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NSTC GREAT LAKES, IL
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ADDENDUM TO SITE INSPECTION REPORT FOR MUNITIONS RESPONSE PROGRAM RANGES VOLUME I OF II NSTC GREAT LAKES IL

5/1/2012

TETRA TECH

123

Addendum To:
Site Inspection Report
(Volume I of II)

for

Munitions Response Program
Ranges

Naval Station Great Lakes
Great Lakes, Illinois

NAVFAC
Naval Facilities Engineering Command
NAVFAC MIDWEST

Naval Facilities Engineering Command Midwest

Contract Number N62472-03-D-0057

Contract Task Order F274

May 2012

ADDENDUM TO:
SITE INSPECTION REPORT

MUNITION RESPONSE PROGRAM RANGES

NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Midwest
201 Decatur Avenue, Building 1A
Great Lakes, Illinois 60088

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CONTRACT NUMBER N62472-03-D-0057
CONTRACT TASK ORDER F274

MAY 2012

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LIST OF ACRONYMS AND ABBREVIATIONS

BAF	Biota-soil bioaccumulation factor
BaP	benzo(a)pyrene
bgs	below ground surface
bss	below sediment surface
BW	Body weight
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
Cf	Chemical concentration in food
CLEAN	Comprehensive Long-Term Environmental Action Navy
COPCs	contaminants of potential concern
Cs	Chemical concentration in surface soil
CSM	conceptual site model
CTO	Contract Task Order
DMM	discarded military munitions
DoD	Department of Defense
DPT	Direct-Push Technology
DQIs	data quality indicators
DQOs	data quality objectives
Eco SSL	Ecological Soil Screening Level
EEQ	Ecological Effects Quotient
ELAP	Environmental Laboratory Approval Program
EPA	Environmental Protection Agency
FBL	fixed-base laboratory
FD	field duplicate
FOL	Field Operations Leader
GIS	Geographic Information System
GPS	global positioning system
H	Portion of food intake from the contaminated area
HA	hand augering
HASP	Health and Safety Plan
IAS	Initial Assessment Study
IDW	Investigation-Derived Waste
If	Food ingestion rate

Is	Incidental surface soil ingestion rate
ITRC	Interstate Technology Regulatory Council
JULIE	Joint Utility Locating Information for Excavators
LOAEL	lowest observed adverse effect level
MC	munitions constituents
MDLs	Method of Detection Limits
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MPPEH	material potentially presenting an explosive hazard
MRP	Munitions Response Program
MRSs	munitions response sites
MS/MSD	matrix spike/matrix spike duplicate
NAD83	North American Datum of 1983
NAVFAC	Naval Facilities Engineering Command
NFA	no further action
NOAEL	no observed adverse effect level
NSGL	Naval Station Great Lakes
NTC	Naval Training Center
PA	Preliminary Assessment
PAL	Project Action Limit
PAHs	polynulcear aromatic hydrocarbons
ppm	parts per million
PQLGs	Project Quantitation Limit Goals
QC	Quality Control
QSM	Quality Systems Manual
RBSLs	risk-based screening levels
RI	remedial investigation
RI/FS	Remedial Investigation/Feasibility Study
RV	recreational vehicle
SI	site inspection
SIM	selected ion monitoring
TACO	Tiered Approach to Corrective Action Objectives
TCLP	Toxicity Characteristic Leaching Procedure
TEF	toxicity equivalency factor
Tetra Tech	Tetra Tech, Inc.
TRV	Toxicity reference value

TSA	Trap, Skeet, and Archery
UFP-SAP	Uniform Federal Policy-Sampling and Analysis Plan
µg/kg	micrograms per kilogram
UXO	unexploded ordnance
WAMS	Water Area Munitions Study
XRF	X-ray fluorescence

EXECUTIVE SUMMARY

Tetra Tech has prepared this Addendum to Volume I of the Site Inspection (SI) Report under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62472-03-D-0057, Contract Task Order (CTO) F274. This addendum report has been prepared for a SI for Munitions Constituents (MC) under the Munitions Response Program (MRP) at a Munitions Response Site (MRS) located at Naval Station Great Lakes (NSGL), Great Lakes, Illinois. The MRP site included in the scope of this supplemental SI is the trap and skeet range portion of the former Trap, Skeet, and Archery (TSA) Ranges site. Figure 1 presents a Facility Location Map depicting the location of the MRS on the NSGL installation. The MRS is described briefly below.

The U.S. Department of Navy (Navy) has conducted various testing and training activities involving military munitions at NSGL. However, the TSA Ranges were used solely as small arms ranges; therefore, munitions and explosives of concern (MEC)/material potentially presenting an explosive hazard (MPPEH) were not expected and/or encountered at this site during the initial phase of the site investigation. MC associated with small arms trap and skeet ranges includes metals (antimony, arsenic, and lead) and polycyclic aromatic hydrocarbons (PAHs). The Department of Defense (DoD) has established the MRP to address MC and MEC environmental concerns at closed ranges. The DoD is following the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) process for the investigation and remediation of these sites. The Navy is responsible for implementing the MRP at NSGL.

The former TSA Ranges site encompasses approximately 30.5 acres, including the land and water portions. The land portion consists of approximately 1 acre of Lake Michigan beachfront, which included the former firing arcs for the skeet and trap ranges and all associated structures. Fill material was added to the beachfront to extend the shoreline for the addition of the skeet range. The water portion of the TSA Ranges, where munitions were fired, includes the maximum extent of shotfall, which is approximately 29.4 acres. The land and water portions are not suspected to contain MEC; therefore, no MEC investigation was planned for the TSA Ranges. Munitions use was limited to small arms ammunition, primarily shotgun ammunition. The land portion has been redeveloped as a recreational vehicle (RV) park, leaving none of the structures associated with the TSA Ranges on the ground surface.

An SI was completed in 2010 and focused on both the land and water portions of the TSA Ranges. For the land portion, surface soil samples were collected and analyzed on-site for lead using X-ray fluorescence (XRF) and off-site for PAHs and select metals (arsenic and lead). The focused SI sampling

activities for the TSA Ranges characterized the local site conditions in surface soils [0 to 0.5 feet below ground surface (bgs)] and sediment [0 to 0.5 feet below sediment surface (bss)]. However, the XRF and fixed-based laboratory data did not correlate; therefore, the XRF data was not acceptable for use in the delineation of the extent of lead in soil. Evidence of the former trap range including shotgun shell wadding and clay pigeon fragments was identified along the erosional surface at the edge of Lake Michigan, within the trap range. However, the extent of this range-related debris is unclear because of the limited surface sampling completed during the SI.

The SI Report determined that additional investigation was required based on the identification of lead and PAH in surface soil within a very limited area of the TSA Ranges at concentrations greater than respective project action limits (PALs) and the Illinois Environmental Protection Agency (EPA) background soil concentrations. Specifically, additional data were needed to determine the horizontal and vertical extent of contamination. It is believed that fill material was brought in during the redevelopment of the trap and skeet ranges to grade the site in preparation for RV parking. It is not clear how much fill was used in the redevelopment, but it appears that the original ground surface may be located approximately 2 to 3 feet bgs.

This Supplemental SI Report documents the results of the 2011 field activities and the current conceptual site model (CSM) for the TSA Ranges. The collected data were used to approximate the extent of soils contaminated with lead and PAHs and assess the potential hazards posed by MC remaining at the site in order to support the final site recommendations. The SI and Supplemental SI generated field data to determine if further response action or remedial investigation (RI) is appropriate, these data augment the data collected in the Preliminary Assessment (PA) Report and Water Area Munitions Study (WAMS) prepared by Malcolm Pirnie in 2005 and 2008.

The investigation samples were analyzed for select metals (antimony, arsenic, and lead) and PAHs potentially associated with historical training activities. Samples were analyzed off-site at a fixed-base laboratory (FBL).

CONCLUSIONS

The environmental data collected during the Supplemental SI sampling activities are sufficient to determine the extent of MC in the soil contamination in soils associated with the former use of the TSA Ranges. The supplemental SI sampling activities for the TSA Ranges characterized the local site conditions in surface soils (0 to 1 foot bgs) and subsurface soils (1 to approximately 4 feet bgs). The Supplemental SI identified concentrations of MC (arsenic, antimony, lead, and PAHs) associated with

small arms ammunition in surface and subsurface soil at concentrations above PALs and Illinois EPA Tiered Approach to Corrective Action Objectives (TACO) background concentrations in a limited surface and subsurface soil area at the TSA Ranges. Lead, antimony, arsenic, and PAH concentrations on site present potential risks to human receptors at the current concentrations; they do not present potential risks to ecological receptors.

The expectation prior to the Supplemental SI intrusive investigation was that wadding from shotgun shells and fragments of clay pigeons, similar to the findings of the 2010 SI surface soil investigation, would be observed during the collection of surface and subsurface soil samples, near the shoreline. The range debris would then indicate both horizontally and vertically the depth of the original ground surface during the active period of the ranges. However, no range debris was identified in any sample collected during the 2011 Supplemental RI. The available information shows that the range debris appears to be limited to the erosional surface along the trap range, and extends westward for 1 to 2 feet, towards the former firing line.

It was also expected that range debris at 3 to 4 feet bgs in the western portions of the ranges would distinguish the boundary between the emplaced soil used to elevate and grade the site for use as a RV park, and the previous ground surface from the active period of the ranges. However, no range debris was identified and construction disposal debris (asphalt, brick, and concrete fragments) were evident across the site (horizontally and vertically) during the intrusive investigation. Multiple investigation borings were prematurely terminated at 2 to 3 feet bgs because of refusal of the drilling equipment when large construction fill was encountered.

The Initial Assessment Study of the Naval Complex, Great Lakes, describes Site 13 A – B (the Demolition Debris Disposal Areas) (Rogers, Golden & Halpern, 1986) "*where fill was placed both behind and in front of bulkheads and piers that were constructed to protect the bluffs from coastal erosion. Most of this fill material was comprised of bricks, concrete, and other building materials large enough to provide protection for the receding shoreline. These materials may be examined in the actual shore zone, and especially in the vicinity of the Skeet Range (Building 743), where typical building demolition debris material is clearly visible. On-ground inspection revealed that only inert materials had been disposed of there.*" However, asphalt (a common source of PAH contamination) was not mentioned as a component of the fill material and the depth of fill was not investigated at the time of the Initial Assessment Study.

RECOMMENDATIONS

Further action is required at a limited area of the TSA Ranges site based on the SI and supplemental SI identification of lead concentrations greater than the Human Health screening criteria (400 mg/kg) and PAHs concentrations greater than the Illinois EPA background soil concentrations (2,100 µg/kg) in soil within the project site. A prescriptive removal of surface and subsurface soils shown to exceed PALs is recommended for specific areas as shown on Figure 8 to reduce the overall risk to human receptors on site to acceptable levels (risks to ecological receptors were already acceptable).

Along the shoreline of the TSA Ranges, removal of contaminated soil and replacement with clean fill is recommended for approximately 13,500 square feet of soil from 0 to 2 feet bgs and 5,650 square feet from 2 to 4 feet bgs (approximately 1400 cubic yards total).

Within the RV park, concentrations of PAHs exceeding the TACO background screening criteria are present near the western portion of the Trap Range at a depth of 2 to 4 feet bgs. In subsurface soil, concentrations at sample points TSA101-0204, TSA103-0203, TSA105-0204, TSA106-0204, BaP Equivalent concentrations range from 2,848.54 µg/kg (TSA103) to 56,524.4 µg/kg (TSA101). A removal of subsurface soil from a depth of 2 to 4 feet bgs from approximately 2,000 square feet area within the RV park would be approximately 150 cubic yards of soil.

For isolated areas of contaminated soils at 2 to 4 feet bgs, surface soil (2 to 4 feet bgs) was not included in the volume calculations for removal. It is assumes that the shallow soil will be scrapped off to access the deeper interval. It is assumes that the shallow soil will be scrapped off to access the deeper interval. Figure 8 shows the areas to be removed from the surface (outlined in solid black line) and subsurface (hatch pattern).

The area near sample location TSA110 (427 mg/kg, lead), located on the northeastern corner of the site outside of the fence along the northern boundary of the RV park is not included because the removal of soil in this area would require removal of mature trees which provide erosional control for the shoreline.

Potential risks to ecological wildlife receptors (birds and mammals) at TSA Ranges, were evaluated by food chain modeling, using average chemical concentrations, and Tier 2, Step 3a exposure parameters, which resulted in a finding of no potential risk for mammals and birds related to on site contamination. Potential risks to soil invertebrates were evaluated by comparing chemical concentrations in the surface soil samples to invertebrate screening levels. This resulted in a finding of no potential risk for soil invertebrates related to on site contamination.

The removal of lead and PAH contaminated soil across the site from 0 to 2 feet bgs would remove the potential risk to human receptors to acceptable risk levels between 10^{-4} to 10^{-6} in those areas, and support a no further action determination for the site.

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

This report presents the results of the 2011 supplemental site inspection (SI) activities performed at the trap and skeet range portion of the Trap, Skeet, and Archery (TSA) Ranges Site at Naval Station Great Lakes (NSGL) in Great Lakes, Illinois (Figure 1). The Department of Defense (DoD) has established a separate program to address closed military ranges known as the Munitions Response Program (MRP). For MRP sites, the DoD follows the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) process. Malcolm Pirnie, Inc. conducted the initial phase of the CERCLA process by completing the Water Area Munitions Study (WAMS) (Malcolm Pirnie, 2005) for the Naval Training Center (NTC) Lakefront Site and the former TSA Ranges, and the Preliminary Assessment (PA) Report (Malcolm Pirnie, 2008). The PA Report was completed in February 2008 and identified the NTC Lakefront Site and TSA Ranges as munitions response sites (MRSs) requiring further investigation at the NSGL (Malcolm Pirnie, 2008).

An SI was completed in 2010 and focused on both the land and water portions of the TSA Ranges. For the land portion, surface soil samples were collected and analyzed on-site for lead using X-ray fluorescence (XRF), and off-site for polynulcear aromatic hydrocarbons (PAHs) and select metals (arsenic and lead). The focused 2010 SI sampling activities for the TSA Ranges characterized the local site conditions in surface soils [0 to 0.5 feet below ground surface (bgs)] and sediment [0 to 0.5 feet below sediment surface (bss)]. However, the XRF and fixed-based laboratory data did not correlate; therefore, the XRF data was not acceptable for use in the delineation of the extent of metals in soil. Evidence of the former trap range, including shotgun shell wadding and clay pigeon fragments, was identified along the erosional surface at the edge of Lake Michigan within the trap range. However, the extent of this range-related debris is unclear because of the limited surface sampling completed during the 2010 SI.

The 2010 SI Report (Tetra Tech, 2010b) determined that additional investigation was required based on the identification of munitions constituents (MC), lead and PAH in surface soil within a very limited area of the TSA Ranges at concentrations greater than respective project action limits (PALs) and the Illinois Environmental Protection Agency (EPA) background soil concentrations. Specifically, additional data were needed to determine the horizontal and vertical extent of contamination prior to remedial activities. It is believed that fill material/soil was brought in during the redevelopment of the trap and skeet ranges to grade the site in preparation for recreational vehicle (RV) parking. It is not clear how much fill material/soil was used in the site redevelopment, but it appears that the original ground surface may be located approximately 2 to 3 feet bgs.

The SI included the investigation of surface and subsurface soil to determine the presence and extent of MC at the TSA Ranges. The TSA Ranges were used solely for small arms trap and skeet training activities; therefore, munitions and explosives of concern (MEC), which consist of unexploded ordnance (UXO), discarded military munitions (DMM), and explosive MC in high enough concentrations to present an explosive hazard were not expected or encountered at this site.

The 2011 supplemental SI was performed by Tetra Tech for Naval Facilities Engineering Command (NAVFAC) Midwest under Contract Task Order (CTO) F274 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) IV Contract Number N62472-03-D-0057.

1.2 SCOPE OF WORK

This supplemental SI Report presents the results of the supplemental SI field program to determine the presence and extent of MC which was conducted in accordance with the Uniform Federal Policy-Sampling and Analysis Plan (UFP-SAP) (Tetra Tech, 2010a) and the TSA Range Supplemental Work Plan (2011) prepared for this project by Tetra Tech.

This document summarizes the 2011 Supplemental MC SI activities and evaluates the presence (or absence) and extent of potential MC based on all available data for the TSA Range from 2010 and 2011.

The following is a summary of the SI field work activities:

- Collection of discrete surface soil samples (0 to 1 foot bgs).
- Collection of discrete subsurface soil samples (1 to 2 feet bgs and 2 to 4 feet bgs).
- Laboratory analysis for select metals and PAHs.

The additional fieldwork was limited to investigating soil on the land portion of the site. No groundwater, surface water, or sediment sampling was conducted.

1.3 OBJECTIVES

The primary objective of the Supplemental SI was to delineate the nature and extent of lead, arsenic, and PAHs in surface and subsurface soil at both the trap and skeet ranges. The level of delineation was expected to be adequate to support a request for a prescriptive remediation (i.e., excavation to a pre-

determined horizontal and vertical boundary without any confirmation sampling) and a risk assessment, if warranted.

The secondary objective of this supplemental SI was to collect an appropriate amount of data to update the site-specific conceptual site model (CSM), so that a decision could be made regarding whether a Remedial Investigation/Feasibility Study (RI/FS) was required or whether the site qualifies for no further action (NFA).

1.4 REPORT ORGANIZATION

Volume I of the SI Report consists of eight sections:

- Section 1.0 – Introduction
- Section 2.0 – Site Background
- Section 3.0 – Field Investigation
- Section 4.0 – Results
- Section 5.0 – Ecological Risk Screening
- Section 6.0 – Updated CSM
- Section 7.0 – Conclusions and Recommendations
- Section 8.0 – References

The appendices are:

- Appendix A – MC Field Forms
- Appendix B – Validated Laboratory Data
- Appendix C – Data Quality Review
- Appendix D – Data Validation Reports
- Appendix E – Ecological Food Chain Models
- Appendix F - Photographs

2.0 BACKGROUND SETTING

2.1 SITE BACKGROUND

The former TSA Ranges (including the land and water portions) encompasses approximately 30.5 acres. The land portion of the TSA Ranges is a small area (approximately 1.1 acres), located east of the bluff on the beachfront of Lake Michigan. The site consisted of a trap range, a skeet range, and an archery range. Only the skeet and trap ranges are the subject of this SI. Fill material was placed at the site to extend the shoreline for the addition of the skeet range to the installation. Structures associated with the skeet and trap ranges and firing lines were located on the land. The shotfall zone, which is defined as the maximum extent that lead shot would travel extends into Lake Michigan. This encompasses an area of approximately 29.4 acres [consisting of overlapping areas for the skeet range (29 acres) and the trap range (6.6 acres)] located over Lake Michigan, as shown on Figures 1 and 2. The site originally consisted of only the trap range (constructed in the early 1940s), where Navy personnel first experienced targeting a moving object before handling the large caliber AA guns. The use of the trap range in conjunction with the AA training center ended with the closing of the NTC Lakefront site in October 1945; however, the trap range was likely used recreationally afterward, because it was common practice to allow enthusiasts to utilize these ranges to offset costs for maintenance. Based on the construction drawings for the site, the skeet and archery ranges were added to the site in 1968, and were likely used for recreational purposes and for military practice sessions. Munitions use was limited to small arms ammunitions, primarily shotgun ammunition.

The equipment storage building and trap/skeet houses that were originally located at the site were demolished, and the ranges were decommissioned. In July 2000, during construction of a RV park (RV sites, 10 tent sites, and one group camping site) within the TSA Ranges site, all visible signs of the ranges and associated structures, such as the trap house, were removed. No prior site investigations had been conducted at the NSGL TSA Ranges.

Figure 2 depicts the TSA Ranges and associated range features. Facility background and regional geology/hydrology information is presented in the Site Inspection Report for the Munitions Response Program Ranges (Tetra Tech, 2010).

2.1.1 Historical Munitions Usage Information

Archival data for ammunition orders from the 1940s and 1950s, identified in the PA Report (Malcolm Pirnie, 2008) included the following munitions-related items that may have been used at the site:

- Shotguns, 12-gauge with slide repeating action and modified choke, 26-inch or 28-inch barrel.
- Shells, shotgun, 12-gauge, No. 7 ½ shot.
- Targets, clay pigeon.

During the 2008 visual survey of the site by Malcolm Pirnie, no physical evidence of the skeet range firing arc and trap range firing points/stations was visible because of the construction of the RV park. Additionally, no evidence of broken clay targets was observed during the site walk. However, during the 2010 SI sampling activities, broken clay targets and shotgun shell wadding were observed in the surface soils of the erosional surface near the shoreline of the Trap Range. The TSA Ranges were dedicated to the use of small arms; therefore, MEC are not expected to be present at the site. In addition, based on the information obtained during the data collection process, no special consideration munitions are known or suspected to have been used at the site. Therefore, the TSA Ranges site is not suspected to contain chemical warfare material-filled munitions, electrically fuzed munitions, or depleted uranium associated munitions.

2.1.2 Munitions Constituents

For shotgun ammunition and clay targets, the primary MC of concern include lead from shot and PAHs from pitch tar used in the manufacturing of clay pigeons to help bind the clay particles. Other associated MC less likely to be of concern may include antimony and arsenic (which may be present in lead). Lead accounts for more than 95 percent of the weight of the projectile Interstate Technology Regulatory Council (ITRC), 2003]. Antimony is added to bullets as a hardening agent in quantities ranging from 0.1 to 2 percent. Arsenic is naturally present in lead at trace levels (0.001 to 0.06 percent). Antimony and arsenic, if present, would be spatially correlated with the lead because they are associated with lead in the bullets. The USEPA screening value commonly used to indicate the presence of potentially unacceptable levels of antimony in soil and sediment is 31 milligrams per kilogram (mg/kg) and the screening value for arsenic is 0.39 mg/kg which is less than the typical soil background concentrations according to Tiered Approach to Corrective Action Objectives (TACO) of 13 mg/kg. Using the relative concentrations of these metals in projectiles, lead would have to be present in soil or sediment at a concentration greater than 600 mg/kg for arsenic or antimony from bullets to be present at potentially unacceptable human health risk levels. Therefore, lead, which is easier to measure in some respects, is

a useful indicator of potentially unacceptable concentrations of any of these three metals in soil or sediment. These MC components are not consumed when the munitions items function as they are designed. Therefore, these MC may exist at the TSA Ranges.

Skeet and trap ranges may contain polycyclic aromatic hydrocarbons (PAHs) that may leach from the binding agents (asphalt/coal tar pitch) within clay targets, thereby contaminating soils and possibly surface and groundwater (NFESC, 1997). Concentration of PAHs in clay targets vary from one manufacturer to the next but may be as high as 1000 mg/kg. PAHS are primarily found 100 feet to 300 feet from the firing line where the clay pigeons are impacted by the lead shot and released to soil through fragmentation and weathering processes. PAHs are not naturally occurring and may be found in areas where asphalt materials are deposited or where burning operations have occurred. The USEPA has established toxicity values for PAHs.

Known MEC Areas

There are no known MEC areas associated within the land portion of the site (Malcolm Pirnie, 2008).

3.0 FIELD INVESTIGATION

3.1 SITE PREPARATION ACTIVITIES AND MOBILIZATION ACTIVITIES

All preliminary activities, such as subcontractor procurement and coordination, authorizations, site access, and clearance of utilities, were completed in accordance with the UFP-SAP (Tetra Tech, 2010). This section describes the sampling design, methods, and documentation utilized during the supplemental SI field activities performed September 12 through 15, 2011, at the TSA Ranges at NSGL.

Mobilization activities included the receipt of field equipment directly from vendors, and obtain a base access pass. Each piece of equipment was checked upon receipt to verify that it was in proper working condition. Documentation of the drill rig inspection is included in Appendix A. The TSA Ranges are located within controlled areas at NSGL, accessible only through an access gate after check-in at security and receipt of a pass for both personnel and vehicles entering the facility. Daily tailgate safety meetings were held each morning by the Field Operations Leader (FOL) to briefly address the day's planned activities.

The field team members reviewed the approved UFP-SAP, associated appendices, and Health and Safety Plan (HASP) prior to the start of project activities. In addition, the FOL held a field team orientation meeting to ensure that personnel were familiar with the scope of field activities.

Upon completion of all SI activities, work areas were thoroughly cleaned, trash was bagged and disposed in the trash dumpster outside the field office, the FOL shipped the equipment back to the third party vendor, and the field crew demobilized from the site.

3.1.1 Utility Clearance

Prior to all field activities, Tetra Tech personnel and the drilling subcontractor, Environmental Field Services, Inc., contacted the Illinois One Call System (Joint Utility Locating Information for Excavators - JULIE) and the Base public works office to begin the utility clearance process. Documentation of the utility clearance is included in Appendix A.

3.1.2 Subcontracting

Preliminary activities included subcontractor mobilization and coordination. The project necessitated the use of two subcontractors: one to provide drilling services, and one to provide analytical laboratory

services. Environmental Field Services, Inc. performed the drilling, and Empirical Laboratories performed the analytical services.

3.1.3 Vegetation Management

Vegetation clearance was not required at the TSA Ranges.

3.1.4 Permitting

Permits were not required for the SI field investigation activities.

3.2 SITE FIELD ACTIVITIES

The MC field effort included surface and subsurface soil sample collection using direct push technology (DPT) and hand augering (HA) (Table 1). Each sample location was identified using a Trimble GeoXH global positioning system (GPS) and marked with an orange pin flag with the sample ID. All samples were collected and analyzed in accordance with the UFP-SAP (Tetra Tech, 2010) and the Technical Memorandum (Tetra Tech, 2011). Surface and subsurface samples were collected and shipped to Empirical Laboratories for analysis of select metals (antimony, arsenic, and lead) and PAHs (Table 1).

3.2.1 Field Data Collection

A track-mounted DPT GeoProbe® 6610DT drill rig was used to collect subsurface soil samples at the TSA Ranges site (Photograph 2, Appendix F). Subsurface soil samples were collected with the use of DPT Macro-core® sampling techniques for chemical and lithologic analysis.

Subsurface soil samples were collected to an average depth of 4 feet bgs. The soil was logged for the entire length of the boring in accordance with the UFP-SAP (Tetra Tech, 2010). Upon advancement to the desired depth, the boring was abandoned by placing bentonite from the bottom of the boring to the ground surface in accordance with federal and local regulations. Boring logs are provided in Appendix A.

All samples were grab samples from each interval based on visual evidence of range debris, if present. Below is summary of field observations and analytical results from this sampling event.

Trap Range (TSA-80 through TSA-106)

- Twenty-two surface soil samples were collected from a depth of 0 to 1 foot bgs during the Supplemental SI sampling event. Surface soil samples were not collected from five boring locations (NTC-SO-TSA081 through NTC-SO-TSA085) because the surface was sampled along the shoreline during the 2010 SI under the location IDs: NTC-SO-TSA015, NTC-SO-TSA016, NTC-SO-TSA017, NTC-SO-TSA059, NTC-SO-TSA060.

- Twenty-six subsurface samples were collected from a depth of 1 to 2 feet bgs during the supplemental sampling event.

- Twenty-six subsurface samples were collected 23 samples from a depth of 2 to 4 feet bgs, two samples from 2 to 3 feet bgs, and 1 sample from a depth of 3 to 4 feet bgs during the supplemental sampling event.

- Samples were collected from NTC-SO-TSA103 at depths of 0 to 1 foot bgs, 2 to 3 feet bgs, and 3 to 4 feet bgs.

Skeet Range (TSA-107 through TSA-131)

- Twenty-five surface soil samples were collected from a depth of 0 to 1 foot bgs.
- Twenty-five subsurface soil samples were collected from a depth of 1 to 2 feet bgs.
- Seventeen subsurface soil samples were collected 16 samples from a depth of 2 to 4 feet bgs and 1 sample from 2 to 3 feet bgs.

Quality Control Samples

All Quality Assurance/Quality Control (QA/QC) samples were collected in accordance with Worksheet #20 of the UFP-SAP. A summary of all QA/QC samples collected during the investigation is provided in Table 2. Sample log sheets were generated for each QA/QC sample and are provided in Appendix A.

- Field Duplicates consisted of a single sample split into two portions. Seven field duplicate (FD) Field duplicates were collected at the rate of one per twenty samples during this field investigation to assess the overall precision of the sampling and analysis program.

- Equipment Rinsate Blanks were obtained under representative field conditions by collecting the rinse water generated by running analyte-free water through or over sample collection equipment after decontamination and before use. One equipment rinsate blanks was analyzed for the same chemical constituents as the associated environmental samples at a rate of one per analyte collected from the hand auger equipment.

- Temperature Blanks were used to determine if samples were adequately cooled during shipment. Temperature blanks consisted of analyte-free water supplied by Empirical Laboratories. One temperature blank was submitted to the laboratory in each cooler, and the temperature was checked upon receipt at the laboratory.

- Laboratory Control Samples measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. Seven matrix spike/matrix spike duplicate (MS/MSD) samples were collected at a minimum frequency of 1 per 20 samples per media and per analyte.

3.2.2 Work Plan Deviations

Sample Re-Location:

Three soil sampling locations were moved due west from their original proposed locations. Soil sampling locations, NTC-SB-TSA080, NTC-SB-TSA081, and NTC-SB-TSA082, were moved due west approximately 4 feet because the proposed locations were beyond the grassy ridge and within the concrete slab debris along the beachfront (Photograph 3, Appendix F).

Hand Auger Sample Locations:

At these soil boring locations, the hand auger was only advanced to a total depth of 2 feet: NTC-SB-TSA110, NTC-SB-TSA116, NTC-SB-TSA122, NTC-SB-TSA128, and NTC-SB-TSA129. Only loose pebbles were encountered at 2 feet bgs at each of these locations; therefore, soil could not be collected and the borings could not be advanced.

Boring Refusal Sample Locations:

Eleven soil borings could not be advanced to the proposed 4 feet bgs depth; eight of these locations were along the beachfront. Boring refusal depths at these locations are noted as follows.

- NTC-SB80 – boring refusal at 3.0 feet bgs (beachfront)
- NTC-SB81 – boring refusal at 2.5 feet bgs (beachfront)
- NTC-SB82 – boring refusal at 3.0 feet bgs (beachfront)
- NTC-SB83 – boring refusal at 3.0 feet bgs (beachfront)
- NTC-SB85 – boring refusal at 2.5 feet bgs (beachfront)
- NTC-SB91 – boring refusal at 3.5 feet bgs
- NTC-SB106 – boring refusal at 3.5 feet bgs
- NTC-SB108 – boring refusal at 2.0 feet bgs (beachfront)
- NTC-SB112 – boring refusal at 2.0 feet bgs (beachfront)
- NTC-SB114 – boring refusal at 2.0 feet bgs (beachfront)
- NTC-SB126 – boring refusal at 3.0 feet bgs

Void Space Sample Location:

NTC-SB117 had a void space from 3 to 4 feet bgs; therefore, no soil sample could be collected at this depth.

Construction Asphalt Pieces:

No clay pigeon fragments or wadding was noted in any of the soil borings during the Supplemental SI investigation. However, construction asphalt, brick, and concrete were observed in some of the borings (Photographs 4 through 8, Appendix F). The asphalt pieces were either initially observed in the soil samples collected, or after the soil was sieved. Asphalt was observed in nine samples (from eight locations) in the Trap Range and six samples in the Skeet Range. The following locations had the presence of asphalt pieces recorded: NTC-SB91, NTC-SB92, NTC-SB94, NTC-SB100, NTC-SB102, NTC-SB103, NTC-SB105, NTC-SB106, NTC-SB109, NTC-SB120, NTC-SB123, NTC-SB125, NTC-SB126, and NTC-SB130. Large asphalt pieces were sieved from the soil samples after collection and prior to samples being sent to Empirical Laboratories for PAH analysis. Clay target remnants were not observed in soil samples collected during the Supplemental SI activities, but were observed during the 2010 SI sampling event in samples along the shoreline in the Trap Range. These were noted on sample log sheets provided in Appendix A of the SI Report (Tetra Tech, 2010).

3.2.3 Field Sample Documentation

Field documentation was performed in accordance with SOP-01 (Field Documentation, Appendix B of UFP-SAP). A field logbook was maintained onsite during field activities. Boring logs and soil sample log

sheets were completed to record locations, depths, and descriptions of the soil collected. A chain-of-custody was completed prior to shipment of the soil samples to Empirical Laboratory.

3.2.4 Sample Handling, Packaging, and Shipping

Methods for sample handling were in accordance with SOP-9 (Non-Radiological Sample Handling, Appendix B of UFP-SAP). Sample containers were provided certified clean from Empirical Laboratories. Sample labeling and numbering was in accordance with the Technical Memorandum Work Plan (Tetra Tech, 2011), the UFP-SAP (Tetra Tech, 2010), and SOP-02 (Sample Nomenclature, Appendix B of UFP-SAP). The selection of containers, sample preservation, packaging, and shipping were in accordance with the UFP-SAP and SOP-9, Appendix B of UFP-SAP.

All sample containers shipped to the laboratory were sealed in plastic Ziploc bags. The sample containers were then placed in a cooler lined with a large plastic garbage bag, and covered with ice. A temperature blank was placed in each cooler prior to shipment. The plastic garbage bag was sealed with tape, and the chain-of-custody form was sealed in a Ziploc® bag and taped to the inside of the cooler lid. A signed and dated custody seal was applied to each end of the cooler and then covered with strapping tape to provide a tamper-evident seal. A Federal Express® airbill was applied to the shipping cooler. Tetra Tech maintained custody of the samples until they were relinquished to Federal Express®. The Federal Express® sender's copy of the airbill was maintained for shipment tracking, if needed. All samples were shipped to the laboratory for overnight delivery and were received within sample holding times.

3.2.5 Global Positioning System

Prior to mobilization for the field effort, all Geographic Information System (GIS) grade sample coordinates were uploaded into a hand-held GPS unit capable of sub-meter accuracy (i.e., Trimble GeoHX). The GPS was then used in the field to locate the sampling points. The GPS coordinate system was set up so that all data points were collected in North American Datum of 1983 (NAD83) Illinois State Plane coordinates in US survey feet.

The Trimble GeoXH GPS unit was used to locate all sampling points which were marked with an orange pin flag labeled with the sample ID in accordance with SOP-04 (Global Positioning System, Appendix B of UFP-SAP). The GPS unit was checked on control monuments before and after each day's use. To ensure sub-meter accuracy, the GPS required a minimum of four satellites to capture a position.

3.2.6 Decontamination Procedures

Disposable acetate liners were utilized for collection of soil samples installed by DPT. Small reusable (non-dedicated) sampling equipment (e.g., hand auger, stainless steel bowl and spoon) was decontaminated prior to beginning sampling and between sample locations. Decontamination procedures for soil samples collected by hand augers are discussed in SOP-11 (Decontamination of Field Sampling Equipment, Appendix B of UFP-SAP). The hand auger was cleaned by removing the loose debris with a scrub brush in a bucket of Alconox and deionized water, and rinsing with deionized water. Disposable gloves were changed between soil samples collected.

3.2.7 Investigation-Derived Waste (IDW)

Unused portions of a collected sample were containerized as IDW. Soil collected from boring installation that was not containerized for Empirical Laboratory analysis was placed into a 55-gallon steel drum, and labeled for disposal. A composite soil sample was collected from the IDW and was analyzed for parameters defined in the Work Plan for disposal.

IDW that was generated, including personal protective equipment (PPE), was handled in accordance with SOP-11 (Decontamination of Field Equipment, Appendix B of UFP-SAP).

3.2.8 Data Management

The principal data generated for this project was from field data and Empirical Laboratory analytical data. An electronic copy was made of field books, boring logs, soil sample collection sheets, and chain-of-custodies and are provided in Appendix B. Data Management was performed in accordance with SOP-03 (Database Record and Quality Assurance, Appendix B of UFP-SAP).

3.3 ANALYTICAL METHODOLOGY

3.3.1 Analytical Methods

Chemical analysis for select metals (arsenic, antimony, and lead), PAHs (acenaphthene; acenaphthylene; anthracene; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene; dibenzo(a,h)anthracene; fluoranthene; fluorene; indeno(1,2,3-cd)pyrene; 1-methylnaphthalene; 2-methylnaphthalene; naphthalene; phenanthrene; and pyrene), was performed by

Empirical Laboratories, LLC. This subcontracted laboratory was DoD Environmental Laboratory Approval Program (ELAP) approved.

All samples were sent to the fixed-base laboratory (FBL) for analysis of select metals by method SW-846 6010B and low-level PAHs by method SW-846 Method 8270 selected ion monitoring (SIM) in accordance with the UFP-SAP. All PAH samples were extracted by the laboratory to preserve the sample holding times until analysis. However, PAH samples from the 2 to 4 foot range were held for analysis until following the evaluation of preliminary data from the surface (0 to 1 feet bgs) and shallow subsurface (1 to 2 feet bgs) samples.

3.3.2 Data Usability Assessment

The data usability process was completed in accordance with Worksheet #37 of the UFP-SAP (Tetra Tech, 2010). Data review processes were used to determine whether analytical laboratory data were of acceptable technical quality for use in decision-making. Full data validation was completed for the data. The review began with data validation, which is a comparison of data quality indicators (DQIs) to prescribed acceptance criteria. The DQIs are measures to assess the bias and precision of the analytical calibrations and sample analyses. The output of this review was a set of alphabetic flags such as "U," "J," "R," or combinations thereof that may have been assigned to individual results based on the validation effort. These flags were used to infer the general quality of the data. Also evaluated were the measures of data completeness, sensitivity, comparability, and representativeness. Biases and imprecision identified during that process, and data comparability, sensitivity, representativeness, and completeness were evaluated further to determine whether the data were of sufficient type, quantity, and quality to support the decision-making required by the UFP-SAP (Tetra Tech, 2010).

All data were validated and usable for this investigation. Validated analytical results are provided in Appendix B, and the MC data usability report is provided in Appendix C.

3.3.3 Data Comparison to Project Action Limits

Screening criteria PALs were evaluated and chosen based on the rationale presented in the SI report (Tetra Tech, 2010). The tables presented in Appendix D of the 2010 SI Report (Tetra Tech, 2010) show: the PALs, rationale, PAL references, the screening criteria that were evaluated and used for comparison to chemical concentrations to determine if and where exceedances occurred in the combined 2010 and 2011 data set, and the minimum and maximum method detection limits (MDLs) achieved by the FBL. If an analyte concentration in any sample within the study area exceeded the PAL, the project team

evaluated whether further investigation was warranted. Detailed discussions regarding PAL evaluations at the TSA Ranges are presented in Section 4 of this report.

3.3.4 Benzo(a)pyrene (BaP) Equivalents

The USEPA has identified seven PAHs as potentially carcinogenic: benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; dibenzo(a,h)anthracene; and indeno(1,2,3-cd)pyrene. Of these PAHs, benzo(a)pyrene has been subjected to the most toxicological study and the USEPA has used the toxicological data to establish quantitative toxicological parameters (cancer slope factors and inhalation unit risks) for benzo(a)pyrene. All seven of these PAHs have a similar chemical structure and similar chemical properties. For example, these PAHs have relatively low solubility in water, have low potential to volatilize into the air, and have a propensity for adsorbing to soil rather than dissolving in water once they are in the environment. Laboratory studies suggest that these chemicals act similarly from the perspective of carcinogenicity, and that the carcinogenic potency of the individual PAHs can be evaluated with reference to the carcinogenic potency of benzo(a)pyrene. Therefore, the USEPA has developed a toxicity equivalency factor (TEF) for each potentially carcinogenic PAH that can be used to convert the concentration of that PAH to an equivalent concentration of benzo(a)pyrene. Since benzo(a)pyrene is often abbreviated BaP, this process is known as determining the BaP equivalent concentration.

The TEFs for the seven potentially carcinogenic PAHs are shown in the table below:

PAH	TEF
Benzo(a)pyrene	1.0
Benz(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.001
Dibenzo(a,h)anthracene	1.0
Indeno(1,2,3-cd)pyrene	0.1

The BaP equivalent concentration was calculated for each sample using the following four step process:

First, for any potentially carcinogenic PAH that was not detected, half the reporting limit was used as the concentration for that PAH. Second, the concentration of each potentially carcinogenic PAH was multiplied by its TEF to give its BaP equivalent concentration. Third, the BaP equivalent concentrations for all potentially carcinogenic PAHs were summed to give the total BaP equivalent concentration.

Fourth, if no potentially carcinogenic PAHs were detected in a sample, the reporting limit for benzo(a)pyrene was used as the total BaP equivalent concentration.

The detection tables for surface and subsurface soil data (Tables 3 and 4) present the concentrations of potentially carcinogenic PAHs in each discrete soil sample submitted for analysis of PAHs. These tables also provide the resulting total BaP equivalent concentration for each sample. The total BaP equivalent concentrations are compared to risk-based screening levels (RBSLs) for BaP for direct contact exposures to soil (i.e., incidental ingestion, dermal contact, and inhalation of constituents emitted from soil to the air).

4.0 RESULTS

4.1 SUPPLEMENTAL SITE INSPECTION DATA COLLECTION RESULTS

Analytical results of the 2010 SI soil sampling event have been combined with the 2011 supplemental SI soil sampling event to determine the path forward. The 2010 data summary is included in the SI Report (Tetra Tech, 2010b), and the Supplemental SI data collected in 2011 are summarized below. Soil samples collected at the TSA Ranges were compared to respective PALs as listed in Worksheet #15 of the UFP-SAP (Tetra Tech, 2010a). The chemical reference limits, background evaluation table, and the complete validated FBL data tables for the 2011 samples are presented in Appendix B.

The lead PAL for the FBL analyses is 11 mg/kg and is based on the USEPA Ecological Soil Screening Levels. The human health screening level for lead is 400 mg/kg, and was based on the Illinois EPA residential Tier 1 TACO soil remediation objectives. The PAH PALs identified in the UFP-SAP were based on USEPA Guidance for Ecological screening criteria. TACO background concentrations have been established for metals and PAHs for sites located within a Metropolitan Statistical Area (MSA). These background concentrations were compared to the past PALs and were found to be higher than the PALS for purposes of determining whether metals (lead, antimony, and arsenic) and PAHs required cleanup. The PAL for benzo(a)pyrene is used to evaluate the BAP equivalent for each sample based on the calculation described in Section 3.3.4. The exceedances of individual PAHs are discussed below in Section 4.3.

Tables 3 and 4 present the metals (antimony, arsenic, and lead) and PAH detections in the surface and subsurface soil samples at the TSA Ranges, respectively. Figure 3 presents the BAP equivalent data for all soil intervals for the combined data set of the 2010 and 2011 TSA Ranges site soil samples. Figures 4 and 5 present the lead exceedances in the surface and subsurface soil samples, respectively, for the combined 2010 and 2011 data set at the Trap Range and Skeet Range.

4.2 DATA PRESENTATION/DATA USABILITY

This section contains a description of the data review processes used to determine whether analytical laboratory data collected during the sampling field effort for the TSA Ranges were of acceptable quality for use in decision-making. The review began with data validation, which is a comparison of DQIs against the prescribed acceptance criteria. The DQIs are measures used to assess the completeness, sensitivity, accuracy, precision, comparability, and representativeness of the sample collection and sample analysis process. The output of this review was a set of alphabetic flags such as "U," "J," "R," or combinations

thereof, assigned to individual results based on the validation effort. These flags were used to infer the general quality of the data and if data quality meets the data quality objectives (DQOs) of the project. The DQOs presented in the approved Supplemental Soil Work Plan (Tetra Tech, 2011) and UFP-SAP (Tetra Tech, 2010a) were maintained through the course of the sampling event. Worksheets #15 and #19 of the UFP-SAP present the analytical methods and compounds analyzed.

4.2.1 Data Validation Process

All of the FBL sample results were validated according to several specifications. Assignment of data qualification flags conformed to rules established in USEPA National Functional Guidelines for Organic Data Validation (USEPA, 1999), USEPA National Functional Guidelines for Inorganic Data Validation (USEPA, 2004), and the DoD Quality Systems Manual (QSM) (DoD, 2006 and 2009) to the greatest extent practicable for non-contract laboratory program data.

Several samples analyzed for various parameters were qualified. Appendix D contains the data validation reports, which outline the specific qualification reasons for each sample by parameter.

4.2.2 Data Quality Review

Some of the DQIs are generated from the analysis of field samples (e.g., field duplicates), while others are from the analysis of FBL samples (e.g., laboratory duplicates). Individually, field and FBL DQIs provide measures of the performance of the respective investigative operations (field or laboratory). If individual QC results were unacceptable, there was an assignment of a validation flag indicating the type of QC deficiency impacting the result. Supporting documentation regarding the data presentation and usability for the TSA Ranges site is presented in Appendix C.

4.2.3 Completeness

The achieved sample collection completeness was adequate to meet the DQOs presented in the Supplemental SI Work Plan. The soil sample collection completeness for the TSA Ranges was 93 percent, because of drilling refusal prior to target sampling depth.

The soil sample FBL analytical completeness was 100 percent for all samples submitted to the FBL for select metals and PAH analysis.

4.2.4 Sensitivity

The Project Quantitation Limit Goals (PQLGs) for each analyte are listed in Worksheet #15 of the UFP-SAP (Tetra Tech, 2010a). Analytical sensitivity for the TSA Ranges data was satisfactory to meet the DQOs presented in the UFP-SAP.

Antimony reporting limits exceeded the Ecological Soil Screening Level (Eco SSL) (0.27 mg/kg), the minimum PAL, in 100 percent of samples with non-detected concentrations of antimony, but did not exceed the TACO background (4 mg/kg) or TACO human health criteria (31 mg/kg).

Dibenzo(a,h)anthracene reporting limits exceeded the USEPA regional screening levels for residential soils [15 micrograms per kilograms (µg/kg)], which is also the minimum PAL, for 30 percent (8 samples) of all samples with non-detected concentrations of dibenzo(a,h)anthracene; however, there were no reporting limit exceedances of the TACO Human Health criteria (90 µg/kg), the Eco SSL (1100 µg/kg), or the TACO Background (420 µg/kg).

4.2.5 Field and Laboratory Accuracy

Various analytical samples had qualified results but no data was rejected. Appendix C contains the data quality review report and Appendix D contains the data validation reports summarizing the data qualifications.

4.2.6 Comparability

Comparability is defined as the confidence with which one data set can be compared with another (e.g., among sampling points and among sampling events). Comparability was achieved by using standardized sampling and analysis methods, as well as standardized data reporting formats. Comparability of laboratory measurements was achieved primarily through the use and documentation of standard sampling and analytical methods. Results were reported in units that ensured comparability with current state and federal standards and guidelines. Comparability of laboratory measurements was assessed primarily through the use of QC samples and through adherence to the quality assurance QA plan. The data comparability for the TSA Ranges was deemed acceptable.

4.2.7 Representativeness

Complying with the supplemental SI Work Plan (Tetra Tech, 2011) and the UFP-SAP (Tetra Tech, 2010a), and using standardized sampling, sample handling, sample analysis, and data reporting

procedures were done so that the final data would be an accurate representation of actual site conditions. Based upon the field logs indicating the conditions during sample collection and FBL audits, it was concluded that all reported data are adequately representative of site conditions at the TSA Ranges.

4.3 DATA COMPARISON TO PROJECT ACTION LIMITS

All soil samples collected (141) were submitted to the FBL for analysis by method SW-846 6010B for select metals (arsenic, antimony, and lead), and by method SW-846 Method 8270 for low-level PAH analysis. Soil samples were collected from three sample intervals: 0 to 1 foot bgs (47 samples), 1 to 2 feet bgs (52 samples), and 2 to 4 feet bgs (42 samples). Sample intervals for each sample are identified by the last four digits of the sample name: -0001 — 0 to 1 foot bgs, -0102 — 1 to 2 feet bgs, -0204 2 to 4 feet bgs.

The laboratory concentrations for the surface soil samples were compared to both the human health-derived PAL and the ecological-derived PAL for screening purposes. In addition, the Illinois EPA TACO area soil background concentrations for each metal and PAH were also standards considered for comparison purposes. The PAL Backup Table is provided in Appendix B.

Tables 3 and 4 summarize the laboratory analytical detection results as compared to the PALs for the TSA Ranges site surface soil (0 to 1 foot bgs) and subsurface soil samples (1 to 4 feet bgs), respectively, for the combined SI data set (data from 2010 and 2011). If a parameter exceeded its respective PAL in any sample, the parameter was shaded and/or bolded depending on the number of criteria and specific criteria exceeded.

4.3.1 Identification of Select Metals Exceeding PALs in Soil

Antimony

For samples collected during the 2011 sampling event, antimony concentrations ranged from 0.348 J to 7.48 J mg/kg (TSA-107-0102, Skeet Range). None of the soil samples exhibited antimony concentrations exceeding the human health PAL of 31 mg/kg (Tables 3 and 4). However, all sample concentrations and all reporting limits for non-detected samples (1.2 U to 1.84 U mg/kg) exceeded the ecological PAL of 0.27 mg/kg. Antimony detection limits are elevated at 5 times the normal detection limit in many samples due to dilutions used to bring elevated concentrations of other analytes (arsenic and lead) into range of the calibration curve, resulting in antimony detection limits above the ecological PAL for the non-detect values.

For the combined data set, 12 samples had concentrations exceeding the Illinois EPA background concentration for antimony of 4 mg/kg. In surface soil, sample TSA-121-0001 (4.51 J mg/kg) located in the Skeet Range was the only exceedance of the background concentration. In subsurface soil, antimony ranged from 4.51 J mg/kg at TSA-118-0204 to 7.48 J mg/kg at TSA107-0102; all subsurface soil exceedances were in the Skeet Range.

Arsenic

For samples collected during the 2011 sampling event, arsenic concentrations ranged from 3.29 mg/kg to 23 mg/kg (TSA102-0102, Trap Range). All soil samples submitted for laboratory analyses had detectable arsenic concentrations. For the combined dataset, in surface soil, all samples exceeded the residential human health PAL of 0.39 mg/kg (Tables 3 and 4) with concentrations ranging from 3.29 mg/kg (TSA122-0001) to 19.6 J (TSA041-0006). In subsurface soil, arsenic concentrations ranged from 3.32 mg/kg (TSA 116-0102) to 23 mg/kg (TSA102-0102). Four samples exceeded the TACO background criteria of 13 mg/kg: one surface location TSA041-0006 (19.6 J mg/kg), and three subsurface locations [TSA102-0102 (23 mg/kg), TSA108-0102 (13.6 mg/kg), and TSA127-0204 (13.6 J mg/kg)]. Additional screening of the arsenic concentrations against the TACO construction worker ingestion criteria of 61 mg/kg yielded no exceedances.

Lead

For samples collected during the 2011 sampling event, lead soil sample concentrations ranged from 13 J mg/kg to 1110 mg/kg, and lead was detected in all samples submitted for analysis. For the combined data set, 15 lead concentrations, located in the Skeet Range, exceeded the human health PAL of 400 mg/kg: 5 samples in the surface and 10 in the subsurface (Figures 4 and 5 and Tables 3 and 4). In surface soil, concentrations exceeding the human health PAL ranged from 408 mg/kg (TSA052-0006) to 1460 mg/kg (TSA030-0006). In subsurface soil, concentrations exceeding the human health PAL ranged from 419 mg/kg (TSA107-0102) to 1110 mg/kg (TSA109-0102). All samples (161) of the combined data set exhibited exceedances of the ecological PAL of 11 mg/kg for lead. In addition, 97 samples exceeded the Illinois EPA soil background concentration for lead of 36 mg/kg (Figures 4 and 5 and Tables 3 and 4). Exceedances of the background criteria primarily occurred along the shoreline at the Trap Range and spread across the northern portion of the site associated with the location of the Skeet Range area. Antimony and arsenic concentrations are not shown on the figures because these contaminants are associated with lead in bullets, and are therefore expected to be spatially correlated with the lead concentrations in the soil.

4.3.2 Identification of PAHs Exceeding PALs in Soil

Tables 3 and 4 summarize the analytical results and show exceedances of the screening PALs for each PAH analyte. If a parameter exceeded its respective PAL in any sample, the parameter was shaded and/or bolded depending on the number of criteria and specific criteria exceeded.

For samples collected during the 2011 sampling event, all 18 PAHs were detected at least once in the soil samples collected from the TSA Ranges. For the combined data set, the TACO background screening criteria was exceeded for each PAH, except 1-methylnaphthalene (1.71 J µg/kg to 727 J µg/kg). Six PAHs exceeded the human health PAL screening criteria. For each of these PAHs, the screening criterion followed by the range of detections is shown below.

- benzo(a)anthracene (900 µg/kg, 2.322 µg/kg to 33,200 µg/kg).
- benzo(a)pyrene (90 µg/kg, 2.63 J µg/kg to 38,200 µg/kg).
- benzo(b)fluoranthene (900 µg/kg, 12.3 µg/kg to 49,100 µg/kg).
- benzo(k)fluoranthene (9,000 µg/kg, 4.08 µg/kg to 16,200 µg/kg).
- dibenzo(a,h)anthracene (90 µg/kg, 3.37 µg/kg to 7,000 µg/kg).
- indeno(1,2,3-cd)pyrene (900 µg/kg, 2.45 µg/kg to 29,000 µg/kg).

In addition, the benzo(a)pyrene (BaP) equivalent concentration was calculated for all samples and used to approximate the toxicity of the seven carcinogenic PAHs, in accordance with USEPA TEF for each potentially carcinogenic PAH. A description of how the BaP equivalent concentration was derived is presented in Section 3.3.4. Tables 3 and 4 present the calculated BaP equivalent concentrations for each sample in the combined data set. There is no specific human health screening criterion for BaP equivalent concentrations; however, because the seven PAHs which are included in the calculation act similarly from the perspective of carcinogenicity and have a similar carcinogenic potency to benzo(a)pyrene, the screening criterion for benzo(a)pyrene (90 µg/kg) will be used to evaluate the BaP equivalent. For samples collected during the 2011 sampling event, BaP Equivalent concentrations ranged from 2.32 µg/kg to 56,524.4 µg/kg. For the combined data set, BaP Equivalent concentrations exceeded the human health PAL (90 µg/kg) in 133 of the 161 soil samples. The TACO background screening level for benzo(a)pyrene is (2,100 µg/kg) for metropolitan areas, and BaP Equivalent concentrations exceeded the TACO background criterion in 21 samples, located primarily near the shoreline of both the trap and skeet ranges. Exceedances of the TACO background screening level for BaP Equivalent concentrations ranged from 2237.22 µg/kg (TSA108-0102) to 56,524.4 µg/kg (TSA101-0204). Figure 3 shows the BaP Equivalent exceedances of the TACO background screening criteria (2100 µg/kg) for all sample intervals in the combined data set.

Although the TACO background number is typically applied to surface soils, a comparison to the background criteria is made for all sample intervals (0 to 4 feet bgs) at the TSA Ranges because of the heterogeneity and amount of construction debris, specifically asphalt, found throughout the site indicating that the majority of soil on site is actually fill material. TACO defines area background as "concentrations of regulated substances that are consistently present in the environment in the vicinity of a site that are the result of natural conditions or human activities, and not the result solely of releases at the site " [415 Illinois Compiled Statutes (ILCS) 5/58.2]. An assumption was made that at some time prior to emplacement at the TSA Ranges, the fill material would have been located at or near the ground surface and therefore exposed to sources of PAHs. Therefore, the TACO background criteria were applicable to the entire investigation depth at the TSA Ranges site.

The ecological PAL is 1,100 µg/kg for individual high molecular weight PAHs, and 29,000 µg/kg for individual low molecular weight PAHs. Eleven individual PAHs exceeded the ecological PALs: all nine high molecular weight PAHs [benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(g,h,i)perylene; benzo(k)fluoranthene; chrysene; dibenzo(a,h)anthracene; indeno(1,2,3-cd)pyrene; and pyrene], and two low molecular weight PAHs (fluoranthene and phenanthrene).

The PAH concentrations are believed to be associated with: the fill material because asphalt, concrete, and brick were observed during intrusive investigations; and also with the clay pigeon fragments used as targets, primarily along the shoreline, where fill depth is minimal and range debris (pigeon fragments and shotgun shell wadding) was observed in the Trap Range. The widespread elevated concentrations are not consistent with a typical distribution of PAH contamination at trap and skeet ranges.

Observations of asphalt were noted on the sample sheets, boring logs, and chains of custody for samples collected during the Supplemental SI field activities as described in Section 3.2.2, and provided in Appendix A. Clay target remnants were not observed in soil samples collected during the Supplemental SI activities, but were observed during the 2010 SI sampling event and were noted in the sample log sheets (Appendix A of the SI Report, Tetra Tech, 2010a). Appendix B includes the full analytical results for the PAHs analyzed.

5.0 ECOLOGICAL RISK SCREENING

This ecological screening presents a brief evaluation of the risks to ecological receptors exposed to chemicals in the surface soil at the site. The terrestrial ecological habitat at the site is generally poor. As seen in Figure 2, and photographs 1 and 2 in Appendix F, the site consists of a small grass area along the shoreline of Lake Michigan, and contains an RV park. Although the habitat is poor, a screening of risks to soil invertebrates and small mammals and birds was conducted as a conservative measure for determining potential ecological risks. The remainder of this section presents this screening.

EVALUATION OF RISKS TO SOIL INVERTEBRATES

To evaluate risks to soil invertebrates, the maximum chemical concentrations in soil from 0 to 1 foot bgs were compared to screening levels based on effects to soil invertebrates (see Table 5). Table 5 also presents the sources of the invertebrate screening levels. All chemicals, except arsenic, were present at concentrations less than their respective screening levels. Arsenic was initially selected as a COPC because its maximum concentration (19.6 mg/kg) exceeded its screening level (17 mg/kg). However, all other sample concentrations were less than the screening level, as was the average site concentration (7.7 mg/kg). The screening level for arsenic is the Canadian Soil Quality Guideline (SQG), which is protective of both plants and invertebrates is based on yield reduction in spinach (CCME, 1999), because plants are more sensitive than invertebrates, according to the data in the Canadian SQG document. This is supported by the fact that the No Observed Effects Concentration for arsenic based on earthworms for one study was 50 mg/kg (CCME, 1999) and the Oak Ridge National Laboratory benchmark for soil invertebrates is 60 mg/kg (Efryomson et al., 1997). All arsenic concentrations were much lower than these values. Therefore, adverse effects to soil invertebrates from arsenic are not expected and arsenic is eliminated as a COPC.

EVALUATION OF RISKS TO BIRDS AND MAMMALS

Potential risks to birds and mammals that may be present at the TSA Ranges site were evaluated by food chain modeling (Appendix E). For this evaluation, the surface soil depth interval was selected as 0 to 1 feet bgs to conservatively estimate potential exposures. Terrestrial receptors are not substantially exposed to subsurface soils, so that pathway was not included in the following evaluation.

Ingestion is the primary route of exposure to contaminants in soil for most mammals and birds. Representative species were selected to estimate the risks to wildlife receptors at the site incurred by intake through eating and drinking. Based on the habitat at the TSA Ranges site, which consists of

mostly grass with adjacent forested areas, herbivorous and invertivorous birds and mammals are receptors of concern. The selection of species used to represent the receptor groups was based on considerations of their preferred habitat, body size, sensitivity to contaminants, home range, abundance, commercial or sport utilization, legal status, and functional role (e.g., predators). The availability of exposure parameters such as body mass, feeding rate, and drinking rate was also a factor in selecting surrogate species. The following surrogate species were used in the food chain modeling conducted:

- Herbivorous mammal - Meadow vole
- Herbivorous bird - Bobwhite quail
- Invertivorous mammal - Short-tailed shrew
- Invertivorous bird - American woodcock

The following generic exposure dose equation was used to calculate the dose terrestrial wildlife receive from exposure to chemicals in soil and associated food items such as plants and soil invertebrates:

$$CDI = \frac{[(Cf * If) + (Cs * Is)] * H}{BW}$$

Where:

CDI	=	Chronic daily intake [milligrams per kilogram (mg/kg)-day]
Cf	=	Chemical concentration in food – (see discussion below)
Cs	=	Chemical concentration in surface soil (mg/kg)
If	=	Food ingestion rate [kilograms per day (kg/day)]
Is	=	Incidental surface soil ingestion rate (kg/day)
H	=	Portion of food intake from the contaminated area (unitless)
BW	=	Body weight (kg)

The exposure factors used for the food chain model (i.e., ingestion rate, body weight) were obtained primarily from the Wildlife Exposure Factors Handbook (USEPA, 1993) and USEPA Eco SSL Guidance Attachment 4-1 (2007) with other sources used as necessary.

Chemical concentrations in food items for soil invertivorous and herbivorous receptors were calculated using soil-to-invertebrate or soil-to-plant biota-soil bioaccumulation factors (BAFs) and regression equations from the USEPA Eco SSL Guidance Document Attachment 4-1 (2007) or BAFs from published sources. The following equation was used to calculate chemical concentrations in plants or invertebrates when BAFs were used:

$$Cf = Cs * BAF$$

Where:

Cf	=	Chemical concentration in food (mg/kg)
Cs	=	Chemical concentration in surface soil (mg/kg)
BAF	=	Biota-soil bioaccumulation factor (unitless)

A default value of 1.0 was used for the BAF when chemical-specific data were not available.

The food chain model scenarios were calculated using various exposure assumptions to present a range of potential risks. For selecting chemicals as contaminants of potential concern (COPCs), the following Tier 1 exposure assumptions were used:

- Maximum soil concentrations.
- 90th percentile BAFs (or maximum value if a 90th percentile value was not available) or regression equations.
- Conservative receptor body weight and ingestion rates.
- Receptors spend 100 percent of their time at the Site.

Exposure assumptions/concentrations were refined to better determine which chemicals contribute to potentially unacceptable levels of ecological risk, and to identify and eliminate from further consideration those COPCs that were initially selected as COPCs because of the use of very conservative exposure scenarios but are not likely causing a significant risk. The Tier 1 exposure doses calculated for terrestrial wildlife were re-calculated using the following Tier 2, Step 3a exposure assumptions and chemical concentrations:

- Average soil concentrations
- Median or mean BAFs (if available)
- Average receptor body weights and ingestion rates

Average soil concentration is the mean concentration of all samples, assuming 1/2 the detection limit for non-detects values, unless the average concentration is greater than the maximum concentration. In that case, the average concentration is the mean of all concentrations above detection limits.

An Ecological Effects Quotient (EEQ) approach was used to characterize the risk to ecological receptors. This approach characterizes potential effects by comparing exposure concentrations with effects data. The EEQs for terrestrial wildlife were calculated as follows:

$$EEQ = \frac{CDI}{TRV}$$

where: EEQ = Ecological Effects Quotient (unitless)
CDI = Chronic daily intake dose (mg/kg-day)
TRV = Toxicity reference value [no observed adverse effect level (NOAEL) or lowest observed adverse effect level (LOAEL)] (mg/kg-day)

The TRVs were developed from NOAELs and LOAELs obtained from wildlife studies. The majority of the TRVs were obtained from the USEPA Eco SSL documents and were supplemented with other toxicity information when necessary. For example, the lead LOAEL TRVs for mammals and birds was used based on a recommendation from the USEPA Region 5 ecological risk assessor (Mr. Dan Mazur). Appendix E.5 presents the TRVs and the sources of the NOAELs and LOAELs used in this ERA. If a subchronic study was used to develop the TRV, the final value was multiplied by a factor of 0.1 to account for uncertainty between subchronic and chronic effects. Also, the LOAEL was multiplied by a factor of 0.1 to estimate a NOAEL TRV if only a LOAEL study was available. The chemical-specific Eco SSL documents provide both NOAELs and LOAELS for various studies, but overall TRVs are calculated only for NOAELs. The geometric mean of the chemical-specific growth and reproduction LOAELs from the chemical-specific Eco SSL documents were used as the LOAEL TRVs.

An EEQ of greater than 1.0 was considered to indicate potential risk. Such values do not necessarily indicate that an effect will occur, but only that a low (i.e., conservative) threshold has been exceeded.

In addition to the food chain model evaluation, habitat was evaluated to determine if the risks are great enough to warrant additional evaluations. Potential risks to ecological receptors may be minimal if there is little habitat for those receptors. Therefore, the extent of habitat was used qualitatively when considering additional evaluation. Areas with little habitat were less of a concern than areas with suitable habitat to support the receptors of interest.

The EEQs from the terrestrial food chain modeling were greater than 1.0 for two inorganics and several PAHs using maximum chemical concentrations and Tier 1 exposure assumptions. Therefore, as part of the Step 3a refinement, risks were recalculated using average chemical concentrations and the Tier 2,

Step 3a exposure parameters. A discussion of the risks to mammals and birds for the TSA Ranges site is presented below.

- No EEQs were greater than 1.0 for herbivorous receptors; therefore, impacts to herbivorous mammals and birds are not expected from chemicals detected in surface soil at the TSA Ranges site.

- The EEQ for antimony (2.0) for the short-tailed shrew was greater than 1.0 using the NOAEL as the TRV. The LOAEL EEQ was less than 1.0.

- The EEQ for lead (4.9) for the American woodcock was greater than 1.0 using the NOAEL as the TRV. The LOAEL EEQ was less than 1.0.

- No EEQs calculated for PAHs were greater than 1.0 for the short-tailed shrew or the American woodcock based on the average chemical concentrations and the Tier 2 Step 3a exposure parameters.

The food chain model assumes that the receptors obtain their entire diet from the site. The portion of the site on land is only 1.1 acres but the potentially impacted areas only comprise a small portion (les than half) of the site. Therefore, it is unlikely that the site comprises the entire home-range for most wildlife receptors. In addition, because of the relatively small size of the site, and it proximity to the RV park, significant populations of small mammals or birds are not likely to be present. For these reasons and because none of the LOAEL EEQs were greater than 1.0, impacts to mammals and birds are not likely. Therefore, antimony and lead are eliminated as COPCs for invertivorous receptors.

Because it is assumed that some soil would be removed based on human health risks, potential risks to birds and mammals were recalculated using data from the samples that would remain after a proposed removal action. Samples from locations where the removal action will occur were eliminated from the evaluation. The EEQs are lower based on the proposed removal action, so risks to mammals and birds, which were already acceptable using all of the data, are still acceptable. Risks to mammals and birds for the TSA Ranges site using the recalculated average chemical concentrations and Tier 2, Step 3a exposure parameters are as follows:

- No EEQs were greater than 1.0 for herbivorous receptors; therefore, impact to herbivorous mammals and birds are not expected from chemicals detected in surface soil at the TSA Ranges site.

- The EEQ for antimony (1.5) for the short-tailed shrew was greater than 1.0 using the NOAEL as the TRV. The LOAEL EEQ was less than 1.0 , therefore, impact to invertivorous mammals are expected to be minimal and antimony is eliminated as a COPC.

- The EEQ for lead (2.8) for the American woodcock was greater than 1.0 using the NOAEL as the TRV. The LOAEL EEQ was less than 1.0, therefore, impacts to invertivorous birds are expected to be minimal and antimony is eliminated as a COPC.

- No EEQs calculated for PAHs were greater than 1.0 for the short-tailed shrew or the American woodcock based on the average chemical concentrations and the Tier 2 Step 3a exposure parameters.

6.0 CSM

The CSM for the TSA Ranges was developed following guidance documents issued by the USEPA for hazardous waste sites and the U.S. Army Corps of Engineers (USACE) for ordnance and explosives sites. Guidance documents included the USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA/540/G-89/004), and the USACE CSM Guidance (USACE, 2003).

A summary of the CSM last updated following the 2010 SI report (Tetra Tech, 2010b) presents information regarding: 1) MC known or suspected to be at the site; 2) current and future reasonably anticipated or proposed uses of the real property; and 3) actual, potentially complete, or incomplete exposure pathways that link them.

Figures 6 and 7 provide graphical representations of the current understanding of the TSA Ranges site. The figures identify the exposure pathways where site receptors could be exposed to MC. Based on the analytical information obtained during the Supplemental SI, MC contamination does exist at the TSA Ranges.

6.1 MEC

The TSA Ranges were used solely as small arms ranges; therefore, MEC/material potentially presenting an explosive hazard (MPPEH) were not expected or encountered at this site. There are no known MEC areas associated with the TSA Ranges site.

6.2 MC

For MC, a complete or potentially complete exposure pathway must include the following components:

- A source (e.g., locations where MC are expected to be found).
- An exposure medium (e.g., surface soil).
- An exposure route (e.g., dermal contact).
- Receptors (e.g., Navy personnel, construction workers, recreational users or authorized visitors).

If the point of exposure is not at the same location as the source, the pathway may also include a release mechanism (e.g., volatilization) and a transport medium (e.g., air).

6.2.1 Surface Soil

Lead, antimony, arsenic, and multiple PAHs are present in the surface soil, at concentrations greater than human and ecological screening criteria, based on the combined 2010 and 2011 SI data set. Complete exposure pathways for surface soil are identified for all human and ecological receptors at the TSA Ranges site via all exposure routes [i.e., dermal contact, inhalation of dust, and ingestion (via hand to mouth behavior for human receptors and via foraging or feeding for biota)].

Exposure of humans and biota via inhalation of dust is possible under dry weather conditions and during periods of high wind. Any future movement of surface soils could make potential MC available for wind or mechanical distribution and subsequent inhalation. Metals are commonly present in particulate form, and receptors may be exposed to these particulates via inhalation of dust at the site.

6.2.2 Subsurface Soil

Fill material was placed at the TSA Ranges to extend the shoreline for the addition of the skeet range to the installation, and additional soil was emplaced to elevate and grade the site for use as an RV park. Construction disposal debris (asphalt, brick, and concrete fragments) were evident across the site during the intrusive investigation. Multiple investigation borings were prematurely terminated between 2 and 4 feet bgs because of refusal of the drilling equipment when large construction fill and course gravel were encountered. The Initial Assessment Study of the Naval Complex, Great Lakes, (Rogers, Golden & Halpern, 1986), describes Site 13 A – B (the Demolition Debris Disposal Areas) "where fill was placed both behind and in front of bulkheads and piers that were constructed to protect the bluffs from coastal erosion. Most of this fill material was comprised of bricks, concrete, and other building materials large enough to provide protection for the receding shoreline. These materials may be examined in the actual shore zone, and especially in the vicinity of the Skeet Range (Building 743), where typical building demolition debris material is clearly visible. On-ground inspection revealed that only inert materials had been disposed of there."

The presence of potential MC (lead, antimony, and PAHs) was confirmed for subsurface soil at the site through sample collection from 1 to 4 feet bgs. The results of the Supplemental SI show that subsurface contamination could be from a combination of the three sources:

- Historical use of the site as a trap and skeet range.
- Emplacement of over 4 feet of fill material consisting of construction debris (concrete, building material, asphalt, and brick).
- Potential unidentified source(s) associated with the RV park.

Potentially complete exposure pathways are identified for human receptors (i.e., contractors) who engage in digging, excavation, or drilling activities during environmental or other types of investigations. Exposure routes for contractors include dermal contact, inhalation of dust, and ingestion via hand to mouth behavior. Exposure pathways are identified as incomplete for other human receptors (i.e., Navy personnel, visitors, and trespassers), since these receptors are not expected to contact subsurface soil under the current and most likely future land uses. A complete exposure pathway would exist for residential receptors for all exposure routes who may contact subsurface soils. In addition, incomplete exposure pathways are identified for biota, since plant roots may penetrate the subsurface soil, and wildlife (e.g., foxes) may construct burrows on the site but the site is small, primarily covered by gravel and regularly maintained grass, and is not a significant habitat and populations are not expected to be large because of the presence of RVs and people.

6.2.3 Groundwater

The presence of potential MC in shallow groundwater at the TSA Ranges site is possible because of the potential migration of MC from surface soil to groundwater via leaching. Groundwater from the site is expected to discharge to Lake Michigan; and because the groundwater is relatively shallow, potentially complete exposure pathways are identified for human receptors (i.e., contractors) who engage in digging, excavation, or drilling activities during environmental or other types of investigations. Contractors may be exposed to potential MC in groundwater via ingestion or dermal contact. However, dermal contact would be unlikely because in the soil borings installed during the 2011 Supplemental SI, groundwater was not encountered in soil between 0 and 4 feet bgs. Exposure pathways are identified as incomplete for other human receptors (i.e., Navy personnel, visitors, and trespassers), since groundwater is not used as a source of potable water. There are incomplete exposure pathways for biota via ingestion and dermal contact, since shallow groundwater is greater than 4 feet bgs.

6.2.4 Receptors

For MC, interaction between the source and receptors involves a release mechanism for the MC, an exposure medium that contains the MC, and an exposure route that places the receptor into contact with the contaminated medium. There are four groups of potential contaminant receptors (Navy personnel,

Navy-escorted visitors/contractors, construction workers, recreational users, and future residential users) and one group of potential biota receptors at NSGL. Shallow ground water from the TSA Ranges site is expected to discharge to Lake Michigan. Surface water run-off from the areas under study in this report eventually discharges to Lake Michigan. Therefore, receptors of groundwater and surface water will be the same. Fish from Lake Michigan are caught and consumed by recreational and commercial fishermen and used as a primary food source by waterfowl. Lake Michigan is a major fishery with over 22,000 square miles of both commercial and recreational fishing adjacent to Naval Station Great Lakes.

6.2.5 Plant/Animal Uptake

The evaluation of ecological risk through the food chain model for assimilative/bioaccumulative MC (lead, antimony, and PAHs) for ecological receptors resulted in incomplete exposure pathways because no COPCs were identified.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

The expectation prior to the Supplemental SI intrusive investigation was that wadding from shotgun shells and fragments of clay pigeons, similar to the findings of the 2010 SI surface soil investigation, would be observed during the collection of surface and subsurface soil samples, near the shoreline. The range debris would then indicate both horizontally and vertically the depth of the original ground surface from the active period of the ranges. However, no range debris was identified in any sample collected during the 2011 Supplemental SI. The available information shows that the range debris appears to be limited to the erosional surface along the trap range and extends westward for 1 to 2 feet, towards the former firing line.

It was also expected that range debris at 3 to 4 feet bgs in the western portions of the ranges would distinguish the boundary between the emplaced soil used to elevate and grade the site for use as a RV park, and the previous ground surface from the active period of the ranges. However, no range debris was identified, and construction disposal debris (asphalt, brick, and concrete fragments) were evident across the site (horizontally and vertically) during the intrusive investigation. Multiple investigation borings were prematurely terminated at 2 to 3 feet bgs because of refusal of the drilling equipment when large construction fill was encountered. The Initial Assessment Study of the Naval Complex, Great Lakes, (Rogers, Golden & Halpern, 1986), describes Site 13 A – B (the Demolition Debris Disposal Areas) *"where fill was placed both behind and in front of bulkheads and piers that were constructed to protect the bluffs from coastal erosion. Most of this fill material was comprised of bricks, concrete, and other building materials large enough to provide protection for the receding shoreline. These materials may be examined in the actual shore zone, and especially in the vicinity of the Skeet Range (Building 743), where typical building demolition debris material is clearly visible. On-ground inspection revealed that only inert materials had been disposed of there."* However, asphalt (a common source of PAH contamination) was not mentioned as a component of the fill material and the depth of fill was not investigated at the time of the Initial Assessment Study.

The 2010 SI sampling activities were sufficient to determine the presence of MC (lead and PAHs) in the surface soil associated with the historical range use, and to provide preliminary lateral (north to south) delineation of impacted surface soils. Clay pigeon fragments and shotgun shell wadding were identified in surface soils and along the erosional face of the former Trap Range which indicated that a potential continuing source of PAHs may be present in the soil. In addition, it was determined that grading of the

site for use as an RV park could have covered soil that contained MC located closer to the former firing line. However, the extent of MC to the west and vertically in the subsurface soil could not be determined for the site from the results of the 2010 SI.

The 2011 Supplemental SI confirmed the presence of lead, arsenic, antimony, and PAHs in surface and subsurface soil. Lead was present at concentrations exceeding the ecological and human health screening criteria.

In addition, the 2011 results show that the vertical extent of fill material containing construction debris is to a minimum depth of 4 feet bgs, and that the lateral extent covers the majority of the site. Surface and subsurface soil samples collected from the fill/soil emplaced throughout the site after the TSA Ranges activities had ended contained asphalt, this indicates that a second potential source of PAHs exists in the fill material.

7.2 RECOMMENDATIONS

The purpose of the SI phase of this project is to identify possible contaminant releases that require further investigation or pose a threat to human health and/or the environment. The 2010 SI identified lead and PAH contamination greater than PALs at the Trap and Skeet Ranges. The Supplemental SI identified a limited area in the TSA Ranges site with lead concentrations greater than the Human Health screening criteria (400 m/kg) and PAH concentrations greater than the TACO background screening criteria (2,100 µg/kg) in soil within the project site. The combined findings from the SI and supplemental SI indicate that further actions are required.

A prescriptive removal of soil with concentrations of lead exceeding human health screening criteria and PAHs exceeding TACO background screening criteria in the area east of the RV park is recommended at the TSA Ranges site. Laterally, the extent of the prescriptive excavation is generally determined to be a distance half way between an exceedance and a sample location with BAP EQ and lead concentrations less than the screening values. In areas where an exceedance is not bound by samples with concentrations less than the screening criteria, the limit of excavation will be approximately 10 feet beyond the exceedance. The only exception will be at the northern boundary where the excavation will end at the fence line where mature trees and unmaintained brush are currently in place for coastal erosion control.

Vertically, the extent of the prescriptive excavation is determined by the sample interval for each exceedance. For example, if surface soil samples from 0 to 2 feet bgs exceeds the BAP EQ and lead

screening values then that soil volume is included in the prescriptive removal. At that same sample location, if the sample from 2 to 4 feet bgs has BAP EQ and lead concentrations less than the screening values, the excavation will end at 2 feet bgs. Conversely, if soil sample concentrations from 2 to 4 feet bgs had BAP EQ and lead concentrations greater than the screening values, the prescribed excavation will extend to a depth of 4 feet bgs, or the depth at which large construction debris (concrete, etc.), which has been identified to underlie the area of excavation, is encountered; whichever occurs first.

East of the RV Park, removal of contaminated soil and replacement with clean fill is recommended for approximately 13,500 square feet of soil from 0 to 2 feet bgs and 5,650 square feet from 2 to 4 feet bgs, about 1400 cubic yards in total. Within the RV park, high concentrations of PAHs are present near the western portion of the Trap Range at a depth of 2 to 4 feet bgs. For isolated areas of contaminated soils at 2 to 4 feet bgs, surface soil (2 to 4 feet bgs) was not included in the volume calculations for removal. It is assumes that the shallow soil will be scrapped off to access the deeper interval. Figure 8 shows the areas where soil is to be removed from the surface (outlined in solid black line) and subsurface (hatch pattern).

Subsurface soil sample concentrations at points TSA101-0204, TSA103-0203, TSA105-0204, TSA106-0204 located in the western portion of the Trap Range within the RV park are above the TACO Background Values for PAHs, with BaP Equivalent concentrations ranging from 2848.54 µg/kg (TSA103) to 56,524.4 µg/kg (TSA101). A removal of subsurface soil from approximately 2,000 square feet area from a depth of 2 to 4 feet bgs would be approximately 150 cubic yards of soil. For isolated areas of contaminated soils at 2 to 4 feet bgs, surface soil (2 to 4 feet bgs) was not included in the volume calculations for removal. It is assumes that the shallow soil will be scrapped off to access the deeper interval. Figure 8 shows the areas to be removed in surface (outlined in solid black line) and subsurface (hatch pattern).

The area near sample location TSA110 (427 mg/kg, lead), located on the northeastern corner of the site outside of the fence at the northern boundary of the RV park is not included because the removal of soil in this area would require removal of mature trees which provide erosional control for the shoreline.

Potential risks to ecological wildlife (birds and mammals) at TSA Ranges, were evaluated by food chain modeling, using average chemical concentrations, and Tier 2, Step 3a exposure parameters (size of the home range and expected population), which resulted in no potential risk to mammals and birds related to on site contamination. Potential risks to soil invertebrates were evaluated by comparing chemical concentrations in the surface soil samples to invertebrate screening levels. This resulted in a finding of no potential risk for soil invertebrates related to on site contamination.

The removal of lead and PAH contaminated soil across the site from 0 to 2 feet bgs will reduce the potential risk and exposure to human receptors to acceptable risk levels between 10^{-4} and 10^{-6} in those areas, which supports a no further action determination for the site.

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TABLE 1

SAMPLING SUMMARY
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Boring Number	Sample ID	Total Depth (feet bgs)	Drilling Method[1]	Date Drilled	Analyses		Asphalt Pieces Observed[2]
					Metals (As, Pb, Sb)	PAHs	
NTC-SB-TSA080	NTC-SS-TSA080-0001	3	DPT	14-Sep-11	X	X	
	NTC-SB-TSA080-0102				X	X	
	NTC-SB-TSA080-0203				X	X	
NTC-SB-TSA081	NTC-SB-TSA081-0102	2.5	DPT	14-Sep-11	X	X	
NTC-SB-TSA082	NTC-SB-TSA082-0102	3	DPT	14-Sep-11	X	X	
	NTC-SB-TSA082-0203				X	X	
NTC-SB-TSA083	NTC-SB-TSA083-0102	3	DPT	14-Sep-11	X	X	
	NTC-SB-TSA083-0203				X	X	
NTC-SB-TSA084	NTC-SB-TSA084-0102	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA084-0204				X	X	
NTC-SB-TSA085	NTC-SB-TSA085-0102	2.5	DPT	14-Sep-11	X	X	
NTC-SB-TSA086	NTC-SB-TSA086-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA086-0102				X	X	
	NTC-SB-TSA086-0204				X	X	
NTC-SB-TSA087	NTC-SB-TSA087-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA087-0102				X	X	
	NTC-SB-TSA087-0204				X	X	
NTC-SB-TSA088	NTC-SB-TSA088-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA088-0102				X	X	
	NTC-SB-TSA088-0204				X	X	
NTC-SB-TSA089	NTC-SB-TSA089-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA089-0102				X	X	
	NTC-SB-TSA089-0204				X	X	
NTC-SB-TSA090	NTC-SB-TSA090-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA090-0102				X	X	
	NTC-SB-TSA090-0204				X	X	
NTC-SB-TSA091	NTC-SB-TSA091-0001	3.5	DPT	14-Sep-11	X	X	
	NTC-SB-TSA091-0102				X	X	
	NTC-SB-TSA091-0204				X	X	X
NTC-SB-TSA092	NTC-SB-TSA092-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA092-0102				X	X	
	NTC-SB-TSA092-0204				X	X	X
NTC-SB-TSA093	NTC-SB-TSA093-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA093-0102				X	X	
	NTC-SB-TSA093-0204				X	X	
NTC-SB-TSA094	NTC-SB-TSA094-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA094-0102				X	X	
	NTC-SB-TSA094-0204				X	X	X
NTC-SB-TSA095	NTC-SB-TSA095-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA095-0102				X	X	
	NTC-SB-TSA095-0204				X	X	

TABLE 1

SAMPLING SUMMARY
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS
PAGE 2 OF 4

Boring Number	Sample ID	Total Depth (feet bgs)	Drilling Method[1]	Date Drilled	Analyses		Asphalt Pieces Observed[2]
					Metals (As, Pb, Sb)	PAHs	
NTC-SB-TSA096	NTC-SB-TSA096-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA096-0102				X	X	
	NTC-SB-TSA096-0204				X	X	
NTC-SB-TSA097	NTC-SB-TSA097-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA097-0102				X	X	
	NTC-SB-TSA097-0204				X	X	
NTC-SB-TSA098	NTC-SB-TSA098-0001	4	DPT	14-Sep-11	X	X	
	NTC-SB-TSA098-0102				X	X	
	NTC-SB-TSA098-0204				X	X	
NTC-SB-TSA099	NTC-SB-TSA099-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA099-0102				X	X	
	NTC-SB-TSA099-0204				X	X	
NTC-SB-TSA100	NTC-SB-TSA100-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA100-0102				X	X	
	NTC-SB-TSA100-0204				X	X	X
NTC-SB-TSA101	NTC-SB-TSA101-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA101-0102				X	X	
	NTC-SB-TSA101-0204				X	X	
NTC-SB-TSA102	NTC-SB-TSA102-0001	5	DPT	13-Sep-11	X	X	
	NTC-SB-TSA102-0102				X	X	X
	NTC-SB-TSA102-0204				X	X	
NTC-SB-TSA103	NTC-SB-TSA103-0001	8	DPT	13-Sep-11	X	X	
	NTC-SB-TSA103-0203				X	X	
	NTC-SB-TSA103-0304				X	X	X
NTC-SB-TSA104	NTC-SB-TSA104-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA104-0102				X	X	
	NTC-SB-TSA104-0204				X	X	
NTC-SB-TSA105	NTC-SB-TSA105-0001	7	DPT	13-Sep-11	X	X	
	NTC-SB-TSA105-0102				X	X	X
	NTC-SB-TSA105-0204				X	X	
NTC-SB-TSA106	NTC-SB-TSA106-0001	3.5	DPT	13-Sep-11	X	X	
	NTC-SB-TSA106-0102				X	X	X
	NTC-SB-TSA106-0204				X	X	X
NTC-SB-TSA107	NTC-SB-TSA107-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA107-0102				X	X	
	NTC-SB-TSA107-0204				X	X	
NTC-SB-TSA108	NTC-SB-TSA108-0001	2	DPT	13-Sep-11	X	X	
	NTC-SB-TSA108-0102				X	X	
NTC-SB-TSA109	NTC-SB-TSA109-0001	5	DPT	13-Sep-11	X	X	
	NTC-SB-TSA109-0102				X	X	
	NTC-SB-TSA109-0204				X	X	X

TABLE 1

SAMPLING SUMMARY
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Boring Number	Sample ID	Total Depth (feet bgs)	Drilling Method[1]	Date Drilled	Analyses		Asphalt Pieces Observed[2]
					Metals (As, Pb, Sb)	PAHs	
NTC-SB-TSA110	NTC-SB-TSA110-0001	2	HA	12-Sep-11	X	X	
	NTC-SB-TSA110-0102				X	X	
NTC-SB-TSA111	NTC-SB-TSA111-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA111-0102				X	X	
	NTC-SB-TSA111-0204				X	X	
NTC-SB-TSA112	NTC-SB-TSA112-0001	2	DPT	13-Sep-11	X	X	
	NTC-SB-TSA112-0102				X	X	
NTC-SB-TSA113	NTC-SB-TSA113-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA113-0102				X	X	
	NTC-SB-TSA113-0204				X	X	
NTC-SB-TSA114	NTC-SB-TSA114-0001	2	DPT	13-Sep-11	X	X	
	NTC-SB-TSA114-0102				X	X	
NTC-SB-TSA115	NTC-SB-TSA115-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA115-0102				X	X	
	NTC-SB-TSA115-0204				X	X	
NTC-SB-TSA116	NTC-SB-TSA116-0001	2	HA	12-Sep-11	X	X	
	NTC-SB-TSA116-0102				X	X	
NTC-SB-TSA117	NTC-SB-TSA117-0001	3	DPT	13-Sep-11	X	X	
	NTC-SB-TSA117-0102				X	X	
	NTC-SB-TSA117-0204				X	X	
NTC-SB-TSA118	NTC-SB-TSA118-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA118-0102				X	X	
	NTC-SB-TSA118-0204				X	X	
NTC-SB-TSA119	NTC-SB-TSA119-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA119-0102				X	X	
	NTC-SB-TSA119-0204				X	X	
NTC-SB-TSA120	NTC-SB-TSA120-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA120-0102				X	X	
	NTC-SB-TSA120-0204				X	X	X
NTC-SB-TSA121	NTC-SB-TSA121-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA121-0102				X	X	
	NTC-SB-TSA121-0204				X	X	
NTC-SB-TSA122	NTC-SB-TSA122-0001	2	HA	12-Sep-11	X	X	
	NTC-SB-TSA122-0102				X	X	
NTC-SB-TSA123	NTC-SB-TSA123-0001	4	DPT	12-Sep-11	X	X	
	NTC-SB-TSA123-0102				X	X	
	NTC-SB-TSA123-0204				X	X	X
NTC-SB-TSA124	NTC-SB-TSA124-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA124-0102				X	X	
	NTC-SB-TSA124-0204				X	X	

TABLE 1

SAMPLING SUMMARY
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Boring Number	Sample ID	Total Depth (feet bgs)	Drilling Method[1]	Date Drilled	Analyses		Asphalt Pieces Observed[2]
					Metals (As, Pb, Sb)	PAHs	
NTC-SB-TSA125	NTC-SB-TSA125-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA125-0102				X	X	
	NTC-SB-TSA125-0204				X	X	X
NTC-SB-TSA126	NTC-SB-TSA126-0001	3	DPT	13-Sep-11	X	X	
	NTC-SB-TSA126-0102				X	X	X
	NTC-SB-TSA126-0203				X	X	
NTC-SB-TSA127	NTC-SB-TSA127-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA127-0102				X	X	
	NTC-SB-TSA127-0204				X	X	
NTC-SB-TSA128	NTC-SB-TSA128-0001	2	HA	12-Sep-11	X	X	
	NTC-SB-TSA128-0102				X	X	
NTC-SB-TSA129	NTC-SB-TSA129-0001	2	HA	12-Sep-11	X	X	
	NTC-SB-TSA129-0102				X	X	
NTC-SB-TSA130	NTC-SB-TSA130-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA130-0102				X	X	
	NTC-SB-TSA130-0204				X	X	X
NTC-SB-TSA131	NTC-SB-TSA131-0001	4	DPT	13-Sep-11	X	X	
	NTC-SB-TSA131-0102				X	X	
	NTC-SB-TSA131-0204				X	X	

Notes:
HA = Hand Auger, DPT = Direct Push Technology
bgs = below ground surface
1. Surface samples (0-1 feet) for soil boring locations TSA81 through TSA85 were collected in a previous investigation.
2. Bulk pieces of ashphalt were removed from samples via sifting after sample collection and prior to sampels being sent to the laboratory.

TABLE 2

QC SAMPLING SUMMARY
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

QC Sample Number	Description
NTC-FD091211-01	Duplicate of NTC-SB-TSA129-0102
NTC-FD091311-01	Duplicate of NTC-SB-TSA125-0204
NTC-FD091311-02	Duplicate of NTC-SB-TSA119-0204
NTC-FD091311-03	Duplicate of NTC-SB-TSA105-0204
NTC-FD091411-01	Duplicate of NTC-SB-TSA087-00204
NTC-FD091411-02	Duplicate of NTC-SB-TSA088-0204
NTC-FD091411-03	Duplicate of NTC-SB-TSA090-0204
NTC-RB091511-01	Rinsate Blank of Hand Auger Equipment
IDW	Composite of Boring Cuttings.

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-015 NTC-SS-TSA-015-0006 20100421 0 - 0.5	NTC-SO-TSA-016 NTC-SS-TSA-016-0006 20100421 0 - 0.5	NTC-SO-TSA-017 NTC-SS-TSA-017-0006 20100421 0 - 0.5	NTC-SO-TSA-018 NTC-SS-TSA-018-0006 20100421 0 - 0.5	NTC-SO-TSA-020 NTC-SS-TSA-020-0006 20100421 0 - 0.5	NTC-SO-TSA-021 NTC-SS-TSA-021-0006 20100421 0 - 0.5	NTC-SO-TSA-023 NTC-SS-TSA-023-0006 20100421 0 - 0.5
Metals (mg/kg)												
Antimony	31	TACO	0.27	Eco SSL	4	1.07 J	0.76 J	0.772 J	0.81 J	1.87 J	1.13 J	3.68 J
Arsenic	0.39	USEPA	18	Eco SSL	13	10.7 J	10.1 J	8.82 J	9.83 J	7.8 J	5.92 J	8.82 J
Lead	400	TACO	11	Eco SSL	36	**193**	**136**	**135**	**148**	**564**	**152**	**1310**
XRF (mg/kg)												
Lead	400	TACO	11	Eco SSL	36	**118**	**115.67**	**120.67**	**119.33**	**112**	**103.33**	**448.33**
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	15 UJ	37.4 J	14.9 UJ	48.2 J	4.2 J	3.87 J	12 J
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	15 UJ	58.5 J	14.9 UJ	72 J	4.68 J	4.54 J	14.5 J
Acenaphthene	4700000	TACO	29000	Eco SSL	130	34.2 J	141 J	14.9 UJ	35.1 J	3.09 J	5.45 J	4.74 J
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	15 UJ	56.9 J	14.9 UJ	14.9 UJ	11 J	7.98 J	10.6 J
Anthracene	23000000	TACO	29000	Eco SSL	400	103 J	379 J	104 J	115 J	20.2 J	18.5 J	36.5 J
Bap Equivalent[1]	90	TACO	1100	Eco SSL	2100	**2453.93**	**20279.6**	**5619.3**	**6957.18**	150.671	127.806	317.131
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	1160 J	**8340 J**	**3370 J**	**3900 J**	88.7 J	78.7 J	199 J
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	1810 J	**15100 J**	**4110 J**	**5110 J**	95.1 J	79.2 J	211 J
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	1020 J	**9560 J**	2070 J	**2260 J**	138 J	130 J	274 J
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	1470 J	**9470 J**	**3090 J**	**3460 J**	92.7 J	66.8 J	147 J
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	258 J	**2730 J**	547 J	462 J	49.7 J	38.3 J	102 J
Chrysene	88000	TACO	1100	Eco SSL	2700	1750 J	**13300 J**	**5830 J**	**6560 J**	104 J	93 J	211 J
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	360 J	**2790 J**	835 J	1070 J	21.9 J	19.2 J	40.1 J
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	862 J	4690 J	1260 J	1160 J	164 J	170 J	323 J
Fluorene	3100000	TACO	29000	Eco SSL	180	15 UJ	75.1 J	14.9 UJ	14.9 UJ	5.76 J	6.36 J	6.71 J
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	616 J	**5590 J**	1190 J	1500 J	104 J	80.6 J	175 J
Naphthalene	1600000	TACO	29000	Eco SSL	200	15 UJ	35.1 J	14.9 UJ	35.3 J	1.38 UJ	6.7 J	11.7 J
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	391 J	1990 J	527 J	574 J	72.9 J	95.2 J	114 J
Pyrene	2300000	TACO	1100	Eco SSL	3000	1160 J	**8060 J**	2420 J	2740 J	142 J	131 J	320 J

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-028 NTC-SS-TSA-028-0006 20100421 0 - 0.5	NTC-SO-TSA-030 NTC-SS-TSA-030-0006 20100421 0 - 0.5	NTC-SO-TSA-031 NTC-SS-TSA-031-0006 20100421 0 - 0.5	NTC-SO-TSA-038 NTC-SS-TSA-038-0006 20100421 0 - 0.5	NTC-SO-TSA-039 NTC-SS-TSA-039-0006 20100421 0 - 0.5	NTC-SO-TSA-041 NTC-SS-TSA-041-0006 20100421 0 - 0.5	NTC-SO-TSA-044 NTC-SS-TSA-044-0006 20100421 0 - 0.5
Metals (mg/kg)												
Antimony	31	TACO	0.27	Eco SSL	4	1.48 J	3.65 J	1.24 J	2.2 J	1.51 J	2.58 J	0.734 J
Arsenic	0.39	USEPA	18	Eco SSL	13	8.28 J	7.31 J	6.53 J	8.91 J	8.51 J	**19.6 J**	6.72 J
Lead	400	TACO	11	Eco SSL	36	**295**	**1460**	**368**	**577**	**357**	**245**	**186**
XRF (mg/kg)												
Lead	400	TACO	11	Eco SSL	36	**116**	**468.33**	**163**	**111.33**	**103**	**143.67**	**129.67**
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	9.29 J	7.44 J	2.69 J	12.7 J	14.5 J	7.06 UJ	2.4 J
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	9.35 J	9.34 J	3.03 J	12.1 J	15.2 J	7.06 UJ	2.52 J
Acenaphthene	4700000	TACO	29000	Eco SSL	130	2.69 J	5.34 J	1.7 J	2.63 J	4.62 J	7.06 UJ	1.72 J
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	9.46 J	13.5 J	4.03 J	6.64 J	11.4 J	21.1 J	2.22 J
Anthracene	23000000	TACO	29000	Eco SSL	400	16 J	22 J	8.68 J	14.6 J	27.1 J	56.2 J	8.37 J
Bap Equivalent[(1)]	90	TACO	1100	Eco SSL	2100	154.355	182.279	79.8617	127.1173	215.553	562.705	23.4331
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	86.5 J	92 J	41.5 J	73.8 J	133 J	474 J	20.2 J
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	99.3 J	116 J	51.6 J	81.4 J	139 J	358 J	17.7 J
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	145 J	163 J	73.3 J	115 J	187 J	475 J	28.5 J
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	84.7 J	95.4 J	44.6 J	64.9 J	105 J	239 J	1.33 UJ
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	46.2 J	57.5 J	26.2 J	37.7 J	70.1 J	174 J	10.9 J
Chrysene	88000	TACO	1100	Eco SSL	2700	103 J	104 J	49.7 J	90.3 J	152 J	565 J	22.6 J
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	21.4 J	29.1 J	11 J	19.1 J	31.4 J	81.7 J	1.33 UJ
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	144 J	156 J	78 J	132 J	238 J	589 J	51.5 J
Fluorene	3100000	TACO	29000	Eco SSL	180	4.77 J	6.56 J	2.13 J	3.94 J	6.29 J	7.06 UJ	3.22 J
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	99.4 J	110 J	54.7 J	72.7 J	123 J	258 J	1.33 UJ
Naphthalene	1600000	TACO	29000	Eco SSL	200	4.24 J	1.41 UJ	1.42 UJ	4.31 J	6.64 J	7.06 UJ	1.33 UJ
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	61.3 J	78.8 J	30.1 J	76.4 J	105 J	179 J	43.3 J
Pyrene	2300000	TACO	1100	Eco SSL	3000	129 J	138 J	68.9 J	119 J	211 J	532 J	36.5 J

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-050 NTC-SS-TSA-050-0006 20100421 0 - 0.5	NTC-SO-TSA-051 NTC-SS-TSA-051-0006 20100421 0 - 0.5	NTC-SO-TSA-052 NTC-SS-TSA-052-0006 20100421 0 - 0.5	NTC-SO-TSA-053 NTC-SS-TSA-053-0006 20100421 0 - 0.5	NTC-SO-TSA-059 NTC-SS-TSA-059-0006 20100421 0 - 0.5	NTC-SO-TSA-060 NTC-SS-TSA-060-0006 20100421 0 - 0.5	NTC-SO-TSA-080 NTC-SS-TSA080-0001 20110914 0 - 1
Metals (mg/kg)												
Antimony	31	TACO	0.27	Eco SSL	4	1.6 J	1.79 J	2.46 J	0.943 J	0.641 J	0.804 J	1.38 UJ
Arsenic	0.39	USEPA	18	Eco SSL	13	8.62 J	7.23 J	9 J	5.58 J	8.51 J	9.5 J	9.05
Lead	400	TACO	11	Eco SSL	36	**204**	**161**	**408**	**200**	**127**	**139**	**76.6**
XRF (mg/kg)												
Lead	400	TACO	11	Eco SSL	36	**171.33**	**165.33**	**210.33**	**143.67**	**142.33**	**146.33**	NA
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	6.37 J	6.17 J	6.67 UJ	12.4 J	31 J	2.91 J	20.2 J
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	8.42 J	7.75 J	6.67 UJ	18 J	51.4 J	3.45 J	21.6 J
Acenaphthene	4700000	TACO	29000	Eco SSL	130	13.6 J	13.4 J	6.67 UJ	4.34 J	118 J	2.34 J	42.6 J
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	12.9 J	15.7 J	27 J	12.4 J	13.7 UJ	5.92 J	47.8 J
Anthracene	23000000	TACO	29000	Eco SSL	400	66.9 J	60.8 J	40.8 J	1.33 UJ	251 J	11.9 J	147
Bap Equivalent[(1)]	90	TACO	1100	Eco SSL	2100	525.131	484.164	537.843	183.636	**13158.6**	121.7988	1219.988
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	338 J	272 J	401 J	129 J	**6800 J**	59.1 J	672
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	337 J	315 J	340 J	104 J	**9860 J**	76 J	831
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	450 J	392 J	463 J	192 J	**5590 J**	122 J	960
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	248 J	243 J	254 J	101 J	**6010 J**	64.1 J	803
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	166 J	154 J	176 J	60.3 J	1380 J	40.4 J	421
Chrysene	88000	TACO	1100	Eco SSL	2700	371 J	324 J	483 J	133 J	**11800 J**	74.8 J	878
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	77.6 J	74.5 J	80.9 J	34.8 J	**1720 J**	19.6 J	155
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	651 J	558 J	552 J	399 J	2930 J	121 J	1220
Fluorene	3100000	TACO	29000	Eco SSL	180	12.4 J	16 J	6.67 UJ	19.3 J	75.1 J	3.62 J	42.3 J
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	297 J	264 J	283 J	120 J	**3140 J**	76.1 J	657
Naphthalene	1600000	TACO	29000	Eco SSL	200	7.79 J	6.49 J	6.67 UJ	21.3 J	44.1 J	1.52 UJ	22.2 J
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	241 J	289 J	195 J	369 J	1280 J	45.5 J	641
Pyrene	2300000	TACO	1100	Eco SSL	3000	573 J	456 J	435 J	212 J	**4620 J**	103 J	1160

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-086 NTC-SS-TSA086-0001 20110913 0 - 1	NTC-SO-TSA-087 NTC-SS-TSA087-0001 20110914 0 - 1	NTC-SO-TSA-088 NTC-SS-TSA088-0001 20110914 0 - 1	NTC-SO-TSA-089 NTC-SS-TSA089-0001 20110914 0 - 1	NTC-SO-TSA-090 NTC-SS-TSA090-0001 20110914 0 - 1	NTC-SO-TSA-091 NTC-SS-TSA091-0001 20110914 0 - 1	NTC-SO-TSA-092 NTC-SS-TSA092-0001 20110914 0 - 1
Metals (mg/kg)												
Antimony	31	TACO	0.27	Eco SSL	4	1.44 UJ	1.36 UJ	2.8 J	1.7 UJ	1.41 UJ	1.41 UJ	1.38 UJ
Arsenic	0.39	USEPA	18	Eco SSL	13	8.2	6.89	9.84	8.77	8.38	7.78	7.73
Lead	400	TACO	11	Eco SSL	36	**93.3**	23.2	21.4	20.7 J	21.9 J	16.4 J	16.2 J
XRF (mg/kg)												
Lead	400	TACO	11	Eco SSL	36	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	13 J	3.21 J	3.79 J	2.24 U	4.65 J	1.81 U	1.81 U
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	16.7 J	3.87 J	3.24 J	2.24 U	6.2 J	1.81 U	1.98 J
Acenaphthene	4700000	TACO	29000	Eco SSL	130	27.7	3.96 J	1.84 U	2.24 U	1.81 U	1.81 U	1.81 U
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	7.33 J	2.76 J	1.84 U	2.24 U	1.81 U	1.81 U	1.81 U
Anthracene	23000000	TACO	29000	Eco SSL	400	77.5	12.3	3.97 J	2.24 U	3.94 J	1.81 U	2.89 J
Bap Equivalent[(1)]	90	TACO	1100	Eco SSL	2100	444.872	82.9573	35.0312	2.77148	53.4888	11.9945	25.0677
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	275	63.8	26.5	2.92 J	27.7	6.83 J	14.2
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	308	61.4	27.1	2.24 U	37	8.53	20.1
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	336	90.1	28.8	2.24 U	40.9	12.3	24.2
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	277	44.3	28.8	2.24 U	31.7	9	16.3
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	142	30.1	9.19	2.24 U	16.4	5.49 J	11.4
Chrysene	88000	TACO	1100	Eco SSL	2700	352	71.3	49.3	4.28 J	34.8	11.6	18.2
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	56.4	1.77 U	1.84 U	2.24 U	7.62	1.81 U	1.81 U
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	539	131	36.2	7.36 J	60.2	16	30.8
Fluorene	3100000	TACO	29000	Eco SSL	180	33.1	5.01 J	1.84 U	2.24 U	1.81 U	1.81 U	1.81 U
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	176	49.1	13.4	2.24 U	18.1	5.8 J	1.81 U
Naphthalene	1600000	TACO	29000	Eco SSL	200	32 J	3.48 J	2.6 J	2.24 U	3.88 J	1.81 U	2.46 J
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	379	50.2	33.1	7.28 J	29.2	8.31	13.5
Pyrene	2300000	TACO	1100	Eco SSL	3000	501	122	34.6	2.24 U	53.2	13.7	29.2

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-093 NTC-SS-TSA093-0001 20110913 0 - 1	NTC-SO-TSA-094 NTC-SS-TSA094-0001 20110914 0 - 1	NTC-SO-TSA-095 NTC-SS-TSA095-0001 20110914 0 - 1	NTC-SO-TSA-096 NTC-SS-TSA096-0001 20110914 0 - 1	NTC-SO-TSA-097 NTC-SS-TSA097-0001 20110914 0 - 1	NTC-SO-TSA-098 NTC-SS-TSA098-0001 20110914 0 - 1	NTC-SO-TSA-099 NTC-SS-TSA099-0001 20110913 0 - 1
Metals (mg/kg)												
Antimony	31	TACO	0.27	Eco SSL	4	1.4 UJ	1.35 UJ	1.34 UJ	1.6 UJ	1.37 UJ	1.36 UJ	1.42 UJ
Arsenic	0.39	USEPA	18	Eco SSL	13	6.9	7.45	7.43	7.99	7.9	9.16	7.43
Lead	400	TACO	11	Eco SSL	36	19.5 J	15.5 J	19.2 J	17.2 J	17.5 J	17.3 J	13 J
XRF (mg/kg)												
Lead	400	TACO	11	Eco SSL	36	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	1.87 U	3.63 J	6.65 J	2.99 J	5.76 J	1.83 U	1.88 U
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	2.34 J	4.73 J	7.29 J	3.48 J	7.02 J	1.83 U	2.1 J
Acenaphthene	4700000	TACO	29000	Eco SSL	130	1.87 U	1.84 U	1.85 U	2.12 U	2.21 J	1.83 U	1.88 U
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	1.87 U	1.84 U	1.85 U	2.12 U	1.85 U	1.83 U	1.88 U
Anthracene	23000000	TACO	29000	Eco SSL	400	2.75 J	3.2 J	1.85 U	2.5 J	6.01 J	1.83 U	1.88 U
Bap Equivalent[(1)]	90	TACO	1100	Eco SSL	2100	22.30465	20.9512	20.4453	15.4037	34.09	10.1826	4.48646
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	13.6	13.1	12.7	14.2	31.4	7.23 J	3.42 J
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	17.3	14.7	15.6	10.4	21	7.17 J	2.85 J
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	25.9	21.1	18.3	15.6	33	12.3	1.88 U
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	15.4	1.84 U	13.6	9.76	16.6	6.97 J	4.63 J
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	1.87 U	9.63	7.19 J	6.86 J	11.1	4.08 J	1.88 U
Chrysene	88000	TACO	1100	Eco SSL	2700	16.8	14.9	15.4	17.1	39	12.3	6.06 J
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	1.87 U	1.84 U	1.85 U	2.12 U	4.8 J	1.83 U	1.88 U
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	29.4	31	26.9	21	57.7	12.9	5.61 J
Fluorene	3100000	TACO	29000	Eco SSL	180	1.87 U	2.13 J	2.17 J	2.12 U	2.43 J	1.83 U	1.88 U
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	1.87 U	18	7.33 J	8.78	17	1.83 U	2.45 J
Naphthalene	1600000	TACO	29000	Eco SSL	200	2.22 J	1.84 U	4.68 J	2.5 J	1.85 U	1.96 J	1.88 U
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	14.3	20.7	17.9	12.8	29.8	6.38 J	5.28 J
Pyrene	2300000	TACO	1100	Eco SSL	3000	25.7	28.9	22.3	16.6	50	11.5	4.77 J

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-100 NTC-SS-TSA100-0001 20110913 0 - 1	NTC-SO-TSA-101 NTC-SS-TSA101-0001 20110913 0 - 1	NTC-SO-TSA-102 NTC-SS-TSA102-0001 20110913 0 - 1	NTC-SO-TSA-103 NTC-SS-TSA103-0001 20110913 0 - 1	NTC-SO-TSA-104 NTC-SS-TSA104-0001 20110913 0 - 1	NTC-SO-TSA-105 NTC-SS-TSA105-0001 20110913 0 - 1	NTC-SO-TSA-106 NTC-SS-TSA106-0001 20110913 0 - 1
Metals (mg/kg)												
Antimony	31	TACO	0.27	Eco SSL	4	1.36 UJ	1.37 UJ	1.37 UJ	1.4 UJ	1.34 UJ	1.38 UJ	1.38 UJ
Arsenic	0.39	USEPA	18	Eco SSL	13	8.45	4.72	6.11	8.3	7.89	6.03	8.98
Lead	400	TACO	11	Eco SSL	36	31.1 J	32.6 J	33.6 J	**44.7 J**	26.3 J	22.8 J	**36.6**
XRF (mg/kg)												
Lead	400	TACO	11	Eco SSL	36	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	11.4	4.61 J	19.5	18.9	11.2	120	58.4 J
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	13.2	8.35	23.5	25.3	14.1	107	50.7 J
Acenaphthene	4700000	TACO	29000	Eco SSL	130	15.3	7.85	63.4	38.3	21.2	144	64.6 J
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	9.06	1.89 U	10.5	6.95 J	5.1 J	18 U	17.9 U
Anthracene	23000000	TACO	29000	Eco SSL	400	52.5	28	199	106	91.7	248	120 J
Bap Equivalent[(1)]	90	TACO	1100	Eco SSL	2100	325.548	163.4544	917.966	634.131	573.652	1045.143	903.324
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	192	92.7	792	471	500	793	658
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	219	111	609	426	377	691	589
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	292	144	845	600	532	893	698
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	153	75	327	231	214	483	448
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	134	57.7	328	244	225	325	319
Chrysene	88000	TACO	1100	Eco SSL	2700	208	97.4	786	491	502	893	734
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	38.7	21.1	102	73	65.6	127	126 J
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	426	211	1560	937	846	1980	1440
Fluorene	3100000	TACO	29000	Eco SSL	180	18	7.4 J	61.7	40	29.1	161	72.2 J
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	179	70.1	392	251	251	544	488
Naphthalene	1600000	TACO	29000	Eco SSL	200	13.1	9.61	32.9	22.6	12.6	179	66.8 J
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	197	95.9	804	488	424	2010	1120
Pyrene	2300000	TACO	1100	Eco SSL	3000	374	177	1320	771	699	1810	1310

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-107 NTC-SS-TSA107-0001 20110913 0 - 1	NTC-SO-TSA-108 NTC-SS-TSA108-0001 20110913 0 - 1	NTC-SO-TSA-109 NTC-SS-TSA109-0001 20110913 0 - 1	NTC-SO-TSA-110 NTC-SS-TSA110-0001 20110912 0 - 1	NTC-SO-TSA-111 NTC-SS-TSA111-0001 20110913 0 - 1	NTC-SO-TSA-112 NTC-SS-TSA112-0001 20110913 0 - 1	NTC-SO-TSA-113 NTC-SS-TSA113-0001 20110913 0 - 1
Metals (mg/kg)												
Antimony	31	TACO	0.27	Eco SSL	4	1.61 J	1.26 UJ	3.24 J	1.28 UJ	1.84 UJ	1.54 UJ	2.25 J
Arsenic	0.39	USEPA	18	Eco SSL	13	6.84	5.7	5.2	6.05	8.87	7	5.74
Lead	400	TACO	11	Eco SSL	36	**203**	**71.3**	**324**	**77.4**	**108**	31.9	**306**
XRF (mg/kg)												
Lead	400	TACO	11	Eco SSL	36	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	16.5 U	6.52 J	31.7 J	8.66	24.1 U	2 U	17.3 U
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	16.5 U	7.85	50.2 J	13.3	24.1 U	2.68 J	17.3 U
Acenaphthene	4700000	TACO	29000	Eco SSL	130	27.1 J	38.5	19.5 J	7.46	56.5 J	6.22 J	17.3 U
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	16.5 U	5.47 J	18.3 U	5.41 J	33 J	3.03 J	17.3 U
Anthracene	23000000	TACO	29000	Eco SSL	400	74.5	79.3	45.4 J	22.5	141	17.9	17.3 U
Bap Equivalent[(1)]	90	TACO	1100	Eco SSL	2100	426.55	454.908	231.643	140.925	954.818	122.3713	69.493
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	337	325	165	120	554	92.4	36.3 J
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	268	299	170	92.7	634	79.8	47.4 J
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	338	395	210	114	768	105	54.6 J
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	251	195	134	59.4 J	433	72.4	49.3 J
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	141	169	83.9	45.2	329	42.2	26.3 J
Chrysene	88000	TACO	1100	Eco SSL	2700	340	318	154	133	628	99.3	40 J
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	62.2 J	58.9	18.3 U	17.7	139	14.8	17.3 U
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	598	648	326	172	1080	164	74.4
Fluorene	3100000	TACO	29000	Eco SSL	180	24 J	30.8	18.3 U	7.09	48.6 J	5.66 J	17.3 U
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	271	230	140	65.4	457	75.1	40.5 J
Naphthalene	1600000	TACO	29000	Eco SSL	200	16.5 U	9.7	102	8.04	30.6 J	4.01 J	17.3 U
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	281	335	190	90.2	601	73.1	41.2 J
Pyrene	2300000	TACO	1100	Eco SSL	3000	511	546	276	146	952	145	63.6 J

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-114 NTC-SS-TSA114-0001 20110913 0 - 1	NTC-SO-TSA-115 NTC-SS-TSA115-0001 20110913 0 - 1	NTC-SO-TSA-116 NTC-SS-TSA116-0001 20110912 0 - 1	NTC-SO-TSA-117 NTC-SS-TSA117-0001 20110913 0 - 1	NTC-SO-TSA-118 NTC-SS-TSA118-0001 20110913 0 - 1	NTC-SO-TSA-119 NTC-SS-TSA119-0001 20110913 0 - 1	NTC-SO-TSA-120 NTC-SS-TSA120-0001 20110913 0 - 1
Metals (mg/kg)												
Antimony	31	TACO	0.27	Eco SSL	4	1.28 J	1.64 UJ	1.23 UJ	2.49 J	1.34 UJ	1.45 UJ	2.13 J
Arsenic	0.39	USEPA	18	Eco SSL	13	7.48	8.86	4.11	6.26	9.32	7.28	7.52
Lead	400	TACO	11	Eco SSL	36	**191**	**93.3**	**83.2 J**	**149 J**	24.8 J	14.6 J	**284 J**
XRF (mg/kg)												
Lead	400	TACO	11	Eco SSL	36	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	8.87	10.1	1.65 U	17.9	18.1 U	1.9 U	2.01 J
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	13.2	10.5	2.32 J	21.7	18.1 U	1.9 U	3.1 J
Acenaphthene	4700000	TACO	29000	Eco SSL	130	7.11	20	1.65 U	119	18.1 U	1.9 U	2.51 J
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	4.23 J	6.55 J	1.65 U	58.9	18.1 U	1.9 U	1.91 U
Anthracene	23000000	TACO	29000	Eco SSL	400	30.5	84.6	3.03 J	586	46.6 J	1.9 U	8.92
Bap Equivalent[(1)]	90	TACO	1100	Eco SSL	2100	266.955	547.569	31.6405	**2921.47**	300.918	6.0427	62.9205
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	266	468	20.9	**2090**	197	8.13	35.5
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	169	355	20.1	1900	195	1.9 U	39.4
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	243	504	29.9	**2760**	260	1.9 U	58.7
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	114	246	17 J	1240	161	16.6	33.2
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	89.2	172	11.3	952	91	1.9 U	23.2
Chrysene	88000	TACO	1100	Eco SSL	2700	263	449	27.5	1950	208	21.2	38.5
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	33.1	66	4.59 J	382	41.2 J	3.37 J	10.5
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	370	789	41.5	4720	324	12.8	80.2
Fluorene	3100000	TACO	29000	Eco SSL	180	10.3	26.5	1.65 U	133	18.1 U	1.9 U	1.91 U
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	128	272	17.3	1430	179	7.84	33.3
Naphthalene	1600000	TACO	29000	Eco SSL	200	6.15 J	15.9	1.65 U	39.8	18.1 U	1.9 U	1.91 U
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	162	370	18.8	1990	170	8.19	38.5
Pyrene	2300000	TACO	1100	Eco SSL	3000	297	669	34.4	**3230**	280	13.1	65.5

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-121 NTC-SS-TSA121-0001 20110913 0 - 1	NTC-SO-TSA-122 NTC-SS-TSA122-0001 20110912 0 - 1	NTC-SO-TSA-123 NTC-SS-TSA123-0001 20110913 0 - 1	NTC-SO-TSA-124 NTC-SS-TSA124-0001 20110913 0 - 1	NTC-SO-TSA-125 NTC-SS-TSA125-0001 20110913 0 - 1	NTC-SO-TSA-126 NTC-SS-TSA126-0001 20110913 0 - 1	NTC-SO-TSA-127 NTC-SS-TSA127-0001 20110913 0 - 1
Metals (mg/kg)												
Antimony	31	TACO	0.27	Eco SSL	4	**4.51 J**	1.25 UJ	1.4 UJ	1.38 UJ	1.4 UJ	1.43 UJ	1.36 UJ
Arsenic	0.39	USEPA	18	Eco SSL	13	7.12	3.29	7.5	8.12 J	6.35 J	6.43 J	6.57 J
Lead	400	TACO	11	Eco SSL	36	**365 J**	**74.2 J**	34.2 J	**47.6**	**81**	**53.9**	**66.7**
XRF (mg/kg)												
Lead	400	TACO	11	Eco SSL	36	NA	NA	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	25.5 U	1.66 U	18.7	2.09 J	89.6 U	1.83 U	14.4
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	25.5 U	1.66 U	22.3	2.41 J	89.6 U	1.83 U	16.4
Acenaphthene	4700000	TACO	29000	Eco SSL	130	25.5 U	1.66 U	28.8	5.02 J	89.6 U	1.83 U	20.4
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	25.5 U	1.66 U	5.99 J	2.65 J	89.6 U	2.14 J	10.1
Anthracene	23000000	TACO	29000	Eco SSL	400	49.3 J	1.66 U	173	22.5	89.6 U	3.54 J	82.1
Bap Equivalent[(1)]	90	TACO	1100	Eco SSL	2100	346.503	13.0864	821.073	280.958	397.607	32.2336	642.063
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	288	10.1	578	184	254 J	22.6	498
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	219	8.96	539	180	273 J	19.4	412
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	303	13.7	838	272	333 J	28.6	604
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	191	9.02 J	396	134	189 J	24.8	269
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	109	5.56 J	277	103	163 J	9.37	205
Chrysene	88000	TACO	1100	Eco SSL	2700	313	13.8	603	228	277 J	29.9	513
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	48.7 J	1.66 U	92.8	38.2	89.6 U	5.62 J	86.7
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	478	19.8	1500	433	488	31.4	873
Fluorene	3100000	TACO	29000	Eco SSL	180	25.5 U	1.66 U	34.8	6.2 J	89.6 U	1.83 U	22.3
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	183	8.47	443	159	192 J	19.7	306
Naphthalene	1600000	TACO	29000	Eco SSL	200	25.5 U	1.66 U	8.55	1.81 U	89.6 U	1.84 J	13.7
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	213	10.2	758	150	223 U	13.8	364
Pyrene	2300000	TACO	1100	Eco SSL	3000	426	16.7	1170	350	417	27.4	737

TABLE 3

SURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	FEDERAL ECOLOGICAL MINIMUM OF AVIAN INVERTEBRATE MAMMALIAN & PLANT SSLs	ECOLOGICAL REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-128 NTC-SS-TSA128-0001 20110912 0 - 1	NTC-SO-TSA-129 NTC-SS-TSA129-0001 20110912 0 - 1	NTC-SO-TSA-130 NTC-SS-TSA130-0001 20110913 0 - 1	NTC-SO-TSA-131 NTC-SS-TSA131-0001 20110913 0 - 1
Metals (mg/kg)									
Antimony	31	TACO	0.27	Eco SSL	4	1.27 UJ	1.71 J	1.46 UJ	1.66 UJ
Arsenic	0.39	USEPA	18	Eco SSL	13	6.25 J	5.66 J	8.18 J	10.3 J
Lead	400	TACO	11	Eco SSL	36	**172**	**213**	**51.7**	**157**
XRF (mg/kg)									
Lead	400	TACO	11	Eco SSL	36	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (ug/kg)									
1-Methylnaphthalene	5500000	NONTACO	29000	Eco SSL	NC	2.36 J	1.62 U	4.06 J	3.5 J
2-Methylnaphthalene	310000	PROPOSED TACO	29000	Eco SSL	140	2.79 J	1.94 J	5.44 J	4.33 J
Acenaphthene	4700000	TACO	29000	Eco SSL	130	3.88 J	1.62 U	3.4 J	3.35 J
Acenaphthylene	2300000	TACO	29000	Eco SSL	70	4.1 J	1.94 J	2.55 J	2.24 J
Anthracene	23000000	TACO	29000	Eco SSL	400	14	3.64 J	11.2	13.7
Bap Equivalent[(1)]	90	TACO	1100	Eco SSL	2100	152.858	35.2996	110.7209	97.6191
Benzo(a)anthracene	900	TACO	1100	Eco SSL	1800	129	24.8	77.6	74.5
Benzo(a)pyrene	90	TACO	1100	Eco SSL	2100	99.2	22.1	69.9	60.4
Benzo(b)fluoranthene	900	TACO	1100	Eco SSL	2100	139	34.2	107	89.4
Benzo(g,h,i)perylene	2300000	TACO	1100	Eco SSL	1700	67.2 J	15.8 J	57.6	52.2
Benzo(k)fluoranthene	9000	TACO	1100	Eco SSL	1700	60.6	13.9	37.5	37.7
Chrysene	88000	TACO	1100	Eco SSL	2700	142	30.6	85.9	82.1
Dibenzo(a,h)anthracene	90	TACO	1100	Eco SSL	420	18.5	5.51 J	15.8	15.2
Fluoranthene	3100000	TACO	29000	Eco SSL	4100	209	46.4	140	135
Fluorene	3100000	TACO	29000	Eco SSL	180	3.8 J	1.62 U	3.6 J	5.95 J
Indeno(1,2,3-cd)pyrene	900	TACO	1100	Eco SSL	1600	76.1	16.2	61	51.7
Naphthalene	1600000	TACO	29000	Eco SSL	200	4.2 J	1.62 U	5.44 J	5.19 J
Phenanthrene	2300000	TACO	29000	Eco SSL	2500	66	21.4	55.7	64.3
Pyrene	2300000	TACO	1100	Eco SSL	3000	174	36.9	114	103

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-080		NTC-SO-TSA-081	NTC-SO-TSA-082		NTC-SO-TSA-083		NTC-SO-TSA-084	
SAMPLE ID				NTC-SB-TSA080-0102	NTC-SB-TSA080-0203	NTC-SB-TSA081-0102	NTC-SB-TSA082-0102	NTC-SB-TSA082-0203	NTC-SB-TSA083-0102	NTC-SB-TSA083-0203	NTC-SB-TSA084-0102	NTC-SB-TSA084-0204
SAMPLE DATE				20110914	20110914	20110914	20110914	20110914	20110914	20110914	20110914	20110914
DEPTH (FEET BGS)				1 - 2	2 - 3	1 - 2	1 - 2	2 - 3	1 - 2	2 - 3	1 - 2	2 - 4
Metals (mg/kg)												
Antimony	31	TACO	4	1.71 UJ	1.39 UJ	1.32 UJ	1.32 UJ	1.36 UJ	1.33 UJ	1.33 UJ	1.36 UJ	1.34 UJ
Arsenic	0.39	USEPA	13	6.33	7.99	8.6	5.48	5.59	9.02	9.55	9.47	7.61
Lead	400	TACO	36	22.9	**78.4**	**117**	24.4	34	**63.7**	**110**	**169**	**137**
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	NC	5.05 J	52.8 J	88.3 U	17.7 U	8.31 J	17.9 U	41 J	17.7 U	33.3 J
2-Methylnaphthalene	310000	PROPOSED TACO	140	5.46 J	61.3 J	88.3 U	17.7 U	9.17 J	25.5 J	58.5 J	17.7 U	37.1 J
Acenaphthene	4700000	TACO	130	11.8	91	88.3 U	27.7 J	7.88	36.1 J	54.7 J	36.8 J	86.7
Acenaphthylene	2300000	TACO	70	5.84 J	18.7 U	88.3 U	17.7 U	3.51 J	28.7 J	23.5 J	25.5 J	23.9 J
Anthracene	23000000	TACO	400	26.6	210	235 J	44.5 J	23	91.2	198	138	281
Bap Equivalent [1]	90	TACO	2100	138.443	872.408	**4526.51**	**3011.33**	321.387	**2368.81**	**3905.32**	1810.35	1681.17
Benzo(a)anthracene	900	TACO	1800	99.3	575	**2010 J**	1590	178	936	1760	1000	1460
Benzo(a)pyrene	90	TACO	2100	90.5	601	**3930 J**	**2120**	230	1810	**2860**	1280	1300
Benzo(b)fluoranthene	900	TACO	2100	126	878	**2120 J**	1380	194	1260	1930	1180	1410
Benzo(g,h,i)perylene	2300000	TACO	1700	84.5	438	**3960 J**	**1780**	163	1300	**2220**	795	885
Benzo(k)fluoranthene	9000	TACO	1700	49.9	257	739 J	397	71.6	363	559	485	534
Chrysene	88000	TACO	2700	104	638	**2970 J**	**3060**	291	1480	**2730**	1700	1830
Dibenzo(a,h)anthracene	90	TACO	420	17	78.7	88.3 U	**504**	43.8	273	**566**	251	18 U
Fluoranthene	3100000	TACO	4100	205	1400	2150 J	702	222 U	841	1750	1410	2560
Fluorene	3100000	TACO	180	10.1	85.4	88.3 U	17.7 U	7.75	31.4 J	59.3 J	61.6 J	69.4 J
Indeno(1,2,3-cd)pyrene	900	TACO	1600	78.1	442	1290 J	833	93.8	611	1020	548	780
Naphthalene	1600000	TACO	200	2.24 U	46.2 J	88.3 U	17.7 U	7.97 J	20.4 J	40 J	17.7 U	36 J
Phenanthrene	2300000	TACO	2500	96.9	959	1130 J	254	117 U	460	985	585	1110
Pyrene	2300000	TACO	3000	178	1160	2680 J	1040	221	1210	2220	1300	2280

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-085	NTC-SO-TSA-086		NTC-SO-TSA-087			NTC-SO-TSA-088	
SAMPLE ID				NTC-SB-TSA085-0102	NTC-SB-TSA086-0102	NTC-SB-TSA086-0204	NTC-SB-TSA087-0102	NTC-SB-TSA087-0204	NTC-SB-TSA087-0204-D	NTC-SB-TSA088-0102	NTC-SB-TSA088-0204
SAMPLE DATE				20110914	20110913	20110913	20110914	20110914	20110914	20110914	20110914
DEPTH (FEET BGS)				1 - 2	1 - 2	2 - 4	1 - 2	2 - 4	2 - 4	1 - 2	2 - 4
Metals (mg/kg)											
Antimony	31	TACO	4	1.41 UJ	1.4 UJ	1.41 UJ	1.37 UJ	0.83 J	1.41 U	1.28 UJ	0.827 J
Arsenic	0.39	USEPA	13	7.59	7.19	7.3	7.97	10.5	7.97	7.31	9.19
Lead	400	TACO	36	33	**37.4**	**121**	**51.7**	**101**	**104**	31.5	**110**
Polycyclic Aromatic Hydrocarbons (ug/kg)											
1-Methylnaphthalene	5500000	NONTACO	NC	17.9 U	9.74 J	42.6 J	17.7 U	12.1 J	10.4	18.7 J	29.3 J
2-Methylnaphthalene	310000	PROPOSED TACO	140	17.9 U	12.5 J	46.5 J	22.1 J	16.3 J	13.1	26 J	35 J
Acenaphthene	4700000	TACO	130	18.1 J	22.7	**139**	40.5 J	61.8 J	27 J	23.6 J	39.3 J
Acenaphthylene	2300000	TACO	70	17.9 U	11.3	28 J	17.9 J	9.08	14.1	26.1 J	23.9 J
Anthracene	23000000	TACO	400	40.3 J	71.4	356	95	166 J	69 J	65.7	124 J
Bap Equivalent [1]	90	TACO	2100	1202.008	253.167	1497.437	1838.92	850.784	459.79	1513.73	1090.109
Benzo(a)anthracene	900	TACO	1800	355	195	937	826	568 J	320 J	732	602
Benzo(a)pyrene	90	TACO	2100	1080	164	982	1300	589 J	301 J	1110	734
Benzo(b)fluoranthene	900	TACO	2100	465	253	1330	1260	772 J	368 J	728	887
Benzo(g,h,i)perylene	2300000	TACO	1700	990	109	699	953	412	268	850	600
Benzo(k)fluoranthene	9000	TACO	1700	150	84.7	566	357	281 J	133 J	167	366
Chrysene	88000	TACO	2700	558	220	977	1250	574	360	1160	649
Dibenzo(a,h)anthracene	90	TACO	420	17.9 U	32.1	211	263	86	63.2	211	144 J
Fluoranthene	3100000	TACO	4100	298	467	2360	1200	1290 J	541 J	496	1220
Fluorene	3100000	TACO	180	17.9 U	31.1	142	31.6 J	60.1 J	23.4 J	16.1 U	37.3 J
Indeno(1,2,3-cd)pyrene	900	TACO	1600	290	112	711	625	384	251	439	589
Naphthalene	1600000	TACO	200	17.9 U	20 J	85.6 J	22.1 J	25.1 J	12.9	17.6 J	31.8 J
Phenanthrene	2300000	TACO	2500	161 U	356	1540	479	706 J	296 J	291	614 J
Pyrene	2300000	TACO	3000	384	389	1960	1190	1100 J	465 J	894	1080

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-089		NTC-SO-TSA-090		NTC-SO-TSA-091		NTC-SO-TSA-092	
SAMPLE ID				NTC-SB-TSA089-0102	NTC-SB-TSA089-0204	NTC-SB-TSA090-0102	NTC-SB-TSA090-0204	NTC-SB-TSA091-0102	NTC-SB-TSA091-0204	NTC-SB-TSA092-0102	NTC-SB-TSA092-0204
SAMPLE DATE				20110914	20110914	20110914	20110914	20110914	20110914	20110914	20110914
DEPTH (FEET BGS)				1 - 2	2 - 4	1 - 2	2 - 4	1 - 2	2 - 4	1 - 2	2 - 4
Metals (mg/kg)											
Antimony	31	TACO	4	1.38 UJ	1.53 UJ	1.37 UJ	0.348 J	1.36 UJ	1.39 UJ	1.43 UJ	1.39 UJ
Arsenic	0.39	USEPA	13	7.59	8.24	8.49	8.66	7.36	7.44	6.99	6.75
Lead	400	TACO	36	35.1 J	**81.2 J**	**41 J**	26.9 J	30.3 J	24 J	17.2 J	24.1 J
Polycyclic Aromatic Hydrocarbons (ug/kg)											
1-Methylnaphthalene	5500000	NONTACO	NC	18.6 U	19.9 U	18.7 U	3.51 J	4.82 J	2.48 J	1.86 U	18.8 U
2-Methylnaphthalene	310000	PROPOSED TACO	140	18.6 U	19.9 U	18.7 U	4.05 J	6.04 J	3.68 J	1.86 U	18.8 U
Acenaphthene	4700000	TACO	130	18.6 U	34.4 J	22.7 J	7.56 J	4.37 J	9.4	1.86 U	**162**
Acenaphthylene	2300000	TACO	70	18.6 U	19.9 U	18.7 U	12.6 J	3.07 J	9.33	1.86 U	**74.8 J**
Anthracene	23000000	TACO	400	30.9 J	114	63.9 J	21.2 J	12.5	50	1.86 U	265
Bap Equivalent [1]	90	TACO	2100	1775.162	940.849	**2774.3744**	263.532	105.3872	351.27	2.32172	**6733.5**
Benzo(a)anthracene	900	TACO	1800	461	501	18.7 U	154 J	64.1	192	2.63 J	**2880**
Benzo(a)pyrene	90	TACO	2100	1330	795	2080	186 J	80.9	245	1.86 U	**4700**
Benzo(b)fluoranthene	900	TACO	2100	560	563	1130	177 J	108	303	1.86 U	**5570**
Benzo(g,h,i)perylene	2300000	TACO	1700	1660	659	1450	126 J	63.1	171	1.86 U	**3080**
Benzo(k)fluoranthene	9000	TACO	1700	18.6 U	189	263	61 J	37.8	103	1.86 U	**2150**
Chrysene	88000	TACO	2700	869	709	18.7 U	252 J	84.2	240	3.42 J	**3000**
Dibenzo(a,h)anthracene	90	TACO	420	296	19.9 U	**539**	35.3 J	1.79 U	42.1	1.86 U	**824**
Fluoranthene	3100000	TACO	4100	229	704	463	188 J	170	453	3.51 J	3680
Fluorene	3100000	TACO	180	18.6 U	36.8 J	18.7 U	6.11 J	5.7 J	10.6	1.86 U	61.9 J
Indeno(1,2,3-cd)pyrene	900	TACO	1600	461	269	388	82.7 J	59.2	134	1.86 U	**3400**
Naphthalene	1600000	TACO	200	18.6 U	26.1 J	18.7 U	5.93 J	8.19	4.33 J	1.86 U	18.8 U
Phenanthrene	2300000	TACO	2500	114	445	292	91.7 J	94.7	184	3.64 J	1080
Pyrene	2300000	TACO	3000	382	708	842	190 J	166	383	3.2 J	**3630**

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION SAMPLE ID SAMPLE DATE DEPTH (FEET BGS)	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-093		NTC-SO-TSA-094		NTC-SO-TSA-095		NTC-SO-TSA-096		NTC-SO-TSA-097	
				NTC-SB-TSA093-0102 20110913 1 - 2	NTC-SB-TSA093-0204 20110913 2 - 4	NTC-SB-TSA094-0102 20110914 1 - 2	NTC-SB-TSA094-0204 20110914 2 - 4	NTC-SB-TSA095-0102 20110914 1 - 2	NTC-SB-TSA095-0204 20110914 2 - 4	NTC-SB-TSA096-0102 20110914 1 - 2	NTC-SB-TSA096-0204 20110914 2 - 4	NTC-SB-TSA097-0102 20110914 1 - 2	NTC-SB-TSA097-0204 20110914 2 - 4
Metals (mg/kg)													
Antimony	31	TACO	4	1.39 UJ	1.49 UJ	1.48 UJ	1.47 UJ	1.38 UJ	1.55 UJ	1.39 UJ	1.47 UJ	1.4 UJ	1.6 UJ
Arsenic	0.39	USEPA	13	7.2	8.42	7.47	6.61	9.22	8.36	7.84	7.57	8.86	8.32
Lead	400	TACO	36	28.6 J	23.2 J	21.3 J	21.9 J	18.5 J	**55.7 J**	25.8 J	15.9 J	**59.2 J**	34.3 J
Polycyclic Aromatic Hydrocarbons (ug/kg)													
1-Methylnaphthalene	5500000	NONTACO	NC	12.4	6.22 J	13.6	3.28 J	10	27.9 J	14.3	3.33 J	26.2	6.45 J
2-Methylnaphthalene	310000	PROPOSED TACO	140	15.2	8.91	17.2	3.82 J	9.7	28.4 J	23.4	4.14 J	37.1	8.01 J
Acenaphthene	4700000	TACO	130	101	10.8	14.1	6.74 J	1.85 U	87.8	28.5	4.14 J	12.8	16.8
Acenaphthylene	2300000	TACO	70	5.98 J	**168**	1.86 U	1.89 U	1.85 U	19.2 U	7.52	1.89 U	5.46 J	25.5
Anthracene	23000000	TACO	400	193	110	44.4	18.2	1.85 U	132	71.8	17.5	38.2	38.3
Bap Equivalent [1]	90	TACO	2100	777.652	904.621	249.541	151.7781	72.3405	**3435.27**	566.305	141.222	344.268	510.873
Benzo(a)anthracene	900	TACO	1800	513	459	148	78.8	46.3	**2390**	503	129	296	357
Benzo(a)pyrene	90	TACO	2100	532	609	170	104	56.4	**2410**	363	94.6	224	344
Benzo(b)fluoranthene	900	TACO	2100	702	802	209	135	67.3	**2320**	481	121	317	428
Benzo(g,h,i)perylene	2300000	TACO	1700	332	450	142	80.8	49.9	1610	265	56.6	143	227
Benzo(k)fluoranthene	9000	TACO	1700	303	316	87.5	48.4	26.6	642	182	43.2	114	156
Chrysene	88000	TACO	2700	522	461	166	84.1	59.5	**3850**	585	130	328	413
Dibenzo(a,h)anthracene	90	TACO	420	82.6	116	31	17.8	1.85 U	415	73.6	15	41.3	63.3
Fluoranthene	3100000	TACO	4100	1370	1150	397	176	101	1880	874	177	477	422
Fluorene	3100000	TACO	180	84.8	27.6	1.86 U	1.89 U	1.85 U	48.5 J	30.2	5.77 J	13.4	12.9
Indeno(1,2,3-cd)pyrene	900	TACO	1600	380	499	118	80.3	33.3	1290	289	60.6	162	231
Naphthalene	1600000	TACO	200	34.3	20.9	12.4	3.71 J	9	36.9 J	31.9	7.74	84.4	11.9
Phenanthrene	2300000	TACO	2500	901	313	270	80.9	84.8	745	450	56.1	221	148
Pyrene	2300000	TACO	3000	1100	974	341	157	88.3	1950	755	161	418	410

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-098		NTC-SO-TSA-099		NTC-SO-TSA-100		NTC-SO-TSA-101	
SAMPLE ID				NTC-SB-TSA098-0102	NTC-SB-TSA098-0204	NTC-SB-TSA099-0102	NTC-SB-TSA099-0204	NTC-SB-TSA100-0102	NTC-SB-TSA100-0204	NTC-SB-TSA101-0102	NTC-SB-TSA101-0204
SAMPLE DATE				20110914	20110914	20110913	20110913	20110913	20110913	20110913	20110913
DEPTH (FEET BGS)				1 - 2	2 - 4	1 - 2	2 - 4	1 - 2	2 - 4	1 - 2	2 - 4
Metals (mg/kg)											
Antimony	31	TACO	4	1.37 UJ	1.38 UJ	1.46 UJ	1.49 UJ	1.47 UJ	1.42 UJ	1.53 UJ	1.51 UJ
Arsenic	0.39	USEPA	13	7.7	7.36	8.52	8.71	9.33	5.42	8.68	9.32
Lead	400	TACO	36	33.4 J	14.7 J	22.1 J	24.7 J	30.6 J	31.6 J	19.6 J	**151 J**
Polycyclic Aromatic Hydrocarbons (ug/kg)											
1-Methylnaphthalene	5500000	NONTACO	NC	17.8	3.04 J	14.3	13.6	20.9	19.6 U	23.8	86.3
2-Methylnaphthalene	310000	PROPOSED TACO	140	26.4	2.76 J	17.5	14.7	32.6	19.6 U	33.9	135
Acenaphthene	4700000	TACO	130	12.8	5.27 J	8.83	65.9	32.6	19.6 U	93.9	**2690**
Acenaphthylene	2300000	TACO	70	6.43 J	1.9 U	1.88 U	10.9	8.95	19.6 U	7.55 J	19.9 U
Anthracene	23000000	TACO	400	42.3	9.36	1.88 U	**682**	121	38.7 J	226	**4790**
Bap Equivalent [1]	90	TACO	2100	417.412	48.0744	2.7364	1340.879	666.404	410.027	919.386	**56524.4**
Benzo(a)anthracene	900	TACO	1800	331	33.4	1.88 U	1030	354	234	529	**33200**
Benzo(a)pyrene	90	TACO	2100	270	31.8	1.88 U	920	449	277	616	**38200**
Benzo(b)fluoranthene	900	TACO	2100	372	45.6	1.88 U	1190	613	372	849	**49100**
Benzo(g,h,i)perylene	2300000	TACO	1700	193	22.1	20.3	450	332	213	468	**25100**
Benzo(k)fluoranthene	9000	TACO	1700	143	15.8	1.88 U	442	213	147	320	**16200**
Chrysene	88000	TACO	2700	382	36.4	34	859	374	257	586	**32400**
Dibenzo(a,h)anthracene	90	TACO	420	54.3	5.89 J	1.88 U	143	84.1	51.4 J	113	**7000**
Fluoranthene	3100000	TACO	4100	555	63.1	20.2	2580	873	442	1330	**37400**
Fluorene	3100000	TACO	180	14.4	4.35 J	1.88 U	**191**	34.6	19.6 U	90.2	**1710**
Indeno(1,2,3-cd)pyrene	900	TACO	1600	210	22.9	6.25 J	506	341	193	488	**29000**
Naphthalene	1600000	TACO	200	25 J	3.52 J	1.88 U	31.2	33.4	19.6 U	40.5	192
Phenanthrene	2300000	TACO	2500	217	36.9	45	1860	479	195	967	**17400**
Pyrene	2300000	TACO	3000	483	54.6	23.6	2040	734	396	1080	**34300**

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-102		NTC-SO-TSA-103		NTC-SO-TSA-104		NTC-SO-TSA-105	
SAMPLE ID				NTC-SB-TSA102-0102	NTC-SB-TSA102-0204	NTC-SB-TSA103-0203	NTC-SB-TSA103-0304	NTC-SB-TSA104-0102	NTC-SB-TSA104-0204	NTC-SB-TSA105-0102	NTC-SB-TSA105-0204
SAMPLE DATE				20110913	20110913	20110913	20110913	20110913	20110913	20110913	20110913
DEPTH (FEET BGS)				1 - 2	2 - 4	2 - 3	3 - 4	1 - 2	2 - 4	1 - 2	2 - 4
Metals (mg/kg)											
Antimony	31	TACO	4	1.41 UJ	1.5 UJ	1.54 UJ	1.88 J	1.41 UJ	1.46 UJ	1.42 UJ	0.471 J
Arsenic	0.39	USEPA	13	**23**	8.04	7.51	9.23	7.91	10.4	7.68	8.09
Lead	400	TACO	36	**85.4 J**	**171 J**	22.2 J	**165 J**	14.7 J	**39.4 J**	35.1 J	**123 J**
Polycyclic Aromatic Hydrocarbons (ug/kg)											
1-Methylnaphthalene	5500000	NONTACO	NC	10.6	67	54.7	29.8	27.2	25.9	18.4 U	20.1 J
2-Methylnaphthalene	310000	PROPOSED TACO	140	16.2	82	50.2	38	33.1	32.9	18.4 U	22.3 J
Acenaphthene	4700000	TACO	130	34.2	29	**358**	112	18.8	64.3	23 J	92.8 J
Acenaphthylene	2300000	TACO	70	4.13 J	9.31	10.4	15.1	1.93 U	14.6	18.4 U	33.5 J
Anthracene	23000000	TACO	400	111	85.4	**1410**	258	35.7	198	66.8 J	230 J
Bap Equivalent [1]	90	TACO	2100	615.957	614.134	**2848.54**	1021.195	621.418	1140.1	381.809	1210.64
Benzo(a)anthracene	900	TACO	1800	465	385	**2400**	865	378	881	263	1050 J
Benzo(a)pyrene	90	TACO	2100	414	413	1850	671	417	729	253	787 J
Benzo(b)fluoranthene	900	TACO	2100	611	564	**2850**	988	734	977	347	1110 J
Benzo(g,h,i)perylene	2300000	TACO	1700	232	251	935	408	229	534	192	517 J
Benzo(k)fluoranthene	9000	TACO	1700	218	223	930	390	315	430	114	397 J
Chrysene	88000	TACO	2700	477	404	2240	895	568	900	269	1070 J
Dibenzo(a,h)anthracene	90	TACO	420	64.1	76.6	344	113	60	159	46.6 J	141 J
Fluoranthene	3100000	TACO	4100	972	782	**7190**	2010	989	1760	533	1900 J
Fluorene	3100000	TACO	180	41	30.5	**546**	129	1.93 U	62.9	23.7 J	90.8 J
Indeno(1,2,3-cd)pyrene	900	TACO	1600	276	270	1180	471	295	611	198	616 J
Naphthalene	1600000	TACO	200	21.3	40.8	61.6	61.5	18	37.7	18.4 U	27.7 J
Phenanthrene	2300000	TACO	2500	466	460	**5610**	1440	153	960	322	1060 J
Pyrene	2300000	TACO	3000	785	644	**5170**	1540	1140	1410	461	1550 J

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-106		NTC-SO-TSA-107		NTC-SO-TSA-108	NTC-SO-TSA-109		NTC-SO-TSA-110
SAMPLE ID				NTC-SB-TSA106-0102	NTC-SB-TSA106-0204	NTC-SB-TSA107-0102	NTC-SB-TSA107-0204	NTC-SB-TSA108-0102	NTC-SB-TSA109-0102	NTC-SB-TSA109-0204	NTC-SB-TSA110-0102
SAMPLE DATE				20110913	20110913	20110913	20110913	20110913	20110913	20110913	20110912
DEPTH (FEET BGS)				1 - 2	2 - 4	1 - 2	2 - 4	1 - 2	1 - 2	2 - 4	1 - 2
Metals (mg/kg)											
Antimony	31	TACO	4	1.37 UJ	1.44 UJ	**7.48 J**	**6.68 J**	**4.95 J**	3.85 J	**4.55 J**	3.02 J
Arsenic	0.39	USEPA	13	7.63	7.83	6.79	8.38	**13.6**	5.85 J	11.3 J	8.93
Lead	400	TACO	36	**46.2**	**334**	**419**	**481**	**383**	**1110**	**858**	**427**
Polycyclic Aromatic Hydrocarbons (ug/kg)											
1-Methylnaphthalene	5500000	NONTACO	NC	21.2	73.2 J	45.3 J	66.8 J	34.8 J	18.6 U	19.7 U	14.2
2-Methylnaphthalene	310000	PROPOSED TACO	140	24.7	81.8	48.7 J	85.6	38.8 J	18.6 U	19.7 U	18.1
Acenaphthene	4700000	TACO	130	30.9	**472**	**136**	**298**	**173**	18.6 U	19.7 U	9.5
Acenaphthylene	2300000	TACO	70	5.63 J	**70.2 J**	22.5 J	29.1 J	21.3 J	18.6 U	19.7 U	39.8
Anthracene	23000000	TACO	400	89.9	**959**	343	**781**	**434**	18.6 U	25 J	55.9
Bap Equivalent [1]	90	TACO	2100	422.237	**5627.1**	1698.279	**3169.13**	**2237.22**	324.757	222.488	326.652
Benzo(a)anthracene	900	TACO	1800	318	**3570**	1030	**2110**	1350	164	96.9	305
Benzo(a)pyrene	90	TACO	2100	278	**3820**	1130	**2160**	1500	211	166	215
Benzo(b)fluoranthene	900	TACO	2100	359	**5240**	1520	**2870**	2040	220	200	261
Benzo(g,h,i)perylene	2300000	TACO	1700	194	**2540**	741	1370	997	181	142	141 J
Benzo(k)fluoranthene	9000	TACO	1700	143	**2220**	588	1210	793	75.7	84.2	113
Chrysene	88000	TACO	2700	307	**3900**	999	2030	1290	300	106	322
Dibenzo(a,h)anthracene	90	TACO	420	54	**617**	221	346	277	58.8 J	19.7 U	38.8
Fluoranthene	3100000	TACO	4100	615	**9660**	2540	**5010**	3120	130	154	416
Fluorene	3100000	TACO	180	28.2	**439**	122	**289**	151	18.6 U	19.7 U	23.3
Indeno(1,2,3-cd)pyrene	900	TACO	1600	208	**2830**	854	1510	1120	155	160	148
Naphthalene	1600000	TACO	200	18.1	172	47.9 J	106	43.3 J	18.6 U	19.7 U	10.4
Phenanthrene	2300000	TACO	2500	313	**6130**	1490	**2960**	1710	56.8 J	97.7	284
Pyrene	2300000	TACO	3000	540	**7570**	2090	**4130**	2560	191	139	428

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-111		NTC-SO-TSA-112	NTC-SO-TSA-113		NTC-SO-TSA-114	NTC-SO-TSA-115		NTC-SO-TSA-116
SAMPLE ID				NTC-SB-TSA111-0102	NTC-SB-TSA111-0204	NTC-SB-TSA112-0102	NTC-SB-TSA113-0102	NTC-SB-TSA113-0204	NTC-SB-TSA114-0102	NTC-SB-TSA115-0102	NTC-SB-TSA115-0204	NTC-SB-TSA116-0102
SAMPLE DATE				20110913	20110913	20110913	20110913	20110913	20110913	20110913	20110913	20110912
DEPTH (FEET BGS)				1 - 2	2 - 4	1 - 2	1 - 2	2 - 4	1 - 2	1 - 2	2 - 4	1 - 2
Metals (mg/kg)												
Antimony	31	TACO	4	**5.07 J**	**7.12 J**	**7.24 J**	**5.04 J**	**5.67 J**	3.92 J	3.79 J	1.6 UJ	1.3 UJ
Arsenic	0.39	USEPA	13	8.45	8.4	8.67	9.62	8.84	7.63	6.75	8.34	3.32
Lead	400	TACO	36	**381**	**469**	**630**	**463**	**603**	**271**	**324**	**249**	**51 J**
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	NC	29	43.6 J	61.5	32.9 J	38.4	23.6 J	19.6 U	5.6 J	1.76 U
2-Methylnaphthalene	310000	PROPOSED TACO	140	33.8	57.1 J	77.7	37.6 J	55.6	30.3 J	19.6 U	8.13 J	1.76 U
Acenaphthene	4700000	TACO	130	**139**	**139**	**238**	120	120	115	24.5 J	3.2 J	1.76 U
Acenaphthylene	2300000	TACO	70	20.2	36.6 J	55.2	20 J	17.5	19.6 J	19.6 U	5.64 J	1.76 U
Anthracene	23000000	TACO	400	348	343	**540**	289	301	320	64.6 J	14.1	2.12 J
Bap Equivalent [1]	90	TACO	2100	1872.27	1891.2	**2739.72**	1756.08	1322.667	1556.61	487.842	146.884	17.7032
Benzo(a)anthracene	900	TACO	1800	1310	1120	**1890**	1010	888	1160	309	106	12.7
Benzo(a)pyrene	90	TACO	2100	1260	1290	1830	1210	872	1020	306	91.6	12.6
Benzo(b)fluoranthene	900	TACO	2100	1770	1690	**2400**	1560	1150	1320	440	142	18.7
Benzo(g,h,i)perylene	2300000	TACO	1700	780	879	1200	786	651	663	246	77.6	9.98 J
Benzo(k)fluoranthene	9000	TACO	1700	649	729	1000	687	429	491	144	42.7	7.87
Chrysene	88000	TACO	2700	1280	1110	1720	1010	877	1100	302	127	17.5
Dibenzo(a,h)anthracene	90	TACO	420	206	218	330	191	167	204	80.5	21.8	1.76 U
Fluoranthene	3100000	TACO	4100	2650	2550	**5050**	2380	1860	2270	607	169	24.9
Fluorene	3100000	TACO	180	116	128	**260**	98.1	126	107	24.6 J	2.1 U	1.76 U
Indeno(1,2,3-cd)pyrene	900	TACO	1600	905	938	1390	902	747	786	247	81.3	9.87
Naphthalene	1600000	TACO	200	38.7	71.1 J	131	45.1 J	69.2	40.7 J	19.6 U	9.06	1.76 U
Phenanthrene	2300000	TACO	2500	1330	1300	2420	1140	1050	1260	299	68	11.8
Pyrene	2300000	TACO	3000	2230	2110	**3160**	1960	1530	1850	517	143	20.1

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-117		NTC-SO-TSA-118		NTC-SO-TSA-119		NTC-SO-TSA-120	
SAMPLE ID				NTC-SB-TSA117-0102	NTC-SB-TSA117-0204	NTC-SB-TSA118-0102	NTC-SB-TSA118-0204	NTC-SB-TSA119-0102	NTC-SB-TSA119-0204	NTC-SB-TSA120-0102	NTC-SB-TSA120-0204
SAMPLE DATE				20110913	20110913	20110913	20110913	20110913	20110913	20110913	20110913
DEPTH (FEET BGS)				1 - 2	2 - 4	1 - 2	2 - 4	1 - 2	2 - 4	1 - 2	2 - 4
Metals (mg/kg)											
Antimony	31	TACO	4	1.44 UJ	**5.72 J**	1.78 J	**4.51 J**	1.4 UJ	3.07 J	1.38 UJ	1.84 J
Arsenic	0.39	USEPA	13	11	6.92	7.76	7.73	6.6	8.89	8.64	7.9
Lead	400	TACO	36	**43.4 J**	**370 J**	**332 J**	**296 J**	**59.8 J**	**202 J**	**52 J**	**166 J**
Polycyclic Aromatic Hydrocarbons (ug/kg)											
1-Methylnaphthalene	5500000	NONTACO	NC	14.4	19 U	2.56 J	4.16 J	2.19 J	18 U	18.2 U	9.79
2-Methylnaphthalene	310000	PROPOSED TACO	140	17.4	19.1 J	3.04 J	5.37 J	2.75 J	18 U	18.2 U	10.8
Acenaphthene	4700000	TACO	130	59.2	**167**	8.42	13.5	3.44 J	29.7 J	18.2 U	14.2
Acenaphthylene	2300000	TACO	70	9.62	19 U	2.72 J	4.52 J	4.34 J	24.4 J	18.2 U	6.4 J
Anthracene	23000000	TACO	400	146	**1630**	37.4	37.5	10.5	91.6 J	54.8 J	51.5
Bap Equivalent [1]	90	TACO	2100	721.563	**5541.25**	369.083	251.71	100.1922	728.766	447.015	400.164
Benzo(a)anthracene	900	TACO	1800	462	**4850**	245	174	64.1	583	397	243
Benzo(a)pyrene	90	TACO	2100	471	**3720**	237	164	63.5	477	278	265
Benzo(b)fluoranthene	900	TACO	2100	647	**4810**	353	226	86.7	663	386	352
Benzo(g,h,i)perylene	2300000	TACO	1700	357	**2180**	195	121	50.5	331	207	204
Benzo(k)fluoranthene	9000	TACO	1700	231	**1800**	129	83.4	32.5	238 J	142	141
Chrysene	88000	TACO	2700	453	**4250**	293	176	67.2	586	395	254
Dibenzo(a,h)anthracene	90	TACO	420	98.2	**580**	49	33.5	15.5	91.7 J	66.2 J	52.1
Fluoranthene	3100000	TACO	4100	1020	**10500**	585	334	128	911	594	477
Fluorene	3100000	TACO	180	51.9	**238**	10.2	11.5	4.75 J	26.3 J	18.2 U	1.96 U
Indeno(1,2,3-cd)pyrene	900	TACO	1600	387	**2530**	217	132	57.2	325 J	227	219
Naphthalene	1600000	TACO	200	16	31.2 J	3.34 J	5.84 J	4.13 J	23.4 J	18.2 U	9.4
Phenanthrene	2300000	TACO	2500	558	**3840**	226	147	57.5	350 J	234	211
Pyrene	2300000	TACO	3000	834	**8140**	460	281	104	829	514	414

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-121		NTC-SO-TSA-122	NTC-SO-TSA-123		NTC-SO-TSA-124		NTC-SO-TSA-125	
SAMPLE ID				NTC-SB-TSA121-0102	NTC-SB-TSA121-0204	NTC-SB-TSA122-0102	NTC-SB-TSA123-0102	NTC-SB-TSA123-0204	NTC-SB-TSA124-0102	NTC-SB-TSA124-0204	NTC-SB-TSA125-0102	NTC-SB-TSA125-0204
SAMPLE DATE				20110913	20110913	20110912	20110913	20110913	20110913	20110913	20110913	20110913
DEPTH (FEET BGS)				1 - 2	2 - 4	1 - 2	1 - 2	2 - 4	1 - 2	2 - 4	1 - 2	2 - 4
Metals (mg/kg)												
Antimony	31	TACO	4	2.58 J	1.64 UJ	1.22 UJ	1.36 UJ	1.43 UJ	1.65 UJ	1.5 UJ	1.4 UJ	1.02 J
Arsenic	0.39	USEPA	13	6.39	8.07	4.64	7.77	7.08	7.04 J	10.6 J	6.96 J	8.17 J
Lead	400	TACO	36	**433 J**	**250 J**	**94.4 J**	**45.7 J**	**42.4 J**	**57.6**	**79.2**	23.1	**119 J**
Polycyclic Aromatic Hydrocarbons (ug/kg)												
1-Methylnaphthalene	5500000	NONTACO	NC	6.57 J	21.1 U	1.71 J	17.1 U	18	20.8 U	11.1	23.6	234 J
2-Methylnaphthalene	310000	PROPOSED TACO	140	8.66	21.1 U	2.47 J	23.6 J	23	20.8 U	18	35.2	**261 J**
Acenaphthene	4700000	TACO	130	11.9	21.1 U	1.64 U	47.5 J	30.1	67.4 J	38.2	66.1	**1150 J**
Acenaphthylene	2300000	TACO	70	5.29 J	21.1 U	1.64 U	**160**	11.8	20.8 U	3.47 J	15.1	**99.9 J**
Anthracene	23000000	TACO	400	39.7	21.1 U	2.04 J	333	109	273	125	265	**5700 J**
Bap Equivalent [1]	90	TACO	2100	310.216	276.792	19.3651	**5229.71**	698.955	541.525	529.486	1353.847	**13435.6**
Benzo(a)anthracene	900	TACO	1800	182	185	14.2	**4070**	623	601	474	989	**12900 J**
Benzo(a)pyrene	90	TACO	2100	199	184	13.5	**3340**	443	357	342	929	**8910 J**
Benzo(b)fluoranthene	900	TACO	2100	267	243	21.4	**4870**	617	482	458	1110	**12200 J**
Benzo(g,h,i)perylene	2300000	TACO	1700	152	156	12.2 J	**2440**	329	231	236	536	**4390 J**
Benzo(k)fluoranthene	9000	TACO	1700	113	89.3	8.58	**1870**	205	180	170	461	**5010 J**
Chrysene	88000	TACO	2700	186	199	19.3	**4010**	705	625	486	937	**12500 J**
Dibenzo(a,h)anthracene	90	TACO	420	48.2	36.3 J	1.64 U	**706**	93.7	51.5 J	67	147	**1410 J**
Fluoranthene	3100000	TACO	4100	383	294	27.4	**5940**	1020	1580	981	1910	**24700 J**
Fluorene	3100000	TACO	180	11.8	21.1 U	1.64 U	59.8 J	33.1	64.6 J	35.7	109	**1850 J**
Indeno(1,2,3-cd)pyrene	900	TACO	1600	168	126	13.8	**2670**	355	223	251	624	**5430 J**
Naphthalene	1600000	TACO	200	6.81 J	21.1 U	1.64 U	30.2 J	18.8	20.8 U	15.9	59.9	**333 J**
Phenanthrene	2300000	TACO	2500	178	128	13.3	912	500	1010	541	899	**17600 J**
Pyrene	2300000	TACO	3000	310	267	22.8	**6640**	838	1240	807	1620	**19500 J**

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

LOCATION	FINAL HUMAN HEALTH CRITERIA VALUE	HUMAN HEALTH REFERENCE	TACO CHEMICALS IN BACKGROUND SOIL CRITERIA	NTC-SO-TSA-126		NTC-SO-TSA-127		NTC-SO-TSA-128	NTC-SO-TSA-129	NTC-SO-TSA-130		NTC-SO-TSA-131	
SAMPLE ID				NTC-SB-TSA126-0102	NTC-SB-TSA126-0203	NTC-SB-TSA127-0102	NTC-SB-TSA127-0204	NTC-SB-TSA128-0102	NTC-SB-TSA129-0102	NTC-SB-TSA130-0102	NTC-SB-TSA130-0204	NTC-SB-TSA131-0102	NTC-SB-TSA131-0204
SAMPLE DATE				20110913	20110913	20110913	20110913	20110912	20110912	20110913	20110913	20110913	20110913
DEPTH (FEET BGS)				1 - 2	2 - 3	1 - 2	2 - 4	1 - 2	1 - 2	1 - 2	2 - 4	1 - 2	2 - 4
Metals (mg/kg)													
Antimony	31	TACO	4	1.46 UJ	1.55 UJ	1.29 UJ	1.51 UJ	1.3 UJ	1.13 J	1.6 UJ	1.7 UJ	1.54 UJ	1.57 UJ
Arsenic	0.39	USEPA	13	7.85 J	7.17 J	4.25 J	**13.6 J**	7.34 J	8.26 J	8.37 J	9.58 J	9.42 J	7.67 J
Lead	400	TACO	36	**36.7**	**37.8**	16.7	35.5	**119**	**178**	**36.1**	**155**	**83.6**	**104**
Polycyclic Aromatic Hydrocarbons (ug/kg)													
1-Methylnaphthalene	5500000	NONTACO	NC	16.3	14.7	3.15 J	19.6 U	2.16 J	2.77 J	20.9 U	10.6	12.1	25.6
2-Methylnaphthalene	310000	PROPOSED TACO	140	24.6	22.3	3.26 J	19.6 U	2.95 J	3.86 J	20.9 U	13.2	13.8	32.5
Acenaphthene	4700000	TACO	130	21.4	28.3	5.16 J	19.6 U	3.01 J	2.37 J	20.9 U	7.66 J	22.1	26.4
Acenaphthylene	2300000	TACO	70	6.16 J	4.92 J	3.52 J	19.6 U	3.54 J	1.65 J	20.9 U	12.1	13.1	7.39 J
Anthracene	23000000	TACO	400	113	104	17	24.8 J	11.9	6.11 J	20.9 U	46.9	73.4	70.6
Bap Equivalent [1]	90	TACO	2100	894.695	483.352	104.6915	215.443	117.117	40.9103	135.2054	805.769	575.369	563.158
Benzo(a)anthracene	900	TACO	1800	758	385	78.7	168	91.3	30.4 J	95	621	392	395
Benzo(a)pyrene	90	TACO	2100	589	323	65	132	73.5	25.8 J	79.9 J	497	366	367
Benzo(b)fluoranthene	900	TACO	2100	746	412	88.6	179	115	37.2 J	123	708	527	491
Benzo(g,h,i)perylene	2300000	TACO	1700	398	200	56	114 J	48.2 J	19.8 J	60.1 J	499	287	295
Benzo(k)fluoranthene	9000	TACO	1700	288	157	35.4	67.4 J	47.7	14.7	43.7 J	260	185	174
Chrysene	88000	TACO	2700	715	382	87.5	169	100	33.3 J	98.4	669	419	418
Dibenzo(a,h)anthracene	90	TACO	420	106	56.1	17	35.1 J	16.6	5.99 J	25.7 J	121	83.4	72.8
Fluoranthene	3100000	TACO	4100	1370	738	141	235	154	54.4	157	815	703	637
Fluorene	3100000	TACO	180	23.1	42.1	1.75 U	19.6 U	3.77 J	3.54 J	20.9 U	10.4	22.1	22.7
Indeno(1,2,3-cd)pyrene	900	TACO	1600	457	226	55.2	128	58.1	21.8	72.7 J	516	318	326
Naphthalene	1600000	TACO	200	26.3	33.1	3.26 J	19.6 U	2.76 J	1.62 U	20.9 U	21.5	14	25.6
Phenanthrene	2300000	TACO	2500	357	396	69.7	104	61.5	34.5 J	63.7 U	201	297	268
Pyrene	2300000	TACO	3000	1250	628	120	209	125	44.6 J	123	752	603	559

TABLE 4

SUBSURFACE SOIL POSITIVE DETECTIONS AND EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS
12 OF 12

Notes:

Black shaded cells indicate a value that is greater than the human health and background screening criteria.

Bolded values indicate a value is less than the human health screening criteria but greater than the background screening criteria.

1. BAP Equivalent-Halfnd was calculated using 1/2 of any nondetected values for each of the PAHs in the following equation.
   BAP Equivalent = [BaA] * 0.1 + [Chry] * 0.01 + [BbFA] * 0.1 + [BkFA] * 0.1 + [BaP] * 1 + [IP] * 0.1 + [DahA] * 5.
   where,
   BaP - Benzo(a)pyrene
   BaA - Benz(a)anthracene
   BbFA - Benzo(b)fluoranthene
   BkFA - Benzo(k)fluoranthene
   Chry - Chrysene
   DahA - Dibenzo(a,h)anthracene
   IP - Indeno[1,2,3-cd]pyrene

J = Estimated concentration.
mg/kg = Milligrams per kilogram.
NA = Not analyzed.
NC = Not considered
U = A concentration less than the method detection limit and considered not-detected.
UJ = Indicates the chemical was not detected and the method detection limit is estimated.
ug/kg = Micrograms per kilogram.

USEPA - US EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites- Residential Soil Values (May, 2009).
Non-TACO = USEPA, 2003. OSWER 9285.7-53. Human Health Toxicity Values in Superfund Risk Assessments, December
Proposed TACO = Illinois EPA Proposed Amendments to Tiered Approach to Corrective Action Objectives - Residential/Industrial/Commercial (2008)
TACO = Illinois EPA Tier 1 Soil Remediation Objectives - Residential/Industrial/Commercial (Online, 2009)

TABLE 5

SURFACE SOIL COPC SELECTION
TSA RANGES (0-1 FOOT DEPTH)
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

Parameter	Frequency of Detection	Minimum Concentration	Maximum Concentration	Sample of Maximum Concentration	Average of Positive Results[1]	Average of All Results[2]	Invertebrate Ecological Screening Level		Ecological Effects Quotient[4]	Deletion or Selection of COPCs for Invertebrates	
							Value	Source[3]		COPC (yes/no)?	Rationale
Inorganics (mg/kg)											
ANTIMONY	29/67	0.641 J	4.51 J	NTC-SS-TSA121-0001	1.8	1.2	78	EcoSSL	0.058	NO	BSL
ARSENIC	67/67	3.29	19.6 J	NTC-SS-TSA-041-0006	7.7	7.7	17	CCME	1.2	YES	ASL
LEAD	67/67	13 J	1460	NTC-SS-TSA-030-0006	166	166	1700	EcoSSL	0.86	NO	BSL
Polycyclic Aromatic Hydrocarbons (ug/kg)											
1-METHYLNAPHTHALENE	45/67	2.01 J	120	NTC-SS-TSA105-0001	14.1	11.4	29000	EcoSSL	0.0041	NO	BSL
2-METHYLNAPHTHALENE	51/67	1.94 J	107	NTC-SS-TSA105-0001	15.1	13.3	29000	EcoSSL	0.0037	NO	BSL
ACENAPHTHENE	44/67	1.7 J	144	NTC-SS-TSA105-0001	26.7	19.1	29000	EcoSSL	0.0050	NO	BSL
ACENAPHTHYLENE	38/67	1.94 J	58.9	NTC-SS-TSA117-0001	12.4	9.4	29000	EcoSSL	0.0020	NO	BSL
ANTHRACENE	58/67	2.5 J	586	NTC-SS-TSA117-0001	68.3	60.0	29000	EcoSSL	0.020	NO	BSL
BENZO(A)ANTHRACENE	67/67	2.92 J	8340 J	NTC-SS-TSA-016-0006	549	549	18000	EcoSSL	0.46	NO	BSL
BENZO(A)PYRENE	65/67	2.85 J	15100 J	NTC-SS-TSA-016-0006	736	714	18000	EcoSSL	0.84	NO	BSL
BENZO(B)FLUORANTHENE	64/67	12.3	9560 J	NTC-SS-TSA-016-0006	580	554	18000	EcoSSL	0.53	NO	BSL
BENZO(G,H,I)PERYLENE	64/67	4.63 J	9470 J	NTC-SS-TSA-016-0006	506	483	18000	EcoSSL	0.53	NO	BSL
BENZO(K)FLUORANTHENE	63/67	4.08 J	2730 J	NTC-SS-TSA-016-0006	188	177	18000	EcoSSL	0.15	NO	BSL
CHRYSENE	67/67	4.28 J	13300 J	NTC-SS-TSA-016-0006	794	794	18000	EcoSSL	0.74	NO	BSL
DIBENZO(A,H)ANTHRACENE	51/67	3.37 J	2790 J	NTC-SS-TSA-016-0006	179	137	18000	EcoSSL	0.16	NO	BSL
FLUORANTHENE	67/67	5.61 J	4720	NTC-SS-TSA117-0001	566	566	29000	EcoSSL	0.16	NO	BSL
FLUORENE	42/67	2.13 J	161	NTC-SS-TSA105-0001	25.5	17.9	29000	EcoSSL	0.0056	NO	BSL
INDENO(1,2,3-CD)PYRENE	62/67	2.45 J	5590 J	NTC-SS-TSA-016-0006	350	324	18000	EcoSSL	0.31	NO	BSL
NAPHTHALENE	42/67	1.84 J	179	NTC-SS-TSA105-0001	19.7	14.1	29000	EcoSSL	0.0062	NO	BSL
PHENANTHRENE	66/67	5.28 J	2010	NTC-SS-TSA105-0001	286	284	29000	EcoSSL	0.069	NO	BSL
PYRENE	66/67	4.77 J	8060 J	NTC-SS-TSA-016-0006	626	617	18000	EcoSSL	0.45	NO	BSL
XRF (mg/kg)											
LEAD	57/57	14.33	468.33	NTC-SS-TSA-030-0006	88.5	88.5	1700	EcoSSL	0.28	NO	BSL

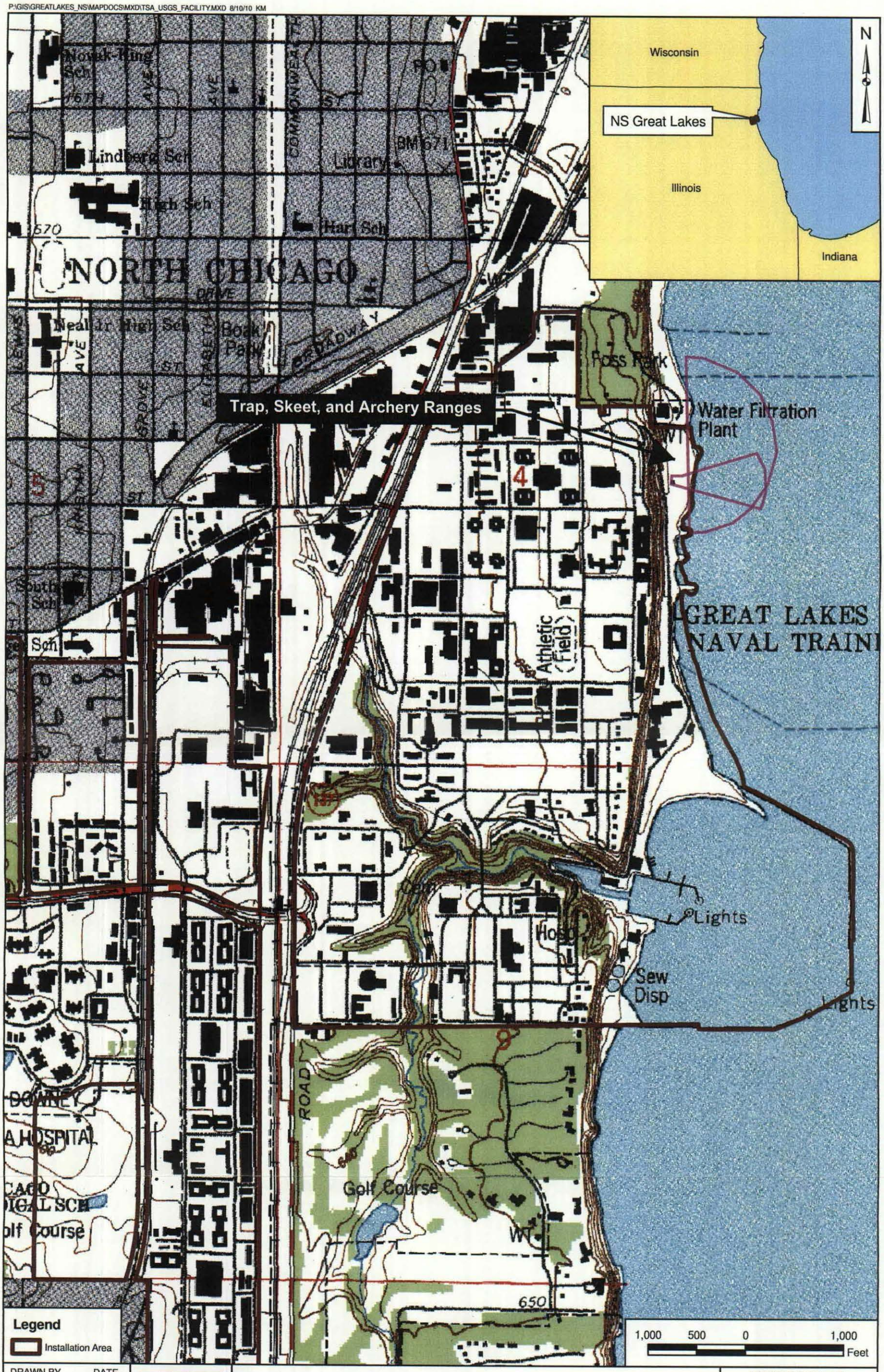
Ecological effects quotients (EEQs) are shaded if the maximum detected concentration exceeds a screening level or a screening level is not available. Other cells are shaded if the chemical is retained as a COPC for Invertebrates.

COPC Selection Rationale:
ASL = Above Screening Level
BSL = Below Screening Level

Footnotes:
1 - Average of detected concentrations only.
2 - Average of all analytical results including one-half of the detection limit for non-detects.
3 - Ecological Screening Level sources used in the order of preference:
EcoSSL - EPA Ecological Soil Screening Levels (USEPA, 2005a, 2005b, 2007)
Region 5 - USEPA Region 5 Ecological Screening Levels (USEPA, 2003). (no values were available from this source)
CCME - Canadian Soil Quality Guidelines (CCME, 2001).
4 - EEQs were calculated by dividing the maximum detected concentration by the ecological screening level. Values are unitless.

NA - Not applicable/not available
J - Estimated concentration

P:\GIS\GREATLAKES_NS\MAPDOCS\MXD\TSA_USGS_FACILITY.MXD 8/10/10 KM



DRAWN BY K. MOORE	DATE 7/26/10
CHECKED BY J. DUCAR	DATE 8/10/10
REVISED BY	DATE
SCALE AS NOTED	

NAVFAC

FACILITY LOCATION
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

CONTRACT NUMBER CTO F274	
OWNER NUMBER —	
APPROVED BY —	DATE —
FIGURE NO. FIGURE 1	REV 0

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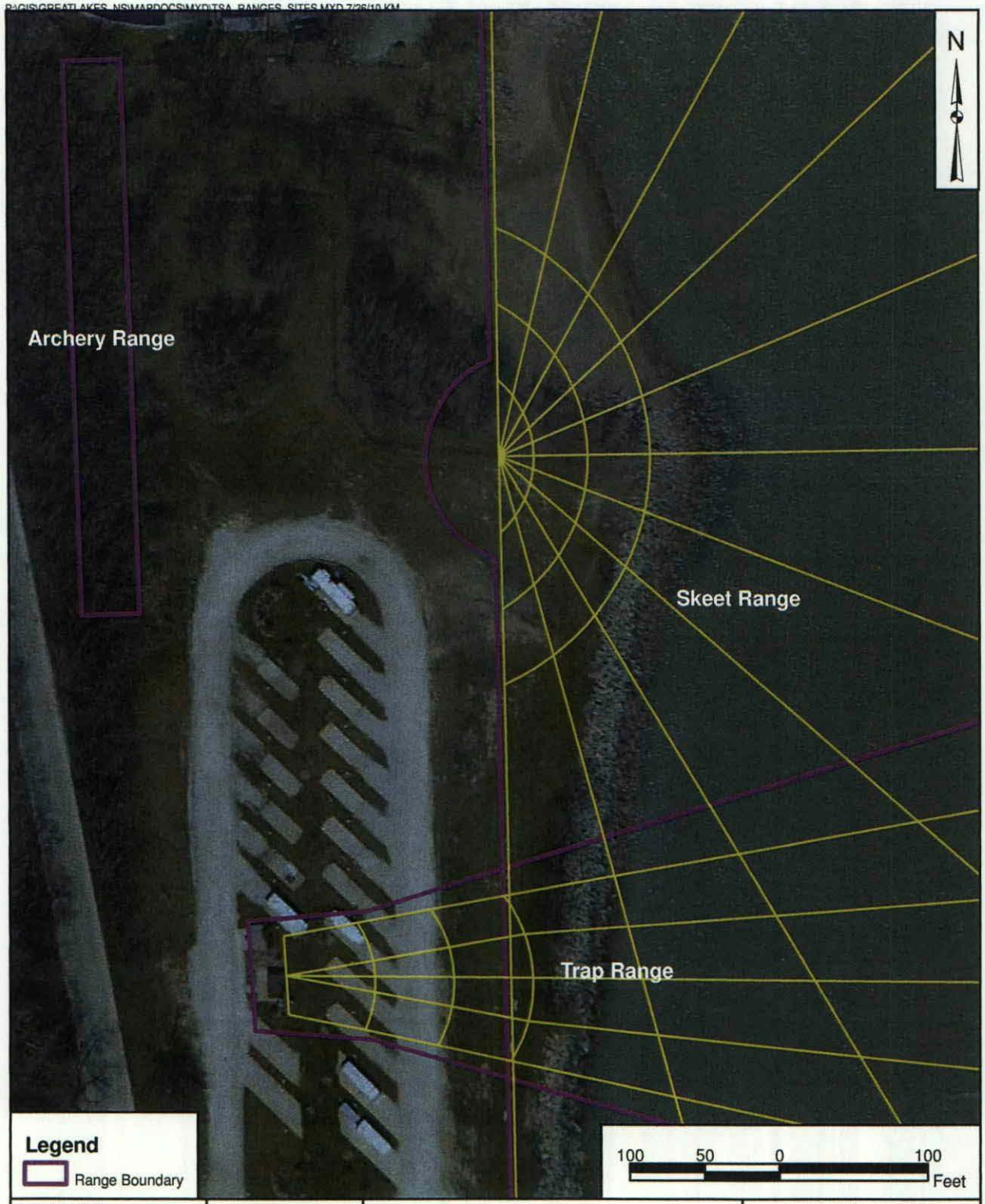

DRAWN BY K. MOORE	DATE 11/12/09	SITE LOCATION TSA RANGES NAVAL STATION GREAT LAKES GREAT LAKES, ILLINOIS	CONTRACT NUMBER CTO F274
CHECKED BY J. DUCAR	DATE 7/26/10		OWNER NUMBER
REVISED BY	DATE		APPROVED BY DATE
SCALE AS NOTED			FIGURE NO. FIGURE 2 / REV 0

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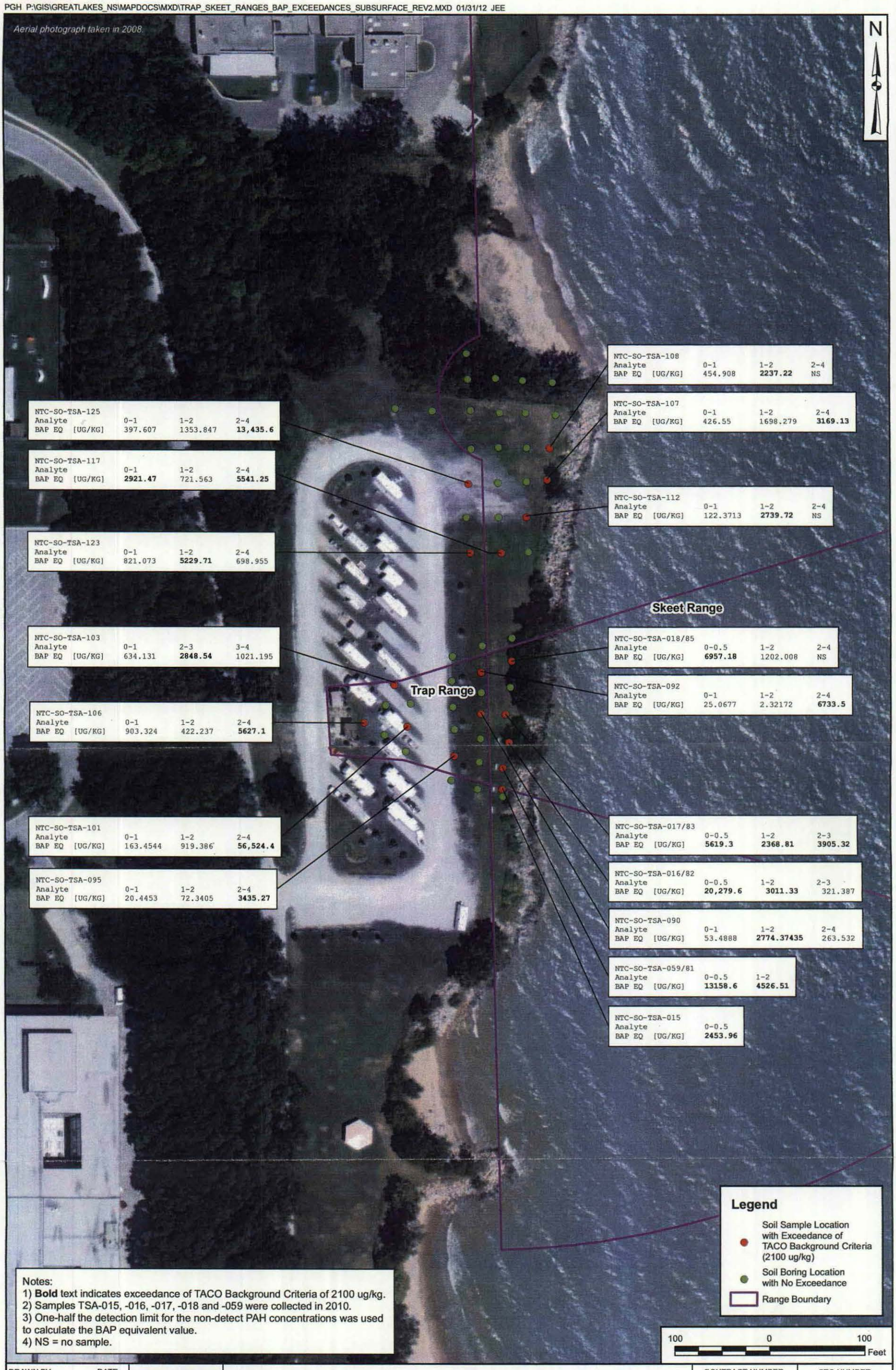

Notes:
1) **Bold** text indicates exceedance of TACO Background Criteria of 2100 ug/kg.
2) Samples TSA-015, -016, -017, -018 and -059 were collected in 2010.
3) One-half the detection limit for the non-detect PAH concentrations was used to calculate the BAP equivalent value.
4) NS = no sample.

DRAWN BY	DATE
J. ENGLISH	01/16/12
CHECKED BY	DATE
E. LOVE	01/31/12
REVISED BY	DATE
SCALE	
AS NOTED	

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SOIL SAMPLE EXCEEDANCES - BAP EQUIVALENT
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

CONTRACT NUMBER	CTO NUMBER
—	—
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
FIGURE NO. FIGURE 3	REV 0

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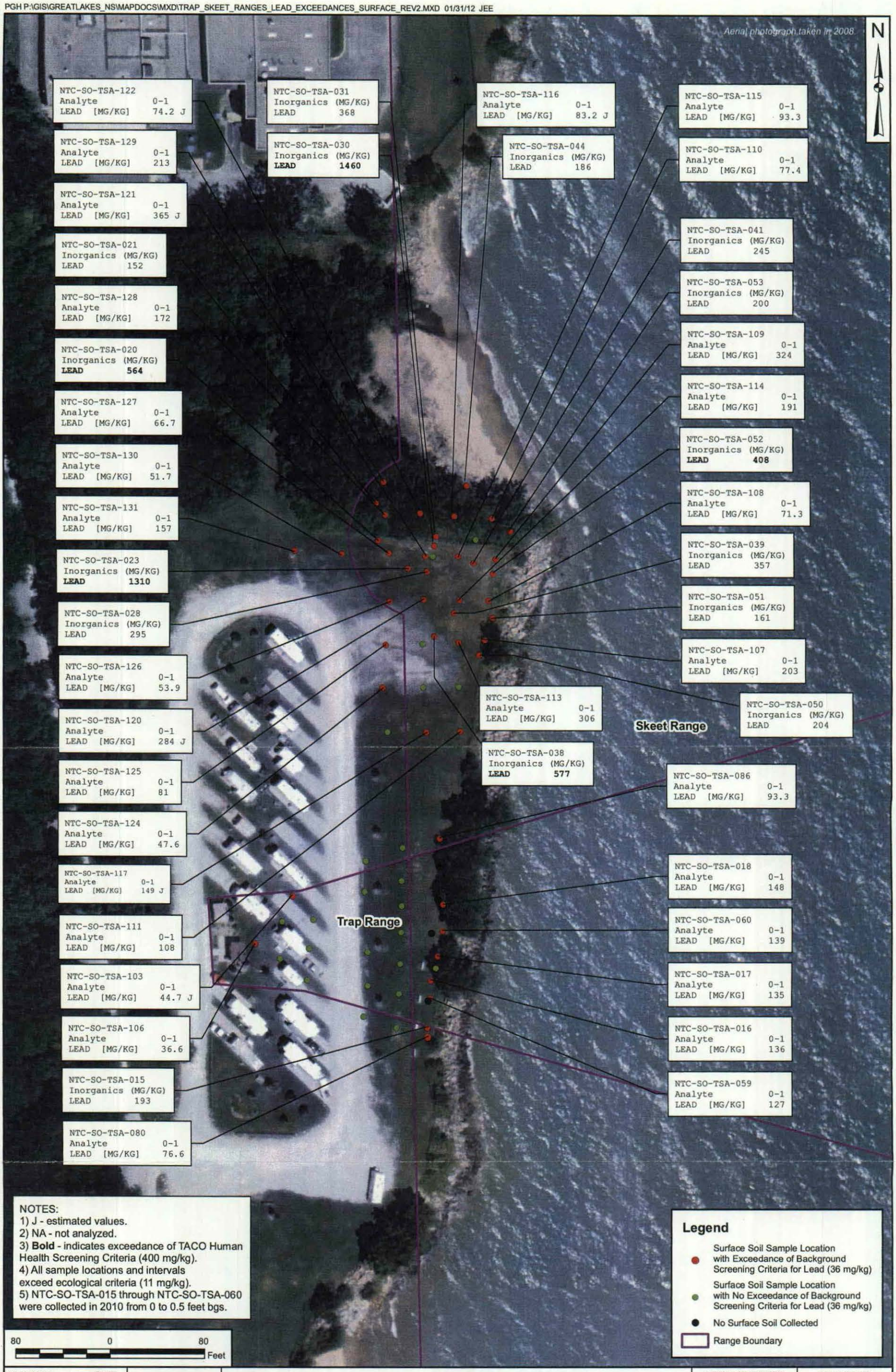

NOTES:
1) J - estimated values.
2) NA - not analyzed.
3) **Bold** - indicates exceedance of TACO Human Health Screening Criteria (400 mg/kg).
4) All sample locations and intervals exceed ecological criteria (11 mg/kg).
5) NTC-SO-TSA-015 through NTC-SO-TSA-060 were collected in 2010 from 0 to 0.5 feet bgs.

Legend

- Surface Soil Sample Location with Exceedance of Background Screening Criteria for Lead (36 mg/kg)
- Surface Soil Sample Location with No Exceedance of Background Screening Criteria for Lead (36 mg/kg)
- No Surface Soil Collected
- Range Boundary

80 0 80 Feet

DRAWN BY	DATE
J. ENGLISH	01/16/12
CHECKED BY	DATE
E. LOVE	01/31/12
REVISED BY	DATE
SCALE	
AS NOTED	

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SURFACE SOIL SAMPLE EXCEEDANCES - LEAD
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

CONTRACT NUMBER	CTO NUMBER
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO. FIGURE 4	REV 0

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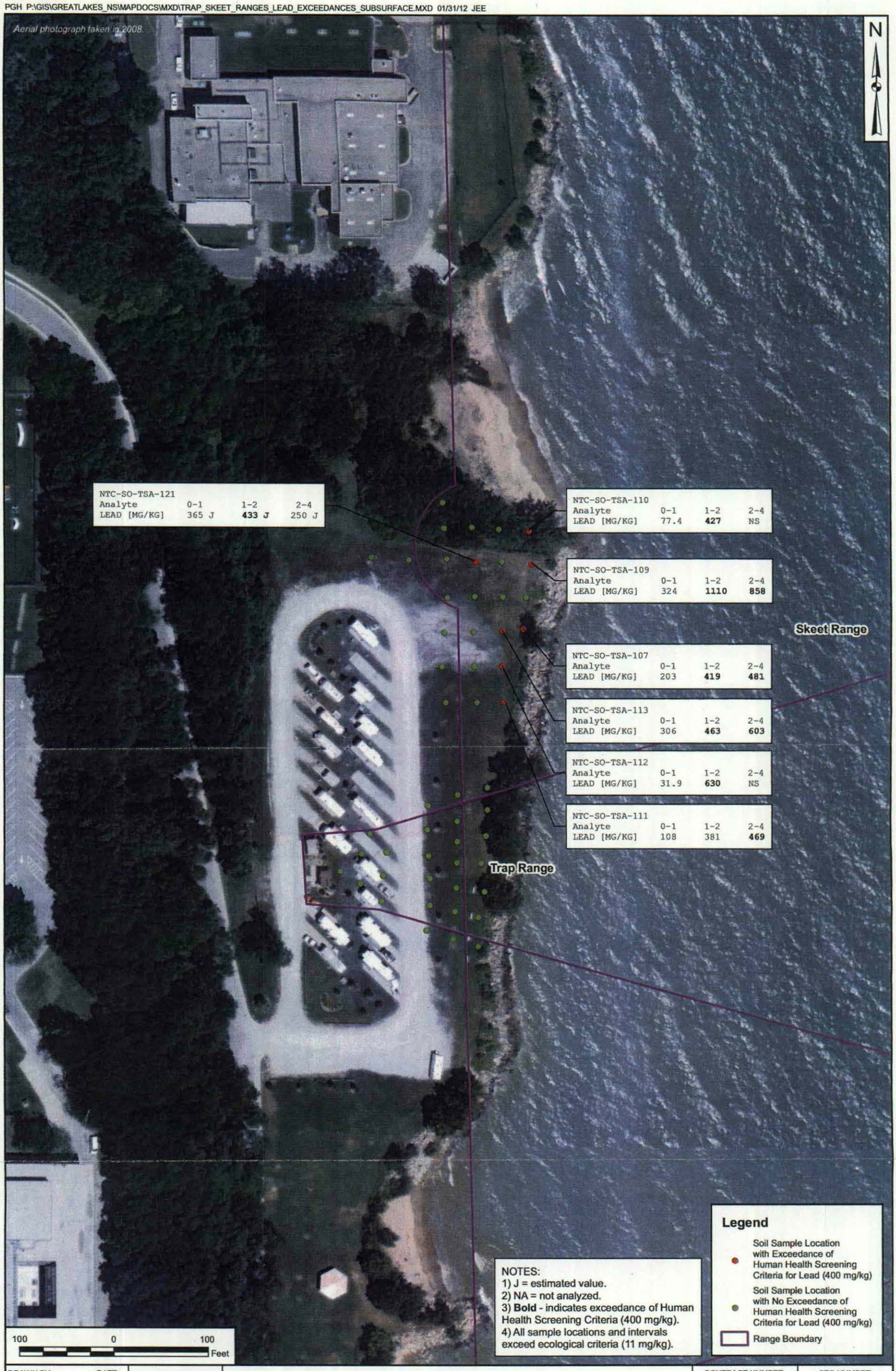

NOTES:
1) J = estimated value.
2) NA = not analyzed.
3) **Bold** - indicates exceedance of Human Health Screening Criteria (400 mg/kg).
4) All sample locations and intervals exceed ecological criteria (11 mg/kg).

Legend

- Soil Sample Location with Exceedance of Human Health Screening Criteria for Lead (400 mg/kg)
- Soil Sample Location with No Exceedance of Human Health Screening Criteria for Lead (400 mg/kg)
- Range Boundary

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C. TULLEY	12/15/11
CHECKED BY	DATE
E. LOVE	01/31/12
REVISED BY	DATE
SCALE	
AS NOTED	

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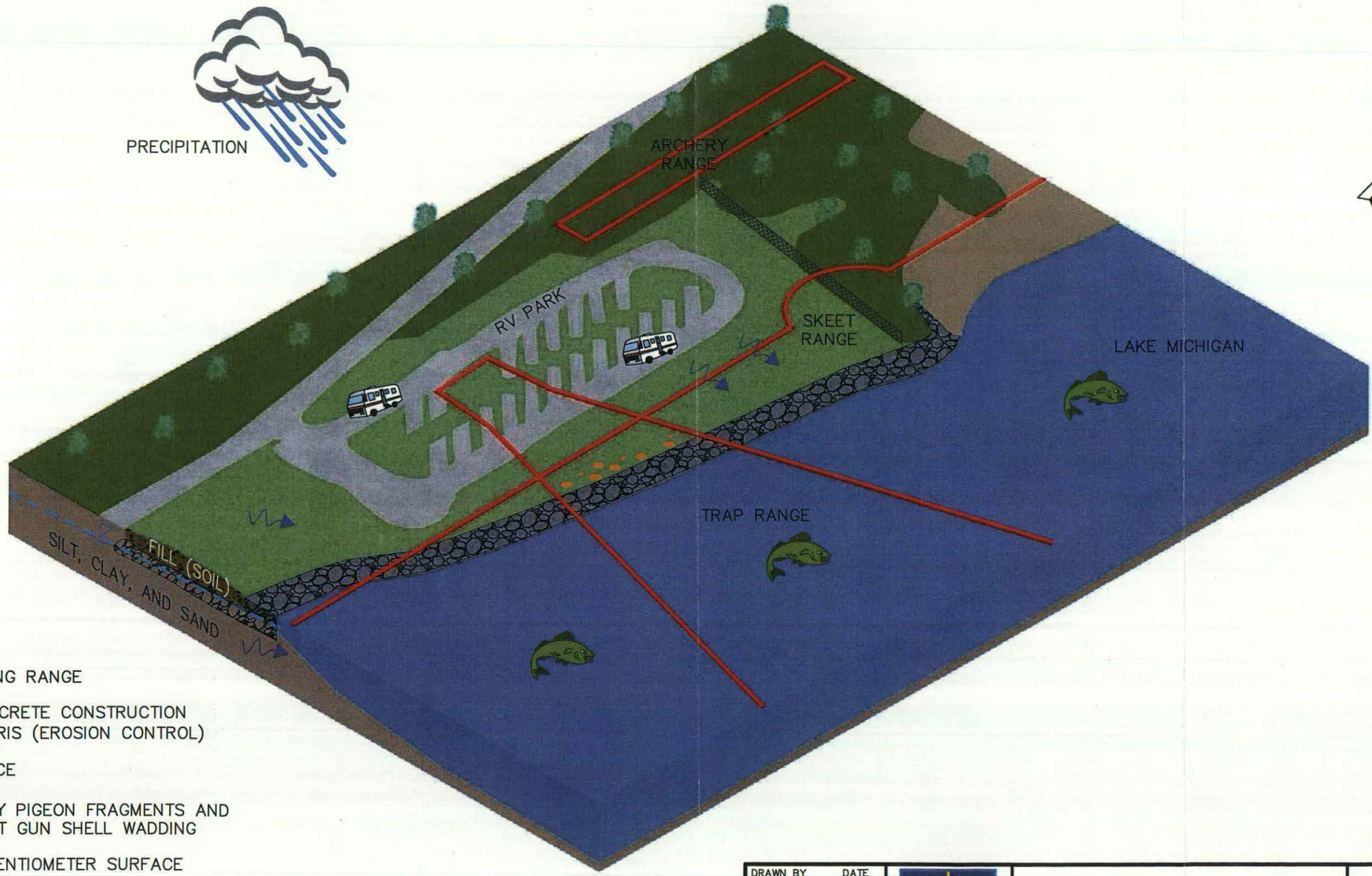
SUBSURFACE SOIL SAMPLE EXCEEDANCES - LEAD
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

CONTRACT NUMBER	CTO NUMBER
APPROVED BY / DATE	
APPROVED BY / DATE	
FIGURE NO. FIGURE 5	REV 0



LEGEND

- FIRING RANGE
- CONCRETE CONSTRUCTION DEBRIS (EROSION CONTROL)
- FENCE
- CLAY PIGEON FRAGMENTS AND SHOT GUN SHELL WADDING
- POTENTIOMETER SURFACE
- RUNOFF/ INFILTRATION/ GROUNDWATER FLOW
- AQUATIC BIOTA

DRAWN BY ND	DATE 7/26/10
CHECKED BY	DATE
REVISED BY	DATE
SCALE NOT TO SCALE	

NAVFAC

CONCEPTUAL SITE MODEL
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

CONTRACT NO. CTO F274	
OWNER NO.	
APPROVED BY	DATE
DRAWING NO. FIGURE 6	SIZE B / REV. 0

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FIGURE 7

MC EXPOSURE PATHWAY ANALYSIS
TSA RANGES
NS GREAT LAKES, GREAT LAKES, ILLINOIS

Source Area	Source Medium	Release Mechanisms	Exposure Medium	Exposure Routes	Receptors

					Current or Future					
					Military/ Civilian	Contractors/ Visitors	Construction Workers	Recreational Users	Residential	Biota/ Critical Habitat
TSA Ranges	Soil	Leaching	Groundwater/ Surface Water	Ingestion	○	○	◐	○	○	○
				Dermal Contact	○	○	◐	○	○	○
	Surface Soil (0 - 1 foot)			Ingestion	○	○	○	○	○	○
				Dermal Contact	○	○	○	○	○	○
				Inhalation (Dust)	○	○	○	○	○	○
	Subsurface Soil			Ingestion	○	○	◐	○	○	○
				Dermal Contact	○	○	◐	○	○	○
				Inhalation (Dust)	○	○	◐	○	○	○
Sediment	Sediment			Ingestion	○	○	○	○	○	○
				Dermal Contact	○	○	○	○	○	○

○	Complete Pathway
○	Incomplete Pathway
◐	Potentially Complete Pathway

Note: Surface soil was conservatively defined as 0 to 2 feet bgs for the evaluation of ecological risk.

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DRAWN BY / DATE	J. ENGLISH 01/16/12
CHECKED BY / DATE	J. DUCAR 05/10/12
REVISED BY / DATE	S. PAXTON 05/10/12
SCALE	AS NOTED

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PROPOSED SOIL EXCAVATION AREAS WITH TACO EXCEEDANCES
TSA RANGES
NAVAL STATION GREAT LAKES
GREAT LAKES, ILLINOIS

CONTRACT NUMBER	CTO NUMBER F274
APPROVED BY / DATE	
APPROVED BY / DATE	
FIGURE NO.	FIGURE 8
REV	0

APPENDICES A THROUGH F

ON SEPARATE CD