Site-Specific Sampling and Analysis Plan Addendum
Surface Soil Sampling
Reservoir No. 2 Burning Ground

Former Plum Brook Ordnance Works, Sandusky, Ohio

Prepared for:

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October 19, 2010

U.S. Army Engineer District, Nashville
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Submittal of the Final Work Plan
Delineation of Soil Contamination Along the Sewer Lines
Between TNT Area A and Waste Water Treatment Plant 1
Former Plum Brook Ordnance Works, Sandusky, Ohio
Contract No. W912QR-08-D-0013: Shaw Project Number 139798

Dear Ms. McClanahan:

In accordance with the requirements of Delivery Order No. DX18 of Contract No. W912QR-08-D-0013 Shaw is pleased to submit this final Work Plan for Delineation of Soil Contamination Along The Sewer Line Between TNT Area A and Waste Water Treatment Plant 1 at the Former Plum Brook Ordnance Works (PBOW) located in Sandusky, Ohio.

Enclosed are four copies of this final work plan. Copies have also been sent to those on the distribution list as shown on the attached page. As requested, the document was sent to the Center of Expertise and the Restoration Advisory Board Co-Chair in electronic format only.

Should you have any questions or require additional information regarding this submittal, please do not hesitate to contact me at (865) 694-7496.

Sincerely,

Steven T. Downey, PE, PMP
Project Manager

Enclosures

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DISCIPLINE SIGN-OFF REVIEW

Client Name: U.S. Army Engineer District, Nashville; CELRN-EC-E

Project Description: Delineation Along the Sewer Lines Between TNTA and WWTP1
Former Plum Brook Ordnance Works, Sandusky, Ohio

Contract No. W912QR-08-D-0013

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List of Acronyms

ASTM	American Society for Testing and Materials
BHHRA	baseline human health risk assessment
DNT	dinitrotoluene
DOD	U.S. Department of Defense
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FS	feasibility study
HI	hazard index
IDW	investigation-derived waste
ILCR	incremental lifetime cancer risk
Jacobs	Jacobs Engineering Group, Inc.
NASA	National Aeronautics and Space Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PAH	polynuclear aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PBOW	Plum Brook Ordnance Works
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzodioxin
PCDF	polychlorinated dibenzofuran
PPE	personal protective equipment
QAPP	quality assurance project plan
RI	remedial investigation
Shaw	Shaw Environmental, Inc.
SLERA	screening-level ecological risk assessment
SSAP	site-specific sampling and analysis plan
SWSAP	site-wide sampling and analysis plan
TNT	trinitrotoluene
USACE	U.S. Army Corps of Engineers

1.0 Project Description

The U.S. Army is conducting studies of the environmental impact of suspected hazardous waste sites at previously owned U.S. Department of Defense (DOD) properties. The former Plum Brook Ordnance Works (PBOW) is located in Sandusky, Erie County, Ohio (Figure 1-1). PBOW is being investigated under the Defense Environmental Restoration Program for Formerly Used Defense Sites. The investigation is being managed and technically overseen by the Nashville District of the U.S. Army Corps of Engineers (USACE). This 9,000-acre facility was used for the manufacture of explosives during World War II. The site is currently owned by the National Aeronautics and Space Administration (NASA) and is operated as the Plum Brook Station of the John Glenn Research Center at Lewis Field.

This site-specific sampling and analysis plan (SSAP) addendum has been prepared by Shaw Environmental, Inc. (Shaw) for the fieldwork to be carried out in support of the feasibility study (FS) for the Reservoir No. 2 Burning Ground. Shaw was contracted to complete the FS during completion of the remedial investigation (RI) performed by another contractor. Review of the RI indicated data gaps associated with the analytical suite and the delineation of the extent of contamination.

The site is located in the northwestern portion of PBOW, approximately 400 feet south of Reservoir No. 2 at the former Plum Brook Station ball field between Ransom Road and Campbell Street. This SSAP was developed in accordance with the PBOW Site-Wide Sampling and Analysis Plan (SWSAP) (Shaw, 2008a) and the Site-Wide Quality Assurance Project Plan (QAPP) (Shaw, 2008b) to ensure that work performed at the subject site will be of the quality required to satisfy the overall and site-specific project objectives. A Site-Wide Health and Safety Plan (Shaw, 2008c) has also been prepared for this investigation to help provide a safe work environment.

1.1 Plum Brook Ordnance Works Facility History

The PBOW site was built in early 1941 and manufactured 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Production of explosives began in December 1941 and continued until 1945. After the plant was shut down, decontamination of TNT, acid, pentolite, and DNT processing lines began. Decontamination was completed during the last quarter of 1945, under the supervision of the Army Ordnance Department. The War Assets Administration accepted custody of the property (3,230 acres) except for the retained area, which is known as the magazine area (2,800 acres), in 1946. The Department of the Army reacquired the 3,230

acres in 1954 and performed cleanup efforts during the 1950s through 1963. Two property use agreements were entered into by the National Advisory Committee of Aeronautics, the predecessor of NASA, and the Army in 1956 and 1958, respectively. In 1963, accountability and custody of the entire PBOW property (6,030 acres) was transferred to NASA by the Department of the Army. NASA has operated and maintained PBOW since 1963, and it is currently the NASA Glenn Research Center, Plum Brook Station. Figure 1-2 shows the various PBOW areas of concern, including the Reservoir No. 2 Burning Ground.

1.2 Site History

The Reservoir No. 2 Burning Ground site was used for burning of production process wastes. It is not known when the site was first used for burning; however, a 1950 aerial photograph clearly shows the site, and photographs dated as late as 1962 show ongoing operations at the site. Restoration of the site was performed in 1963, when the area was cleared of debris and the ground restored to proper grade. Aerial photographs taken in 1950, 1958, and 1968 indicate the presence of a disturbed area with a rectangular berm (1950), a pronounced burning ground (1958), and a large cleared area that shows the land to have been restored (1968). Based on these photos, the size of the burning ground was estimated to be 125 feet wide by 175 feet long (Jacobs Engineering Group, Inc. [Jacobs], 2006).

Previous investigations include a site investigation (IT Corporation, 1997) completed in 1996 and an RI (Jacobs, 2006) completed in 2004. Additional sampling was conducted west of the historic burn area in December 2005 in support of the baseline human health risk assessment (BHHRA) (Jacobs, 2010) to better delineate the extent of contamination. Sample locations from these investigations are shown on Figure 1-3; the additional samples included in the BHHRA evaluation are BH-25 through BH-49. The site investigation identified surface and subsurface soil contamination above U.S. Environmental Protection Agency (EPA) Region 3 risk-based criteria. Contaminants exceeding the risk-based criteria in surface and subsurface soil included polynuclear aromatic hydrocarbons (PAH), explosives, polychlorinated biphenyls (PCB), and lead. The RI was performed to define the extent of soil contamination and to evaluate impacts to the groundwater, surface water, and sediment in the vicinity of the Reservoir No. 2 Burning Ground. RI sample collection and data evaluation are discussed in detail in the *Final Site Characterization Report, Remedial Investigation Part 1 at Reservoir No. 2 Burning Ground* (Jacobs, 2006).

Based on the information obtained from these investigations, the burn layer at the Reservoir No. 2 Burning Ground covers an area of approximately 21,000 square feet, or approximately half an acre. This area covers much of the southeastern portion of the existing open field and extends

approximately 20 to 30 feet into the wooded area south of the clearing. The burn layer is on average 1 foot below ground surface and 1 foot thick.

The BHHRA concluded that contamination present within the burn layer boundary, referred to hereinafter as the "burn area," may pose potential unacceptable risks and hazards to human receptors. The incremental lifetime cancer risk (ILCR) associated with the combined child/adult resident was 4E-3 for subsurface soil and 3E-4 for surface soil within the burn area, both of which exceeded the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (EPA, 1990) risk management range of 1E-6 to 1E-4. The hazard index (HI) values for the child resident receptor exposed to subsurface soil (HI=651) and surface soil (HI=140) within the burn area both exceeded the target HI of 1. These risk/hazard estimates were primarily the result of exposure to dioxin/furans, nitroaromatics, and/or PCBs present in the soil. The mean lead concentrations for surface soil (486 milligrams per kilogram) and subsurface soil (757 milligrams per kilogram) within the burn area were also found to be elevated with respect to human health concerns. Pesticides, volatile organic compounds, and semivolatile organic compounds were determined not to be a concern for this site.

The BHHRA calculations also indicate an ILCR of 1E-4 (mostly associated with nitroaromatics and PCBs) for the child/adult resident and an HI of 15 for the child resident (mostly associated with TNT) exposed to surface soil located outside of the burn area (Figure 1-4). This HI exceeds the target criterion of 1, and the ILCR exceeds the PBOW target ILCR of 1E-5 and equals the upper bound of the NCP 1E-6 to 1E-4 risk management range. It is also concluded from the BHHRA that site-related risks/hazards for subsurface soil outside of the burn area, sediment, and surface water are de minimis. Groundwater pathways were identified in the BHHRA as incomplete; therefore, potential human health risks associated with groundwater exposure are regarded as negligible.

Locations of elevated surface soil concentrations of chemicals of potential concern outside of the burn area are not well delineated. Also, although dioxins/furans were analyzed for in the samples collected from within the burn area, only three samples collected from outside of the burn area were analyzed for dioxins/furans, none of which exhibited elevated levels of dioxins/furans or any other chemicals of concern. The decision to collect only limited samples for dioxins/furans analysis outside the burn area was based on the concern that dioxins/furans are ubiquitous in soil and that any detection may not have been site related.

Most of the samples collected from within the burn layer exhibiting elevated dioxins/furan also had high level of other chemicals of concern (i.e., nitroaromatics, PCBs). Thus, the fact that the

three samples analyzed for dioxins/furans collected from outside of the burn area did not exhibit elevated dioxins/furans does not suggest that samples from other areas outside of the burn area do not have elevated levels of dioxins/furans. Conversely, because dioxins/furans were the major contributors to the estimated cancer risk at some locations within the burn area which also exhibited elevated concentrations of nitroaromatics and PCBs, it is possible that dioxins/furans may contribute appreciably to potential cancer risks of surface soil outside of the burn area that have already been estimated as exceeding or approaching the upper bound of the NCP risk management range.

A screening-level ecological risk assessment (SLERA) was also completed for this site. The SLERA identified elevated hazards for terrestrial receptors within the burn area associated with exposure to elevated concentrations of dioxins/furans, nitroaromatics, and PAHs in soil. Outside the burn area, terrestrial receptors were identified as having elevated hazards associated with exposure to nitroaromatics. Given the very limited aquatic habitat in the vicinity of the site, impacts to aquatic biota are regarded as negligible in the SLERA. Based on previous work at PBOW, it is anticipated that any remedial action take to address human health concerns at this site will also address impacts to ecological receptors as well.

2.0 Scope of Work and Objectives

2.1 Scope of Work

As specified in the scope of work (USACE, 2010), this SSAP addendum describes the following tasks:

- Surface soil sampling
- Laboratory analysis of surface soil samples
- Management and disposal of investigation-derived waste (IDW).

The analytical data will be presented and evaluated in the Reservoir No. 2 Burning Ground FS.

2.2 Objectives

The primary objective of the Reservoir No. 2 Burning Ground fieldwork is to complete the delineation of surface soil contamination by addressing the data gaps identified during a review of the existing data and site risk assessment. As noted in Section 1.2, the chemicals of concern are dioxins/furans, nitroaroamatics, PCBs, and/or PAHs. Lead is also a chemical of concern but is confined to the burn area. Evaluation of the RI data indicates that surface soil is the only medium impacted by burning activities outside of the burn area and that the impact may have resulted from regrading after site activities ended. Surface water at the site is only present for brief periods following precipitation events. Specifically, the following sampling is planned for the Reservoir No. 2 Burning Ground site:

- Collection of surface soil samples at 22 historical locations and analyzing for dioxins/furans

- Collection of surface soil samples at 12 new areas to delineate the extent of soil contamination associated with potential regrading activities.

The sampling locations were determined based on risk assessment and engineering requirements to complete a remedial design.

2.3 Site-Specific Data Quality Objectives

2.3.1 Overview

The data quality objectives (DQO) process followed during the project planning stages evaluated data requirements needed to support the decision-making process and select the best action to satisfy these requirements. Incorporated components of the DQO process, described in EPA Publication 9355.9-01 (EPA, 2006), are discussed in detail in Section 3.3 of the SWSAP.

Determining factors for procedures necessary to satisfy investigative objectives and to establish the basis of future actions at PBOW are presented on Figure 2-2 of the SWSAP (Shaw, 2008a).

2.3.2 Data Users and Available Data

A site-specific conceptual model developed using existing data was used by project risk assessors and remedial design engineers to identify data gaps. During the project planning process, effective methodologies for filling the data gaps were designed and reviewed by the data users with the most efficient data collection design implemented. The SSAP records the rationale for the design, including the location, number, and type of samples necessary to fill the data gaps and to satisfy the DQOs. The SSAP, along with companion documents, provides the regulatory agencies with sufficient detail to conclude whether the investigative effort is adequate to satisfy the study objectives.

2.3.3 Conceptual Site Model

The four factors considered in defining the conceptual model are as follows:

- Potential contaminant sources
- Migration pathways
- Potential human health and ecological receptors
- Types of contaminant of an affected medium.

The source of contamination at the Reservoir 2 Burning Ground is the storage and burning of TNT production process wastes. Potential regrading activities may have moved contaminated soil outside of the burn area. The migration pathways for potential contaminants include leaching to overburden/shale groundwater and bedrock groundwater, and runoff to creeks associated with precipitation events. The bedrock groundwater is not of sufficient quality to be used as a potable water supply (Jacobs, 2000). The overburden/shale groundwater is not of sufficient yield to be used as a potable source (Jacobs, 2010).

The Reservoir No. 2 Burning Ground is currently a grass-covered open field with young hardwood trees and brush surrounding the area (Jacobs, 2006). The assumption for future land use is unrestricted. Plum Brook Station employees and contractors may have casual contact with the soil in the Reservoir No. 2 Burning Ground incidental to routine utility servicing or maintenance activities. Hunters may also have casual contact with the soil, as NASA does open the area to hunting during certain times of the year. The possibility of trespassers being exposed to the Reservoir No. 2 Burning Ground soil is not regarded as plausible because of the security fence and NASA security force. Potential ecological receptors at the Reservoir No. 2 Burning Ground are wildlife communities and plant communities. Groundwater in the vicinity of the site

is not used as a potable source. Based on an evaluation of existing data (Jacobs, 2006; 2010), chemicals of concern likely include nitroaromatic compounds, PAHs, PCBs, and polychlorinated dibenzodioxins/furans. The potential contaminants of concern are restricted to surface soil.

2.3.4 Decision-Making Process, Data Uses, and Needs

The decision-making process that will be followed during the soil delineation activities, as presented in detail in Section 3.3.4 of the SWSAP (Shaw, 2008a), consists of a seven-step DQO process. DQOs are summarized in Table 2-1.

2.3.5 Risk-Based Evaluation

Definitive data from samples collected in this effort will be used in combination with existing analytical results described in the RI (Jacobs, 2006) and BHHRA (Jacobs, 2010) to delineate contamination and to support the FS.

2.3.6 Data Quality, Types, and Quantities

A total of 34 surface soil samples will be collected and analyzed to meet the objectives of the delineation activities. Quality assurance/quality control samples will be collected for all sample types described in Chapter 3.0 of this SSAP (Table 2-2). All samples will be analyzed by EPA-approved methods and will comply with EPA definitive data requirements. In addition to meeting the quality needs of the delineation activities, data analyzed at this level of quality are appropriate for all phases of the investigation and the FS.

2.3.7 Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity

Laboratory requirements of precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) for all samples generated during the soil delineation activities are provided in Chapter 3.0 of the QAPP (Shaw, 2008b). Tables 7-1 through 7-5 of the QAPP (Shaw, 2008b) list the laboratory reporting limits (sensitivity). Table 9-1 of the QAPP (Shaw, 2008b) addresses the laboratory requirements and laboratory quality control parameters that affect PARCCS.

3.0 Field Activities

Soil delineation activities will be conducted in a manner consistent with work conducted previously at the PBOW facility. Soil samples will be collected from 22 existing and 12 new locations to delineate the nature and extent of contamination in surface soil at the site. The existing locations proposed to be resampled for dioxin/furans are necessary to fill the data gap identified in Section 1.2. The new surface soil locations are being sampled for nitroaromatics, PCBs, PAHs, and dioxin/furans to aid in the delineation of the extent of contamination. The proposed locations have been selected using data and knowledge from the previous investigations. The field activities to be executed under this SSAP are discussed in the following sections.

3.1 Land Surveying

Prior to the collection of surface soil samples, Shaw will secure the services of an Ohio-registered professional land surveyor to determine the coordinates and elevations of both existing and new locations. The existing locations were previously surveyed. Survey coordinates for proposed locations were derived from geo-referenced site figures. Both the existing and proposed new sample locations are shown in Table 3-1. Due to the difficulty in locating the proposed locations in the field based solely on site-specific maps and the need to resample historical locations, all sampling locations will be surveyed by a Ohio-registered surveyor prior to sampling. Note that no post-sampling surveying will be completed unless a sample point is moved due to surface obstruction or other site conditions (e.g., refusal during sampling).

The horizontal coordinates will be to the closest 0.1 foot and referenced to the State Plane Coordinate System. Vertical coordinates (ground elevation) will be to the nearest 0.01 foot and referenced to the 1929 National Geodetic Vertical Datum. If the 1929 datum is not readily available, the existing local vertical datum will be used. All survey data will be tabulated. Loop closure for survey accuracy for PBOW is Third Order, Class II as specified in the Standards and Specifications for Geodetic Control Networks, which correlates to 1 part in 5000 (1:5000). Modern survey equipment typically achieves loop closures of 1 part in 40,000 on a routine basis. Sample survey data will be entered on approved Shaw sample collection logs. Critical reference points, landmarks, and sample locations will be plotted on appropriate map figures with a scale large enough to show their locations relative to other structures at the site.

3.2 Surface Soil Sampling

Surface soil samples will be collected using a stainless-steel hand auger from the uppermost 1 foot of soil at each of the locations shown on Figure 3-1. A qualified geologist or geotechnical engineer will be on site for all sampling operations. Prior to collecting the samples, surface debris (e.g., rocks, vegetation) will be removed from the immediate sample area. The remaining soil will be transferred from the sampler to a clean stainless-steel bowl and placed in the appropriate sample containers. Upon filling a sample container, the jar will be placed on ice. Any remaining soil will be returned to the soil boring location.

Soil samples will be documented by sample collection logs and analysis request/chain-of-custody record forms (Figures 4-7 and 6-2 of the SWSAP [Shaw, 2008a]), following field custody procedures specified in Section 5.1 of the QAPP (Shaw, 2008b). Any changes from this SSAP or the SWSAP will be recorded in chronological order in the variance log shown on Figure 9-1 of the SWSAP (Shaw, 2008a). Analytical parameters and methods are summarized in Table 3-2.

Daily field notes will be kept on a field activity daily log and will include sufficient information to reconstruct the progress of the sampling activities. After completion of database entry, all field forms and documents will be archived in the project files at the Shaw office in Knoxville, Tennessee.

3.3 Utility Clearances

Prior to beginning sampling activities, the site will be marked for underground utilities by personnel from NASA, Plum Brook Station Health and Safety Division, or other appropriate department.

3.4 Site Access and Safety Communication

All personnel will meet each morning at the NASA/Plum Brook Station, white/red barn area, or other “headquarters” type area for the morning tailgate safety/job safety analysis meeting, equipment calibration, gathering of needed material, and replenishing of water. At the end of each day, IDW generated during fieldwork will be moved to the Shaw IDW storage area located in the secured NASA staging area. Names of all personnel, including any subcontracted personnel, will be provided by Shaw to Mr. Robert Lallier, NASA Environmental Coordinator, at least 72 hours in advance so that site access can be arranged. All personnel entering the NASA (former PBOW) facility will be appropriately trained and instructed by Plum Brook Station concerning site safety issues. All Shaw personnel and any subcontracted personnel participating in this sampling activity must be U.S. citizens.

4.0 Sample Analysis and Decontamination Procedures

4.1 Sample Number System

The sample numbering system to be used during this investigation will conform to the USACE Nashville District's numbering convention. Specifically, each sample will be assigned a unique sample identification number that describes where the sample was collected. Each number will consist of a group of letters and numbers separated by hyphens. The sample media and numbering system are described as follows.

Project Code	Year	Sample Type[a]	Site Identification[b]	Location (Well ID)	Sample Number	Depth[c]
PBOW	10	XX	XXXX	XXXX	XXXX	(XXXX)

[a]Sample type:
SS – surface soil sample
MS – matrix spike
MD – matrix spike duplicate

[b]Site:
The Reservoir No. 2 Burning Ground – R2BG

[c]Depth: Required for soil samples.

The complete sample number will be recorded by the Shaw field geologist/geotechnical engineer in the field activity daily log and/or in the boring log and as appropriate in the sample collection log.

4.2 Analytical Program

The analytical program has been designed to acquire sufficient and defensible data to determine the nature and extent of contamination at the site in support of the FS. Table 3-2 summarizes the analytical parameters required and associated laboratory methods to be used during this investigation.

A DOD Environmental Laboratory Accreditation Program accredited laboratory will analyze samples for nitroaromatics by EPA Method SW-846 8330, PCBs by SW-846 8082, polychlorinated dibenzodioxins (PCDD)/polychlorinated dibenzofurans (PCDF) by SW-846 8290, and PAHs by SW-846 8270 SIMS. All applicable analyses will meet the recommended method guidance found in *Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods* (EPA, 1996) and its subsequent updates. They will meet the quality assurance/quality

control requirements outlined in EM-200-1-6, *Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects* (USACE, 1997). The analytical laboratory must comply with *Quality Systems Manual for Environmental Laboratories* (DOD, 2009). Project-specific reporting limits are included in Tables 7-1 through 7-4 of the QAPP (Shaw, 2008b). All other requested analyses must conform to their specified method(s).

4.3 Decontamination Procedures

Decontamination requirements and procedures are specified in detail in Chapter 5.0 of the SWSAP (Shaw, 2008a) and will be followed during soil delineation activities. The Shaw field coordinator must contact Plum Brook Station for access to a potable water source for decontamination use. The following text summarizes decontamination procedures for equipment that may come in contact with samples for chemical analysis (stainless-steel homogenization bowls, mixing spoons, etc.):

- Remove excess soil from the equipment and return soil to the soil boring.
- Pre-wash sampling equipment in potable water (no detergent) using a brush.
- Wash and scrub using a brush with nonphosphate detergent.
- Rinse with potable water.
- Rinse with reagent grade isopropanol.
- Rinse with American Society for Testing and Materials (ASTM) Type II water.
- Rinse with hexane (when sampling for PCBs).
- Final rinse with ASTM Type II water; the volume of water used will be at least five times greater than the volume of hexane used.
- Air dry.
- Wrap in aluminum foil.

Decontamination wash water and rinse water will be managed for disposal as described in Section 6.1.

5.0 Sample Preservation, Packing, and Shipping

Sample containers and caps will be new, certified as precleaned, and made of materials recommended by EPA in Title 40, Code of Federal Regulations, Part 136 and SW-846 (EPA, 1996). Sample containers and preservatives/preservation methods are summarized in Table 5-1. Sample containers will be supplied and shipped to the job site by the designated primary laboratory.

Each sample container will be bagged before placement in the cooler. Sample holding times will be calculated based on the date and time of sample collection.

Samples for chemical analysis will be placed in coolers as soon as possible after collection and will be packed to minimize container breakage by using styrofoam peanuts or bubble wrap to fill void spaces in the cooler; vermiculite will not be used. Coolers will be taped, marked, and sealed, and custody will be maintained, as described in Chapter 6.0 of the SWSAP. Samples will be cooled to a temperature within 0 to 6 degrees Celsius and maintained at that temperature by means of double-bagged ice until the cooler is received at the laboratory. Coolers will be shipped to the laboratory by a next-day delivery service. The temperature of each cooler will be taken with an infrared thermometer upon receipt. Notification of shipment, including airbill number, will be telephoned or faxed to the laboratory on the day of sample collection. If this is not possible, the laboratory will be notified the following morning.

For samples collected for PAHs, PCBs, and nitroaromatic analyses, a completed analytical request/chain-of-custody record will be secured and included with each shipment of coolers to:

ATTN: Sue Bell
Accutest Southeast
4405 Vineland Road
Suite C-15
Orlando, FL 32811
P:407-425-6700
F:407-425-0707

For samples collected for analysis of PCDDs/PCDFs, a completed analytical request/chain-of-custody record will be secured and included with each shipment of coolers to:

ATTN: Jamie McKinney
Test America
5815 Middlebrook Pike
Knoxville, TN 37921
P:865-291-3000
F:865-584-4315

For split samples collected for analysis of PCDDs/PCDFs, a completed analytical request/chain-of-custody record will be secured and included with each shipment of coolers to:

ATTN: Matt Burns
Cape Fear Analytical, LLC
3306 Kitty Hawk Road, Suite 120
Wilmington, NC 28405
P:910-795-0421
C:919-270-6042

For split samples collected for PAHs, PCBs, and nitroaromatic analyses, a completed analytical request/chain-of-custody record will be secured and included with each shipment of coolers to:

ATTN: Jamie McKinney
Test America
5815 Middlebrook Pike
Knoxville, TN 37921
P:865-291-3000
F:865-584-4315

6.0 Investigation-Derived Waste Management Plan

Anticipated IDW during field activities includes decontamination fluids and disposable personal protective equipment (PPE). Detailed procedures for IDW management are provided in Chapter 8.0 of the SWSAP (Shaw, 2008a). The following is a brief summary of the procedures for handling IDW.

6.1 Decontamination Fluid

Limited quantities of decontamination fluid, including wash water, nonphosphate soapy water, and final rinse water, will be kept in plastic tubs during the decontamination process and will be placed in 55-gallon drums upon completion of field sampling. Decontamination fluid containing small quantities of solvents such as isopropanol, methanol, and hexane will be collected in metal pans for evaporation.

6.2 Sampling Equipment and Personal Protective Equipment

Limited quantities of PPE and sampling equipment, including Tyvek® suits, latex/nitrile gloves, and plastic, will be generated during sampling. All sampling equipment and PPE will be double-bagged and disposed of in on-site Shaw-contracted dumpsters. If any of the sampling equipment and PPE appears to be grossly contaminated, it will be decontaminated prior to disposal.

6.3 Investigation-Derived Waste Sampling

All decontamination fluid will be sampled at the completion of fieldwork. Table 3-2 summarizes the analytical parameters and methods for the IDW samples. Seven-day turnaround time will be used unless otherwise directed by the Shaw project manager.

When the analytical results are received, Shaw personnel will evaluate the results and make a determination of off-site disposal methods. Possible disposal facilities will be identified by Shaw; however, selection of the facility or facilities to receive the IDW will be the responsibility of USACE.

7.0 References

IT Corporation, 1997, ***Site-Wide Groundwater Investigation Report, Plum Brook Ordnance Works, Sandusky, Ohio,*** September.

Jacobs Engineering Group, Inc. (Jacobs), 2010, ***Revised Final Baseline Human Health Risk Assessment, Reservoir No. 2 Burning Ground***, February.

Jacobs Engineering Group, Inc. (Jacobs), 2006, ***Final Site Characterization Report, Remedial Investigation Part 1 at Reservoir No. 2 Burning Ground***, January.

Shaw Environmental, Inc. (Shaw), 2008a, ***Site-Wide Sampling and Analysis Plan, Plum Brook Ordnance Works, Sandusky, Ohio,*** July.

Shaw Environmental, Inc. (Shaw), 2008b, ***Site-Wide Quality Assurance Project Plan, Plum Brook Ordnance Works, Sandusky, Ohio,*** July.

Shaw Environmental, Inc. (Shaw), 2008c, ***Site-Wide Health and Safety Plan, Plum Brook Ordnance Works, Sandusky, Ohio,*** July.

U.S. Army Corps of Engineers (USACE), 2010, ***Modification to the Scope of Work for Feasibility Study, Proposed Plan, and Decision Document, Reservoir No. 2 Burning Ground, Former Plum Brook Ordnance Works (PBOW), Sandusky, Ohio,*** June.

U.S. Army Corps of Engineers (USACE), 1997, ***Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects***, EM 200-1-6, October 1997.

U.S. Department of Defense (DOD), 2009, ***Quality Systems Manual for Environmental Laboratories***, Final Version 4.1, April.

U.S. Environmental Protection Agency (EPA), 2006, ***Guidance on Systematic Planning Using the Data Quality Objectives Process***, EAP QC/G-4, February, EPA/240/B-6/001.

U.S. Environmental Protection Agency (EPA), 1996, ***Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods***, EPA Publications SW-0846, Third Edition, Update III, (http://www.epa.gov/sw-846/sw846.htm).

U.S. Environmental Protection Agency (EPA), 1990, "National Oil and Hazardous Substances Pollution Contingency Plan," ***Federal Register*** 55(46): 8666-8865.

TABLES

Table 2-1

Summary of Data Quality Objectives
Reservoir No. 2 Burning Ground
Former Plum Brook Ordnance Works, Sandusky, Ohio

Potential Data Users	Available Data	Conceptual Model	Media of Concern	Data Uses and Objectives	Data Types	Analytical Level
OEPA DOD USACE NASA Shaw Other Contractors Possible Future Land Users	Previous environmental investigations show varying degrees of contamination in the soil. - COCs include PCBs, PAHS, nitroaromatics and dioxins/furans - VOCs, SVOCs (other than PAHs), and metals are not considered COCs.	Contaminant Source Burning of process wastes from the production of TNT, DNT, and pentolite. Past DOD operations. Migration Pathways Soil, sediment, surface water, and groundwater Potential receptors Wildlife, human Potential Contaminants of Concern PCBs, PCDDs, PCDFs, PAHs, and nitroaromatic explosives	Soil	Determine if there are hazardous substances present that constitute an unacceptable risk to human health and/or the environment. Address data gaps in delineation of soil contamination and data gaps in the analytical suite at existing sample locations collected during the RI.	Soil PAHs Explosives PCBs PCDDs/PCDFs	Definitive data for all sample analyses.

DNT - Dinitrotoluene.
DOD - U.S. Department of Defense.
EPA - U.S. Environmental Protection Agency.
OEPA - Ohio Environmental Protection Agency.
USACE - U.S. Army Corps of Engineers.
PCDD - Polychlorinated dibenzodioxin.
COC - Chemical of concern.
NASA - National Aeronautics and Space Administration.
PAH - Polyaromatic hydrocarbon.
TNT - Trinitrotoluene.
PCB - Polychlorinated biphenyl.
Shaw - Shaw Environmental, Inc.
PCDF -Polychlorinated dibenzofuran.

Table 2-2

Summary of Analytical Samples
Surface Soil Sampling
Reservoir No. 2 Burning Ground
Former Plum Brook Ordnance Works, Sandusky, Ohio

Surface Soil Samples						
Parameters	**Field samples**	**QA/QC Samples**	**Rinsates**	**Source Water**	**Trip Blanks**	**Matrix Spike/Duplicates**
Nitroaromatics	12	1	1	1	NA	1/1
PCBs	12	1	1	1	NA	1/1
PAHs	12	1	1	1	NA	1/1
PCDDs/PCDFs	34	3	1	1	NA	2/2

PAH - Polyaromatic hydrocarbon.

PCB - Polychlorinated biphenyl.

PCDD - Polychlorinated dibenzodioxins .

PCDF - Polychlorinated dibenzofurans.

Table 3-1

Existing and Proposed Sample Survey Data
Soil Delineation Samples for Reservoir No. 2 Burning Grounds
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Easting	Northing
2BGSO-05	1913019.7	622351.8
BH14	1912993.5	622290.3
BH21	1913036.0	622211.5
BH22	1913018.5	622175.6
BH26	1912937.1	622231.6
BH27	1912953.6	622198.4
BH28	1912935.4	622168.0
BH29	1912958.9	622142.2
BH30	1912957.9	622263.7
BH31	1912937.5	622219.8
BH32	1912913.4	622182.0
BH36	1913074.0	622351.1
BH37	1913067.9	622310.6
BH38	1913061.5	622267.3
BH39	1913030.2	622285.7
BH40	1912898.0	622131.4
BH41	1912908.3	622098.4
BH43	1912954.4	622081.7
BH44	1912994.1	622094.4
BH45	1913007.3	622060.9
BH46	1913045.0	622074.1
BH47	1913098.5	622042.6
BH50	1913083.5	622295.6
BH51	1913004.2	622269.8
BH53	1912957.5	622232.6
BH54	1913030.0	622121.5
BH55	1913077.2	622101.1
BH56	1912917.6	622074.4
BH60	1913143.8	622307.0
BH61	1913201.6	622253.1
BH52	1912815.4	622160.9
BH57	1912965.0	622042.7
BH58	1913028.2	622021.4
BH59	1912916.0	622004.3
BH62	1912857.1	622231.6

Table 3-2

Summary of Analytical Parameters and Methods
Soil Delineation Samples for Reservoir No. 2 Burning Grounds
Former Plum Brook Ordnance Works, Sandusky, Ohio

Sample Matrix	Analytical Parameters[a]	Analytical Method[b]
Surface Soils	Polyaromatic Hydrocarbons	SW-846 3541/8270 LL
	Nitroaromatic Compounds	SW-846 8330
	PCBs	SW-846 3541/8082
	Dioxins/Furans	SW-846 8290
Water IDW	TCL Volatile Organic Compounds	SW-846 5030B/8260B
	TCL Semivolatile Organic Compounds	SW-846 3510C/8270C
	Nitroaromatic Compounds	SW-846 3535/8330
	TAL Metals	SW-846 3005A/6010B/7470A
	Ignitability	SW-846 1010
	pH	SW-846 9045B
	Corrosivity	SW-846 1110
	Reactive Cyanide	7.3.3/7.3.4
	Reactive Sulfide	7.3.3/7.3.4

[a]Target analyte list (TAL) and target compound list (TCL) are used to designate parameter lists with no requirements for Contract Laboratory Program (CLP) method quality control or data reporting packages

[b]Analyses found in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* USEPA Publication, Third Edition and *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, March 1983 and subsequent revisions.

IDW - Investigation-derived waste.
PCB - Polychlorinated biphenyl.
TCL - Target compound list.
TAL - Target analyte list.

Table 5-1

Analytical Methods, Containers, Preservatives, and Holding Times
Soil Delineation Samples for Reservoir No. 2 Burning Grounds
Former Plum Brook Ordnance Works, Sandusky, Ohio

Matrix	Parameter	Analytical Method	Sample Container*	Preservation Requirements	Holding Time
Surface Soils	PAHs	SW-846 3541/8270 LL	(1) 8 oz CWM glass with Teflon-lined lid	Cool to 4°C	14 days extraction/40 days
	Nitroaromatics	SW-846 8330			14 days extraction/40 days
	PCBs	SW-846 3541/8082			14 days extraction/40 days
	PCDD/PCDF	SW-846 8290	(1) 4 oz CWM glass with	Cool to 4°C	None
Water IDW	TCL VOCs	SW-846 5030B/8260B	(3) 40 ml VOA vial	Cool to 4°C, HCL to pH <2	14 days
	TCL SVOCs	SW-846 3510C/8270C	(2) 1 L amber glass	Cool to 4°C	7 days extraction/40 days
	Nitroaromatics	SW-846 3535/8330	(1) 1 L amber glass	Cool to 4°C	7 days extraction/40 days
	TAL Metals	SW-846 3005A/6010B/7470A	(1) 250 mL HDPE	Cool to 4°C, HNO_3 to pH <2	6 months (28 days for Hg)
	Ignitability	SW-846 1010	(1) 1 L Amber	Cool to 4°C	ASAP
	pH	SW-846 9045B			
	Corrosivity	SW-846 1110			
	Reactive Cyanide	7.3.3/7.3.4			
	Reactive Sulfide	7.3.3/7.3.4			

°C - Degrees Celsius.
CWM - Clear wide mouth.
HNO_3 - Nitric acid.
HCl - Hydrochloric acid.
HDPE - High density polyethylene.
oz - Ounces.
L - Liter.
mL - Milliliter.
PAH - Polynuclear aromatic hydrocarbon.
PCB - Polychlorinated biphenyl.
PCDD - Polychlorinated dibenzodioxin.
PCDF - Polychlorinated dibenzofuran.
SVOC - Semivolatile organic compound.
TAL - Target analyte list.
TCL - Target compound list.
VOC - Volatile organic compound.
IDW - Investigative-derived waste.

*Number of containers required in ( ).

FIGURES

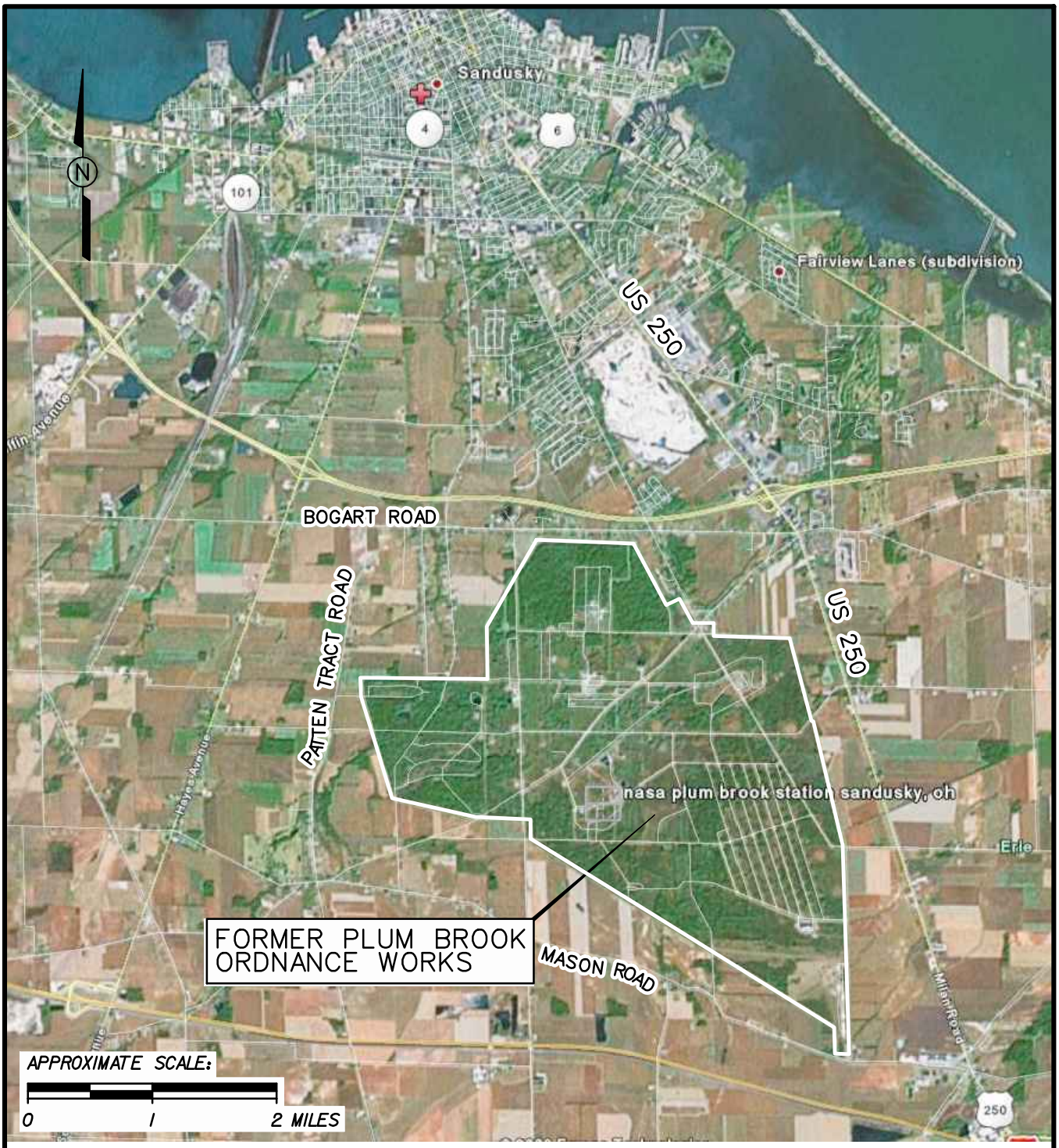

FIGURE 1-1
PBOW VICINITY MAP

RESERVOIR NO. 2 BURNING GROUND SSAP
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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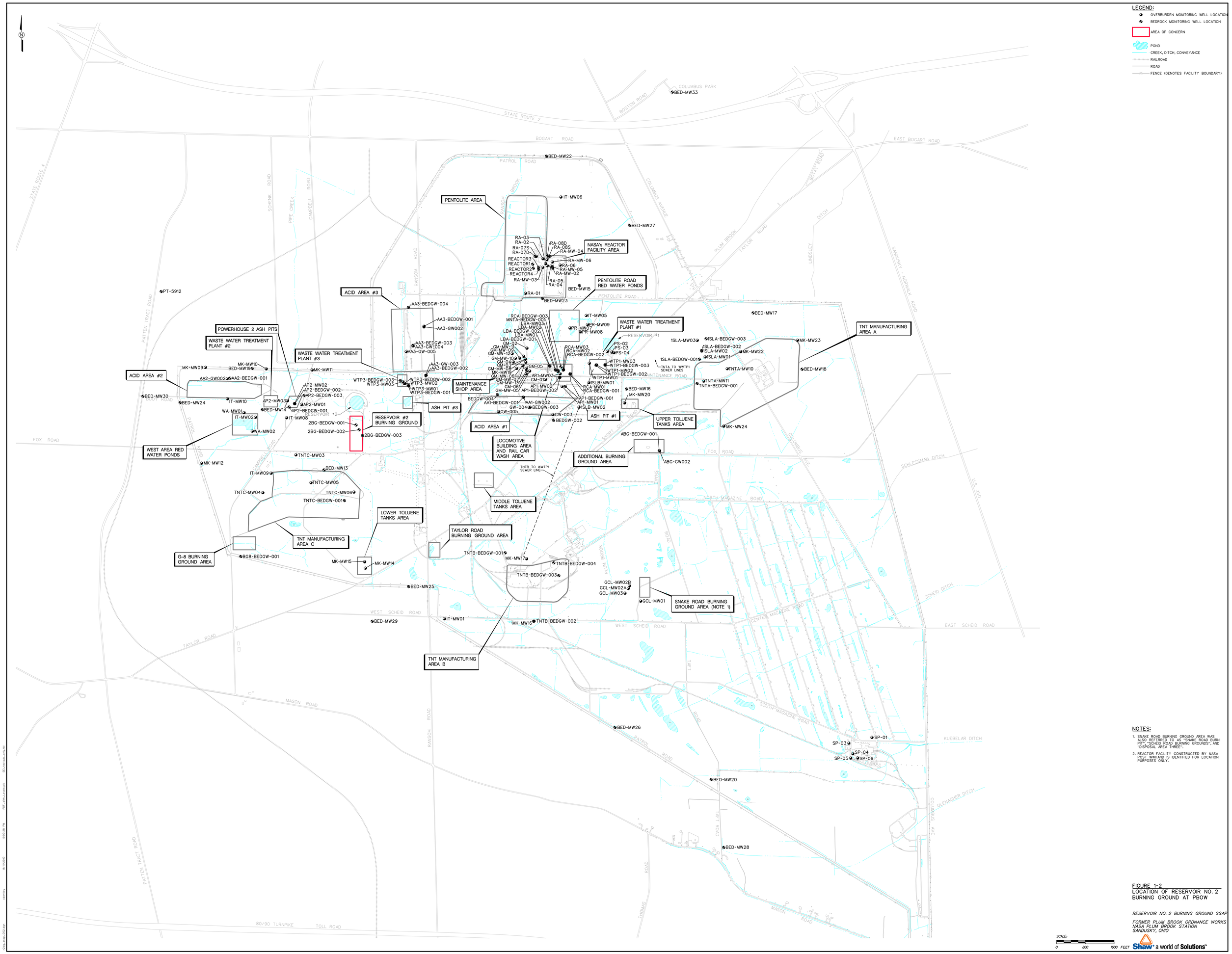

NOTES:

1. SNAKE ROAD BURNING GROUND AREA WAS ALSO REFERRED TO AS "SNAKE ROAD BURN PIT", "SCHEID ROAD BURNING GROUNDS", AND "DISPOSAL AREA THREE".
2. REACTOR FACILITY CONSTRUCTED BY NASA POST WWII AND IS IDENTIFIED FOR LOCATION PURPOSES ONLY.

FIGURE 1-2
LOCATION OF RESERVOIR NO. 2 BURNING GROUND AT PBOW

RESERVOIR NO. 2 BURNING GROUND SSAP

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

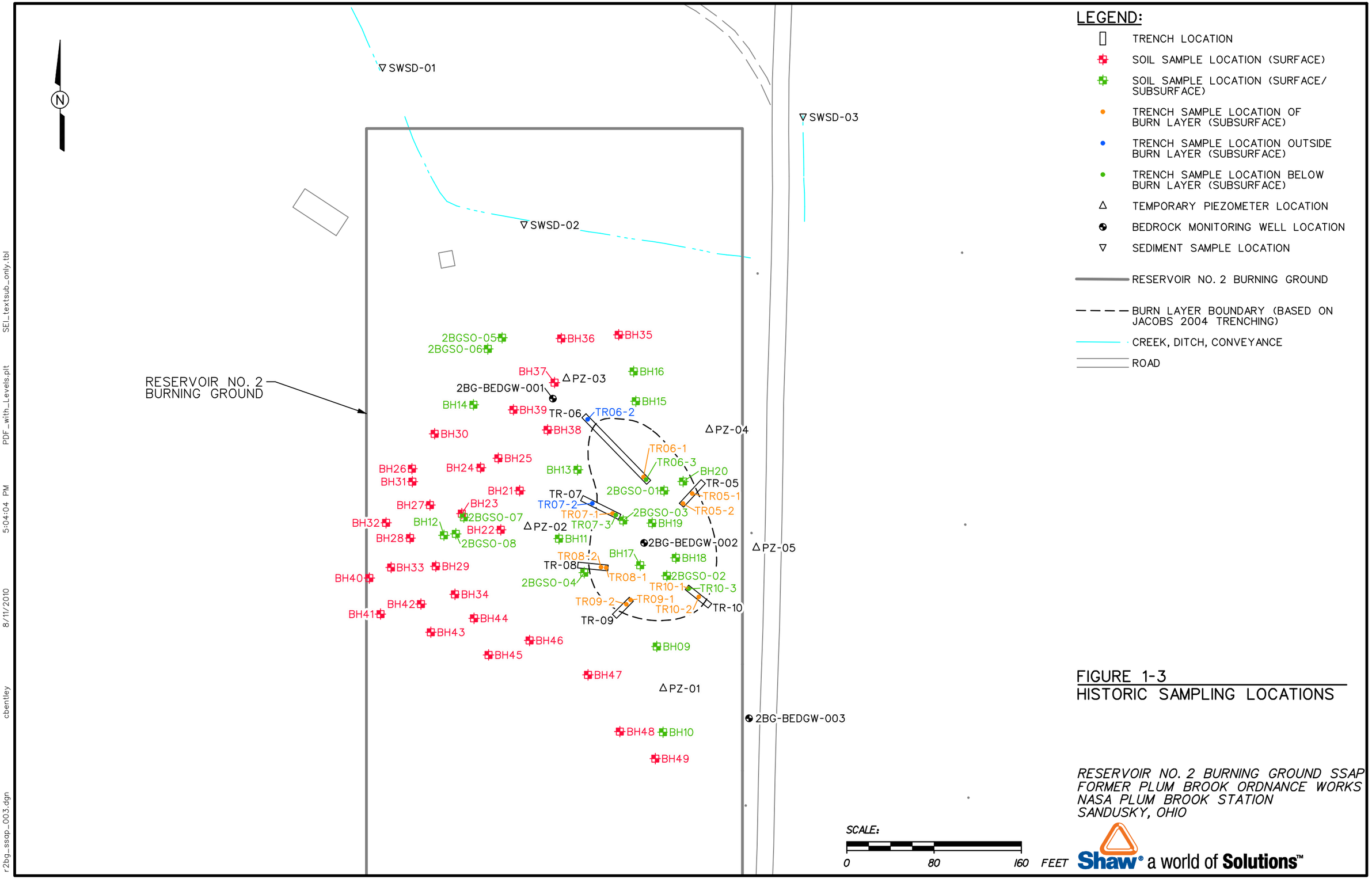

FIGURE 1-3
HISTORIC SAMPLING LOCATIONS

RESERVOIR NO. 2 BURNING GROUND SSAP
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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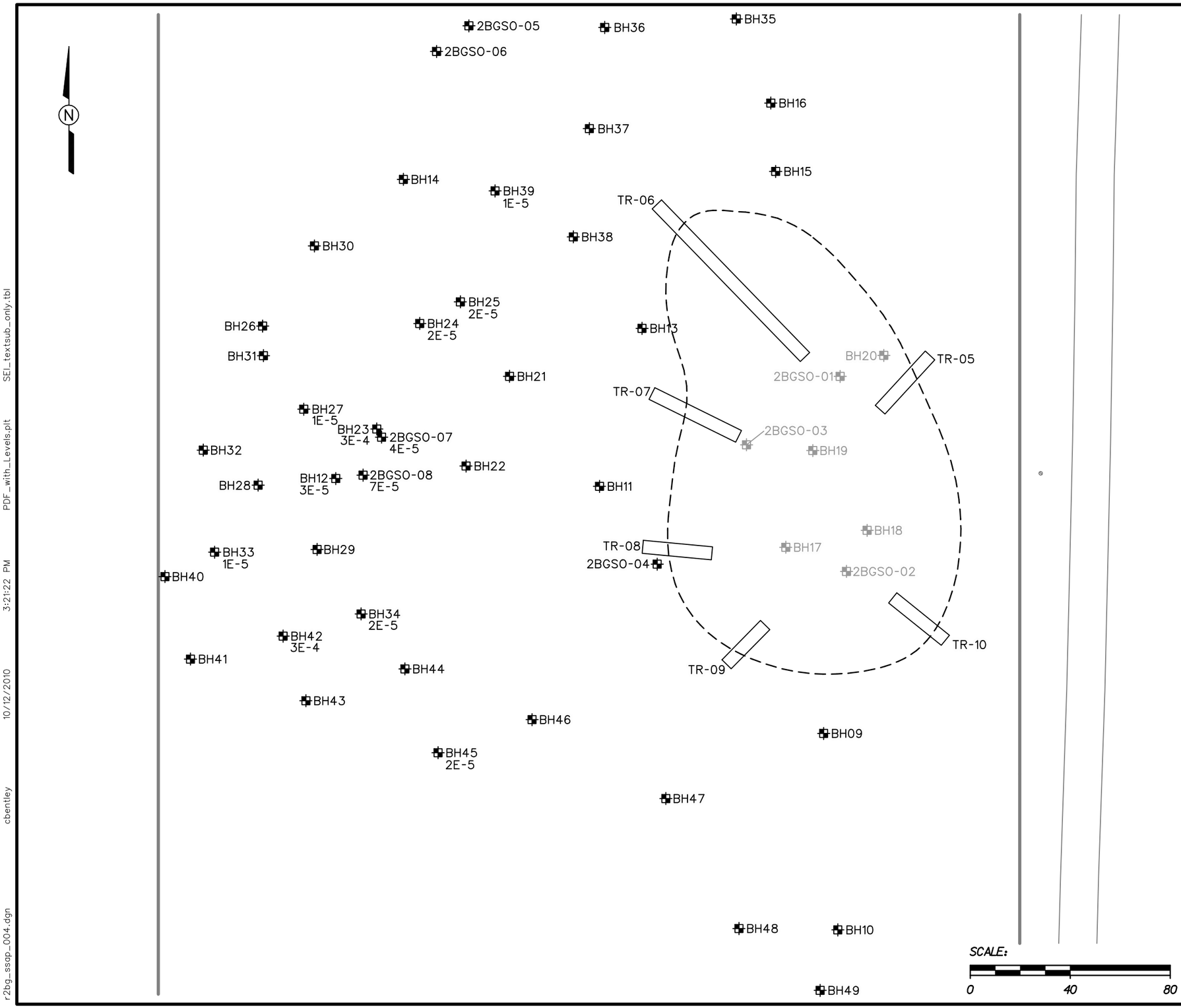

LEGEND:

- TRENCH LOCATION
- HISTORIC SOIL SAMPLE LOCATION
- RESERVOIR NO. 2 BURNING GROUND BOUNDARY
- BURN LAYER BOUNDARY (BASED ON JACOBS 2004 TRENCHING)
- 1E-5 INCREMENTAL LIFETIME CANCER RISK (ILCR) VALUE

NOTES:

1. SEE FIGURE 1-3 FOR DESCRIPTION OF HISTORIC SAMPLE LOCATIONS.
2. ILCR VALUES NOT SHOWN FOR SAMPLES COLLECTED WITHIN THE BURN LAYER BOUNDARY.
3. SAMPLES WITHOUT ASSOCIATED ILCR VALUES ARE LESS THAN 1E-5, BASED ON EXISTING DATA.

FIGURE 1-4
EXISTING SOIL SAMPLE LOCATIONS EQUAL TO OR EXCEEDING 1E-5 ILCR

RESERVOIR NO. 2 BURNING GROUND SSAP
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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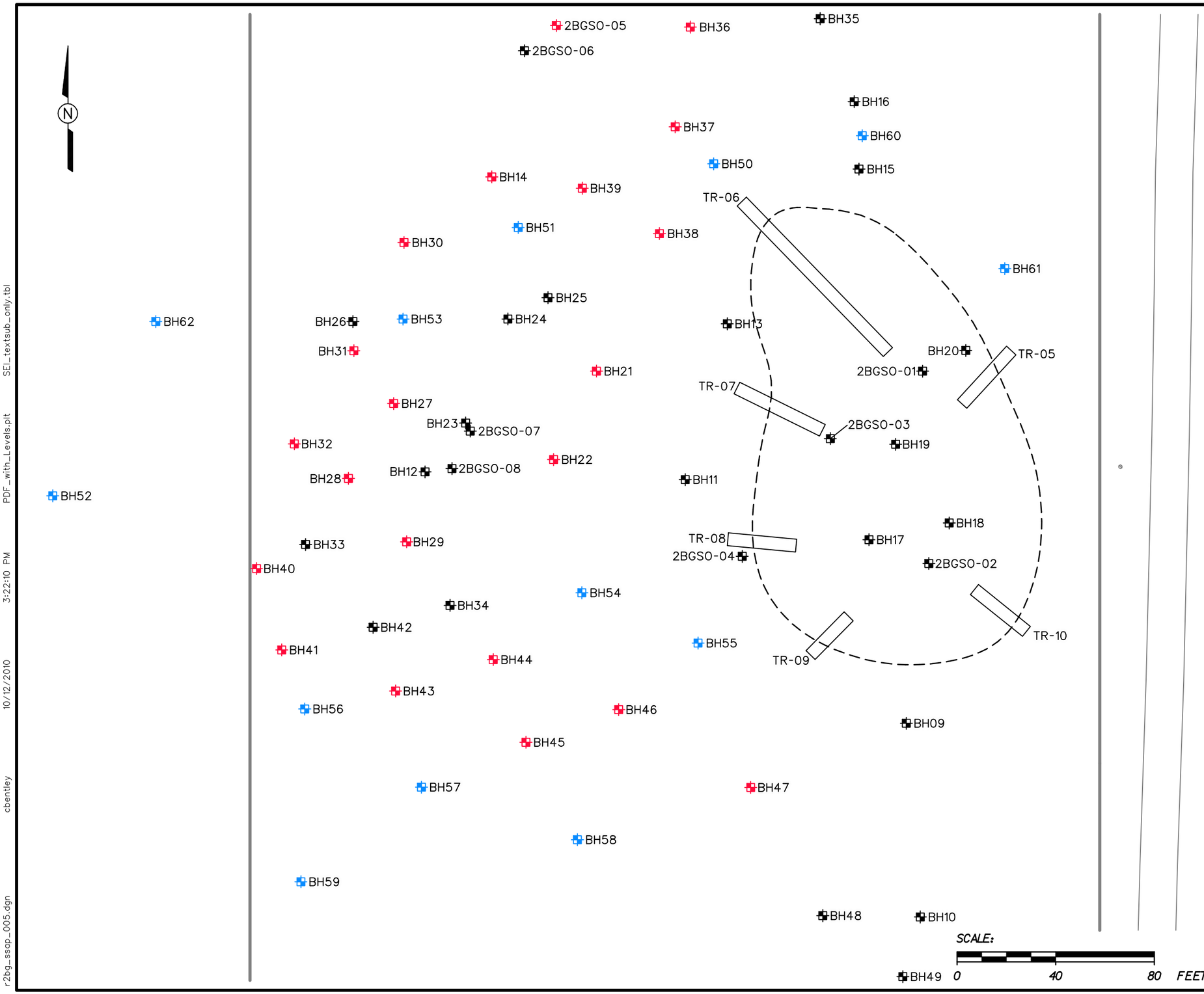

LEGEND:

- TRENCH LOCATION
- EXISTING SOIL SAMPLE LOCATION
- PROPOSED SURFACE SOIL SAMPLE LOCATION PCDD/PCDF ANALYSIS (EXISTING LOCATION)
- PROPOSED SURFACE SOIL SAMPLE LOCATION FULL SUITE ANALYSIS (NEW LOCATION)
- RESERVOIR NO. 2 BURNING GROUND BOUNDARY
- BURN LAYER BOUNDARY (BASED ON JACOBS 2004 TRENCHING)

NOTES:

1. SEE FIGURE 1-3 FOR DESCRIPTION OF HISTORIC SAMPLE LOCATIONS.
2. LOCATIONS SHOWN IN RED WERE PREVIOUSLY SAMPLED, BUT NOT FOR POLYCHLORINATED DIBENZODIOXINS/FURANS (PCDD/PCDF).
3. "FULL SUITE" INCLUDES NITROAROMATICS, PCBs, PAHs, AND PCDD/PCDF ANALYSIS.
4. PROPOSED SAMPLE LOCATIONS BH52, BH59, AND BH62 MAY BE ADJUSTED IN THE FIELD BASED ON SITE CONDITIONS (TOPOGRAPHY, DRAINAGE, DISTURBED SOIL, ETC.).

FIGURE 3-1
PROPOSED SOIL SAMPLE LOCATIONS

RESERVOIR NO. 2 BURNING GROUND SSAP
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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