency Class— Summary by Map Unit — Morris County, New Jersey (NJ027)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AnoB	Annandale gravelly loam, 3 to 8 percent slopes	None	52.5	12.7%
CakA	Califon loam, 0 to 3 percent slopes	None	27.9	6.8%
CakB	Califon loam, 3 to 8 percent slopes	None	49.9	12.1%
CoaBc	Cokesbury loam, 0 to 8 percent slopes, extremely stony	None	58.8	14.3%
CobA	Cokesbury gravelly loam, 0 to 3 percent slopes	None	10.2	2.5%
CobB	Cokesbury gravelly loam, 3 to 8 percent slopes	None	14.1	3.4%
GkaoB	Gladstone gravelly loam, 3 to 8 percent slopes	None	6.3	1.5%
GkaoC	Gladstone gravelly loam, 8 to 15 percent slopes	None	49.7	12.0%
GkaoD	Gladstone gravelly loam, 15 to 25 percent slopes	None	7.7	1.9%
PaoC	Parker gravelly sandy loam, 3 to 15 percent slopes	None	78.3	19.0%
PapD	Parker very gravelly sandy loam, 15 to 25 percent slopes	None	22.6	5.5%
PauCc	Parker-Gladstone complex, 0 to 15 percent slopes, extremely stony	None	18.0	4.4%
PauDc	Parker-Gladstone complex, 15 to 25 percent slopes, extremely stony	None	3.1	0.7%
UdrB	Udorthents, refuse substratum, 0 to 8 percent slopes	None	13.3	3.2%
Totals for Area of Interest			**412.3**	**100.0%**

Rating Options—Flooding Frequency Class

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: More Frequent

Beginning Month: January

Ending Month: December

Wetland Delineation Data Sheets

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/09/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	Acer rubrum*	FAC	60%	5	63	1
2	Betula alleghaniensis	FAC	4%	1	3	3
3	Carpinus caroliniana	FAC	5%	1	3	3
4	Nyssa sylvatica	FAC	10%	2	10.5	2
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 79.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 39.75

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/09/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Lindera benzoin**	FACW-	60%	5	63	1
2 *Vaccinium corymbosum*	FACW-	5%	1	3	2
3 *Viburnum lentago*	FAC	5%	1	3	2
4					
5					
6					
7					
8					
9					
10					
				Sum of Midpoints:	69
			Dominance Threshold Number Equals 50% x Sum of Midpoints:		34.5

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1					
2					
3					
4					
5					
				Sum of Midpoints:	
			Dominance Threshold Number Equals 50% x Sum of Midpoints:		

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 Amelanchier canadensis*	FAC	5%	1	3	1
2 Carpinus caroliniana*	FAC	5%	1	3	1
3					
4					
5					
6					
7					
8					
9					
				Sum of Midpoints:	6
			Dominance Threshold Number Equals 50% x Sum of Midpoints:		3

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/09/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	Arisaema triphyllum	FACW-	5%	1	3	3
2	Carex stricta	OBL	5%	1	3	3
3	Dryopteris marginalis	FACU-	5%	1	3	3
4	Impatiens capensis	FACW	18%	3	20.5	2
5	Microstegium vimineum	FAC	20%	3	20.5	2
6	Symplocarpus foetidus*	OBL	60%	5	63	1
7	Viola ×palmata	NL	5%	1	3	3
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
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35						
36						

Sum of Midpoints: 116
Dominance Threshold Number Equals 50% x Sum of Midpoints: 58

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/09/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury gravely loam___ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _X____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Reduced matrix with mottles

Soil Borings Depth (inches)	Soil Colors	Description
-1-0"	Organic Material	
0-4"	7.5 YR 3/2	Loamy Sand
4-14"	5Y 7/1	Sandy Loam
4-14"	7.5YR 5/8	Mottles

HYDROLOGY

Is the soil saturated? Yes _X___ No _____
Depth to free standing water in pit/soil probe hole:__14 inches_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:_Presence of soil saturation and high water table.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation, hydrology and hydric soils are present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/09/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Sp	Indicator Status	Stratum
1	*Acer rubrun**	FAC	T	11			
2	*Lindera benzoin**	FACW-	SH	12			
3	*Symplocarpus foetidus**	OBL	H	13			
4	Amelanchier canadensis*	FAC	SAP	14			
5	Carpinus caroliniana*	FAC	SAP	15			
6				16			
7				17			
8				18			
9				19			
10				20			

Percent of dominant species that are OBL, FACW, and/or FAC: 100%
Is the hydrophytic vegetation criterion met? Yes__X__ No_____
Rationale: Greater than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury gravely loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _X____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Reduced matrix with mottles

Soil Borings Depth (inches)	Soil Colors	Description
-1-0"	Organic Mate	0
0-4"	7.5 YR 3/2	Loamy Sand
4-14"	5Y 7/1	Sandy Loam
4-14"	7.5YR 5/8	Mottles

HYDROLOGY

0

Is the soil saturated? Yes _X___ No _____
Depth to free standing water in pit/soil probe hole:__14 inches_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:_Presence of soil saturation and high water table.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation, hydrology and hydric soils are

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	Acer rubrum*	FAC	20%	3	20.5	2
2	Betula lenta*	FACU	20%	3	20.5	2
3	Fraxinus americana	FACU	10%	2	10.5	3
4	Prunus serotina*	FACU	40%	4	28	1
5						
6						
7						
8						
9						
10						
11						

Sum of Midpoints: 79.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 39.75

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Berberis thunbergii*	FACU	10%	2	10.5	3
2 *Lindera benzoin*	FACW-	10%	2	10.5	3
3 *Rosa multiflora**	FACU	40%	4	38	1
4 *Rubus strigosus**	NI	20%	3	20.5	2
5					
6					
7					
8					
9					
10					
				Sum of Midpoints:	79.5
				Dominance Threshold Number Equals 50% x Sum of Midpoints:	39.75

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 Ampelopsis brevipedunculata	NL	5%	1	3	2
2 *Parthenocissus quinquefolia*	FACU	5%	1	3	2
3 Toxicodendron radicans	FAC	5%	1	3	2
4 Vitis aestivalis*	FACU	20%	3	20.5	1
5					
				Sum of Midpoints:	29.5
				Dominance Threshold Number Equals 50% x Sum of Midpoints:	14.75

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 Fraxinus americana*	FACU	5%	1	3	1
2 Prunus serotina*	FACU	4%	1	3	1
3					
4					
5					
6					
7					
8					
9					
				Sum of Midpoints:	6
				Dominance Threshold Number Equals 50% x Sum of Midpoints:	3

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	Ageratina altissima	FACU-	5%	1	3	2
2	Arisaema triphyllum	FACW-	5%	1	3	2
3	Dryopteris marginalis	FACU-	5%	1	3	2
4	Impatiens capensis*	FACW	10%	2	10.5	1
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 19.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 9.75

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

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2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury Loam___ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes _X_____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No __X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Presence of depleted matrix with mottles.

Soil Borings Depth (inches)	Soil Colors	Description
0-14"	10YR 4/3	Sandy Loam
0-14"	10YR 5/6	Mottles (less than 1%)
14-17"	10YR 5/1	Sandy Loam
14-17"	5YR 4/6	Mottles
17-20.5"	2.5Y 7/2	Sandy Loam
17-20.5"	5YR 5/8	Mottles
20.5-24"	10YR 5/1	Oxidized Root Channels 5YR 4/6

HYDROLOGY

Is the ground surface inundated? Yes _____ No _X__ Surface water depth: _
Is the soil saturated? Yes ____ No ___X__
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No __X___ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No _X____
Rationale for juristiction decision: No indicators of hydrophytic vegetation and hydrology are present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Sp	Indicator Status	Stratum
1	Acer rubrum*	FAC	T			
2	Betula lenta*	FACU	T			
3	Fraxinus americana	FACU	T			
4	Prunus serotina*	FACU	T			
5	*Rosa multiflora**	FACU	SH			
6	*Rubus strigosus**	NI	SH			
7	Vitis aestivalis*	FACU	V			
8	Fraxinus americana*	FACU	SAP			
9	Prunus serotina*	FACU	SAP			
10	Impatiens capensis*	FACW	H			

Percent of dominant species that are OBL, FACW, and/or FAC: 10%
Is the hydrophytic vegetation criterion met? Yes____ No___X__
Rationale: Less than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury Loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes _X_____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No __X_
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Presence of depleted matrix with mottles.

Soil Borings Depth (inches)	Soil Colors	Description
0-14"	10YR 4/3	Sandy Loam
0-14"	10YR 5/6	Mottles (less than 1%)
14-17"	10YR 5/1	Sandy Loam
14-17"	5YR 4/6	Mottles
17-20.5"	2.5Y 7/2	Sandy Loam
17-20.5"	5YR 5/8	Mottles
20.5-24"	10YR 5/1	Oxidized Root Channels 5YR 4/6

HYDROLOGY

Is the ground surface inundated? Yes _____ No _X__ Surface water depth: _
Is the soil saturated? Yes ____ No ___X__
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No __X___ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No _X____
Rationale for juristiction decision: No indicators of hydrophytic vegetation and hydrology are present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	Acer rubrum*	FAC	18%	3	20.5	1
2	Betula lenta	FACU	15%	2	10.5	2
3	Carpinus caroliniana	FAC	3%	1	3	3
4	Carya ovata	FACU-	10%	2	10.5	2
5	Cornus florida	FACU-	5%	1	3	3
6	Liriodendron tuliperfera*	FACU	20%	3	20.5	1
7	Nyssa sylvatica	FAC	10%	2	10.5	2
8	Prunus serotina	UPL	3%	1	3	3
9	Quercus alba	UPL	5%	1	3	3
10	Quercus prinus	UPL	10%	2	10.5	2
11	Quercus rubra*	UPL	25%	3	20.5	1
				Sum of Midpoints:	115.5	
			Dominance Threshold Number Equals 50% x Sum of Midpoints:		57.75	

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	Berberis thunbergii*	FACU	20%	3	20.5	2
2	Hamamelis virginiana	FAC-	5%	1	3	4
3	Rhamnus cathartica*	UPL	30%	4	28	1
4	Rosa multiflora	FACU	10%	2	10.5	3
5	Vaccinium corymbosum	FACW-	5%	1	3	4
6						
7						
8						
9						
10						
				Sum of Midpoints:	65	
			Dominance Threshold Number Equals 50%	x Sum of Midpoints:	32.5	

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	Ampelopsis brevipedunculata	NL	5%	1	3	2
2	Smilax glauca	FACU	5%	1	3	2
3	Toxicodendron radicans	FAC	5%	1	3	2
4	Vitis aestivalis*	FACU	20%	3	10.5	1
5						
				Sum of Midpoints:	19.5	
			Dominance Threshold Number Equals 50%	x Sum of Midpoints:	9.75	

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	Carpinus caroliniana	FAC	5%	1	3	2
2	Rhamnus cathartica*	UPL	10%	2	10.5	1
3						
4						
5						
6						
7						
8						
9						
				Sum of Midpoints:	13.5	
			Dominance Threshold Number Equals 50%	x Sum of Midpoints:	6.75	

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	Danthonia spicata*	NL	15%	2	10.5	1
2	Hypnum sp.*	NL	10%	2	10.5	1
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 21
Dominance Threshold Number Equals 50% x Sum of Midpoints: 10.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury Loam___ Subgroup:__
Is the soil on the hydric soils list? Yes _____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes _____ No __X___
Rationale: Soils lack indicators of hydrology. Mottles are present but are not distinct and do not occur in a depleted matrix.

Soil Borings Depth (inches)	Soil Colors Description

HYDROLOGY

Is the ground surface inundated? Yes _____ No ___ Surface water depth: _
Is the soil saturated? Yes ____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No _____ (Inconclusive)____X_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: status.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Sp	Indicator Status	Stratum
1	Acer rubrum*	FAC	T			
2	Liriodendron tuliperfera*	FACU	T			
3	Quercus rubra*	UPL	T			
4	Berberis thunbergii*	FACU	SH			
5	Rhamnus cathartica*	UPL	SH			
6	Vitis aestivalis*	FACU	V			
7	Rhamnus cathartica*	UPL	SAP			
8	Danthonia spicata*	NL	H			
9	Hypnum sp.*	NL	H			
10						

Percent of dominant species that are OBL, FACW, and/or FAC: 11%
Is the hydrophytic vegetation criterion met? Yes____ No___X__
Rationale: Less than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury Loam_ Subgroup:__
Is the soil on the hydric soils list? Yes _____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes _____ No __X___

Rationale: Soils lack indicators of hydrology. Mottles are present but are not distinct and do not occur in a depleted matrix.

Soil Borings Depth (inches)	Soil Colors	Description
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0

HYDROLOGY

Is the ground surface inundated? Yes _____ No ___ Surface water depth: _
Is the soil saturated? Yes ____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No _____ (Inconclusive)____X_____
Rationale:_

0

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: status.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	*Betula lenta*	FACU	5%	1	3	3
2	*Nyssa sylvatica**	FAC	20%	3	20.5	2
3	*Quercus alba**	FACU-	20%	3	20.5	2
4	*Quercus rubra**	FACU-	50%	4	28	1
5						
6						
7						
8						
9						
10						
11						

Sum of Midpoints: 72
Dominance Threshold Number Equals 50% x Sum of Midpoints: 36

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Vaccinium angustifolium**	FACU-	2%	1	3	1
2						
3						
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 3
Dominance Threshold Number Equals 50% x Sum of Midpoints: 1.5

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Smilax glauca**	FACU	2%	1	3	1
2						
3						
4						
5						

Sum of Midpoints: 3
Dominance Threshold Number Equals 50% x Sum of Midpoints: 1.5

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Acer rubrum*	FAC	5%	1	3	2
2	*Cornus florida*	FACU-	5%	1	3	2
3	*Nyssa sylvatica**	FAC	20%	3	20.5	1
4						
5						
6						
7						
8						
9						

Sum of Midpoints: 26.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 13.25

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Danthonia spicata**	NL	1%	1	3	1
2	*Dryopteris marginalis**	FACU-	5%	1	3	1
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
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23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 6
Dominance Threshold Number Equals 50% x Sum of Midpoints: 3

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury Loam___ Subgroup:__Typic Fragiaquults
Is the soil on the hydric soils list? Yes _____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes _____ No __X___
Rationale: Soils lack indicators of hydrology. Mottles are present but are not distinct and do not occur in a depleted matrix.

Soil Borings Depth (inches)	Soil Colors	Description
0-1"	7.5YR 3/1	Organic Layer
1-12"	10YR 6/6	Sandy Loam
1-12"	10YR 6/4	Mottles (not distinct)
12-18+"	10YR 6/6	Sandy Loam No Mottles

HYDROLOGY

Is the ground surface inundated? Yes _____ No __X_ Surface water depth: _
Is the soil saturated? Yes ____ No _X____
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No ____X_ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators of hydric soils or hydrophytic vegetation present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Sp	Indicator Status	Stratum
1	*Nyssa sylvatica**	FAC	T			
2	*Quercus alba**	FACU	T			
3	*Quercus rubra**	FACU	T			
4	*Vaccinium angustifolium**	FACU	SH			
5	*Smilax glauca**	FACU	V			
6	*Nyssa sylvatica**	FAC	SAP			
7	*Danthonia spicata**	NL	H			
8	*Dryopteris marginalis**	FACU	H			
9						
10						

Percent of dominant species that are OBL, FACW, and/or FAC: ____25%_____
Is the hydrophytic vegetation criterion met? Yes____ No___X__
Rationale: Less than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury Loam_ Subgroup:__Typic Fragiaquults
Is the soil on the hydric soils list? Yes _____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes _____ No __X___

Rationale: Soils lack indicators of hydrology. Mottles are present but are not distinct and do not occur in a depleted matrix.

Soil Borings Depth (inches)	Soil Colors	Description
0-1"	7.5YR 3/1	Organic Layer
1-12"	10YR 6/6	Sandy Loam
1-12"	10YR 6/4	Mottles (not distinct)
12-18+"	10YR 6/6	Sandy Loam No Mottles

HYDROLOGY

Is the ground surface inundated? Yes _____ No __X_ Surface water depth: _
Is the soil saturated? Yes ____ No _X____
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No ____X_ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators of hydric soils or hydrophytic vegetation present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA05
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	*Picea abies**	NL	50%	4	28	1
2	*Pinus resinosa**	FACU	20%	3	20.5	2
3	*Fraxinus americana*	FACU	5%	1	3	3
4						
5						
6						
7						
8						
9						
10						
11						

Sum of Midpoints: 51.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 25.75

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA05
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Lindera benzoin**	FACW-	50%	4	28	1
2	*Prunus cerasus L.*	NL	5%	1	3	3
3	*Rubus strigosus**	NI	10%	2	10.5	2
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 41.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 20.75

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1						
2						
3						
4						
5						

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Acer rubrum**	FAC	5%	1	3	1
2	*Prunus cerasus L.**	NL	5%	1	3	1
3						
4						
5						
6						
7						
8						
9						

Sum of Midpoints: 6
Dominance Threshold Number Equals 50% x Sum of Midpoints: 3

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA05
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Dryopteris marginalis**	FACU-	5%	1	3	1
2	*Maianthemum canadense**	FAC-	5%	1	3	1
3	Sassafrass albidum*	FACU-	1%	1	3	1
4	Carya glabra*	FACU-	1%	1	3	1
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 12
Dominance Threshold Number Equals 50% x Sum of Midpoints: 6

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA05
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury Loam___ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes ___X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes _____ No __X___
Rationale: Soils lack indicators of hydrology. Mottles are present but are not distinct and do not occur in a depleted matrix.

Soil Borings Depth (inches)	Soil Colors	Description
0-1"	7.5YR 3/1	Organic Layer
1-8"	10YR 5/3	Sandy Loam
8-18"	10YR 6/6	Sandy Loam
8-18"	10YR 5/3	Some Mottling

HYDROLOGY

Is the ground surface inundated? Yes _____ No _X__ Surface water depth: _
Is the soil saturated? Yes ____ No __X___
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No __X___ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators of hydric soils or hydrophytic vegetation present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA05
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Sp	Indicator Status	Stratum
1	*Picea abies**	NL	T			
2	*Pinus resinosa**	FACU	T			
3	*Lindera benzoin**	FACW	SH			
4	*Rubus strigosus**	NI	SH			
5	*Acer rubrum**	FAC	SAP			
6	*Prunus cerasus L.**	NL	SAP			
7	*Dryopteris marginalis**	FACU	H			
8	*Maianthemum canadense**	FAC	H			
9	Sassafrass albidum*	FACU	H			
10	Carya glabra*	FACU	H			

Percent of dominant species that are OBL, FACW, and/or FAC: ____30%_____
Is the hydrophytic vegetation criterion met? Yes____ No___X__
Rationale: Less than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury Loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes ___X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes _____ No __X___

Rationale: Soils lack indicators of hydrology. Mottles are present but are not distinct and do not occur in a depleted matrix.

Soil Borings Depth (inches)	Soil Colors	Description
0-1"	7.5YR 3/1	Organic Layer
1-8"	10YR 5/3	Sandy Loam
8-18"	10YR 6/6	Sandy Loam
8-18"	10YR 5/3	Some Mottling

HYDROLOGY

Is the ground surface inundated? Yes _____ No _X__ Surface water depth: _
Is the soil saturated? Yes ____ No __X___
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No __X___ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators of hydric soils or hydrophytic vegetation present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA06
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	*Acer rubrum**	FAC	35%	4	28	1
2	*Betula nigra*	FACW	5%	1	3	3
3	*Carpinus caroliniana*	FAC	10%	2	10.5	2
4	*Juglans cinerea*	FACU+	10%	2	10.5	2
5	*Quercus bicolor**	FACW+	40%	4	28	1
6						
7						
8						
9						
10						
11						

Sum of Midpoints: 80
Dominance Threshold Number Equals 50% x Sum of Midpoints: 40

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA06
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Berberis thunbergii*	FACU	5%	1	3	2
2	*Lindera benzoin**	FACW-	80%	6	85.5	1
3	*Vaccinium corymbosum*	FACW-	5%	1	3	2
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 91.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 45.75

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Parthenocissus quinquefolia**	FACU	1%	1	3	1
2	*Toxicodendron radicans**	FAC	5%	1	3	1
3						
4						
5						

Sum of Midpoints: 6
Dominance Threshold Number Equals 50% x Sum of Midpoints: 3

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Carpinus caroliniana**	FAC	2%	1	3	1
2						
3						
4						
5						
6						
7						
8						
9						

Sum of Midpoints: 3
Dominance Threshold Number Equals 50% x Sum of Midpoints: 1.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA06
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Carex stricta*	OBL	5%	1	3	2
2	*Onoclea sensibilis**	FACW	15%	2	10.5	1
3	*Symplocarpus foetidus**	OBL	10%	2	10.5	1
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 24
Dominance Threshold Number Equals 50% x Sum of Midpoints: 12

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA06
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury Loam___ Subgroup: Typic Fragiaquults __
Is the soil on the hydric soils list? Yes _____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____

Rationale: Indicators of hydric soils include depleted layers with mottles.

Soil Borings Depth (inches)	Soil Colors	Description
0-1"	10YR 2/1	Organic Layer
1-6"	10YR 4/1	Lomy Clay
6-12"	10YR 6/1	Lomy Clay
6-12"	10YR 5/8	Mottles
12-18"	2.5Y 5/	Loamy Clay
12-18"	10YR 6/8	Mottles

HYDROLOGY

Is the ground surface inundated? Yes _____ No __X_ Surface water depth: _
Is the soil saturated? Yes ____ No _X____
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No _____ (Inconclusive)____X_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes __X__ No _____
Rationale for juristiction decision: Presence of hydric soils and hydrophytic vegetation.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA06
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Sp	Indicator Status	Stratum
1	*Acer rubrum**	FAC	T			
2	*Quercus bicolor**	FACW	T			
3	*Lindera benzoin**	FACW	SH			
4	*Parthenocissus quinquefolia**	FACU	V			
5	*Toxicodendron radicans**	FAC	V			
6	*Carpinus caroliniana**	FAC	SAP			
7	*Onoclea sensibilis**	FACW	H			
8	*Symplocarpus foetidus**	OBL	H			
9						
10						

Percent of dominant species that are OBL, FACW, and/or FAC: ____87%_____
Is the hydrophytic vegetation criterion met? Yes_X___ No_____
Rationale: More than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury Loam_ Subgroup: Typic Fragiaquults __
Is the soil on the hydric soils list? Yes _____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____

Rationale: Indicators of hydric soils include depleted layers with mottles.

Soil Borings Depth (inches)	Soil Colors	Description
0-1"	10YR 2/1	Organic Layer
1-6"	10YR 4/1	Lomy Clay
6-12"	10YR 6/1	Lomy Clay
6-12"	10YR 5/8	Mottles
12-18"	2.5Y 5/	Loamy Clay
12-18"	10YR 6/8	Mottles

HYDROLOGY

Is the ground surface inundated? Yes _____ No __X_ Surface water depth: _
Is the soil saturated? Yes ____ No _X____
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No _____ (Inconclusive)____X_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes __X__ No _____
Rationale for juristiction decision: Presence of hydric soils and hydrophytic vegetation.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA07
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	*Acer rubrum*	FAC	2%	1	3	3
2	*Betula lenta*	FACU	5%	1	3	3
3	*Carpinus caroliniana*	FAC	5%	1	3	3
4	*Fagus grandifolia*	FACU	5%	1	3	3
5	*Liriodendron tulipifera**	FACU	30%	4	28	1
6	*Nyssa sylvatica**	FAC	20%	3	20.5	2
7	*Quercus rubra*	FACU-	5%	1	3	3
8	*Ulmus americana*	FACW-	5%	1	3	3
9						
10						
11						

Sum of Midpoints: 66.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 33.25

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA07
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Hamamelis virginiana**	FAC-	15%	2	10.5	1
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sum of Midpoints: 10.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 5.25

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1					
2					
3					
4					
5					

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Betula lenta**	FACU	10%	2	10.5	1
2 *Carpinus caroliniana**	FAC	10%	2	10.5	1
3 *Fagus grandifolia**	FACU	10%	2	10.5	1
4 *Liriodendron tulipifera**	FACU	10%	2	10.5	1
5					
6					
7					
8					
9					

Sum of Midpoints: 42
Dominance Threshold Number Equals 50% x Sum of Midpoints: 21

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA07
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Dryopteris marginalis**	FACU-	80%	6	80.5	1
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 80.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 40.25

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA07
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury Loam___ Subgroup:__Typic Fragiaquults
Is the soil on the hydric soils list? Yes __X____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_None
Is the hydric soil criterion met? Yes _____ No __X___

Rationale: Indicators of hydric soils include mottled soils and organic content at surface.

Soil Borings Depth (inches)	Soil Colors	Description
0-2"	10YR 3/1	Organic
2-6"	10YR 4/2	Sandy Loam
6-18"	10YR 6/6	
6-18"	10YR 5/4	Mottles (not distinct)

HYDROLOGY

Is the ground surface inundated? Yes _____ No _X__ Surface water depth: _
Is the soil saturated? Yes ____ No __X___
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No _X____ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators of wetland hydrology, hydrophytic vegetation or hydric soils present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA07
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Sp	Indicator Status	Stratum
1	*Liriodendron tulipifera**	FACU	T			
2	*Nyssa sylvatica**	FAC	T			
3	*Hamamelis virginiana**	FAC	SH			
4	*Betula lenta**	FACU	SAP			
5	*Carpinus caroliniana**	FAC	SAP			
6	*Fagus grandifolia**	FACU	SAP			
7	*Liriodendron tulipifera**	FACU	SAP			
8	*Dryopteris marginalis**	FACU	H			
9						
10						

Percent of dominant species that are OBL, FACW, and/or FAC: ___38%_____
Is the hydrophytic vegetation criterion met? Yes____ No_X_____
Rationale: Less than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury Loam_ Subgroup:__Typic Fragiaquults
Is the soil on the hydric soils list? Yes __X____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_None
Is the hydric soil criterion met? Yes _____ No __X___

Rationale: Indicators of hydric soils include mottled soils and organic content at surface.

Soil Borings Depth (inches)	Soil Colors	Description
0-2"	10YR 3/1	Organic
2-6"	10YR 4/2	Sandy Loam
6-18"	10YR 6/6	0
6-18"	10YR 5/4	Mottles (not distinct)

HYDROLOGY

Is the ground surface inundated? Yes _____ No _X__ Surface water depth: _
Is the soil saturated? Yes ____ No __X___
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No _X____ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators of wetland hydrology, hydrophytic vegetation or hydric

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA08
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	*Betula alleghaniensis*	FAC	5%	1	3	3
2	*Fagus grandifolia**	FACU	70%	5	63	1
3	*Nyssa sylvatica*	FAC	15%	2	10.5	2
4	*Quercus rubra*	FACU-	15%	2	10.5	2
5						
6						
7						
8						
9						
10						
11						

Sum of Midpoints: 87
Dominance Threshold Number Equals 50% x Sum of Midpoints: 43.5

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA08
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1					
2					
3					
4					
5					

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Fagus grandifolia**	FACU	30%	4	28	1
2					
3					
4					
5					
6					
7					
8					
9					

Sum of Midpoints: 28
Dominance Threshold Number Equals 50% x Sum of Midpoints: 14

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA08
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Dryopteris marginalis**	FACU-	40%	4	28	1
2	*Lycopodium complanatum*	FACU-	1%	1	3	2
3	*Symplocarpus foetidus*	OBL	5%	1	3	2
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 34
Dominance Threshold Number Equals 50% x Sum of Midpoints: 17

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA08
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Califon Loam___ Subgroup:__Typic Fragiudults
Is the soil on the hydric soils list? Yes __X____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No __X___
Matrix color:____See Table_____
Other hydric soil indicators:_None
Is the hydric soil criterion met? Yes __X____ No _____

Rationale: Mottles are present but very faint.

Soil Borings Depth (inches)	Soil Colors	Description
0-2"	7.5YR 3/1	Organic
2-4"	10YR 2/1	Sandy Loam
4-8"	2.5Y 4/1	Sandy Loam
4-8"	10YR 5/8	Faint Mottles
8-18"	10YR 5/1	Sandy Loam
8-18"	10YR 5/8	Mottles (not prominent)

HYDROLOGY

Is the ground surface inundated? Yes _____ No _X__ Surface water depth: _
Is the soil saturated? Yes __X__ No _____
Depth to free standing water in pit/soil probe hole:_____16 inches_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No __X___ (Inconclusive)_____
Rationale:_Free standing water in the pit was below 12 inches.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _____ No __X___
Rationale for juristiction decision: Indicators of wetland hydrology and hydrophytic vegetation are not present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA08
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Sp	Indicator Status	Stratum
1	*Fagus grandifolia**	FACU	T			
2	*Fagus grandifolia**	FACU	SAP			
3	*Dryopteris marginalis**	FACU	H			
4						
5						
6						
7						
8						
9						
10						

Percent of dominant species that are OBL, FACW, and/or FAC: ___38%_____
Is the hydrophytic vegetation criterion met? Yes____ No_X_____
Rationale: Less than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Califon Loam_ Subgroup:__Typic Fragiudults
Is the soil on the hydric soils list? Yes __X____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No __X__
Matrix color:____See Table_____
Other hydric soil indicators:_None
Is the hydric soil criterion met? Yes __X____ No _____

Rationale: Mottles are present but very faint.

Soil Borings Depth (inches)	Soil Colors	Description
0-2"	7.5YR 3/1	Organic
2-4"	10YR 2/1	Sandy Loam
4-8"	2.5Y 4/1	Sandy Loam
4-8"	10YR 5/1	Sandy Loam
8-18"	10YR 5/8	Mottles (not prominent)
8-18"		

HYDROLOGY

Is the ground surface inundated? Yes _____ No _X__ Surface water depth: _
Is the soil saturated? Yes __X__ No _____
Depth to free standing water in pit/soil probe hole:_____16 inches_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes ____ No __X___ (Inconclusive)_____
Rationale:_Free standing water in the pit was below 12 inches.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _____ No __X___
Rationale for juristiction decision: Indicators of wetland hydrology and hydrophytic vegetation are not present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	*Acer rubrum**	FAC	40%	4	28	1
2	*Betula alleghaniensis*	FAC	10%	2	10.5	2
3	*Carpinus caroliniana*	FAC	15%	2	10.5	2
4	*Nyssa sylvatica**	FAC	30%	4	28	1
5						
6						
7						
8						
9						
10						
11						

Sum of Midpoints: 77
Dominance Threshold Number Equals 50% x Sum of Midpoints: 38.5

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Berberis thunbergii*	FACU	5%	1	3	2
2	*Lindera benzoin**	FACW-	15%	2	10.5	1
3						
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 13.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 6.75

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Toxicodendron radicans**	FAC	10%	2	10.5	1
2						
3						
4						
5						

Sum of Midpoints: 10.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 5.25

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Arisaema triphyllum**	FACW-	1%	1	3	1
2	*Galium boreale**	FACU	2%	1	3	1
3	*Hypnum sp.**	NL	2%	1	3	1
4	*Impatiens capensis**	FACW	2%	1	3	1
5	*Maianthemum canadense**	FAC-	2%	1	3	1
6	*Microstegium vimineum**	FAC	5%	1	3	1
7	*Symplocarpus foetidus**	OBL	5%	1	3	1
8	*Viola ×palmata**	NL	2%	1	3	1
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 21
Dominance Threshold Number Equals 50% x Sum of Midpoints: 10.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Califon Loam_ Subgroup:__Typic Fragiudults
Is the soil on the hydric soils list? Yes __X____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No ___X__
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No __X___

Rationale: Indicators of hydric soils include depleted layers with distinct mottles.

Soil Borings Depth (inches)	Soil Colors	Description
0-4"	10YR 4/1	Sandy Loam
0-4"	10YR 5/6	Mottles (some)
4-8"	10YR 5/1	Sandy Loam
8-18"	2.5Y 6/2	Sandy Loam
8-18"	10YR 5/8	Distinct Mottles

HYDROLOGY

Is the ground surface inundated? Yes _____ No __X_ Surface water depth: _
Is the soil saturated? Yes __X__ No _____
Depth to free standing water in pit/soil probe hole:____3 inches_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes __X__ No _____ (Inconclusive)_____
Rationale:_Water table occurs within the upper 12 inches.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes __X__ No _____
Rationale for juristiction decision: Indicators for wetland hydrology, hydrophytic vegetation and hydric soils are present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1	*Acer rubrum**	FAC	T			
2	*Nyssa sylvatica**	FAC	T	*Symplocarpus foetidus**	OBL	H
3	*Lindera benzoin**	FACW	SH	*Viola ×palmata**	NL	H
4	*Toxicodendron radicans**	FAC	V			
5	*Arisaema triphyllum**	FACW-	H			
6	*Galium boreale**	FACU	H			
7	*Hypnum sp.**	NL	H			
8	*Impatiens capensis**	FACW	H			
9	*Maianthemum canadense**	FAC-	H			
10	*Microstegium vimineum**	FAC	H			

Percent of dominant species that are OBL, FACW, and/or FAC: ____75%_____
Is the hydrophytic vegetation criterion met? Yes_X___ No_____
Rationale: More than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Califon Loam_ Subgroup:__Typic Fragiudults
Is the soil on the hydric soils list? Yes __X____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No ___X__
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No __X___

Rationale: Indicators of hydric soils include depleted layers with distinct mottles.

Soil Borings Depth (inches)	Soil Colors	Description
0-4"	10YR 4/1	Sandy Loam
0-4"	10YR 5/6	Mottles (some)
4-8"	10YR 5/1	Sandy Loam
8-18"	2.5Y 6/2	Sandy Loam
8-18"	10YR 5/8	Distinct Mottles

HYDROLOGY

Is the ground surface inundated? Yes _____ No __X_ Surface water depth: _
Is the soil saturated? Yes __X__ No _____
Depth to free standing water in pit/soil probe hole:____3 inches_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes __X__ No _____ (Inconclusive)_____
Rationale:_Water table occurs within the upper 12 inches.

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes __X__ No _____
Rationale for juristiction decision: Indicators for wetland hydrology, hydrophytic vegetation and hydric soils are present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	*Acer rubrum**	FAC	30%	4	28	1
2	*Carpinus caroliniana*	FAC	10%	2	10.5	3
3	*Fagus grandifolia**	FACU	20%	3	20.5	2
4	*Nyssa sylvatica**	FAC	20%	3	20.5	2
5						
6						
7						
8						
9						
10						
11						

Sum of Midpoints: 79.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 39.75

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Berberis thunbergii**	FACU	20%	3	20.5	2
2 *Lindera benzoin**	FACW-	30%	4	28	1
3					
4					
5					
6					
7					
8					
9					
10					
				Sum of Midpoints:	48.5
				Dominance Threshold Number Equals 50% x Sum of Midpoints:	24.25

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Parthenocissus quinquefolia**	FACU	20%	3	20.5	1
2					
3					
4					
5					
				Sum of Midpoints:	20.5
				Dominance Threshold Number Equals 50% x Sum of Midpoints:	10.25

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1					
2					
3					
4					
5					
6					
7					
8					
9					
				Sum of Midpoints:	0
				Dominance Threshold Number Equals 50% x Sum of Midpoints:	0

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Ageratina altissima**	FACU-	5%	1	3	1
2	*Arisaema triphyllum**	FACW-	1%	1	3	1
3	*Maianthemum canadense**	FAC-	1%	1	3	1
4	*Microstegium vimineum**	FAC	5%	1	3	1
5	*Symplocarpus foetidus**	OBL	2%	1	3	1
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 15
Dominance Threshold Number Equals 50% x Sum of Midpoints: 7.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

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DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Califon Loam_ Subgroup:__Typic Fragiudults
Is the soil on the hydric soils list? Yes __X____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No __X___
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No __X____

Rationale: Mottles are present but not distinct and matrix is not depleted.

Soil Borings Depth (inches)	Soil Colors	Description
0-2"	10YR 3/1	Sandy Loam
2-6"	10YR 6/4	Sandy Loam
6-18"	10YR 6/4	Sandy Loam
6-18"	10YR 6/2	Mottles (some)

HYDROLOGY

Is the ground surface inundated? Yes _____ No __X_ Surface water depth: _
Is the soil saturated? Yes _____ No _X____
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No __X___ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No _X____
Rationale for juristiction decision: Indicators for wetland hydrology and hydric soils are not present.

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DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/23/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPA09
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1	*Acer rubrum**	FAC	T	*Symplocarpus foetidus**	OBL	H
2	*Fagus grandifolia**	FACU	T			
3	*Nyssa sylvatica**	FAC	T			
4	*Berberis thunbergii**	FACU	SH			
5	*Lindera benzoin**	FACW-	SH			
6	*Parthenocissus quinquefolia**	FACU	V			
7	*Ageratina altissima**	FACU-	H			
8	*Arisaema triphyllum**	FACW-	H			
9	*Maianthemum canadense**	FAC-	H			
10	*Microstegium vimineum**	FAC	H			

Percent of dominant species that are OBL, FACW, and/or FAC: ____63%_____
Is the hydrophytic vegetation criterion met? Yes_X___ No_____
Rationale: More than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Califon Loam_ Subgroup:__Typic Fragiudults
Is the soil on the hydric soils list? Yes __X____ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No _X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X___ No _____ Gleyed? Yes _____ No __X__
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No __X____

Rationale: Mottles are present but not distinct and matrix is not depleted.

Soil Borings Depth (inches)	Soil Colors	Description
0-2"	10YR 3/1	Sandy Loam
2-6"	10YR 6/4	Sandy Loam
6-18"	10YR 6/4	Sandy Loam
6-18"	10YR 6/2	Mottles (some)

HYDROLOGY

Is the ground surface inundated? Yes _____ No __X_ Surface water depth: _
Is the soil saturated? Yes _____ No _X____
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No __X___ (Inconclusive)_____
Rationale:_

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No _X____
Rationale for juristiction decision: Indicators for wetland hydrology and hydric soils are not present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPB01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	Acer rubrum*	FAC	50%	3	20.5	2
2						
3						
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 20.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 10.25

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Berberis thunbergii**	FACU	20%	3	20.5	1
2 *Rosa multiflora*	FACU	2%	1	3	2
3 *Viburnum recognitum*	FACW-	2%	1	3	2
4					
5					
6					
7					
8					
9					
10					

Sum of Midpoints: 26.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 13.25

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Parthenocissus quinquefolia**	FACU	2%	1	3	1
2 *Toxicodendron radicans**	FAC	2%	1	3	1
3					
4					
5					

Sum of Midpoints: 6
Dominance Threshold Number Equals 50% x Sum of Midpoints: 3

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1					
2					
3					
4					
5					
6					
7					
8					
9					

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Arisaema triphyllum*	FACW-	1%	1	3	4
2	*Carex vulpinoidea**	OBL	50%	4	28	1
3	*Dryopteris marginalis*	FACU-	2%	1	3	4
4	*Impatiens capensis*	FACW	5%	1	3	4
5	*Juncus effusus*	FACW+	10%	2	10.5	3
6	*Microstegium vimineum*	FAC	25%	3	20.5	2
7	*Onoclea sensibilis**	FACW	4%	1	3	4
8	*Polygonum arifolium*	OBL	1%	1	3	4
9	*Polygonum sagittatum*	OBL	1%	1	3	4
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 71
Dominance Threshold Number Equals 50% x Sum of Midpoints: 35.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

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2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury loam___ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No ____
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.		

HYDROLOGY

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:__ _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation, hydrology and hydric soils are present.

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2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Sp	Indicator Status	Stratum
1	Acer rubrum*	FAC	T	11			
2	*Berberis thunbergii**	FACU	SH	12			
3	*Parthenocissus quinquefolia**	FACU	V	13			
4	*Toxicodendron radicans**	FAC	V	14			
5	*Carex vulpinoidea**	OBL	H	15			
6	*Onoclea sensibilis**	FACW	H	16			
7				17			
8				18			
9				19			
10				20			

Percent of dominant species that are OBL, FACW, and/or FAC: 66%
Is the hydrophytic vegetation criterion met? Yes__X__ No_____
Rationale: Greater than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No ____
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses

Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.

HYDROLOGY

0

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation, hydrology and hydric soils are

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2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPB02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	Acer rubrum*	FAC	80%	6	85.50	
2						
3						
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 85.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 42.75

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Lonicera Morrowi*	NI	5%	1	3	2
2	*Rosa multiflora**	FACU	80%	6	85.5	1
3	*Viburnum recognitum*	FACW-	2%	1	3	2
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 91.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 45.75

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Parthenocissus quinquefolia**	FACU	15%	2	10.5	1
2	*Toxicodendron radicans**	FAC	10%	2	10.5	1
3						
4						
5						

Sum of Midpoints: 21
Dominance Threshold Number Equals 50% x Sum of Midpoints: 10.5

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Acer rubrum**	FAC	10%	2	10.5	1
2	*Fraxinus americana**	FACU	15%	2	10.5	1
3						
4						
5						
6						
7						
8						
9						

Sum of Midpoints: 21
Dominance Threshold Number Equals 50% x Sum of Midpoints: 10.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Arisaema triphyllum*	FACW-	5%	1	3	3
2	*Fragaria virginiana**	FACU	20%	3	20.5	1
3	*Impatiens capensis*	FACW	5%	1	3	3
4	*Microstegium vimineum**	FAC	10%	2	10.5	2
5	*Onoclea sensibilis**	FACW	10%	2	10.5	2
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 47.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 23.75

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury loam___ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.		

HYDROLOGY

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:__ _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No _X____ (Inconclusive)_____
Rationale: No indicators of hydrology present

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: Indicators of wetland hydrology are not present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Sp	Indicator Status	Stratum
1	Acer rubrum*	FAC	T	11			
2	*Rosa multiflora**	FACU	SH	12			
3	*Parthenocissus quinquefolia**	FACU	V	13			
4	*Toxicodendron radicans**	FAC	V	14			
5	*Acer rubrum**	FAC	SAP	15			
6	*Fraxinus americana**	FACU	SAP	16			
7	*Fragaria virginiana**	FACU	H	17			
8	*Microstegium vimineum**	FAC	H	18			
9	*Onoclea sensibilis**	FACW	H	19			
10				20			

Percent of dominant species that are OBL, FACW, and/or FAC: 55%
Is the hydrophytic vegetation criterion met? Yes__X__ No_____
Rationale: Greater than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X__
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses

Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.

HYDROLOGY

0

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No _X____ (Inconclusive)_____
Rationale: No indicators of hydrology present

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: Indicators of wetland hydrology are not present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPB03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	Acer rubrum*	FAC	30%	4	28.00	1
2						
3						
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 28
Dominance Threshold Number Equals 50% x Sum of Midpoints: 14

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Cornus racemosa**	NL	10%	2	10.5	2
2	*Hamamelis virginiana**	FAC-	10%	2	10.5	2
3	*Lindera benzoin**	FACW-	20%	3	20.5	1
4	*Rhamnus cathartica*	UPL	2%	1	3	3
5	*Rosa multiflora**	FACU	10%	2	10.5	2
6						
7						
8						
9						
10						

Sum of Midpoints: 55
Dominance Threshold Number Equals 50% x Sum of Midpoints: 27.5

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Parthenocissus quinquefolia**	FACU	5%	1	3	2
2	*Vitis palmata Vahl**	NI	10%	2	10.5	1
3						
4						
5						

Sum of Midpoints: 13.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 6.75

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Arisaema triphyllum*	FACW-	5%	1	3	4
2	*Impatiens capensis*	FACW	5%	1	3	4
3	*Microstegium vimineum**	FAC	20%	3	20.5	2
4	*Onoclea sensibilis*	FACW	5%	1	3	4
5	*Osmunda cinnamomea*	FACW	15%	2	10.5	3
6	*Symplocarpus foetidus**	OBL	35%	4	28	1
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 68
Dominance Threshold Number Equals 50% x Sum of Midpoints: 34

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Parker gravelly sandy loam___ Subgroup:_Typic Dystrudepts _
Is the soil on the hydric soils list? Yes _____ No ___X____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No _X____
Rationale: _Soils are not listed on the National Hydric Soils list.

Soil Depth (inches)	Soil Colors	Description
3-0"	Organic vegetative debris	
0-7"	10YR 2/1	gravel and stones with organics
7-12"	7.5YR 3/2	gravelly sandy loam
12-27"	7.5 YR 4/4	gravelly sandy loam
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Parker Series.		

HYDROLOGY

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:__ _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X____ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision:

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Sp	Indicator Status	Stratum
1	Acer rubrum*	FAC	T	11			
2	*Cornus racemosa**	NL	SH	12			
3	*Hamamelis virginiana**	FAC-	SH	13			
4	*Lindera benzoin**	FACW-	SH	14			
5	*Rosa multiflora**	FACU	SH	15			
6	*Parthenocissus quinquefolia**	FACU	V	16			
7	*Vitis palmata Vahl**	NI	V	17			
8	*Microstegium vimineum**	FAC	H	18			
9	*Symplocarpus foetidus**	OBL	H	19			
10				20			

Percent of dominant species that are OBL, FACW, and/or FAC: ____62%_____
Is the hydrophytic vegetation criterion met? Yes__X___ No_____
Rationale: Greater than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Parker gravelly sandy loam_ Subgroup:_Typic Dystrudepts _
Is the soil on the hydric soils list? Yes _____ No ___X____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X__
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No _X____
Rationale: _Soils are not listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
3-0"	Organic vegetative debris	
0-7"	10YR 2/1	gravel and stones with organics
7-12"	7.5YR 3/2	gravelly sandy loam
12-27"	7.5 YR 4/4	gravelly sandy loam
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Parker Series.		

HYDROLOGY

0

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X____ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision:

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPB04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	*Acer rubrum*	FAC	10%	2	10.50	2
2	*Cornus florida*	FACU-	5%	1	3.00	3
3	*Quercus alba**	FACU-	25%	3	20.50	1
4	*Quercus lyrata*	OBL	5%	1	3.00	3
5	*Quercus rubra**	FACU-	25%	3	20.50	1
6	*Quercus velutina*	NL	10%	2	10.50	2
7						
8						
9						
10						

Sum of Midpoints: 68
Dominance Threshold Number Equals 50% x Sum of Midpoints: 34

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Berberis thunbergii*	FACU	2%	1	3	2
2	*Cornus racemosa*	NL	5%	1	3	2
3	*Hamamelis virginiana**	FAC-	30%	4	28	1
4	*Rosa multiflora*	FACU	2	1	3	2
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 37
Dominance Threshold Number Equals 50% x Sum of Midpoints: 18.5

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Parthenocissus quinquefolia*	FACU	1%	1	3	2
2	*Smilax glauca*	FACU	5%	1	3	2
3	*Vitis aestivalis**	FACU	20%	3	20.5	1
4						
5						

Sum of Midpoints: 26.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 13.25

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Acer rubrum**	FAC	10%	2	10.5	1
2	*Carya glabra**	FACU-	10%	2	10.5	1
3						
4						
5						
6						
7						
8						
9						

Sum of Midpoints: 21
Dominance Threshold Number Equals 50% x Sum of Midpoints: 10.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	Chimaphila maculata	NL	2%	1	3	2
2	Hamamelis virginiana	FAC-	2%	1	3	2
3	Hypnum sp.*	NL	30%	4	28	1
4	Thelypteris noveboracensis	FAC	5%	1	3	2
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 37
Dominance Threshold Number Equals 50% x Sum of Midpoints: 18.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Parker very gravelly sandy loam___ Subgroup:_Typic Dystrudepts _
Is the soil on the hydric soils list? Yes _____ No ___X____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No _X____
Rationale: _Soils are not listed on the National Hydric Soils list.

Soil Depth (inches)	Soil Colors	Description
3-0"	Organic vegetative debris	
0-7"	10YR 2/1	gravel and stones with organics
7-12"	7.5YR 3/2	gravelly sandy loam
12-27"	7.5 YR 4/4	gravelly sandy loam
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Parker Series.		

HYDROLOGY

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:__ _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No ___X__ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators for hydrology, hydrophytic vegetation present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Sp	Indicator Status	Stratum
1	*Quercus alba**	FACU-	T	11			
2	*Quercus rubra**	FACU-	T	12			
3	*Hamamelis virginiana**	FAC-	SH	13			
4	*Vitis aestivalis**	FACU	V	14			
5	*Acer rubrum**	FAC	SAP	15			
6	*Carya glabra**	FACU-	SAP	16			
7	*Hypnum sp.**	NL	H	17			
8				18			
9				19			
10				20			

Percent of dominant species that are OBL, FACW, and/or FAC: ____16%_____
Is the hydrophytic vegetation criterion met? Yes_____ No_X____
Rationale: Less than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Parker very gravelly sandy loam_ Subgroup:_Typic Dystrudepts _
Is the soil on the hydric soils list? Yes _____ No ___X____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X__
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No _X____
Rationale: _Soils are not listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
3-0"	Organic vegetative debris	
0-7"	10YR 2/1	gravel and stones with organics
7-12"	7.5YR 3/2	gravelly sandy loam
12-27"	7.5 YR 4/4	gravelly sandy loam
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Parker Series.		

HYDROLOGY

0

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No ___X__ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators for hydrology, hydrophytic vegetation present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPC01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	*Acer rubrum**	FAC	75%	5	63.0	1
2	*Liriodendron tulipifera*	FACU	5%	1	3	3
3	*Betula lenta*	FACU	10%	2	10.5	2
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 76.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 38.25

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Cornus racemosa**	FAC-	20%	3	20.5	1
2 *Rosa multiflora*	FACU	5%	1	3	2
3 *Vaccinium corymbosum**	FACW-	25%	3	20.5	1
4					
5					
6					
7					
8					
9					
10					
			Sum of Midpoints:	44	
		Dominance Threshold Number Equals 50% x Sum of Midpoints:		22	

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Vitis aestivalis**	FACU	15%	2	10.5	1
2 *Toxicodendron radicans**	FAC	15%	2	10.5	1
3 *Parthenocissus quinquefolia**	FACU	15%	2	10.5	1
4 *Smilax glauca**	FACU	10%	2	10.5	1
5					
			Sum of Midpoints:	42	
		Dominance Threshold Number Equals 50% x Sum of Midpoints:		21	

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Quercus bicolor**	FACW+	2%	1	3	1
2					
3					
4					
5					
6					
7					
8					
9					
			Sum of Midpoints:	3	
		Dominance Threshold Number Equals 50% x Sum of Midpoints:		1.5	

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Symplocarpus foetidus**	OBL	40%	4	28	1
2	*Osmundastrum cinnamomeum**	FACW	10%	2	10.5	2
3	*Gymnocarpium dryopteris*	UPL	5%	1	3	3
4	*Hypnum sp. **	NL	10%	2	10.5	2
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
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28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 52
Dominance Threshold Number Equals 50% x Sum of Midpoints: 26

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury loam___ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No ____
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.		

HYDROLOGY

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:__ _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation, hydrology and hydric soils are present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Sp	Indicator Status	Stratum
1 *Acer rubrum**	FAC	T	11		
2 *Cornus racemosa**	FAC-		12		
3 *Vaccinium corymbosum**	FACW-		13		
4 *Vitis aestivalis**	FACU		14		
5 *Toxicodendron radicans**	FAC		15		
6 *Parthenocissus quinquefolia**	FACU		16		
7 *Smilax glauca**	FACU		17		
8 *Quercus bicolor**	FACW+		18		
9 *Symplocarpus foetidus**	OBL		19		
10 *Osmundastrum cinnamomeum**	FACW		20		

Percent of dominant species that are OBL, FACW, and/or FAC: ____70%_____
Is the hydrophytic vegetation criterion met? Yes__X__ No_____
Rationale: Greater than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No ____
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses

Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.

HYDROLOGY

0

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation, hydrology and hydric soils are

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPC02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	Acer rubrum*	FAC	40%	4	38.00	1
2	Carya glabra*	FACU-	20%	3	20.50	2
3	Quercus palustris	FACW	10%	2	10.50	3
4	Quercus alba	FACU-	15%	2	10.50	3
5	Fagus grandifolia	FACU	15	2	10.50	3
6						
7						
8						
9						
10						

Sum of Midpoints: 90
Dominance Threshold Number Equals 50% x Sum of Midpoints: 45

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Cornus racemosa**	FAC-	10%	2	10.5	1
2 *Vaccinium corymbosum**	FACW-	10%	2	10.5	1
3 *Vaccinium angustifolium**	FACU-	10%	2	10.5	1
4 *Rhododendron viscosum*	FACW+	5%	1	3	2
5					
6					
7					
8					
9					
10					

Sum of Midpoints: 34.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 17.25

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Vitis aestivalis**	FACU	25%	3	20.5	3
2 *Parthenocissus quinquefolia**	FACU	10%	2	10.5	2
3 *Smilax glauca*	FACU	2%	1	3	1
4					
5					

Sum of Midpoints: 34
Dominance Threshold Number Equals 50% x Sum of Midpoints: 17

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Quercus velutina**	NI	15%	2	10.5	1
2 *Fraxinus americana*	FACU	5%	1	3	2
3 *Quercus bicolor*	FACW+	2%	1	3	2
4					
5					
6					
7					
8					
9					

Sum of Midpoints: 16.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 8.25

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Thelypteris noveboracensis**	FAC	20%	3	20.5	1
2	*Pteridium aquilinum**	FACU	15%	2	10.5	2
3	*Maianthemum canadensis*	FAC-	5%	1	3	3
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 34
Dominance Threshold Number Equals 50% x Sum of Midpoints: 17

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury loam___ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.		

HYDROLOGY

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:__ _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No _X____ (Inconclusive)_____
Rationale: No indicators of hydrology present

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: Indicators of wetland hydrology are not present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Sp	Indicator Status	Stratum
1	Acer rubrum*	FAC	T	11			
2	Carya glabra*	FACU-	T	12			
3	*Cornus racemosa**	FAC-	SH	13			
4	*Vaccinium corymbosum**	FACW-	SH	14			
5	*Vaccinium angustifolium**	FACU-	SH	15			
6	*Vitis aestivalis**	FACU	V	16			
7	*Parthenocissus quinquefolia**	FACU	V	17			
8	*Quercus velutina**	NI	SAP	18			
9	*Thelypteris noveboracensis**	FAC	H	19			
10	*Pteridium aquilinum**	FACU	H	20			

Percent of dominant species that are OBL, FACW, and/or FAC: ____40%_____
Is the hydrophytic vegetation criterion met? Yes____ No__X___
Rationale: Less than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X__
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses

Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.

HYDROLOGY

0

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No _X____ (Inconclusive)_____
Rationale: No indicators of hydrology present

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: Indicators of wetland hydrology are not present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig,Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPC03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1	Acer rubrum*	FAC	70%	5	63.00	1
2	Betula populifolia	FAC	15%	2	10.50	2
3						
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 73.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 36.75

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig,Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Berberis thunbergii**	FACU	15%	2	10.5	1
2	*Ligustrum amurense*	NL	5%	1	3	2
3	*Prunus serotina*	FACU	5%	1	3	2
4	*Rosa multiflora**	FACU	10%	2	10.5	1
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 27
Dominance Threshold Number Equals 50% x Sum of Midpoints: 13.5

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Parthenocissus quinquefolia**	FACU	5%	1	3	2
2	*Toxicodendron radicans**	FAC	5%	1	3	2
3						
4						
5						

Sum of Midpoints: 6
Dominance Threshold Number Equals 50% x Sum of Midpoints: 3

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Acer rubrum**	FAC	20%	3	20.5	1
2						
3						
4						
5						
6						
7						
8						
9						

Sum of Midpoints: 20.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 10.25

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig,Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Symplocarpus foetidus**	OBL	75%	5	63	1
2	*Onoclea sensibilis*	FACW	2%	1	3	3
3	*Prunus serotina*	FACU	2%	1	3	3
4	*Liriodendron tulipifera*	FACU	2%	1	3	3
5	*Viola palmata*	NL	1%	1	3	3
6	*Microstegium vimineum*	FAC	10%	2	10.5	2
7	*Impatens capensis*	FACW	2%	1	3	3
8	*Arisaema triphyllum*	FACW-	1%	1	3	3
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 88.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 44.25

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig,Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes _X____ No ___X____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X____ No _____ Gleyed? Yes _____ No ___X___
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes __X___ No ____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.		

HYDROLOGY

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:__ _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X____ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators for hydrophytic vegetation, hydric soils and hydrology are present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Sp	Indicator Status	Stratum
1	Acer rubrum*	FAC	T	11			
2	*Berberis thunbergii**	FACU	SH	12			
3	*Rosa multiflora**	FACU	SH	13			
4	*Parthenocissus quinquefolia**	FACU	V	14			
5	*Toxicodendron radicans**	FAC	V	15			
6	*Acer rubrum**	FAC	SAP	16			
7	*Symplocarpus foetidus**	OBL	H	17			
8				18			
9				19			
10				20			

Percent of dominant species that are OBL, FACW, and/or FAC: 57%
Is the hydrophytic vegetation criterion met? Yes__X__ No_____
Rationale: Greater than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No ____
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses

Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.

HYDROLOGY

0

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation, hydrology and hydric soils are

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPB04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1 *Acer rubrum**	FAC	70%	5	63.00	1
2					
3					
4					
5					
6					
7					
8					
9					
10					
			Sum of Midpoints:	63	
		Dominance Threshold Number Equals 50% x Sum of Midpoints:		31.5	

Tree Species (Basal Area Option)

Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

	Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Rosa multiflora**	FACU	20%	3	20.5	1
2	*Berberis thunbergii**	FACU	10%	2	10.5	2
3	*Cornus racemosa*	NL	5%	1	3	4
4	*Vaccinium corymbosum*	FACW-	5%	1	3	4
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 37
Dominance Threshold Number Equals 50% x Sum of Midpoints: 18.5

	Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Parthenocissus quinquefolia**	FACU	10%	2	10.5	1
2	*Smilax glauca**	FACU	5%	1	3	2
3						
4						
5						

Sum of Midpoints: 13.5
Dominance Threshold Number Equals 50% x Sum of Midpoints: 6.75

	Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Acer rubrum**	FAC	15%	2	10.5	1
2	*Prunus serotina**	FACU	15%	2	10.5	1
3						
4						
5						
6						
7						
8						
9						

Sum of Midpoints: 21
Dominance Threshold Number Equals 50% x Sum of Midpoints: 10.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	Prunus serotina*	FACU	40%	4	28	1
2	Maianthum canadense	FAC-	1%	1	3	2
3	Fraxinus americana	FACU	1%	1	3	2
4	Fagus grandifolia	FACU	2%	1	3	2
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 37
Dominance Threshold Number Equals 50% x Sum of Midpoints: 18.5

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig, Tara Santamauro Date: 05/11/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPB04
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Parker very gravelly sandy loam___ Subgroup:_Typic Dystrudepts _
Is the soil on the hydric soils list? Yes _____ No ___X____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No _X____
Rationale: _Soils are not listed on the National Hydric Soils list.

Soil Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses

Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.

HYDROLOGY

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:__ _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No ___X__ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators for hydrology, hydrophytic vegetation present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig, Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC02
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No _X_ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Sp	Indicator Status	Stratum
1	Acer rubrum*	FAC	T	11			
2	*Rosa multiflora**	FACU	SH	12			
3	*Berberis thunbergii**	FACU	SH	13			
4	*Parthenocissus quinquefolia**	FACU	V	14			
5	*Smilax glauca**	FACU	V	15			
6	*Acer rubrum**	FAC	SAP	16			
7	*Prunus serotina**	FACU	SAP	17			
8	Prunus serotina*	FACU	H	18			
9				19			
10				20			

Percent of dominant species that are OBL, FACW, and/or FAC: ___25%_____
Is the hydrophytic vegetation criterion met? Yes____ No__X___
Rationale: Less than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X__
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description
0-9"	2.5Y 7/2	Gravelly Loam
9-15"	2.5Y 6/2	Loam
15-25"	2.5Y 6/2	gravely clay loam
15-25"	10YR 6/4	Distinct Iron-manganese Massess
15-25"	7.5YR 5/8	Oxidized Iron Masses
Note: Soil colors and descriptions obtained from the USDA Official Soil Series Description for the Cokesbury Series.		

HYDROLOGY

0

Is the soil saturated? Yes _____ No _____
Depth to free standing water in pit/soil probe hole:_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _____ No _X____ (Inconclusive)_____
Rationale: No indicators of hydrology present

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes ____ No __X___
Rationale for juristiction decision: No indicators for hydrology, hydrophytic vegetation present.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig Date: 05/13/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPJ01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
				Sum of Midpoints:	0
			Dominance Threshold Number Equals 50% x Sum of Midpoints:		0

Tree Species (Basal Area Option)

Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig Date: 05/13/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPJ01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Cornus amomum**	FACW	60%	5	63	1
2 *Viburnum recognitum**	FAC	35%	4	38	2
3 *Rosa multiflora*	FACU	5%	1	3	3
4 *Cornus foemina**	FAC	30%	4	38	2
5					
6					
7					
8					
9					
10					
			Sum of Midpoints:	142	
		Dominance Threshold Number Equals 50% x Sum of Midpoints:		71	

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Toxicodendron radicans**	FAC	10%	2	10.5	1
2 *Vitis palmata**	NI	8%	2	10.5	1
3					
4					
5					
			Sum of Midpoints:	21	
		Dominance Threshold Number Equals 50% x Sum of Midpoints:		10.5	

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1 *Quercus palustris**	FAC	2%	1	3	1
2					
3					
4					
5					
6					
7					
8					
9					
			Sum of Midpoints:	3	
		Dominance Threshold Number Equals 50% x Sum of Midpoints:		1.5	

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig Date: 05/13/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPJ01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Juncus effusus**	FACW+	10%	2	10.5	1
2	*Carex vulpinoidea*	OBL	5%	1	3	2
3	*Onoclea sensibilis**	FACW	15%	2	10.5	1
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 24
Dominance Threshold Number Equals 50% x Sum of Midpoints: 12

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig Date: 05/13/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPJ01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Cokesbury loam___ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description

'The area has been altered since the 1960's as a result of the landfill. Soils do not display a normal soil profile but indicate a more homogenous soil profile with some mottles developed in recent years.

HYDROLOGY

Is the soil saturated? Yes _____ No __X___
Depth to free standing water in pit/soil probe hole:__ ____NA_ _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation and hydrology are present. Soils are significantly disturbed and therefore cannot be used to determine the presence of hydric soils.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig Date: 05/13/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPJ01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes __X___ No _____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes __X__ No ___ (if yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Sp	Indicator Status	Stratum
1 *Cornus amomum**	FACW	SH	11		
2 *Viburnum recognitum**	FAC	SH	12		
3 *Cornus foemina**	FAC	SH	13		
4 *Toxicodendron radicans**	FAC	V	14		
5 *Vitis palmata**	NI	V	15		
6 *Quercus palustris**	FAC	SAP	16		
7 *Juncus effusus**	FACW+	H	17		
8 *Onoclea sensibilis**	FACW	H	18		
9			19		
10			20		

Percent of dominant species that are OBL, FACW, and/or FAC: 88%
Is the hydrophytic vegetation criterion met? Yes__X__ No_____
Rationale: Greater than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes _____ No _____ Gleyed? Yes _____ No _____
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description

The area has been altered since the 1960's as a result of the landfill. Soils do not display a normal soil profile but indicate a more homogenous soil profile with some mottles developed in recent years.

HYDROLOGY

0

Is the soil saturated? Yes _____ No __X___
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation and hydrology are present. Soils are significantly disturbed and therefore cannot be used to determine the presence of hydric soils.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Trees)

Field Investigator(s): John Roebig,Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner: USEPA Community: OPC03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Trees)

	Tree Species (Percent Cover Option)	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[1]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

Tree Species (Basal Area Option)

	Tree Species (Percent Cover Option)	Indicator Status	Tally 1 2 3 4 5 6 7 8	Total Trees	Basal[3] Area	Rank[2]
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Basal Area Factor (e.g. Prism Used).,

Total Basal Area of All Species Combined:
Dominance Threshold Number Equals 50% of Total Basal Area:

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Shrubs, Woody Vines and Saplings)

Field Investigator(s): John Roebig,Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Shrubs, Woody Vines and Saplings)

Shrub Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

Woody Vine Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1					
2					
3					
4					
5					

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

Sapling Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1					
2					
3					
4					
5					
6					
7					
8					
9					

Sum of Midpoints: 0
Dominance Threshold Number Equals 50% x Sum of Midpoints: 0

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).

[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.

[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of individual trees tallied for all tally areas by the number of tallies and multipying by the basal area factor.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Herbs and Byrophytes)

Field Investigator(s): John Roebig,Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

VEGETATION (Herbs and Bryophtes)

	Herbaceous Species	Indicator Status	Percent Areal Cover	Cover[1] Class	Midpoint[1] of Cover Class	Rank[2]
1	*Apocynum sibiricum**	FAC	50%	4	28	1
2	*Scirpus cyperinus*	FACW+				
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Sum of Midpoints: 28
Dominance Threshold Number Equals 50% x Sum of Midpoints: 14

[1] Cover classes (midpoints): T <1% (none); 1= 1-5% (3.0); 2= 6-15% (10.5%); 3= 16-25% (20.5); 4= 26-50% (28.0);5= 51-75% (63.0); 6= 76-95% (85.5); 7= 96-1005 (96.0).
[2] To determine the dominants, first rank the species by their midpoints (or basal area). Then cumulatively sum the midpoints (basal areas) of the ranked species until 50% of the total for all species midpoints (or basal area) is immediately exceeded. All species contributing to that cumulative total (the dominance threshold number) plus any additional species having 20% of the total midpoint, or basal area, value should be considered dominants and marked with an asterick.
[3] The basal area for a species (on a per acre basis) is determined by dividing the total number of

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Soils)

Field Investigator(s): John Roebig,Erin Roth Date: 05/24/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPC03
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

SOILS

Series/Phase:_Parker gravelly sandy loam_ Subgroup:_Typic Dystrudepts _
Is the soil on the hydric soils list? Yes _X____ No ___X____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X____ No _____ Gleyed? Yes _____ No ___X___
Matrix color:____See Table_____
Other hydric soil indicators:
Is the hydric soil criterion met? Yes __X___ No ____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Depth (inches)	Soil Colors	Description

'The area has been altered since the 1960's as a result of the landfill. Soils do not display a normal soil profile but indicate a more homogenous soil profile with some mottles developed in recent years.

HYDROLOGY

Is the soil saturated? Yes _____ No __X___
Depth to free standing water in pit/soil probe hole:__ _____NA _____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X____ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation and hydrology are present. Soils are significantly disturbed and therefore cannot be used to determine the presence of hydric soils.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

DATA FORM
INTERMEDIATE-LEVEL ONSITE DETERMINATION METHOD[1]
VEGETATION UNIT SAMPLING PROCEDURE
(Summary Sheet)

Field Investigator(s): John Roebig Date: 05/13/2011
Project/Site: Combe South State: NJ County: Morris
Applicant/Owner:_USEPA Community: OPJ01
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes _____ No __X____
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes __X__ No ___ (if yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Sp	Indicator Status	Stratum
1	*Apocynum sibiricum**	FAC	H	11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

Percent of dominant species that are OBL, FACW, and/or FAC: ___100%_____
Is the hydrophytic vegetation criterion met? Yes__X__ No_____
Rationale: Greater than 50% of all dominant species are FAC, FACW or OBL.

SOILS

Series/Phase:_Cokesbury loam_ Subgroup:_Typic Fragiaquults _
Is the soil on the hydric soils list? Yes __X___ No _____ Undetermined _____
Is the soil a Histosol? Yes _____ No __X___ Histic epipedon present? Yes _____ No _X___
Is the soil Mottled? Yes __X____ No _____ Gleyed? Yes _____ No ___X__
Matrix color:____See Table_____
Other hydric soil indicators:_High organic content in surface horizon
Is the hydric soil criterion met? Yes ___X___ No _____
Rationale: _Soils are listed on the National Hydric Soils list.

Soil Borings Depth (inches)	Soil Colors	Description

The area has been altered since the 1960's as a result of the landfill. Soils do not display a normal soil profile but indicate a more homogenous soil profile with some mottles developed in recent years.

HYDROLOGY

0

Is the soil saturated? Yes _____ No __X___
Depth to free standing water in pit/soil probe hole:_____NA_____
List the other field evidence of surface inundation or soil saturation:

Is the wetland hydrology criterion met? Yes _X___ No _____ (Inconclusive)_____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is this plant community a wetland? Yes _X___ No _____
Rationale for juristiction decision: Indicators of hydrophytic vegetation and hydrology are present. Soils are significantly disturbed and therefore cannot be used to determine the presence of hydric soils.

1This data can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure
2Classification according to "Soil Taxonomy"

Site Photograph Log

Combe Fill South Landfill OU2 Superfund Site

Picture 1: Picture taken looking south at Wetland WA.

Picture 2: Picture taken looking south in Wetland WA and headwaters of Trout Brook

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**1 & 2**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 3:Picture taken looking west in Wetland WA and headwaters of Trout Brook.

Picture 4: Picture taken looking north toward horse farm, small emergent area (PEM) of wetland WA.

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**3 & 4**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 5: Picture taken within palustrine forested (PFO) wetland WA.

Picture 6: Picture taken within palustrine forested (PFO) wetland WA.

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**5 & 6**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 7: Picture taken within palustrine forested (PFO) wetland WA.

Picture 8: Picture taken within palustrine forested (PFO) wetland WA.

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**7 & 8**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 9: Picture taken in Wetland WA; robust tree, shrub and herbacous layers.

Picture 10: Picture taken of Wetland WA and within Trib to Tanners Brook watershed.

Combe Fill South Landfill Superfund Site

Picture 11: Picture taken in Wetland WB; small disturbed area.

Picture 12: Picture taken in wetland WB; Swamp Jack in the Pulpit (Arisaema triphyllum).

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**11 & 12**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 13: Picture taken in wetland WB.

Picture 14: Picture taken in wetland WB within Trout Brook watershed.

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**13 & 14**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 15: Picture taken in Wetland WB and tributary to Trout Brook.

Picture 16: Picture taken in Wetland WB and tributary to Trout Brook.

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**15 & 16**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 17: Picture taken in Wetland WC; UNT to Lamington River.

Picture 18: Picture taken in Wetland WC; UNT to Lamington River.

Combe Fill South Landfill Superfund Site

Picture 19: Picture taken in Wetland WD; UNT to Lamington River.

Picture 20: Picture taken in Wetland WD; UNT Lamington River.

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**19 & 20**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 21: Picture taken in Wetland WE; lucustrine waters and outlet to Lamington River.

Picture 22: Lacustrine Wetland WE.

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**21 & 22**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 23: Picture taken in Wetland WF; and Lamington River UNT.

Picture 24. Picture taken in Wetland WF and the UNT to Lamington River.

Combe Fill South Landfill Superfund Site

Picture 25: Picture taken in Wetland WH; UNT to Lamington River.

Picture 26 : Picture taken in Wetland WH; UNT to Lamington River.

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**25 & 26**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 27: Lacustrine Wetland WI.

Picture 28 : Lacustrine Wetland WI.

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**27 & 28**
		REVIEWED BY:		
		JOB NO:	134975	

Combe Fill South Landfill Superfund Site

Picture 29: Picture taken in Wetland WJ; palustrine emergent wetland (PEM).

Picture 30. Picture taken in Wetland WJ; palustrine emergent wetland (PEM).

Combe Fill South Landfill Superfund Site

Picture 31: Picture taken in Wetland WJ; palustrine emergent wetland (PEM) .

Picture 32. Picture taken in Wetland WJ; palustrine emergent wetland (PEM).

Wetland Report	**Combe Fill South Landfill OU2 Superfund Site Photos**	DATE:	12/04/15	**PHOTO**
		CREATED BY:	JR	**31 & 32**
		REVIEWED BY:		
		JOB NO:	134975	

Wetland Functional Assessment Forms

Wetland Function-Value Evaluation Form

Total area of wetland: 5.5 acres Human made? N0 Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use: Residential Distance to nearest roadway or other development: 50 feet

Dominant wetland systems present: PFO Contiguous undeveloped buffer zone present: Yes

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Upper portion

How many tributaries contribute to the wetland? Two (Trout and Uncoded) Wildlife & vegetation diversity/abundance (see attached list): High

Wetland I.D. Combe Fill South Wetland WA

Latitude: 40°46'5.87"N Longitude: 74°44'42.11"W

Prepared by: JR Date: 2/16/2015

Wetland Impact:

Type: Test Pits Area:

Evaluation based on:

Office: X Field: X

Corps manual wetland delineation completed?

Yes X No

Function / Value		Suitability		Rationale (Reference #)*	Principal Function(s)	Comments
		Yes	No			
	Groundwater Recharge / Discharge	X		2,6,7,9,10,11,12,13		This wetland is an expression of groundwater discharge.
	Floodflow Alteration	X		2,5,6,7,8,9,11,13,14		Provides storage and attenuated floods
	Fish and Shellfish Habitat	X		1,5,9,10,14,15,17		Provide shade and cover for Trout Brook and Uncoded t.
	Sediment / Toxicant Retention	X		3,4,5,6,7,8,9,10,12		Sediment from land fill drops out in wetland
	Nutrient Removal	X		2,3,5,15		Potential for sediment and nutrient removal exists, land fill activities have occurred adjacent to wetland.
	Production Export	X		1,2,4,5,6,7,9,10,12, 14		Direct connection to streams; direct transport occurs into adjacent stream and via wildlife routes.
	Sediment / Shoreline Stabilization		X	4,6,9,10,12,14		Low flow velocities in stream so minimum stabilization and shoreline protection is limited.
	Wildlife Habitat	X		1,2,4,5,6,7,8, 16, 17, 18, 19, 21.	Yes	This wetland is well buffered from surrounding roads and development and directly connected to both Tributary to Trout Brook and to Uncoded tributary to Tanners Brook. Habitat for terrestrial wildlife, avian, amphibian and insect.
	Recreation		X			Wetland is not open to the public access very limited
	Educational / Scientific Value		X			Wetland is not open to the public access very limited
	Uniqueness / Heritage		X			No known prehistoric archaeological sensitive areas adjacent to wetland
	Visual Quality / Aesthetics		X			. Wetland is not open to the public access very limited
ES	Endangered Species Habitat		X			None listed during review.
Other						

Notes: *Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland: 2.041 acres Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use: Residential Distance to nearest roadway or other development: < 15 feet

Dominant wetland systems present: PFO/PSS/PEM Contiguous undeveloped buffer zone present: Yes

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Upper portion

How many tributaries contribute to the wetland? One, Trout Brook Wildlife & vegetation diversity/abundance (see report): High

Wetland I.D. Combe Fill Wetland WB

Latitude: 40°46'3.75"N Longitude: 74°44'15.65"W

Prepared by: JR Date: 2/16/2015

Wetland Impact:

Type: Sampling Area:

Evaluation based on:

Office: X Field: X

Corps manual wetland delineation completed?

Yes X No

Function / Value		Suitability		Rationale (Reference #)*	Principal Function(s)	Comments
		Yes	No			
	Groundwater Recharge / Discharge	X		2,6,7,9,10,11,12,13		This wetland is an expression of groundwater discharge.
	Floodflow Alteration	X		2,5,6,7,8,9,11,13,14		Provides storage and attenuated floods
	Fish and Shellfish Habitat	X		1,5,9,10,14,15,17		Provide shade and cover for Tributary to Trout Brook.
	Sediment / Toxicant Retention	X		3,4,5,6,7,8,9,10,12		Sediment from land fill drops out in wetland
	Nutrient Removal	X		2,3,5,15		Potential for sediment and nutrient removal exists, land fill activities have occurred adjacent to wetland.
	Production Export	X		1,2,4,5,6,7,9,10,12,14		Direct connection to streams; direct transport occurs into adjacent stream and via wildlife routes.
	Sediment / Shoreline Stabilization		X	4,6,9,10,12,14		Low flow velocities in stream so minimum stabilization and shoreline protection is limited.
	Wildlife Habitat	X		1,2,4,5,6,7,8, 16, 17, 18, 19, 21.	Yes	This wetland is well buffered from surrounding roads and development and directly connected to Trout Brook. Habitat for terrestrial wildlife, avian, amphibian and insect species.
	Recreation		X			Wetland is not open to the public access very limited
	Educational / Scientific Value		X			Wetland is not open to the public access very limited
	Uniqueness / Heritage		X			No known prehistoric archaeological sensitive areas adjacent to wetland
	Visual Quality / Aesthetics		X			. Wetland is not open to the public access very limited
ES	Endangered Species Habitat		X			None listed during review.
Other						

Notes: *Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland: 1.5 ac Human made? No Is wetland part of a wildlife corridor? No or a "habitat island"? No

Adjacent land use: Farm ponds; adjacent residential use Distance to nearest roadway or other development: 10ft s. of paved road

Dominant wetland systems present: PFO Contiguous undeveloped buffer zone present: Partially

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Upper portion

How many tributaries contribute to the wetland? One, 1st order tributary Wildlife & vegetation diversity/abundance : Medium

Wetland I.D. Combe Fill Wetland WC,WD,WE,WF,WG,WH,WI

Latitude: "40°46'36.41"N Longitude: 74°43'46.17"W

Prepared by: JR Date: 2/16/2015

Wetland Impact:

Type: Sampling Area:

Evaluation based on:

Office: X Field: X

Corps manual wetland delineation completed?

Yes X No

Function / Value	Suitability		Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
	Yes	No			
Groundwater Recharge / Discharge	X		7, 8, 9, 13 (within watershed)	No	Groundwater discharge from seeps within Stream 1
Floodflow Alteration	X			No	Wetland will receive overbank flows (2yr storm and greater)
Fish and Shellfish Habitat		X			No fish or shellfish were observed in existing streams or wetlands
Sediment / Toxicant Retention	X		1, 3, 7, 10, 11, 14, 15, 16	Yes	Wetland microrelief has potential for sediment removal. Sediment removal would occur when streams exceed bankfull elevations
Nutrient Removal	X				Wetland microrelief has potential for nutrient removal
Production Export	X		1, 7, 10	No	Ponds and dams restrict export; limited transport occurs
Sediment / Shoreline Stabilization		X			Low velocities and ponds, very limited
Wildlife Habitat	X		2, 3, 4, 6, 7, 11, 13, 19, 20	Yes	Residential adjacent use limiting; deer, raccoon tracks, amphibians present.
Recreation		X			Not suited for recreation, privately owned.
Educational / Scientific Value		X		No	Limited potential use, privately owned.
Uniqueness / Heritage		X			
Visual Quality / Aesthetics	X		3, 5, 7, 8, 9	No	Viewed by residents
ES Endangered Species Habitat		X			None listed during review
Other					

*Refer to backup list of numbered considerations.

Notes:

Wetland Function-Value Evaluation Form

Total area of wetland: 0.5 ac Human made? Yes Is wetland part of a wildlife corridor? No or a "habitat island"? Yes

Adjacent land use: Farm ponds; adjacent residential use Distance to nearest roadway or other development: 100ft paved road

Dominant wetland systems present: PEM/PSS Contiguous undeveloped buffer zone present: Partially

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Upper portion

How many tributaries contribute to the wetland? None Wildlife & vegetation diversity/abundance (see attached list): Medium

Wetland I.D. Combe Fill Wetland WJ

Latitude: " 40°46'21.38"N Longitude: 74°44'11.18"W

Prepared by: JR Date: 2/16/2015

Wetland Impact:

Type: Sampling Area:

Evaluation based on:

Office: X Field: X

Corps manual wetland delineation completed?

Yes X No

Function / Value		Suitability		Rationale (Reference #)*	Principal Function(s)	Comments
		Yes	No			
	Groundwater Recharge / Discharge	X		7, 8, 9, 13 (within watershed)	No	Groundwater recharge from landfill runoff' limited by size
	Floodflow Alteration	X			No	
	Fish and Shellfish Habitat		X			No fish or shellfish were observed in existing streams or wetlands
	Sediment / Toxicant Retention	X		1, 3, 7, 10, 11, 14, 15, 16	Yes	Wetland microrelief has potential for sediment removal from landfill runoff
	Nutrient Removal	X				Wetland microrelief has potential for nutrient removal
	Production Export	X		1, 7, 10	No	Limited outflow
	Sediment / Shoreline Stabilization		X			Low velocities very limited
	Wildlife Habitat	X		2, 3, 4, 6, 7, 11, 13, 19, 20	Yes	Potential for wildlife limited by size.
	Recreation		X			Not suited for recreation, no public access.
	Educational / Scientific Value		X		No	Limited potential use, no public access.
	Uniqueness / Heritage		X			
	Visual Quality / Aesthetics	X		3, 5, 7, 8, 9	No	Limited, no public access
ES	Endangered Species Habitat		X			None listed during review
Other						

*Refer to backup list of numbered considerations.

Notes:

Appendix A

Wetland evaluation supporting documentation; Reproducible forms.

Below is an example list of considerations that was used for a New Hampshire highway project. Considerations are flexible, based on best professional judgment and interdisciplinary team consensus. This example provides a comprehensive base, however, and may only need slight modifications for use in other projects.

GROUNDWATER RECHARGE/DISCHARGE— This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area. It refers to the fundamental interaction between wetlands and aquifers, regardless of the size or importance of either.

CONSIDERATIONS/QUALIFIERS

1. Public or private wells occur downstream of the wetland.
2. Potential exists for public or private wells downstream of the wetland.
3. Wetland is underlain by stratified drift.
4. Gravel or sandy soils present in or adjacent to the wetland.
5. Fragipan does not occur in the wetland.
6. Fragipan, impervious soils, or bedrock does occur in the wetland.
7. Wetland is associated with a perennial or intermittent watercourse.
8. Signs of groundwater recharge are present or piezometer data demonstrates recharge.
9. Wetland is associated with a watercourse but lacks a defined outlet or contains a constricted outlet.
10. Wetland contains only an outlet, no inlet.
11. Groundwater quality of stratified drift aquifer within or downstream of wetland meets drinking water standards.
12. Quality of water associated with the wetland is high.
13. Signs of groundwater discharge are present (e.g., springs).
14. Water temperature suggests it is a discharge site.
15. Wetland shows signs of variable water levels.
16. Piezometer data demonstrates discharge.
17. Other

FLOODFLOW ALTERATION (Storage & Desynchronization) — This function considers the effectiveness of the wetland in reducing flood damage by water retention for prolonged periods following precipitation events and the gradual release of floodwaters. It adds to the stability of the wetland ecological system or its buffering characteristics and provides social or economic value relative to erosion and/or flood prone areas.

CONSIDERATIONS/QUALIFIERS

1. Area of this wetland is large relative to its watershed.
2. Wetland occurs in the upper portions of its watershed.
3. Effective flood storage is small or non-existent upslope of or above the wetland.
4. Wetland watershed contains a high percent of impervious surfaces.
5. Wetland contains hydric soils which are able to absorb and detain water.
6. Wetland exists in a relatively flat area that has flood storage potential.
7. Wetland has an intermittent outlet, ponded water, or signs are present of variable water level.
8. During flood events, this wetland can retain higher volumes of water than under normal or average rainfall conditions.
9. Wetland receives and retains overland or sheet flow runoff from surrounding uplands.
10. In the event of a large storm, this wetland may receive and detain excessive flood water from a nearby watercourse.
11. Valuable properties, structures, or resources are located in or near the floodplain downstream from the wetland.
12. The watershed has a history of economic loss due to flooding.
13. This wetland is associated with one or more watercourses.
14. This wetland watercourse is sinuous or diffuse.
15. This wetland outlet is constricted.
16. Channel flow velocity is affected by this wetland.
17. Land uses downstream are protected by this wetland.
18. This wetland contains a high density of vegetation.
19. Other

FISH AND SHELLFISH HABITAT (FRESHWATER) — This function considers the effectiveness of seasonal or permanent watercourses associated with the wetland in question for fish and shellfish habitat.

CONSIDERATIONS/QUALIFIERS

1. Forest land dominant in the watershed above this wetland.
2. Abundance of cover objects present.

STOP HERE IF THIS WETLAND IS NOT ASSOCIATED WITH A WATERCOURSE

3. Size of this wetland is able to support large fish/shellfish populations.
4. Wetland is part of a larger, contiguous watercourse.
5. Wetland has sufficient size and depth in open water areas so as not to freeze solid and retain some open water during winter.
6. Stream width (bank to bank) is more than 50 feet.
7. Quality of the watercourse associated with this wetland is able to support healthy fish/shellfish populations.
8. Streamside vegetation provides shade for the watercourse.
9. Spawning areas are present (submerged vegetation or gravel beds).
10. Food is available to fish/shellfish populations within this wetland.
11. Barrier(s) to anadromous fish (such as dams, including beaver dams, waterfalls, road crossing) are absent from the stream reach associated with this wetland.
12. Evidence of fish is present.
13. Wetland is stocked with fish.
14. The watercourse is persistent.
15. Man-made streams are absent.
16. Water velocities are not too excessive for fish usage.
17. Defined stream channel is present.
18. Other

Although the above example refers to freshwater wetlands, it can also be adapted for marine ecosystems. The following is an example provided by the National Marine Fisheries Service (NMFS) of an adaptation for the fish and shellfish function.

FISH AND SHELLFISH HABITAT (MARINE) — This function considers the effectiveness of wetlands, embayments, tidal flats, vegetated shallows, and other environments in supporting marine resources such as fish, shellfish, marine mammals, and sea turtles.

CONSIDERATIONS/QUALIFIERS

1. Special aquatic sites (tidal marsh, mud flats, eelgrass beds) are present.
2. Suitable spawning habitat is present at the site or in the area.
3. Commercially or recreationally important species are present or suitable habitat exists.
4. The wetland/waterway supports prey for higher trophic level marine organisms.
5. The waterway provides migratory habitat for anadromous fish.
6. Essential fish habitat, as defined by the 1996 amendments to the Magnuson-Stevens Fishery & Conservation Act, is present (consultation with NMFS may be necessary).
7. Other

SEDIMENT/TOXICANT/PATHOGEN RETENTION — This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens in runoff water from surrounding uplands or upstream eroding wetland areas.

CONSIDERATIONS/QUALIFIERS

1. Potential sources of excess sediment are in the watershed above the wetland.
2. Potential or known sources of toxicants are in the watershed above the wetland.
3. Opportunity for sediment trapping by slow moving water or deepwater habitat are present in this wetland.
4. Fine grained mineral or organic soils are present.
5. Long duration water retention time is present in this wetland.
6. Public or private water sources occur downstream.
7. The wetland edge is broad and intermittently aerobic.
8. The wetland is known to have existed for more than 50 years.
9. Drainage ditches have not been constructed in the wetland.

STOP HERE IF WETLAND IS NOT ASSOCIATED WITH A WATERCOURSE.

10. Wetland is associated with an intermittent or perennial stream or a lake.
11. Channelized flows have visible velocity decreases in the wetland.
12. Effective floodwater storage in wetland is occurring. Areas of impounded open water are present.
13. No indicators of erosive forces are present. No high water velocities are present.
14. Diffuse water flows are present in the wetland.
15. Wetland has a high degree of water and vegetation interspersion.
16. Dense vegetation provides opportunity for sediment trapping and/or signs of sediment accumulation by dense vegetation is present.
17. Other

NUTRIENT REMOVAL/RETENTION/TRANSFORMATION — This function considers the effectiveness of the wetland as a trap for nutrients in runoff water from surrounding uplands or contiguous wetlands and the ability of the wetland to process these nutrients into other forms or trophic levels. One aspect of this function is to prevent ill effects of nutrients entering aquifers or surface waters such as ponds, lakes, streams, rivers, or estuaries.

CONSIDERATIONS/QUALIFIERS

1. Wetland is large relative to the size of its watershed.
2. Deep water or open water habitat exists.
3. Overall potential for sediment trapping exists in the wetland.

4. Potential sources of excess nutrients are present in the watershed above the wetland.
5. Wetland saturated for most of the season. Ponded water is present in the wetland.
6. Deep organic/sediment deposits are present.
7. Slowly drained fine grained mineral or organic soils are present.
8. Dense vegetation is present.
9. Emergent vegetation and/or dense woody stems are dominant.
10. Opportunity for nutrient attenuation exists.
11. Vegetation diversity/abundance sufficient to utilize nutrients.

STOP HERE IF WETLAND IS NOT ASSOCIATED WITH A WATERCOURSE.

12. Waterflow through this wetland is diffuse.
13. Water retention/detention time in this wetland is increased by constricted outlet or thick vegetation.
14. Water moves slowly through this wetland.
15. Other

PRODUCTION EXPORT (Nutrient) — This function evaluates the effectiveness of the wetland to produce food or usable products for humans or other living organisms.

CONSIDERATIONS/QUALIFIERS

1. Wildlife food sources grow within this wetland.
2. Detritus development is present within this wetland
3. Economically or commercially used products found in this wetland.
4. Evidence of wildlife use found within this wetland.
5. Higher trophic level consumers are utilizing this wetland.
6. Fish or shellfish develop or occur in this wetland.
7. High vegetation density is present.
8. Wetland exhibits high degree of plant community structure/species diversity.
9. High aquatic vegetative diversity/abundance is present.
10. Nutrients exported in wetland watercourses (permanent outlet present).
11. “Flushing” of relatively large amounts of organic plant material occurs from this wetland.
12. Wetland contains flowering plants that are used by nectar-gathering insects.
13. Indications of export are present.
14. High production levels occurring, however, no visible signs of export (assumes export is attenuated).
15. Other

SEDIMENT/SHORELINE STABILIZATION — This function considers the effectiveness of a wetland to stabilize streambanks and shorelines against erosion.

CONSIDERATIONS/QUALIFIERS

1. Indications of erosion or siltation are present.
2. Topographical gradient is present in wetland.
3. Potential sediment sources are present up-slope.
4. Potential sediment sources are present upstream.
5. No distinct shoreline or bank is evident between the waterbody and the wetland or upland.
6. A distinct step between the open waterbody or stream and the adjacent land exists (i.e., sharp bank) with dense roots throughout.
7. Wide wetland (>10’) borders watercourse, lake, or pond.
8. High flow velocities in the wetland.
9. The watershed is of sufficient size to produce channelized flow.
10. Open water fetch is present.
11. Boating activity is present.
12. Dense vegetation is bordering watercourse, lake, or pond.
13. High percentage of energy-absorbing emergents and/or shrubs border a watercourse, lake, or pond.
14. Vegetation is comprised of large trees and shrubs that withstand major flood events or erosive incidents and stabilize the shoreline on a large scale (feet).
15. Vegetation is comprised of a dense resilient herbaceous layer that stabilizes sediments and the shoreline on a small scale (inches) during minor flood events or potentially erosive events.
16. Other

WILDLIFE HABITAT — This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge. Both resident and/or migrating species must be considered. Species lists of observed and potential animals should be included in the wetland assessment report.[1]

CONSIDERATIONS/QUALIFIERS

1. Wetland is not degraded by human activity.
2. Water quality of the watercourse, pond, or lake associated with this wetland meets or exceeds Class A or B standards.
3. Wetland is not fragmented by development.
4. Upland surrounding this wetland is undeveloped.
5. More than 40% of this wetland edge is bordered by upland wildlife habitat (e.g., brushland, woodland, active farmland, or idle land) at least 500 feet in width.
6. Wetland is contiguous with other wetland systems connected by a watercourse or lake.
7. Wildlife overland access to other wetlands is present.
8. Wildlife food sources are within this wetland or are nearby.
9. Wetland exhibits a high degree of interspersion of vegetation classes and/or open water.
10. Two or more islands or inclusions of upland within the wetland are present.
11. Dominant wetland class includes deep or shallow marsh or wooded swamp.
12. More than three acres of shallow permanent open water (less than 6.6 feet deep), including streams in or adjacent to wetland, are present.
13. Density of the wetland vegetation is high.
14. Wetland exhibits a high degree of plant species diversity.
15. Wetland exhibits a high degree of diversity in plant community structure (e.g., tree/shrub/vine/grasses/mosses)
16. Plant/animal indicator species are present. (List species for project)
17. Animal signs observed (tracks, scats, nesting areas, etc.)
18. Seasonal uses vary for wildlife and wetland appears to support varied population diversity/abundance during different seasons.
19. Wetland contains or has potential to contain a high population of insects.
20. Wetland contains or has potential to contain large amphibian populations.
21. Wetland has a high avian utilization or its potential.
22. Indications of less disturbance-tolerant species are present.
23. Signs of wildlife habitat enhancement are present (birdhouses, nesting boxes, food sources, etc.).
24. Other

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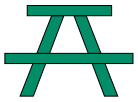
[1]In March 1995, a rapid wildlife habitat assessment method was completed by a University of Massachusetts research team with funding and oversight provided by the New England Transportation Consortium. The method is called WEThings (wetland habitat indicators for non-game species). It produces a list of potential wetland-dependent mammal, reptile, and amphibian species that may be present in the wetland. The output is based on observable habitat characteristics documented on the field data form. This method may be used to generate the wildlife species list recommended as backup information to the wetland evaluation form and to augment the considerations. Use of this method should first be coordinated with the Corps project manager. A computer program is also available to expedite this process.

RECREATION (Consumptive and Non-Consumptive) — This value considers the suitability of the wetland and associated watercourses to provide recreational opportunities such as hiking, canoeing, boating, fishing, hunting, and other active or passive recreational activities. Consumptive opportunities consume or diminish the plants, animals, or other resources that are intrinsic to the wetland. Non-consumptive opportunities do not consume or diminish these resources of the wetland.



CONSIDERATIONS/QUALIFIERS

1. Wetland is part of a recreation area, park, forest, or refuge.
2. Fishing is available within or from the wetland.
3. Hunting is permitted in the wetland.
4. Hiking occurs or has potential to occur within the wetland.
5. Wetland is a valuable wildlife habitat.
6. The watercourse, pond, or lake associated with the wetland is unpolluted.
7. High visual/aesthetic quality of this potential recreation site.
8. Access to water is available at this potential recreation site for boating, canoeing, or fishing.
9. The watercourse associated with this wetland is wide and deep enough to accommodate canoeing and/or non-powered boating.
10. Off-road public parking available at the potential recreation site.
11. Accessibility and travel ease is present at this site.
12. The wetland is within a short drive or safe walk from highly populated public and private areas.
13. Other

EDUCATIONAL/SCIENTIFIC VALUE — This value considers the suitability of the wetland as a site for an “outdoor classroom” or as a location for scientific study or research.

CONSIDERATIONS/QUALIFIERS

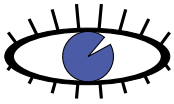
1. Wetland contains or is known to contain threatened, rare, or endangered species.
2. Little or no disturbance is occurring in this wetland.
3. Potential educational site contains a diversity of wetland classes which are accessible or potentially accessible.
4. Potential educational site is undisturbed and natural.
5. Wetland is considered to be a valuable wildlife habitat.
6. Wetland is located within a nature preserve or wildlife management area.
7. Signs of wildlife habitat enhancement present (bird houses, nesting boxes, food sources, etc.).
8. Off-road parking at potential educational site suitable for school bus access in or near wetland.
9. Potential educational site is within safe walking distance or a short drive to schools.
10. Potential educational site is within safe walking distance to other plant communities.
11. Direct access to perennial stream at potential educational site is available.
12. Direct access to pond or lake at potential educational site is available.
13. No known safety hazards exist within the potential educational site.
14. Public access to the potential educational site is controlled.
15. Handicap accessibility is available.
16. Site is currently used for educational or scientific purposes.
17. Other

UNIQUENESS/HERITAGE — This value considers the effectiveness of the wetland or its associated waterbodies to provide certain special values. These may include archaeological sites, critical habitat for endangered species, its overall health and appearance, its role in the ecological system of the area, its relative importance as a typical wetland class for this geographic location. These functions are clearly valuable wetland attributes relative to aspects of public health, recreation, and habitat diversity.

CONSIDERATIONS/QUALIFIERS

1. Upland surrounding wetland is primarily urban.
2. Upland surrounding wetland is developing rapidly.
3. More than 3 acres of shallow permanent open water (less than 6.6 feet deep), including streams, occur in wetlands.
4. Three or more wetland classes are present.
5. Deep and/or shallow marsh or wooded swamp dominate.
6. High degree of interspersion of vegetation and/or open water occur in this wetland.
7. Well-vegetated stream corridor (15 feet on each side of the stream) occurs in this wetland.
8. Potential educational site is within a short drive or a safe walk from schools.
9. Off-road parking at potential educational site is suitable for school buses.
10. No known safety hazards exist within this potential educational site.
11. Direct access to perennial stream or lake exists at potential educational site.
12. Two or more wetland classes are visible from primary viewing locations.
13. Low-growing wetlands (marshes, scrub-shrub, bogs, open water) are visible from primary viewing locations.
14. Half an acre of open water or 200 feet of stream is visible from the primary viewing locations.
15. Large area of wetland is dominated by flowering plants or plants that turn vibrant colors in different seasons.
16. General appearance of the wetland visible from primary viewing locations is unpolluted and/or undisturbed.
17. Overall view of the wetland is available from the surrounding upland.
18. Quality of the water associated with the wetland is high.
19. Opportunities for wildlife observations are available.
20. Historical buildings are found within the wetland.
21. Presence of pond or pond site and remains of a dam occur within the wetland.
22. Wetland is within 50 yards of the nearest perennial watercourse.
23. Visible stone or earthen foundations, berms, dams, standing structures, or associated features occur within the wetland.
24. Wetland contains critical habitat for a state- or federally-listed threatened or endangered species.
25. Wetland is known to be a study site for scientific research.
26. Wetland is a natural landmark or recognized by the state natural heritage inventory authority as an exemplary natural community.
27. Wetland has local significance because it serves several functional values.
28. Wetland has local significance because it has biological, geological, or other features that are locally rare or unique.
29. Wetland is known to contain an important archaeological site.
30. Wetland is hydrologically connected to a state or federally designated scenic river.
31. Wetland is located in an area experiencing a high wetland loss rate.
32. Other

VISUAL QUALITY/AESTHETICS — This value considers the visual and aesthetic quality or usefulness of the wetland.



CONSIDERATIONS/QUALIFIERS

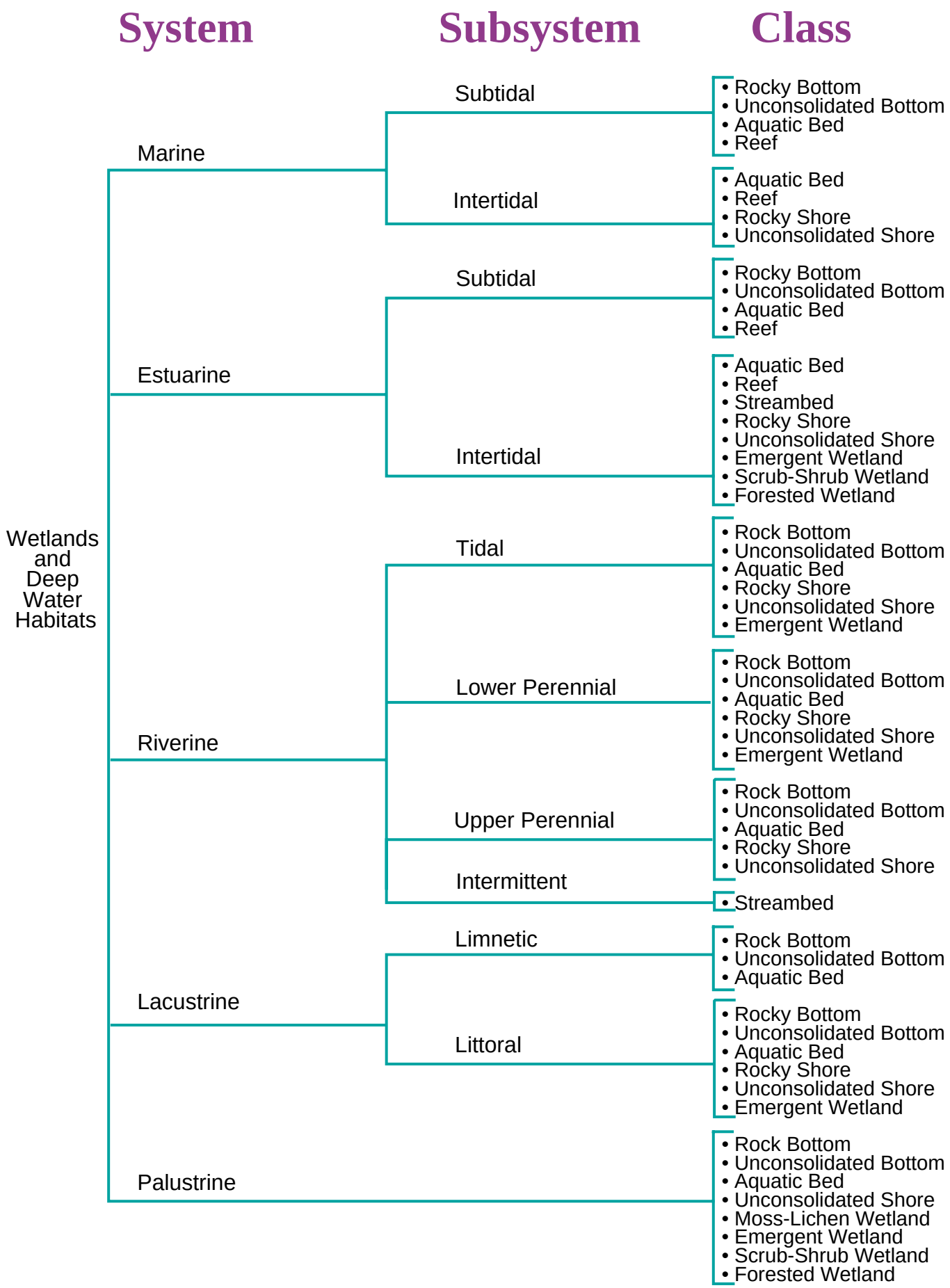
1. Multiple wetland classes are visible from primary viewing locations.
2. Emergent marsh and/or open water are visible from primary viewing locations.
3. A diversity of vegetative species is visible from primary viewing locations.
4. Wetland is dominated by flowering plants or plants that turn vibrant colors in different seasons.
5. Land use surrounding the wetland is undeveloped as seen from primary viewing locations.
6. Visible surrounding land use form contrasts with wetland.
7. Wetland views absent of trash, debris, and signs of disturbance.
8. Wetland is considered to be a valuable wildlife habitat.
9. Wetland is easily accessed.
10. Low noise level at primary viewing locations.
11. Unpleasant odors absent at primary viewing locations.
12. Relatively unobstructed sight line exists through wetland.
13. Other

ENDANGERED SPECIES HABITAT — This value considers the suitability of the wetland to support threatened or endangered species.

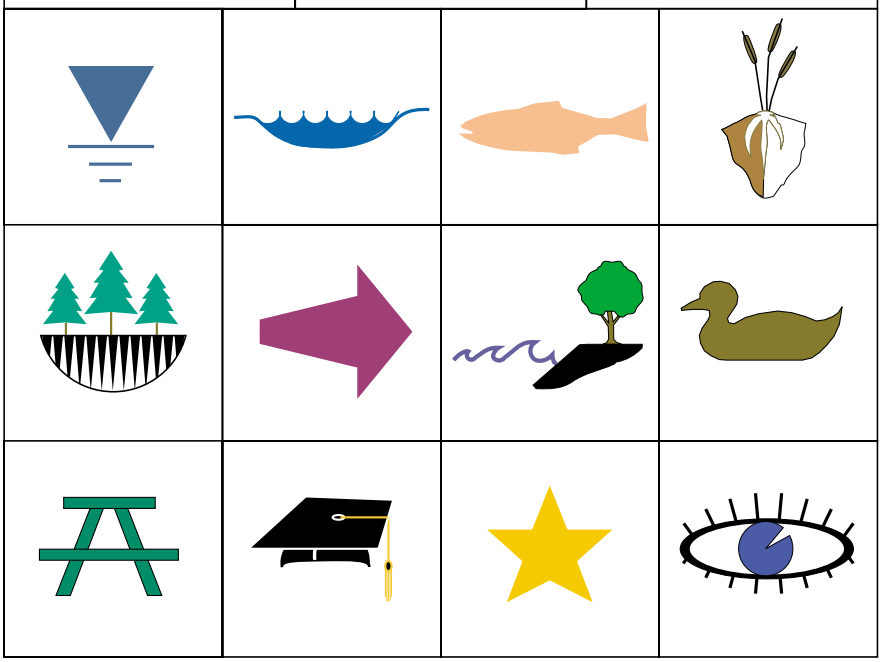
ES

CONSIDERATIONS/QUALIFIERS

1. Wetland contains or is known to contain threatened or endangered species.
2. Wetland contains critical habitat for a state or federally listed threatened or endangered species.


System
Subsystem
Class
Wetlands and Deep Water Habitats
Marine
Subtidal
• Rocky Bottom
• Unconsolidated Bottom
• Aquatic Bed
• Reef
Intertidal
• Aquatic Bed
• Reef
• Rocky Shore
• Unconsolidated Shore
Estuarine
Subtidal
• Rocky Bottom
• Unconsolidated Bottom
• Aquatic Bed
• Reef
Intertidal
• Aquatic Bed
• Reef
• Streambed
• Rocky Shore
• Unconsolidated Shore
• Emergent Wetland
• Scrub-Shrub Wetland
• Forested Wetland
Riverine
Tidal
• Rock Bottom
• Unconsolidated Bottom
• Aquatic Bed
• Rocky Shore
• Unconsolidated Shore
• Emergent Wetland
Lower Perennial
• Rock Bottom
• Unconsolidated Bottom
• Aquatic Bed
• Rocky Shore
• Unconsolidated Shore
• Emergent Wetland
Upper Perennial
• Rock Bottom
• Unconsolidated Bottom
• Aquatic Bed
• Rocky Shore
• Unconsolidated Shore
Intermittent
• Streambed
Lacustrine
Limnetic
• Rock Bottom
• Unconsolidated Bottom
• Aquatic Bed
Littoral
• Rocky Bottom
• Unconsolidated Bottom
• Aquatic Bed
• Rocky Shore
• Unconsolidated Shore
• Emergent Wetland
Palustrine
• Rock Bottom
• Unconsolidated Bottom
• Aquatic Bed
• Unconsolidated Shore
• Moss-Lichen Wetland
• Emergent Wetland
• Scrub-Shrub Wetland
• Forested Wetland

Wetland I.D.	Total Acres	Impacted Acres



Symbols Key

Groundwater Recharge/ Discharge

Floodflow Alteration (Storage & Desynchronization)

Fish and Shellfish Habitat

Sediment/Toxicant Retention

Nutrient Removal/ Retention/Transformation

Production Export (Nutrient)

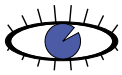
Sediment/Shoreline Stabilization

Wildlife Habitat

Recreation(Consumptive & Non-Consumptive)

Educational/Scientific Value

Uniqueness/Heritage


Visual Quality/Aesthetics

ES Endangered Species