March 25, 2013

Mr. John Nicholson
Health Physicist
U.S. Nuclear Regulatory Commission
Region I
Division of Nuclear Materials Safety
2100 Renaissance Boulevard
King of Prussia, PA 19406

SUBJECT: REVISED FINAL REPORT—CONFIRMATORY SURVEY RESULTS FOR THE ABB COMBUSTION ENGINEERING SITE, WINDSOR, CONNECTICUT DCN 5158-SR-02-2 (DOCKET NO. 030-03754; RFTA NO. 12-003)

Dear Mr. Nicholson:

Oak Ridge Associated Universities (ORAU), operating under the Oak Ridge Institute for Science and Education (ORISE) contract, performed confirmatory radiological survey activities on portions of the ABB Combustion Engineering Site (ABB) in Windsor, Connecticut during the periods of October 24 through 27, 2011 and April 30 to May 3, 2012. These survey activities were requested and approved by the U.S. Nuclear Regulatory Commission (NRC). Enclosed is Revision 2 of the final report that summarizes ORAU's survey procedures and provides the results of the ORAU radiological survey activities. The surveys included gamma surface scans, gamma direct measurements, and soil sampling. This revision corrects errors in Table 4, page 14 of the report where the Sum-of-Ratios was incorrectly reported for Confirmatory Unit 7. I apologize for any inconvenience due to this error.

If you have any questions, please direct them to me at the information listed below, Erika Bailey at 865.576.6659, or Tim Vitkus at 865.576.5073.

Sincerely,

Wade C. Adams

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Project Manager/Health Physicist
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CONFIRMATORY SURVEY RESULTS FOR THE ABB COMBUSTION ENGINEERING SITE WINDSOR, CONNECTICUT

W. C. Adams

Prepared for the
U.S. Nuclear Regulatory Commission

ORAU
OAK RIDGE ASSOCIATED UNIVERSITIES

Oak Ridge Associated Universities manages the Oak Ridge Institute for Science and Education (ORISE) contract for the U.S. Department of Energy. ORISE focuses on scientific initiatives to research health risks from occupational hazards, assess environmental cleanup, respond to radiation medical emergencies, support national security and emergency preparedness, and educate the next generation of scientists.

CONFIRMATORY SURVEY RESULTS FOR THE ABB COMBUSTION ENGINEERING SITE WINDSOR, CONNECTICUT

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Prepared for the
U.S. Nuclear Regulatory Commission

FINAL REPORT

MARCH 2013

Prepared by Oak Ridge Associated Universities under the Oak Ridge Institute of Science and Education contract, number DE-AC05-06OR23100, with the U.S. Department of Energy under interagency agreement (NRC FIN No. F-1244) between the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy.

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ORAU
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CONFIRMATORY SURVEY RESULTS FOR THE ABB COMBUSTION ENGINEERING SITE WINDSOR, CONNECTICUT

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FINAL REPORT

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ACRONYMS

ABB	Asea Brown Boveri Incorporated
CE	Combustion Engineering, Inc.
cpm	counts per minute
CU	confirmatory unit
DCGL	derived concentration guideline level
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FSS	final status survey
GPS	global positioning system
IA	impacted area
IEAV	Independent Environmental Assessment and Verification
IWL	industrial waste line
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	minimum detectable concentration
NIA	non-impacted area
NRC	U.S. Nuclear Regulatory Commission
ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram
ROC	radionuclide of concern
RSS	Ranked Set Sampling
SOR	sum of ratios
SU	survey unit
WWTP	Waste Water Treatment Plant

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CONFIRMATORY SURVEY RESULTS FOR THE ABB COMBUSTION ENGINEERING SITE WINDSOR, CONNECTICUT

1. INTRODUCTION AND SITE HISTORY

From the mid-1950s until mid-2000, the Combustion Engineering, Inc. (CE) site in Windsor, Connecticut (Fig. A-1) was involved in the research, development, engineering, production, and servicing of nuclear fuels, systems, and services. The site is currently undergoing decommissioning that will lead to license termination and unrestricted release in accordance with the requirements of the License Termination Rule in 10 CFR Part 20, Subpart E. Asea Brown Boveri Incorporated (ABB) has been decommissioning the CE site since 2001.

The CE Windsor site (Fig. A-2) is located on 613 acres. A Partial Site Release for unrestricted use was completed on approximately 365 acres during the spring of 2008 (ORAU/ORISE 2008). The balance of the site—contained within the Partial Site Release boundary—remains under U.S. Nuclear Regulatory Commission (NRC) license 06-00216-06, and is referred to as the Controlled Area. Currently, all remaining areas have undergone remediation and final status surveys (FSSs). Remediation of the remaining impacted areas (IAs) included the decontamination of buildings, demolition of structures to ground surface, removal of floor slabs and footings three (or four) feet below ground surface, as well as the removal of underground utilities and any soils impacted above the derived concentration guideline levels (DCGLs) (MACTEC 2010a).

Personnel from the NRC and the State of Connecticut have been to the CE site on numerous occasions prior to the backfilling and restoration of FSS survey units (SUs) and collected in-process confirmatory split samples from multiple FSS SUs during excavation and FSS survey activities. These confirmatory samples were sent to the Oak Ridge Associated Universities (ORAU)/ Oak Ridge Institute for Science and Education (ORISE) Radiological and Environmental Analysis Laboratory and the analytical results were reported to the NRC (refer to Appendix F references).

At the request of the NRC's Headquarters and Region I Offices, the Independent Environmental Assessment and Verification Program (IEAV) of the Oak Ridge Institute for Science and Education (ORISE), managed and operated by ORAU, performed confirmatory radiological survey activities of the areas designated by ABB for unrestricted release at the ABB CE site in Windsor, Connecticut.

During the time of the ORAU survey activities, many of these areas had already been backfilled and remedial restorations of the soil surfaces had been completed. The confirmatory survey activities were scheduled to occur in two phases: the Fall 2011 phase consisted of the Woods Area, the Burning Grounds, the Drum Burial Pit, and the Clamshell Pile, while the Spring 2012 phase consisted of the Equipment Storage Yard, Small Pond Buffer Area, Buildings 3 and 6 Complexes, the Industrial Waste Lines (IWLs), the Waste Water Treatment Plant (WWTP) Area, and the Former Controlled Storage Area. The Site Brook was deemed not available for ORAU confirmatory survey activities since the Site Brook excavations had been restored under an environmental permit specification plan. A previous report, documenting the Fall 2011 survey results, was presented to the NRC on December 7, 2011 (ORAU/ORISE 2011a). The NRC also requested that all NRC FSS split soil samples and ORAU confirmatory soil samples be combined into one report.

2. SITE DESCRIPTION

The CE Windsor site is located at 2000 Day Hill Road in the Town of Windsor, in Hartford County, approximately eight miles north of Hartford, Connecticut (Figs. A-1 and A-2). The site is within an industrial zone with nearby property being commercial, agricultural, industrial, and residential areas. The northern and western portions of the property are wooded. Day Hill Road borders the southern portion of the site; tobacco fields and a sand and gravel quarry border the western side; the Windsor/Bloomfield Sanitary Landfill and Recycling Center and the Rainbow Reservoir portion of the Farmington River are to the north. Forested land with residential and commercial development is to the east.

Since the ABB FSS SUs scheduled for confirmatory surveys had already been backfilled and the soil surfaces had been restored, ORAU grouped combined FSS SUs into the following confirmatory units (CUs) which included the FSS SUs and the immediately contiguous land areas (refer to Fig. A-3). The decision to pool the confirmatory survey data for the ABB FSS SUs was based on the site logistics and grouping of contiguous areas. The FSS SUs included in each ORAU CU are identified and provided in Table 1.

Table 1. ORAU Confirmatory Units		
Confirmatory Units (CU)[a]	**Areas Included**	**Final Status Survey (FSS) Units included in ORAU CU**
1	Clamshell Pile and immediately adjacent land areas	CE-FSS-35-01 and -02
2	Burning Grounds Area	CE-FSS-39-01 and -02
3	Drum Burial Pit and Woods Areas	CE-FSS-36-01 and -02, CE-FSS-38-01, -02, -03, -04, and -05
4	Buildings 3 and 6 Complexes	CE-FSS-03-01, -02, -03, -04, -05, -06, and -07; CE-FSS-06-04, -05, -06, -07, and -08
5	Equipment Storage Yard and Small Pond Buffer	CE-FSS-23-02, -03, -04, -05, -06, -07, -08; CE-FSS-25-02
6	Industrial Waste Lines	CE-FSS-42-01, -02, -03, -04, -05, -06, -07, and -08
7	Waste Water Treatment Plant and Former Controlled Access Area Waste Staging/Storage Area Footprint	CE-FSS-43-01, -02, -03, -04, and CE-FSS-26-11
8	Debris Pile Footprint and Site Brook Outfall Industrial Waste Line	CE-FSS-34-01; CE-FSS-42-09 and -10
9	Former S1C Area	Previously released

[a]Refer to Figs. A-2 through A-4 and Appendix F.

The following descriptions are for those areas that were part of the Fall 2011 and Spring 2012 survey activities.

2.1 CONFIRMATORY UNIT 1 - CLAMSHELL PILE AREA

The Clamshell Pile, CU 1, is located in a shallow swale approximately 600 feet north of the Site Brook in the northwestern portion of the property (Figs. A-2 through A-4). This area is approximately 15 feet (ft) wide × 30 ft long and 6 ft deep, filling a natural gully. In the late 1950s, clamshells were used to buffer the pH concentration of the Site Brook near the industrial waste outfalls. Because the Site Brook received industrial wastewater, including low-level radioactive wastewater, the shells absorbed some amount of uranium and contained radioactive materials. The clamshells were removed from the Site Brook during previous remedial actions and were placed at this location. The Clamshell Pile has since been remediated and backfilled.

2.2 CONFIRMATORY UNIT 2 - BURNING GROUNDS

The Burning Grounds, CU 2, are located north of the Woods Area and west of the Debris Piles (Figs. A-2 through A-4). This area, the former zirconium, magnesium, and thorium burning grounds, is approximately 2 acres in size. The burning area consisted of a bermed concrete pad which has since been removed. After burning activities ceased, the area was used as a storage area for drums of radiological waste. The Burning Grounds has since been remediated and backfilled.

2.3 CONFIRMATORY UNIT 3 - DRUM BURIAL PIT AND WOODS AREA

The Drum Burial Pit, in the northwest section of CU 3, is located west of the Woods Area in the northern portion of the site (Figs. A-2 through A-4). The area is approximately 1 acre in size and was used to dispose of miscellaneous waste material including piping, personal protective equipment, and soils. These materials were mostly contained in 55 gallon drums that over time became either rusted and/or crushed. The drums eventually decayed and the adjacent soils were pushed over the waste, essentially burying the drums in place (MACTEC 2010a). The Drum Burial Pit has since been remediated and backfilled.

The Woods Area, in the southern section of CU 3, is located west of East Main Street and east of the Drum Burial Pit Area (Figs. A-2 through A-4) and straddles the access road that runs northwest from former Building 2. The area is approximately 7 acres in size. Previous radiological investigations indicated that surface and subsurface soils on both sides of the access road and adjacent to the Waste Pad Area contained residual radiological concentrations above background levels. The Woods Area has since been remediated and backfilled.

2.4 CONFIRMATORY UNIT 4 – BUILDINGS 3 AND 6 COMPLEXES

Buildings 3 and 6, within CU 4, were located in the southern portion of the Site and were constructed under the initial U.S. Atomic Energy Commission contracts (Figs. A-2 through A-4). The Building 3 Complex was approximately 5 acres in size and Building 6 Complex was about 1 acre in size. Nuclear fuel fabrication was conducted in Building 3 prior to 1961 and Building 6 was used as a liquid radiological waste processing facility. These two buildings were grouped together in this investigation due to their geographical proximity, original use in the manufacturing of nuclear fuels, and the fact that the area located between the two buildings was used for storage of equipment and waste.

With the exception of the south end of Building 3 (High Bay), the Buildings 3 and 6 Complexes have been decontaminated and dismantled and the below-ground utilities have been removed. The Buildings 3 and 6 Complexes were located at the southern end of the Controlled Area (Fig. A-2) and the CU area is approximately 15 acres in size.

2.5 CONFIRMATORY UNIT 5 – EQUIPMENT STORAGE YARD AND SMALL POND BUFFER AREA

The Equipment Storage Yard, within CU 5, is located on the western side of Small Pond and northeast of Building 3 and is approximately 4 acres in size (Figs. A-2 through A-4). This area was originally used in the mid to late 1950s as a disposal area for miscellaneous fill and construction debris. Waste drums were stored in two areas located on the southern edge of the yard near the shoreline of the Small Pond and a third area was identified as a test pit. The Small Pond Buffer Area is located west of the Small Pond and east of the Equipment Storage Yard. The area is mostly marshy and is approximately 2 acres in size.

2.6 CONFIRMATORY UNIT 6 – INDUSTRIAL WASTE LINES

Building 6 functioned as the radioactive waste collection, monitoring and dilution facility for the fuel fabrication and laboratory operations at the site. The liquid was sampled, diluted if necessary, and discharged to the Site Brook via the industrial waste lines (IWLs) that run south-to-north from the Building 6 Complex to the Site Brook. The industrial waste lines, within CU 6, occupy approximately 5 acres and the CU including the IWLs and the immediately adjacent areas surveyed by ORAU total approximately 11.5 acres (Figs. A-2 through A-4).

2.7 CONFIRMATORY UNIT 7 – WASTE WATER TREATMENT PLANT AND THE FORMER CONTROLLED ACCESS AREA

The WWTP was primarily used for treatment of wastes that came through the sanitary waste lines. After the sanitary waste was treated, affluent was released into the Site Brook. The Former Controlled Access Area was used as a staging and storage area for other site remediation activities. Together, the FSS units for the WWTP, the Former Controlled Access Area and the immediately surrounding grounds, within CU 7, account for approximately 7.2 acres (Figs. A-2 through A-4).

2.8 CONFIRMATORY UNIT 8 – DEBRIS PILE FOOTPRINT AND SITE BROOK OUTFALL INDUSTRIAL WASTE LINE

The Debris Pile Footprint and Site Brook Outfall Industrial Waste Line, within CU 8, are FSS units that were immediately north of the WWTP. As the name implies, the Debris Pile Footprint had been a location where debris had been dumped. The Site Brook Outfall is where the IWLs discharged into the Site Brook. The Debris Pile Footprint and Site Brook Outfall CU occupy approximately 0.41 acres and the CU, including the IWLs and the immediately adjacent areas surveyed by ORAU, was approximately 2.6 acres (Figs. A-2 through A-4).

2.9 CONFIRMATORY UNIT 9 – FORMER S1C AREA

This area was the site of the former S1C facility, a test naval reactor, and had been previously owned and remediated by the U.S. Department of Energy (DOE). The Former S1C Area CU occupies approximately 10.9 acres (Figs. A-2 through A-4).

3. OBJECTIVES

The objectives of the confirmatory activities were to provide independent contractor field data reviews and to generate independent radiological data for use by the NRC in evaluating the adequacy and accuracy of the contractor's procedures and FSS results.

4. DOCUMENT REVIEW

ORAU reviewed ABB CE's decommissioning plan, final status survey plan, and the applicable soil DCGLs, which were developed based on an NRC-approved radiation dose assessment (MACTEC 2003a, 2003b, 2004, 2008 and 2010b). The decommissioning plan was specifically reviewed for historical information, to identify the radionuclides of concern (ROCs), and the dose assessment was reviewed for the applicable dose-based DCGLs. ORAU also reviewed preliminary FSS data for the Drum Burial Pit, Burning Grounds, Clamshell Pile, Woods Area, Building 3 Complex, Building 6 Complex, IWLs, Equipment Storage Yard Area, WWTP Area, and the Former Controlled Access Area specifically to design a statistical survey prior to performing confirmatory surveys (ABB 2011a, b, c, and d; 2012a, b, and c). The purpose of these reviews was to ensure that

regulatory requirements were being met by the ABB CE and to develop the confirmatory survey plan. ORAU also ensured that the current FSS activities within the areas to be released for unrestricted use were adequate and appropriate, taking into account any supporting documentation and *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) guidance (NRC 2000).

5. RADIOLOGICAL SURVEY PROCEDURES

ORAU personnel visited the ABB CE property from October 24 to 27, 2011 and from April 30 to May 3, 2012, to perform visual inspections and independent measurements and sampling. The radiological survey activities were conducted in accordance with a project-specific plan, the ORAU/ORISE *Survey Procedures Manual* and the ORAU *Quality Program Manual* (ORAU/ORISE 2011b, 2012a; ORAU 2012).

The SUs were classified—in accordance with MARSSIM guidance (NRC 2000) and the contractor's three classifications for IAs, based on contamination potential—as either Class 1, 2, or 3. IAs are areas that have some potential for containing contaminated material. Descriptions for each classification for IAs are as follows:

- **Class 1:** Buildings or land areas that have a significant potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiological surveys) that exceeds the expected DCGL
- **Class 2:** Buildings or land areas that have, or had prior to remediation, a potential for radioactive contamination or known contamination, but are not expected to exceed the DCGL
- **Class 3:** Any impacted areas that are not expected to contain residual contamination, or are expected to contain levels of residual contamination at a small fraction of the DCGL

Non-Impacted Areas (NIAs) are areas that do not have the potential to contain contaminated materials.

Since the ABB FSS SUs scheduled for confirmatory surveys had already been backfilled and the soil surfaces had been restored, ORAU grouped area ABB FSS Class 1 and Class 2 SUs into Class 2 or Class 3 Confirmatory Units as described in Section 2.

5.1 REFERENCE SYSTEM

Global positioning system (GPS) coordinates were used for referencing measurement and sampling locations. The specific reference system used by the licensee was the Connecticut State Plane Coordinate System (FIPS 0600, feet; North American Datum 83).

5.2 SURFACE SCANS

Medium density gamma radiation surface scans were conducted over the soil surface within each of the Class 2 CUs and low-density scans were performed over the Class 3 CUs. Surface scans were performed using sodium iodide (thallium-activated) (NaI[Tl]) scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators. Detectors were also coupled to GPS systems that enabled real-time gamma count rate and position data capture. Field personnel relied on the audio output to identify and mark any locations of elevated direct gamma radiation for further investigations that might suggest the presence of residual contamination (Figs. A-5 through A-13).

5.3 RANKED SET SAMPLING

In each of the Class 2 CUs, ORAU performed a Ranked Set Sampling (RSS) approach, following U.S. Environmental Protection Agency (EPA) guidance, for randomly selecting locations for gamma measurements and subsequent soil sampling (EPA 2002). Visual Sample Plan software was used to generate the random coordinates comprising the soil investigation and sample selection population. These measurement/sample points were downloaded to the GPS units and were based upon the ORAU-generated reference CUs established for the site (refer to Figs. A-14 through A-20). ORAU did not perform RSS measurements in the Class 3 CU's (CUs 8 and 9).

RSS provides a methodology to determine the necessary number of soil samples to estimate the mean concentration of a population; however, it does not require the assumption of a normal distribution. The process combines random sampling with the use of professional judgment to select sampling locations. Professional judgment relies upon the ability to assess the magnitude of gamma radiation levels between randomly selected locations. In this case, the gamma count rate data collected at randomly selected locations provided the measurable field screening method that correlates with the relative concentrations of the gamma-emitting ROCs. The count rate data obtained were then used to select a specific sampling location.

The RSS process uses a ranking method of the field screening measurement population to create the ranked sets; the first phase of the soil sample location selection process is to randomly partition the gamma measurement locations into sets of equal size. The set size is maintained at three locations to minimize ranking errors. With a set size of three locations, the three sets would then require nine measurement locations that are randomly combined into one cycle. Three soil sample locations are then selected for each cycle based on the following ranking criteria:

- **Set 1:** the lowest of three gamma measurement locations within Set 1 is sampled
- **Set 2:** the medium of three gamma measurement locations within Set 2 is sampled
- **Set 3:** the highest of three gamma measurement locations within Set 3 is sampled

For CU's 1 through 3, nine soil samples from each CU were determined to be adequate to estimate the mean concentrations at the 95% confidence level; for CUs 4 through 7, six soil samples were determined to be adequate for confidence level determinations. The estimated sum of ratios (SOR) mean concentration and variability used to calculate the required number of samples was obtained from the ABB sample results (ABB 2011a, b, c, and d; 2012a, b, and c). Therefore, the ABB soil sampling plan required three RSS cycles within CUs 1 through 3 from which the nine soil samples were collected per CU and two RSS cycles within CUs 4 through 7 from which six samples were collected per CU.

5.4 GAMMA DIRECT MEASUREMENTS

A one-minute static gamma count rate measurement was performed at each of the 27 RSS locations determined per CUs 1 through 3 and at 18 RSS locations determined per CUs 4 through 7 (Figs. A-14 through A-20). The data within a given cycle-set were then ranked as exhibiting either the lowest, medium, or highest gamma count; these data are provided in Table B-1 (Fall 2011 survey) and Table B-2 (Spring 2012 survey). Gamma direct measurements were also performed at judgmentally-selected elevated gamma radiation level locations determined by surface scans.

5.5 SOIL SAMPLING

5.5.1 RSS Sample Locations

Soil samples were collected in accordance with the RSS process as described in Section 5.3 within the three RSS cycles for CUs 1 through 3 and two RSS cycles for CUs 4 through 7: Set 1, lowest gamma radiation location; Set 2, medium location; Set 3, highest location (Figs. A-14 through A-20). A total of 51 random surface (0 to 15 cm) soil samples were collected; nine surface soil samples were collected from each CU (CUs 1 through 3) during the Fall 2011 survey activities and six surface soil samples were collected from each CU (CUs 4 through 7) during the Spring 2012 survey activities (Figs. A-21 through A-27). Tables B-1 and B-2 provide the RSS method showing field assessment data and the locations selected for soil sampling.

5.5.2 Judgmentally-Selected Locations

A judgmental surface soil sample was collected from one location within CU 6 that exhibited elevated gamma radiation detected during gamma soil surface scans (Refer to Fig. A-26).

5.5.3 Background Soil Samples

For consistency with the data reported by the licensee, background soil samples were not necessary since background concentrations were not to be subtracted from soil samples collected in the CUs.

5.5.4 NRC Split Soil Samples

During the FSS by the licensee, the NRC and State of Connecticut personnel collected split soil samples from the FSS excavations prior to the backfilling of the FSS SUs. The NRC split soil samples were submitted to the ORAU/ORISE Radiological and Environmental Analysis Laboratory for processing and radiological analyses. A total of 328 soil samples were analyzed by the ORAU/ORISE laboratory and the analytical results were presented in eighteen letter reports to the NRC. At the request of the NRC, ORAU compiled all the split soil sample results into one data table and generated sample location maps to indicate the FSS SUs for each split soil sample. To compile maps for the split soil samples, ORAU requested split sample geographic information system maps and data from ABB; the data tables and the sample maps are provided in Appendix F.

6. SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data were returned to the ORAU/ORISE facilities in Oak Ridge, Tennessee for analysis and interpretation. Sample analyses were performed in accordance with the ORAU Laboratory Procedures Manual (ORAU/ORISE 2012b). Soil samples were analyzed by gamma spectroscopy for Co-60, Ra-226, Th-232, U-235, and U-238. The spectra were also reviewed for any other identifiable photopeaks to ensure there were no indications of other potential ROCs. Soil sample results were reported in units of picocuries per gram (pCi/g). Gamma count rate measurement results were reported in units of counts per minute (cpm). The data generated were compared with the NRC-approved release criteria established for each site-specific ROC for the ABB Site and with the ABB FSS statistical results for each area. Additional information regarding instrumentation and procedures may be found in Appendices C and D.

7. FINDINGS AND RESULTS

The results for each radiological survey procedure component are discussed in the following sections.

7.1 DOCUMENT REVIEW

ABB radiological survey data were used to determine the number of random soil samples necessary to estimate the mean SOR (for ROCs for each CU) concentrations. Specifically, the inputs used were the ABB-reported average SOR concentrations and the ORAU-calculated observed variability based on ABB preliminary FSS data results (ABB 2011a, b, c, and d; 2012a, b, and c).

7.2 SURFACE SCANS

The gamma scan paths within each CU are provided in Figs. A-5 through A-13. Figs. A-28 through A-36 provide frequency histograms of the walkover gamma count rate data population for each of the CUs. The gamma scan ranges for each CU are provided in Table 2.

Table 2. Gamma Scan Ranges Summary Results			
Confirmatory Units	**Gamma Scan Ranges (cpm)**		
	Minimum	**Maximum**	**Average**
Confirmatory Unit 1	5,091	10,439	7,261
Confirmatory Unit 2	4,228	10,586	6,949
Confirmatory Unit 3	4,662	14,979	7,290
Confirmatory Unit 4	2,319	13,936	6,808
Confirmatory Unit 5	5,385	9,079	7,213
Confirmatory Unit 6	1,367	12,165	9,235
Confirmatory Unit 7	2,589	11,559	7,807
Confirmatory Unit 8	3,174	8,967	6,704
Confirmatory Unit 9	3,112	8,330	6,435

For the Fall 2011 surveys, the histograms for CU 2 and CU 3 indicate normal distributions typical of the background concentrations associated with those areas (Figs. A-29 and A-30). The histogram for CU 1 (Fig. A-28) is skewed to the right which represents the presence of slightly elevated gamma radiation levels above the typical native soil background levels. ORAU did observe slightly elevated gamma radiation levels over the ground swale surface where the Clamshell Pile had been remediated and backfilled (refer to Fig. A-5); however, those levels were not indicative of residual contamination greater than the release criteria for uranium contamination that was the primary ROC within the clamshells. The elevated gamma radiation levels were deemed attributable to the gamma scan instrumentation geometries within the U-shaped ground swale left behind by the removal of the Clamshell Pile.

For the Spring 2012 surveys, the histograms for CU 5 and CU 7 indicated a normal distribution (Figs. A-32 and A-34), while histograms of the scan gamma range distribution for CU 4, CU 6, CU 8, and CU 9 (Figs. A-31, A-33, A-35, and A-36) indicate that there were at a minimum two distinct surface matrices being scanned. Specifically, there were soil and asphalt matrices within CU 4 and soil and gravel matrices within CU 7. However, for each of the matrices, ORAU determined that the scan ranges within those areas were at background levels. For the soil majority matrix, the scan range indicated a normal distribution.

7.3 GAMMA DIRECT MEASUREMENTS

The summary data for the seven CUs are presented in Table 3; the average background gamma count rate was 7,347 cpm for soil surfaces and 5,094 cpm for asphalt and gravel surfaces. The data for the individual direct gamma measurements are provided in Table B-1; the background data was determined onsite for the different matrices.

Table 3. Ranked Set Sampling Gamma Direct Measurements Summary Results

Confirmatory Units	Gamma Direct Measurement (cpm)		
	Minimum	Maximum	Background
Confirmatory Unit 1	5,596	8,485	7,347
Confirmatory Unit 2	5,885	8,678	7,347
Confirmatory Unit 3	5,791	9,639	7,347
Confirmatory Unit 4	6,541 soil/4,950 asphalt	8,264 soil/5,990 asphalt	7,347 soil/5,094 asphalt
Confirmatory Unit 5	6,630	8,236	7,347
Confirmatory Unit 6	9,159	10,906	7,347
Confirmatory Unit 7	7,156 soil/5,047 gravel	9,804 soil/7,889 gravel	7,347 soil/5,094 gravel
Confirmatory Unit 8	NA[a]	NA	7,347
Confirmatory Unit 9	NA	NA	7,347

[a]NA=not applicable. Confirmatory units 8 and 9 were Class 3 survey units; RSS was not performed on these survey units.

7.4 RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES

The summary data for the seven CUs are presented in Table 4. The data for the radionuclide concentrations in individual samples are provided in Tables B-3 and B-4. The gamma count rate data used for selecting the appropriate sample locations are shown in Tables B-1 and B-2.

Table 4. Radionuclide Concentrations in RSS Soil Samples Summary Results						
Confirmatory Units	Radionuclide Concentrations (pCi/g)				Sum of Ratios[a]	ABB Sum of Ratios[b]
	Co-60	Ra-226	Th-232	Total U		
Confirmatory Unit 1	-0.03 to 0.02	0.48 to 0.69	0.68 to 0.98	1.07 to 2.23	0.00 to 0.01	NA[c]
Mean concentration	0.00	0.60	0.79	1.47	0.00	0.01
Confirmatory Unit 2	-0.01 to 0.08	0.42 to 0.86	0.63 to 1.22	1.02 to 2.66	0.25 to 0.50	NA
Mean concentration	0.02	0.62	0.91	1.73	0.37	0.36
Confirmatory Unit 3	-0.03 to 0.08	0.35 to 0.90	0.42 to 1.0	0.97 to 5.6	0.19 to 0.46	NA
Mean concentration	0.02	0.65	0.81	1.95	0.35	0.36
Confirmatory Unit 4	-0.01 to 0.03	0.47 to 0.64	0.63 to 0.92	0.76 to 1.95	0.00 to 0.01	NA
Mean concentration	0.01	0.58	0.78	1.30	0.00	0.01
Confirmatory Unit 5	-0.02 to 0.02	0.60 to 0.80	0.74 to 1.28	1.36 to 2.60	0.33 to 0.50	NA
Mean concentration	0.00	0.70	1.02	1.88	0.41	0.30
Confirmatory Unit 6	-0.04 to 0.00	0.46 to 0.71	0.71 to 1.05	1.26 to 2.05	0.00	NA
Mean concentration	-0.01	0.55	0.82	1.68	0.00	0.00
Confirmatory Unit 7	-0.03 to 0.02	0.55 to 0.75	0.73 to 1.14	1.07 to 5.6	0.00 to 0.01	NA
Mean concentration	-0.01	0.65	0.91	2.45	0.00	0.00
Site RSS mean	0.00	0.62	0.86	1.77	0.18	0.08
Site RSS std. dev.	0.02	0.11	0.17	0.91	0.19	0.15

[a]SOR = sum of ratios. For CUs 1, 4, 6, and 7, the radiological contaminants were Co-60 and Total Uranium. For CUs 2, 3 and 5, the radiological contaminants were Co-60, Ra-226, Th-232, and Total Uranium.
[b]ABB SORs calculated by ORAU based on ABB preliminary FSS data for each of the FSS survey units in the ORAU confirmatory unit areas.
[c]NA=not applicable.

7.5 RADIONUCLIDE CONCENTRATIONS IN NRC SPLIT SOIL SAMPLES

The soil gamma radionuclide concentrations for the NRC split soil samples are provided in Table F-2. At the request of the NRC, the ORAU laboratory also performed gross alpha, gross beta, and alpha spectroscopy analyses on selected samples based on the initial gamma spectroscopy results. The gross alpha and gross beta results are provided in Table F-3 and the alpha spectroscopy results are provided in Table F-4.

8. COMPARISON OF RESULTS WITH RELEASE CRITERIA

The primary ROCs for the site are total uranium (U-234, U-235, and U-238) and Co-60; thorium and radium were characterized within the Burning Grounds and to a much lesser extent in the adjacent Woods Area and the Drum Burial Pit Area. The applicable site-specific soil DCGLs for the ROCs are provided in Table 5 and have been approved by the NRC (MACTEC 2003b, 2004, and 2010b). To demonstrate compliance with the Table 5 criteria, each radionuclide concentration should be less than its respective DCGL—with consideration for small areas of elevated activity—as well as application of the unity rule (sum of ratios). The unity rule requires that the sum of the concentration of each contaminant divided by the respective guideline be less than one.

$$SOR = \frac{Conc_1}{DCGL_1} + \frac{Conc_2}{DCGL_2} + \cdots + \frac{Conc_n}{DCGL_n} \leq 1$$

Table 5. ABB Soil DCGLs[a]

Radionuclide	DCGL (pCi/g)
Total Uranium	557[b]
Co-60	5.0
Thorium (Th-232)	4.0
Radium (Ra-226)	4.5

[a]ABB soil DCGLs are from ABB CE's Derivation of Site-Specific Soil DCGL report (MACTEC 2003b) for uranium and cobalt and from the Addendum to the original Derivation of the Site-Specific Soil DCGL report (MACTEC 2010b).
[b]Total uranium DCGL regardless of enrichment (MACTEC 2004).

8.1 ORAU CONFIRMATORY SOIL SAMPLE RESULTS

Radionuclide concentrations in confirmatory soil samples were directly compared with the DCGLs provided in Table 5. ORAU also applied the unity rule (SOR) in the activity calculations for each of the soil samples. All of the 51 soil samples were below the individual ROC DCGLs and all SORs were less than 1. Also, the calculated CU mean concentrations and ABB Site mean concentrations were less than the respective DCGLs; and, the ABB Site mean (average) SOR for each CU was less than 1.

8.2 NRC Split Soil Sample Results

Radionuclide concentrations in the NRC split soil samples were directly compared with the DCGLs provided in Table 5. ORAU also applied the unity rule (SOR) in the activity calculations for each of the soil samples. Three of the 328 soil samples exceeded the DCGL and SOR, and one sample exceeded the SOR without exceeding an individual DCGL; however, these samples were collected during the FSS activities and the remediation of these areas may not have been completed at the time. The licensee's final data for those areas reported in the FSS Reports (ABB 2011a, b, c, and d; 2012a, b, and c) indicated that the FSS status of these areas met the release criteria.

9. SUMMARY

During the periods of October 24 to 27, 2011, and April 30 to May 3, 2012, ORAU performed radiological survey activities for portions of the ABB CE Site in Windsor, Connecticut. The radiological survey results demonstrate that residual surface soil contamination was not likely to be present above background levels within the confirmatory units surveyed by ORAU. Therefore, it is ORAU's opinion that the radiological conditions for all confirmatory units surveyed by ORAU during the fall of 2011 (refer to Tables 3 and B-3) and the spring of 2012 (refer to Tables 3 and B-4) are commensurate with the site release criteria and unity rule requirement for FSSs as specified in ABB CE's *Site-Specific Soil DCGLs* and *Derivation of the Site-Specific Soil DCGLs Addendum* reports that were approved by the NRC (MACTEC 2003b and 2010b). Furthermore, the confirmatory results indicated that the ORAU CU SOR results compared favorably with the FSS SOR means calculated by ORAU from the ABB FSS data (refer to Table 4).

In addition, the NRC requested that split soil samples be collected by the licensee from the bottom of each FSS excavation during the FSS activities. The licensee collected 328 split soil samples for the NRC and those samples were submitted to the ORAU/ORISE Radiological Environmental Analysis Laboratory for analyses. Four of the 328 NRC FSS split samples exceeded the DCGL and/or SOR release criteria. The radiological results were submitted to NRC in eighteen separate letter reports issued from August 9, 2010 to December 20, 2011 (refer to Appendix F References).

10. REFERENCES

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ABB 2011c. *Final Status Survey Report Submittal Number 3, Burning Grounds, Drum Burial Pit, Woods Area, Building 2 Sanitary Waste Line, and Clam Shell Pile. CE Windsor Site, Windsor, Connecticut.* Volume I. Windsor, Connecticut. December.

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APPENDIX A
FIGURES

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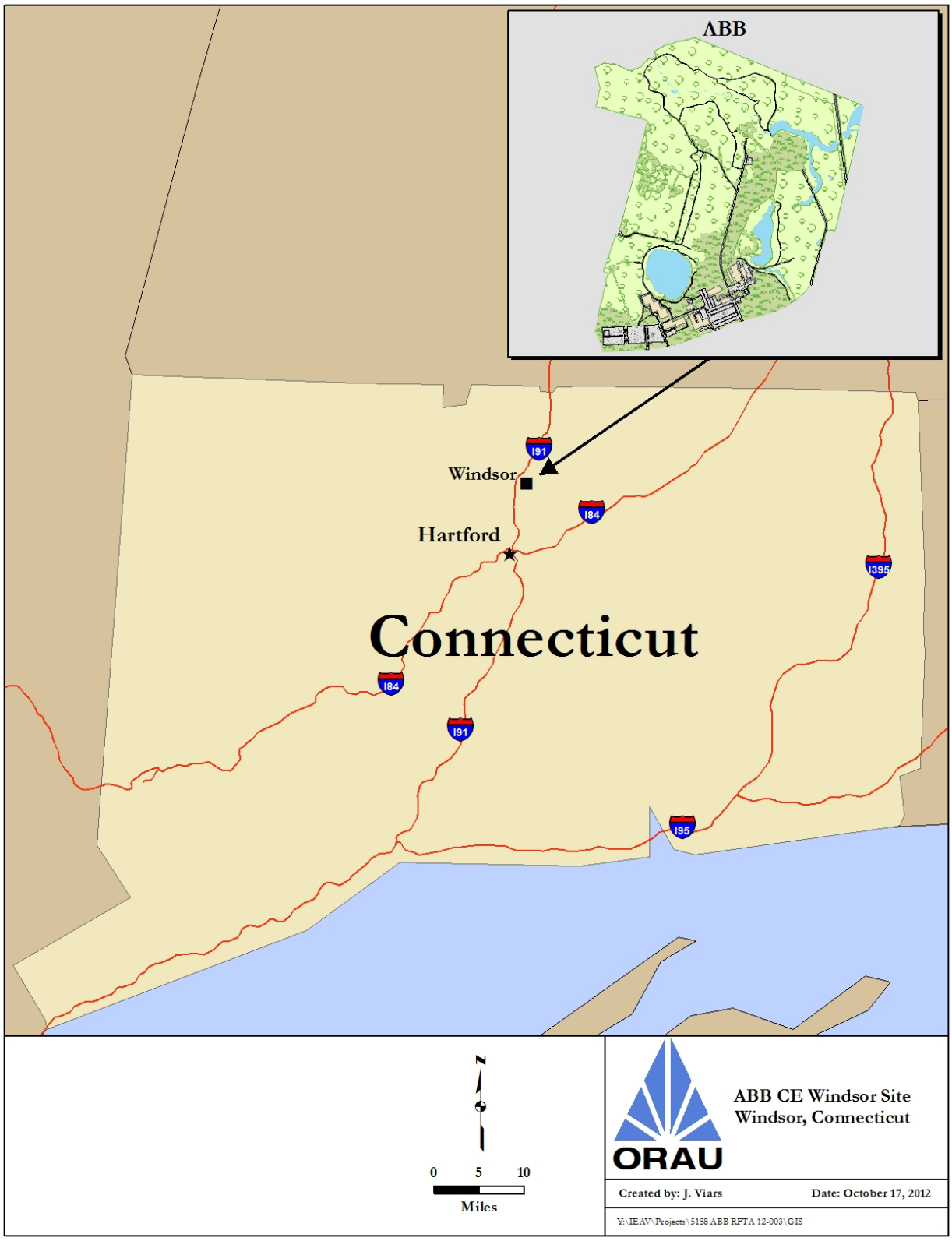

Fig. A-1. Site Location Map – ABB CE Windsor Site, Windsor, Connecticut

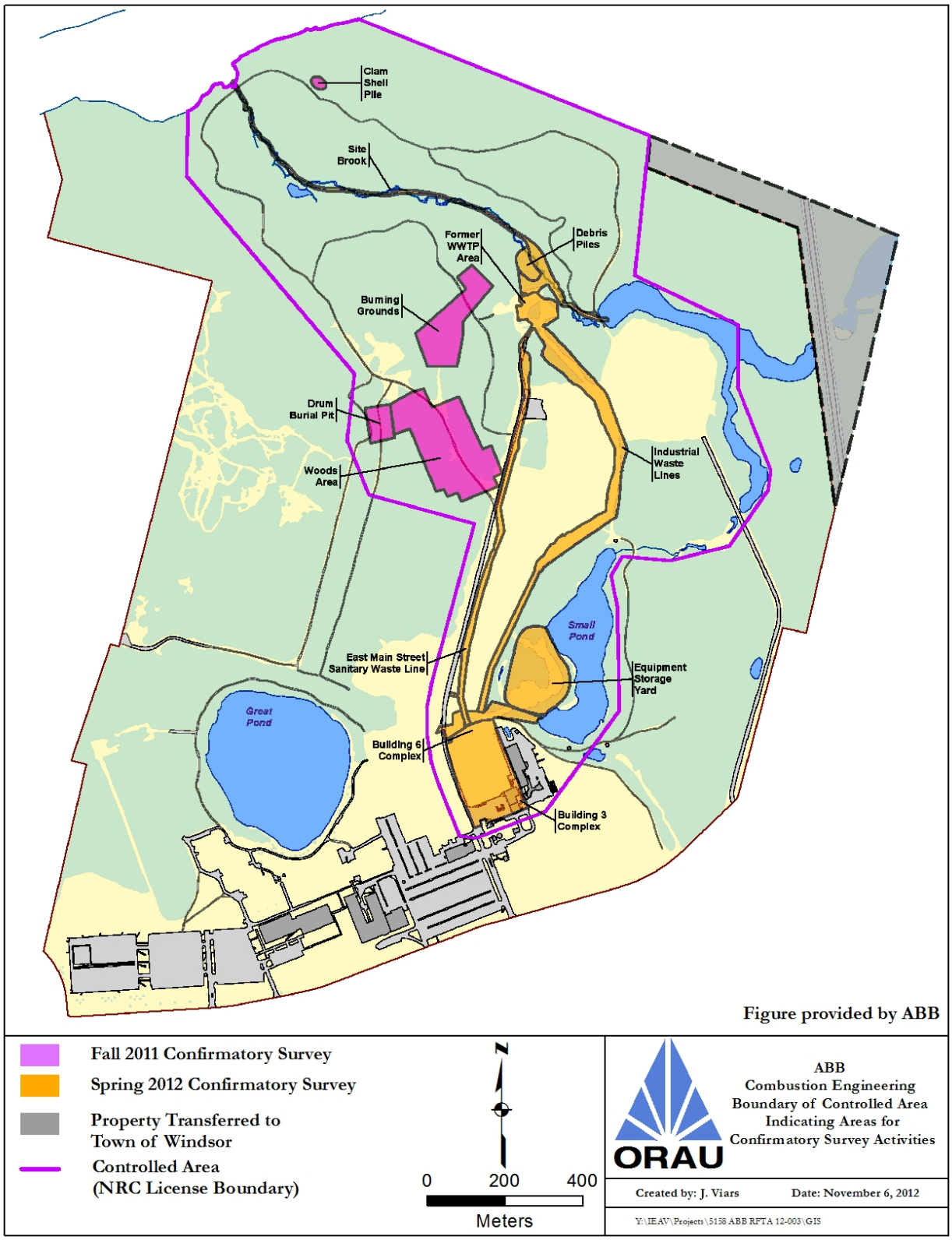

Fig. A-2. Site Overview – ABB CE Windsor Site, Windsor, Connecticut

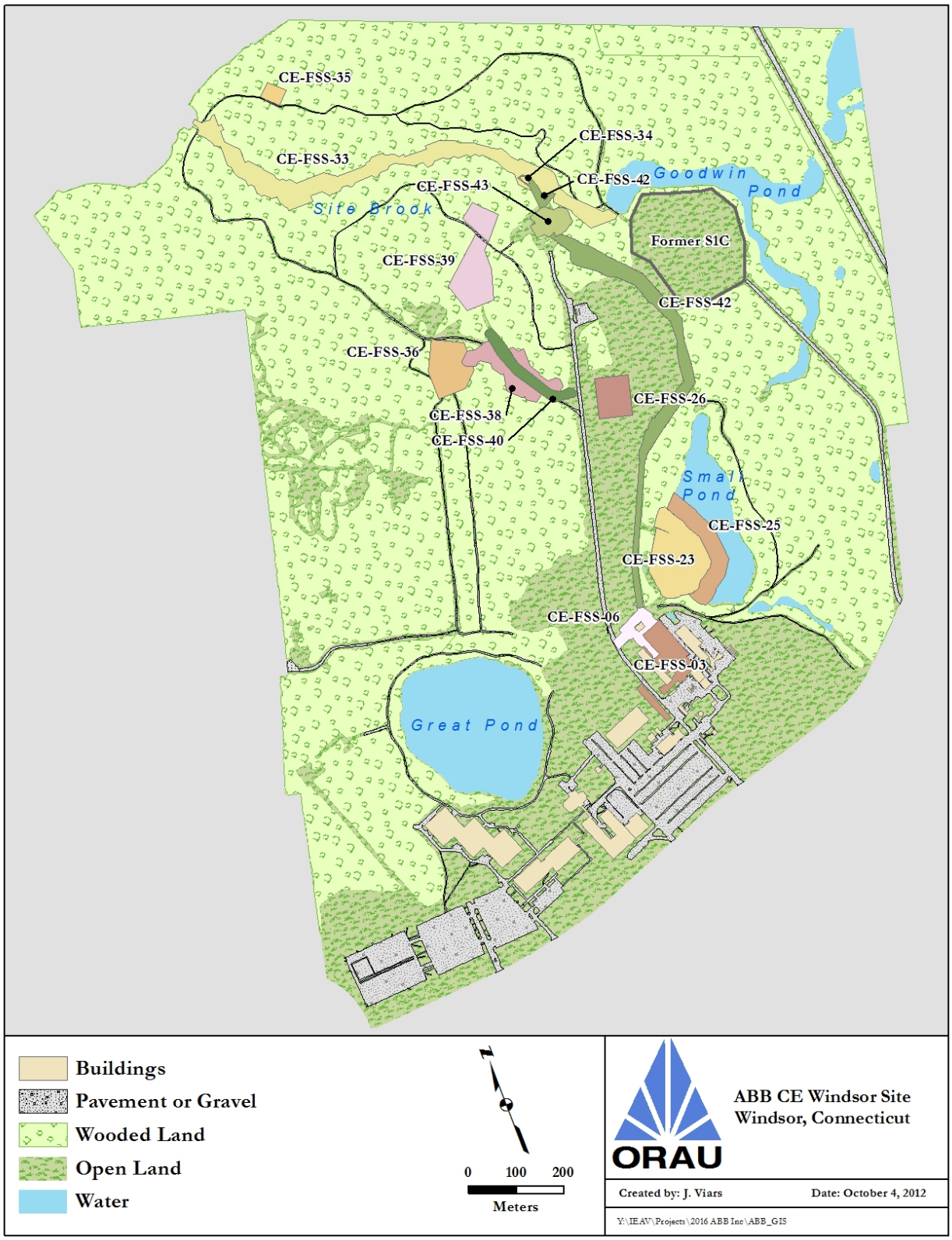

Fig. A-3. Boundary of Controlled Area Indicating Areas for Confirmatory Survey Activities

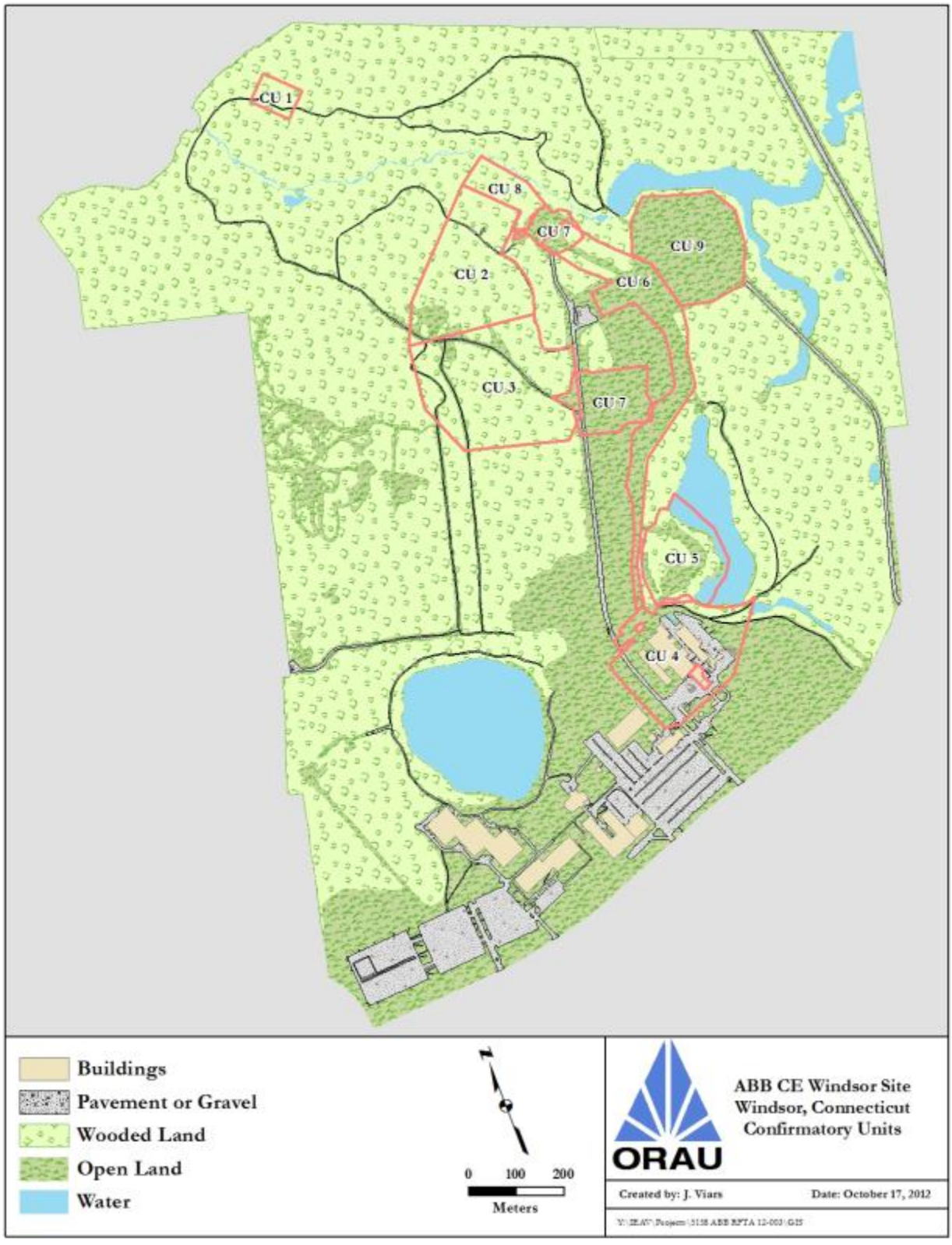

Fig. A-4. ORAU Confirmatory Units Boundaries – ABB CE Windsor Site

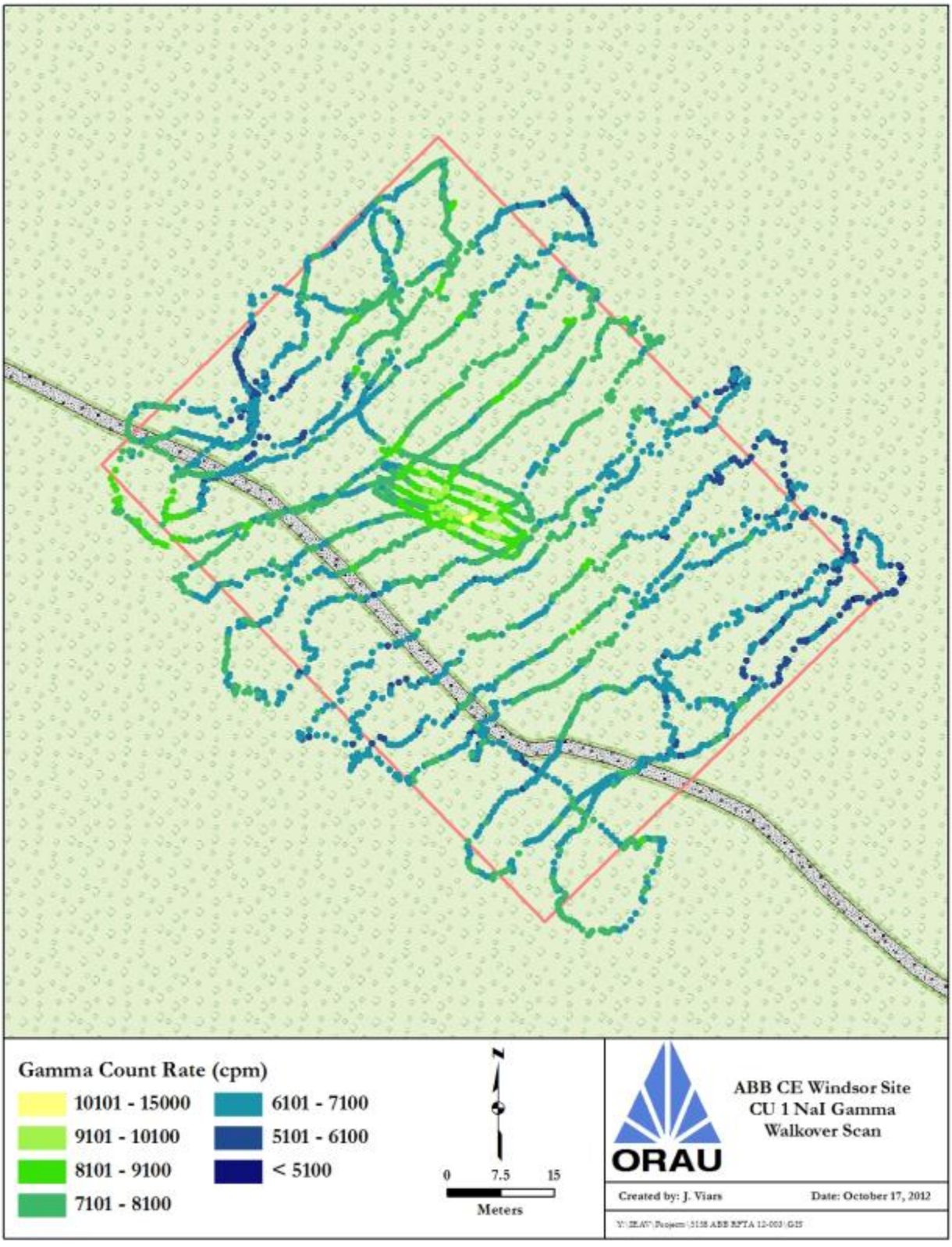

Fig. A-5. Confirmatory Unit 1, Clamshell Pile Area – Gamma Scans

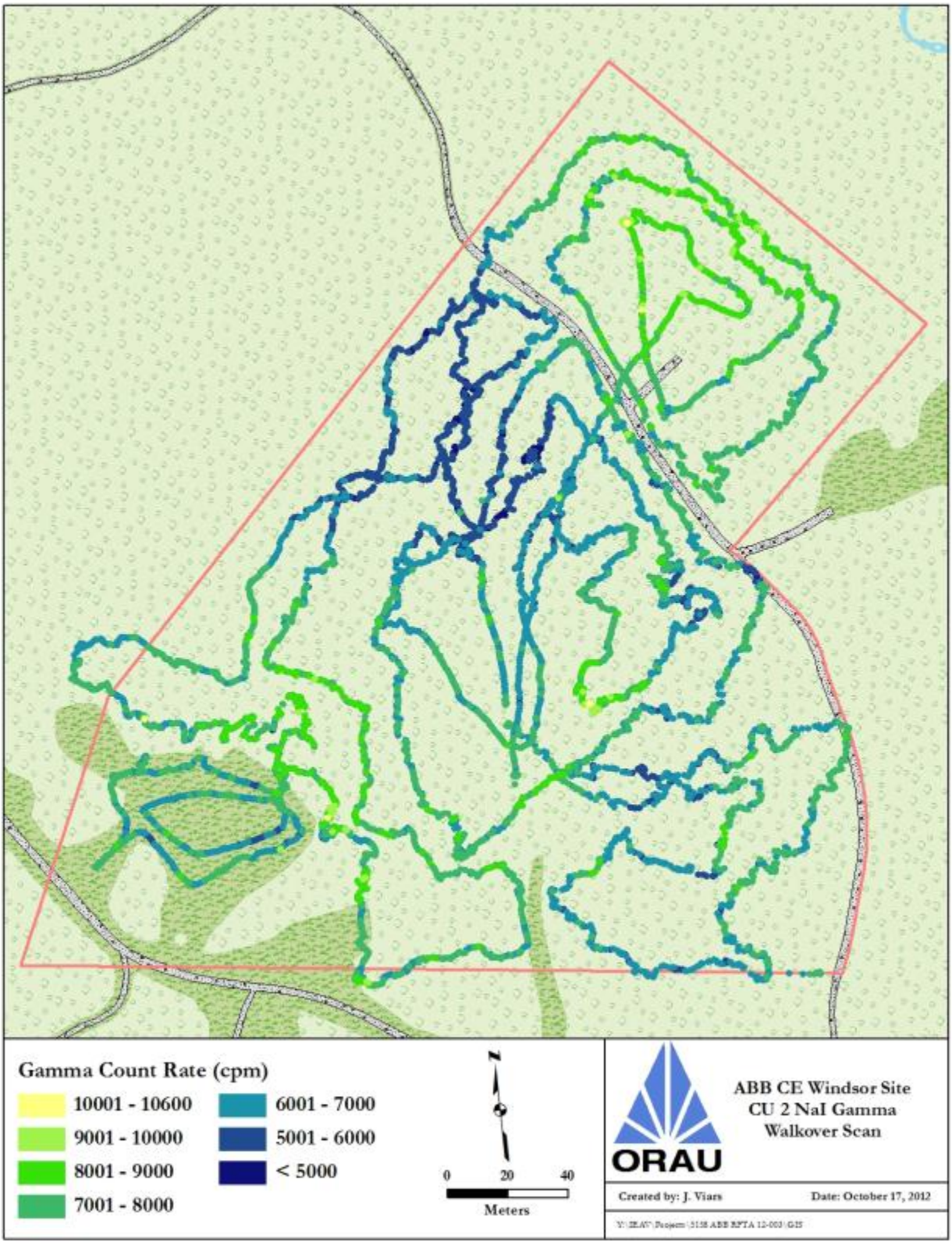

Fig. A-6. Confirmatory Unit 2, Burning Grounds – Gamma Scans

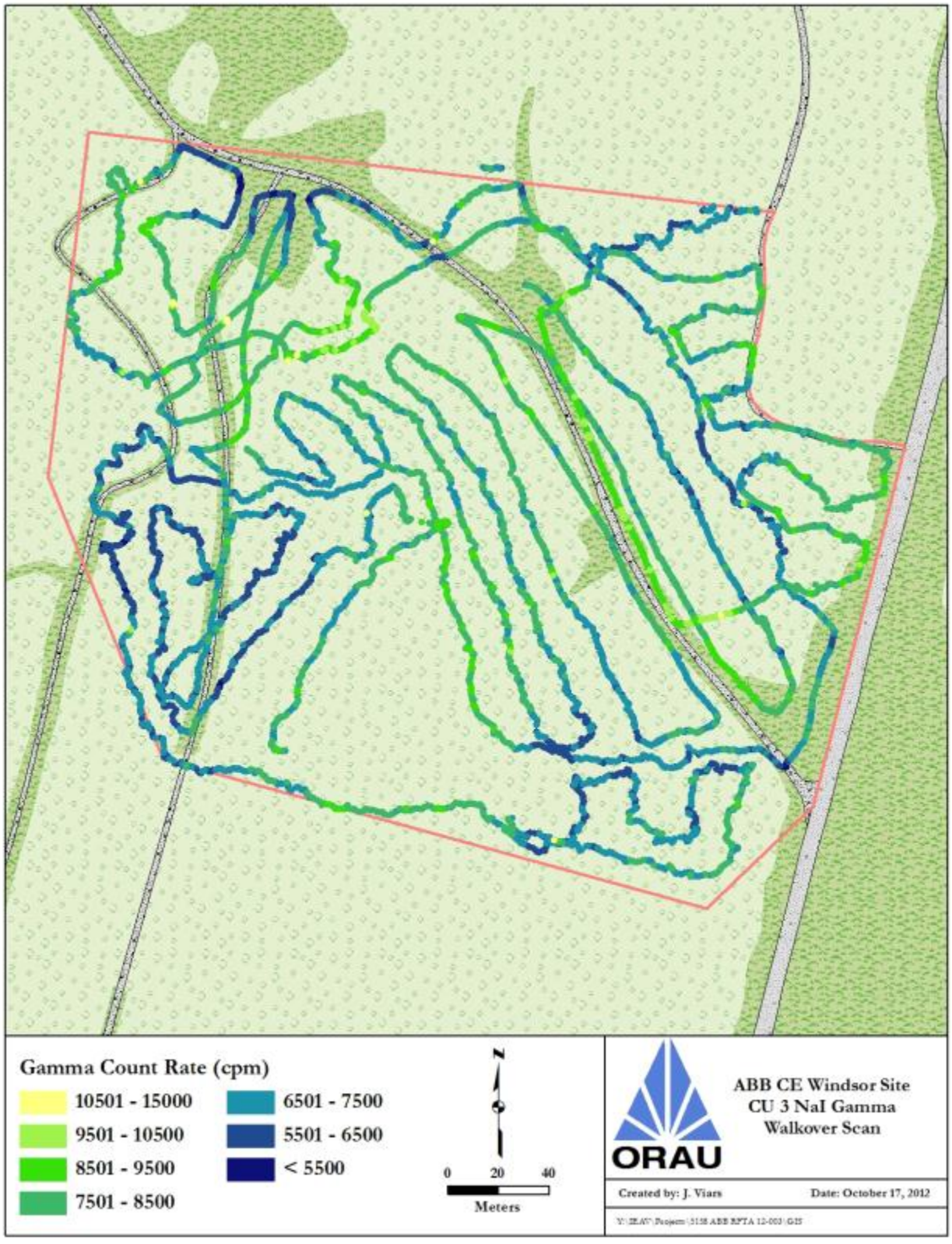

Fig. A-7. Confirmatory Unit 3, Drum Burial Pit and Woods Area – Gamma Scans

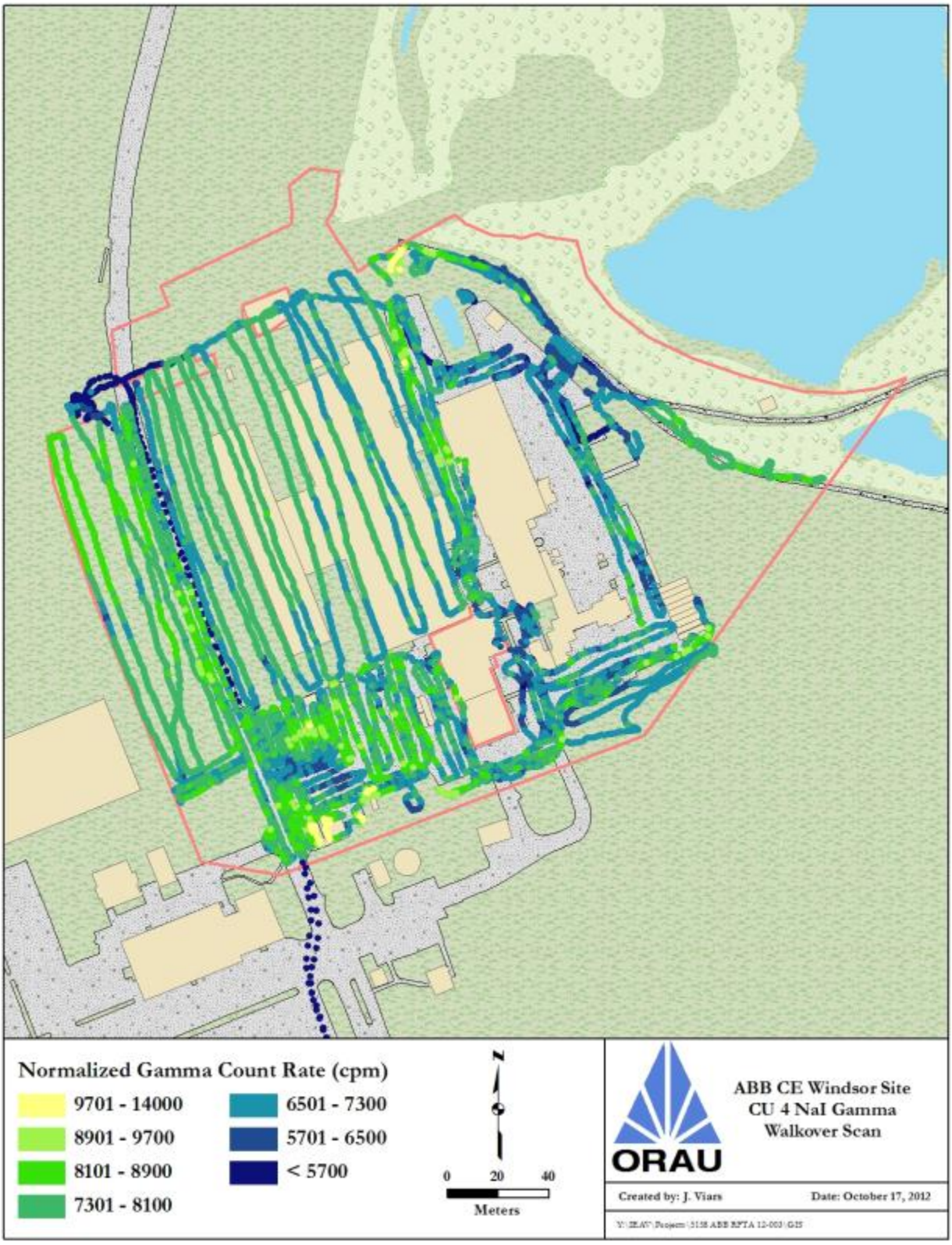

Fig. A-8. Confirmatory Unit 4, Buildings 3 and 6 Complexes – Gamma Scans

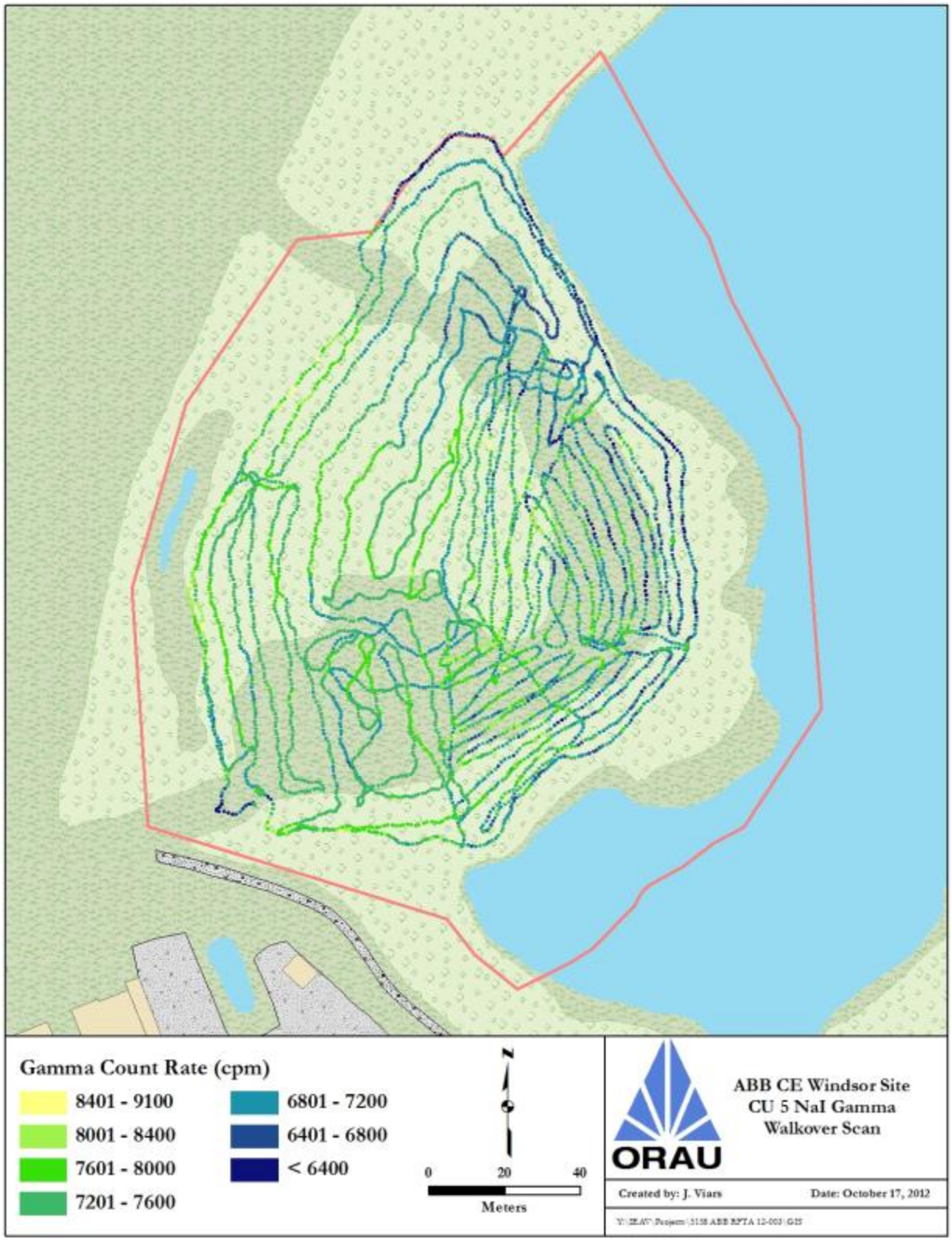

Fig. A-9. Confirmatory Unit 5, Equipment Storage Yard and Small Pond Buffer Area – Gamma Scans

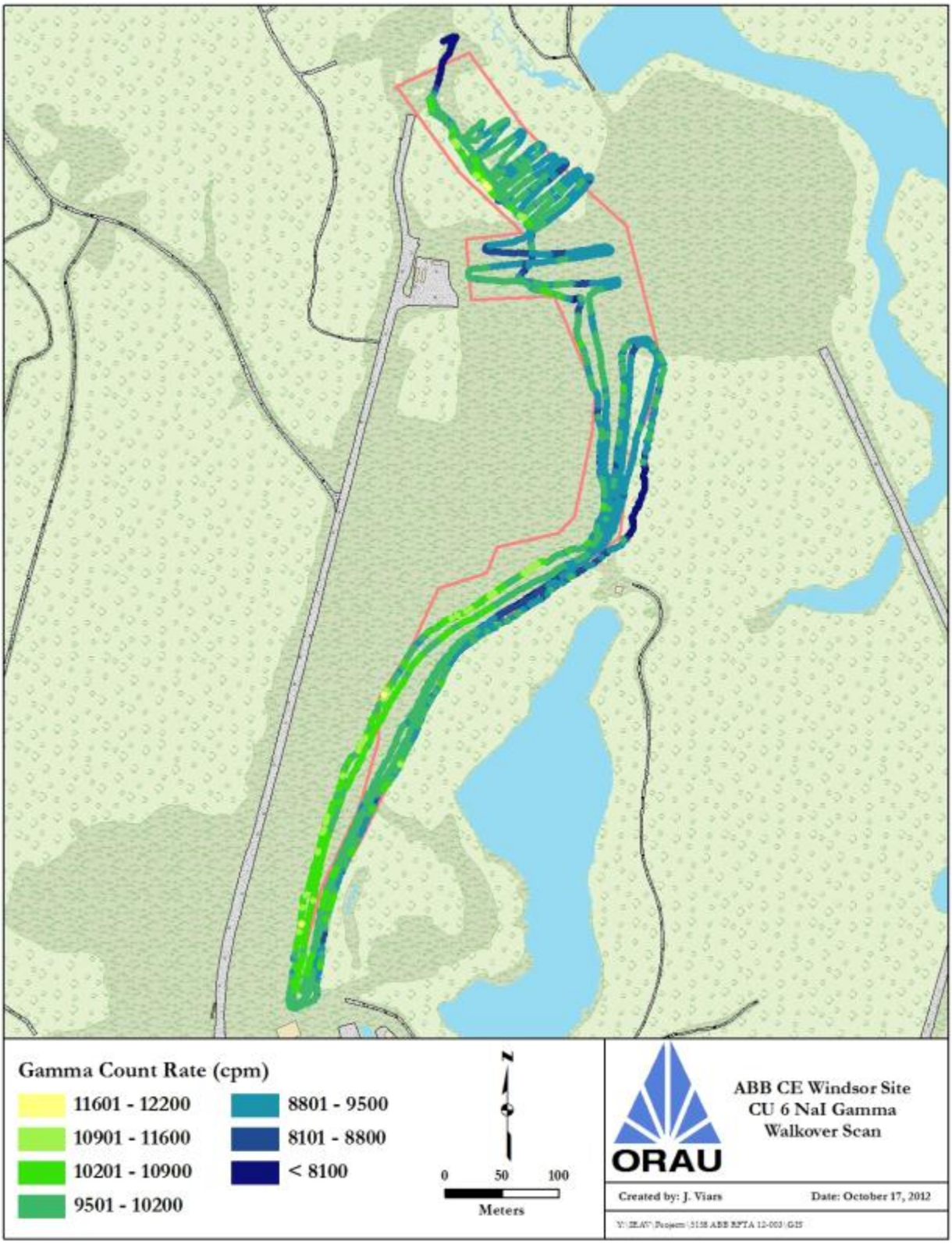

Fig. A-10. Confirmatory Unit 6, Industrial Waste Lines – Gamma Scans

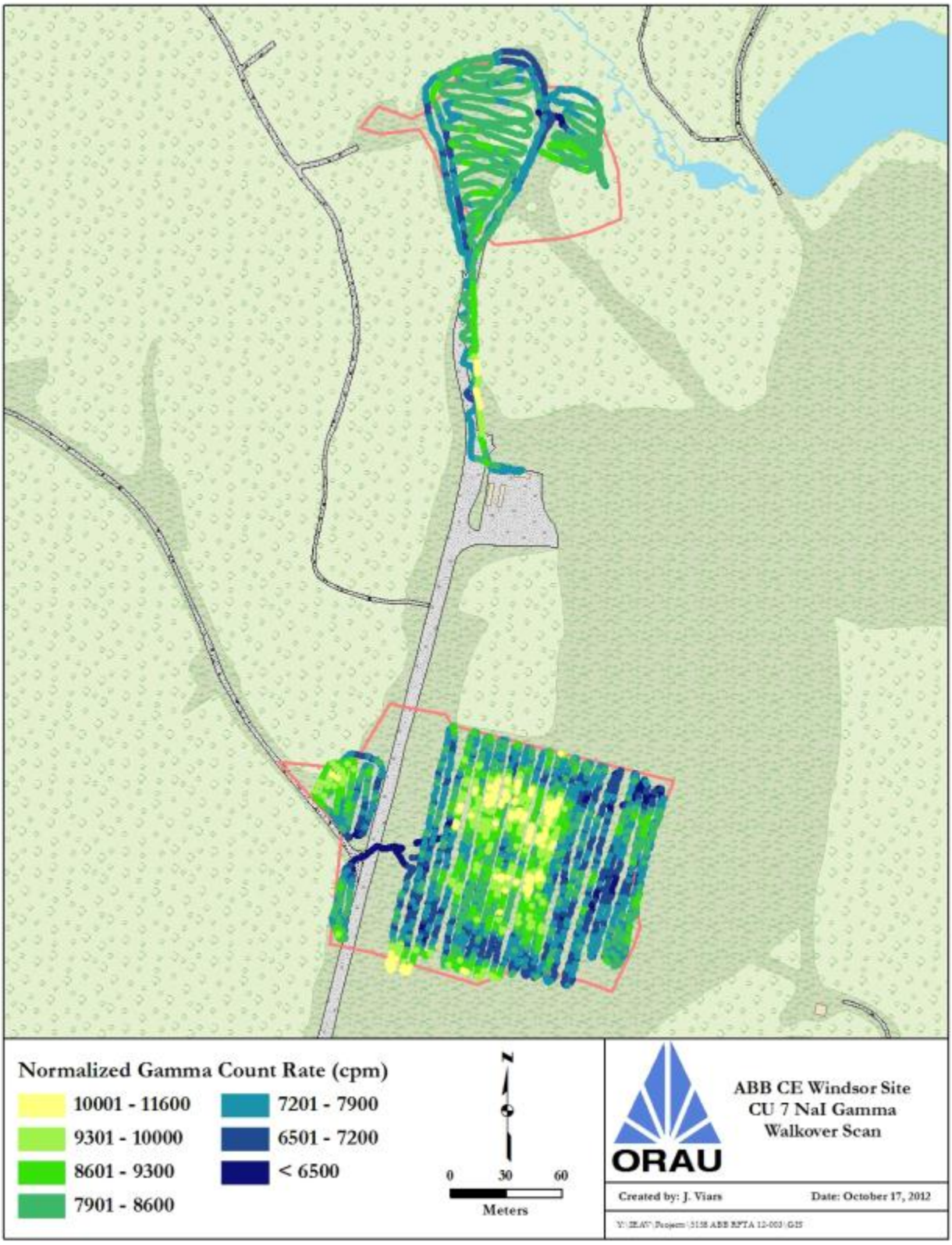

Fig. A-11. Confirmatory Unit 7, Waste Water Treatment Plant and the Former Controlled Access Area – Gamma Scans

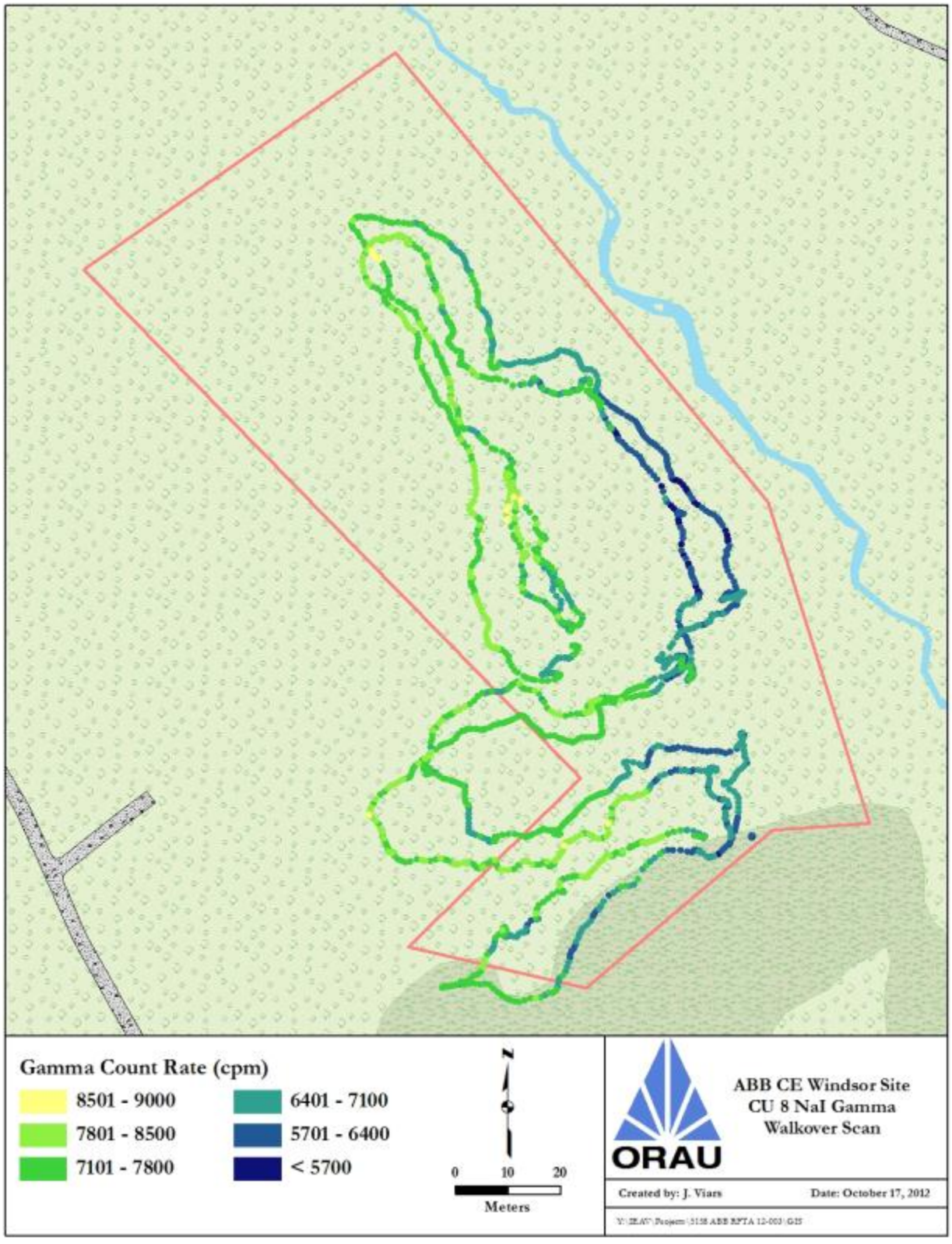

Fig. A-12. Confirmatory Unit 8, Debris Pile Footprint and Site Brook Outfall Industrial Waste Line – Gamma Scans

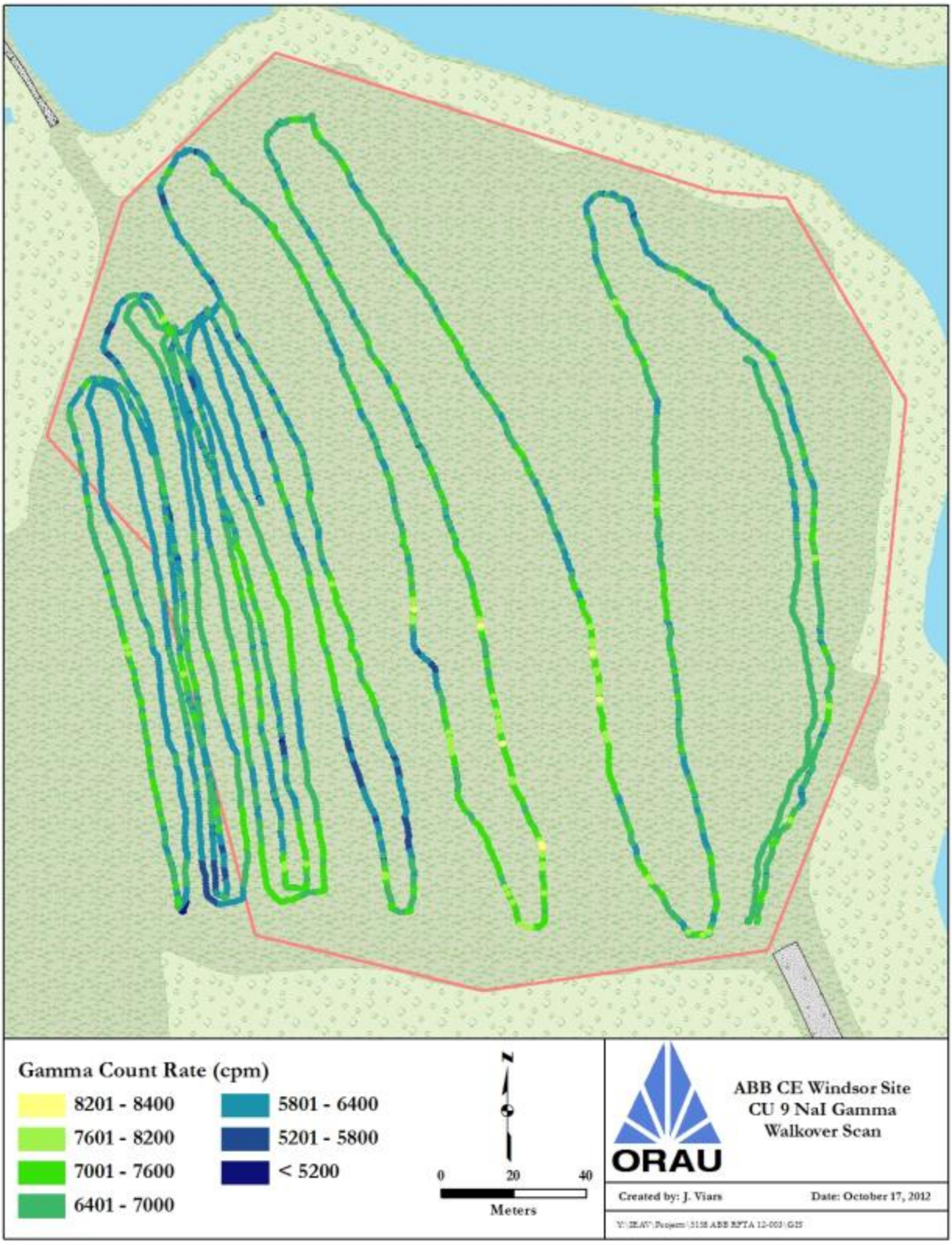

Fig. A-13. Confirmatory Unit 9, Former S1C Area – Gamma Scans

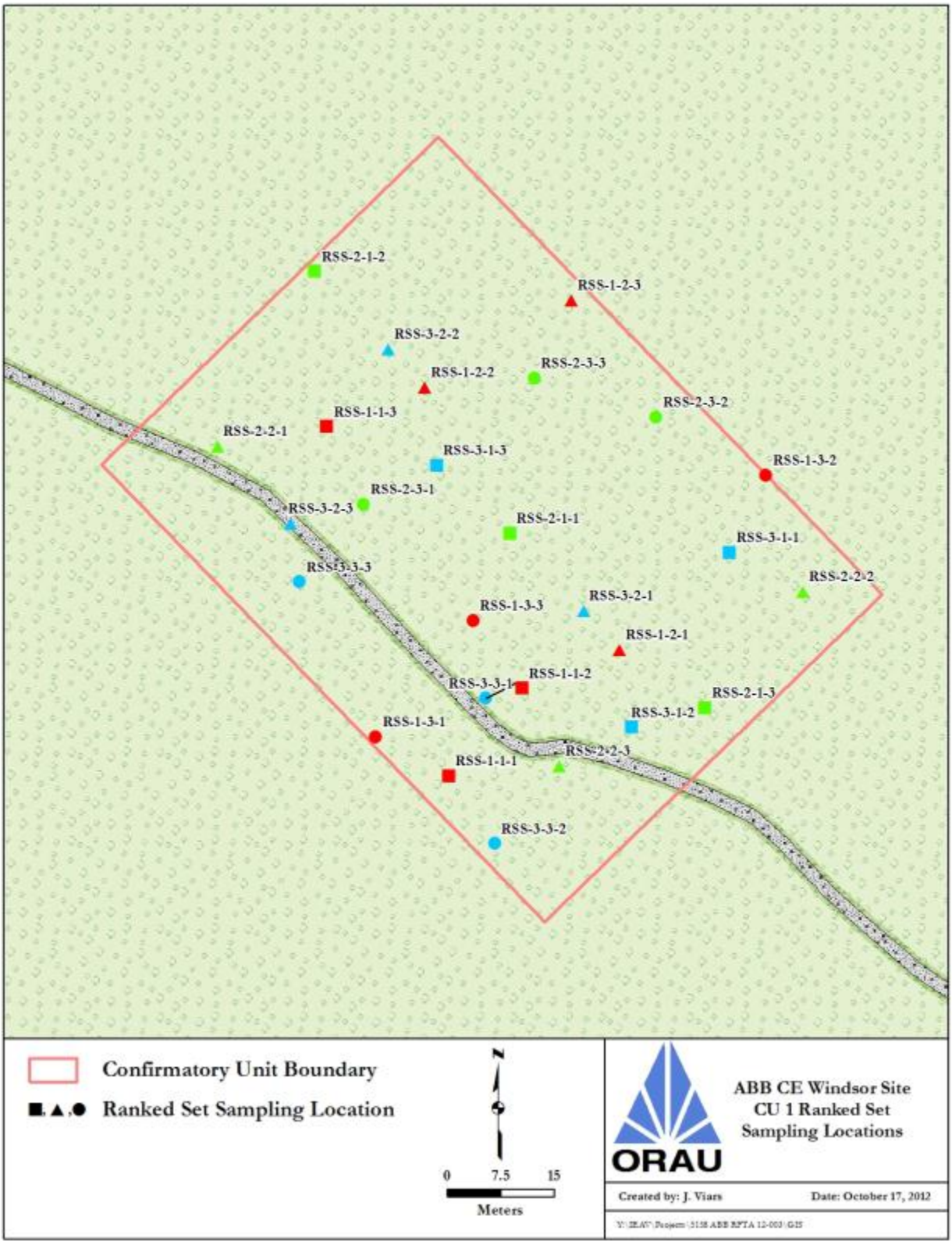

Fig. A-14. Confirmatory Unit 1, Clamshell Pile Area – Ranked Set Sampling Locations

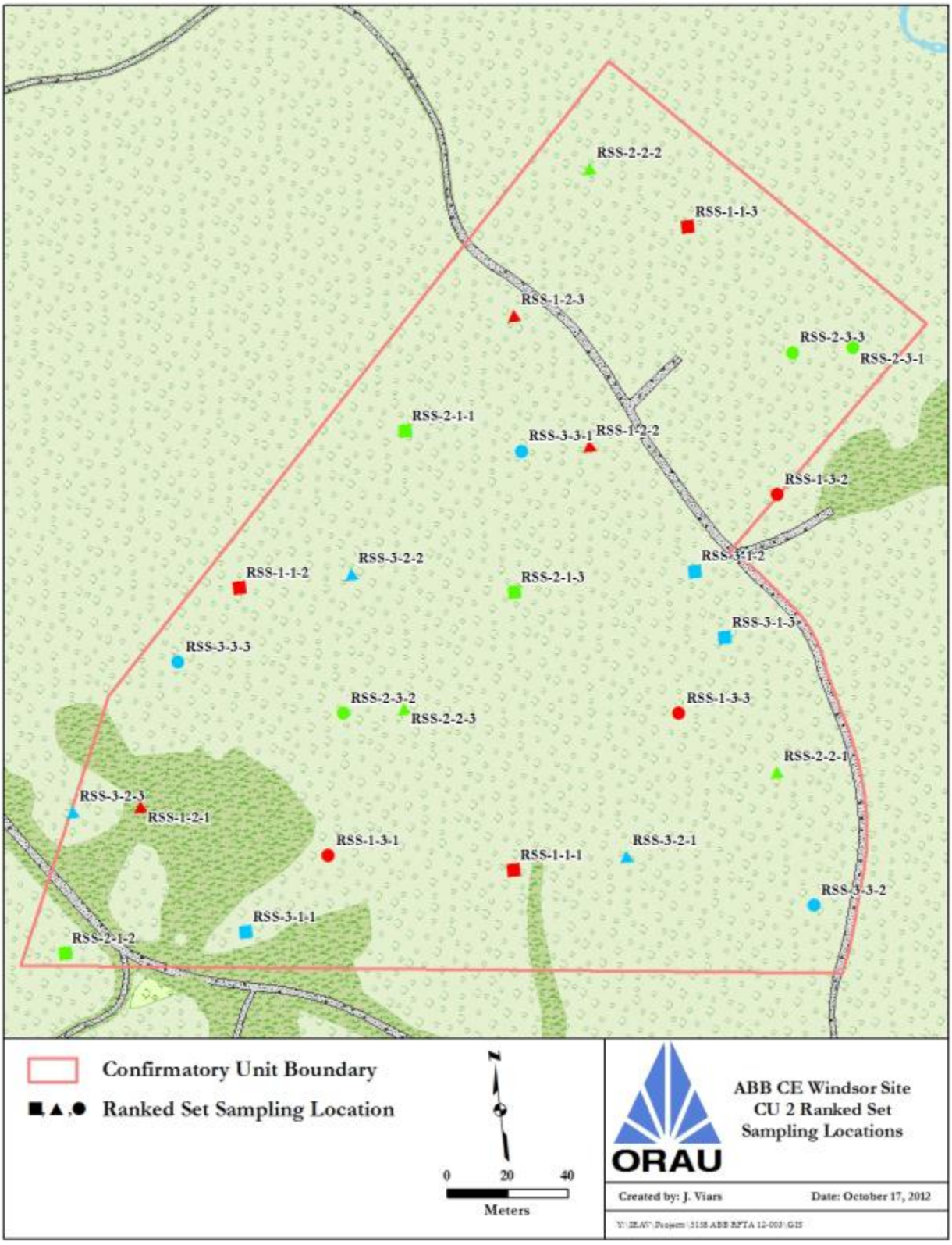

Fig. A-15. Confirmatory Unit 2, Burning Grounds Area – Ranked Set Sampling Locations

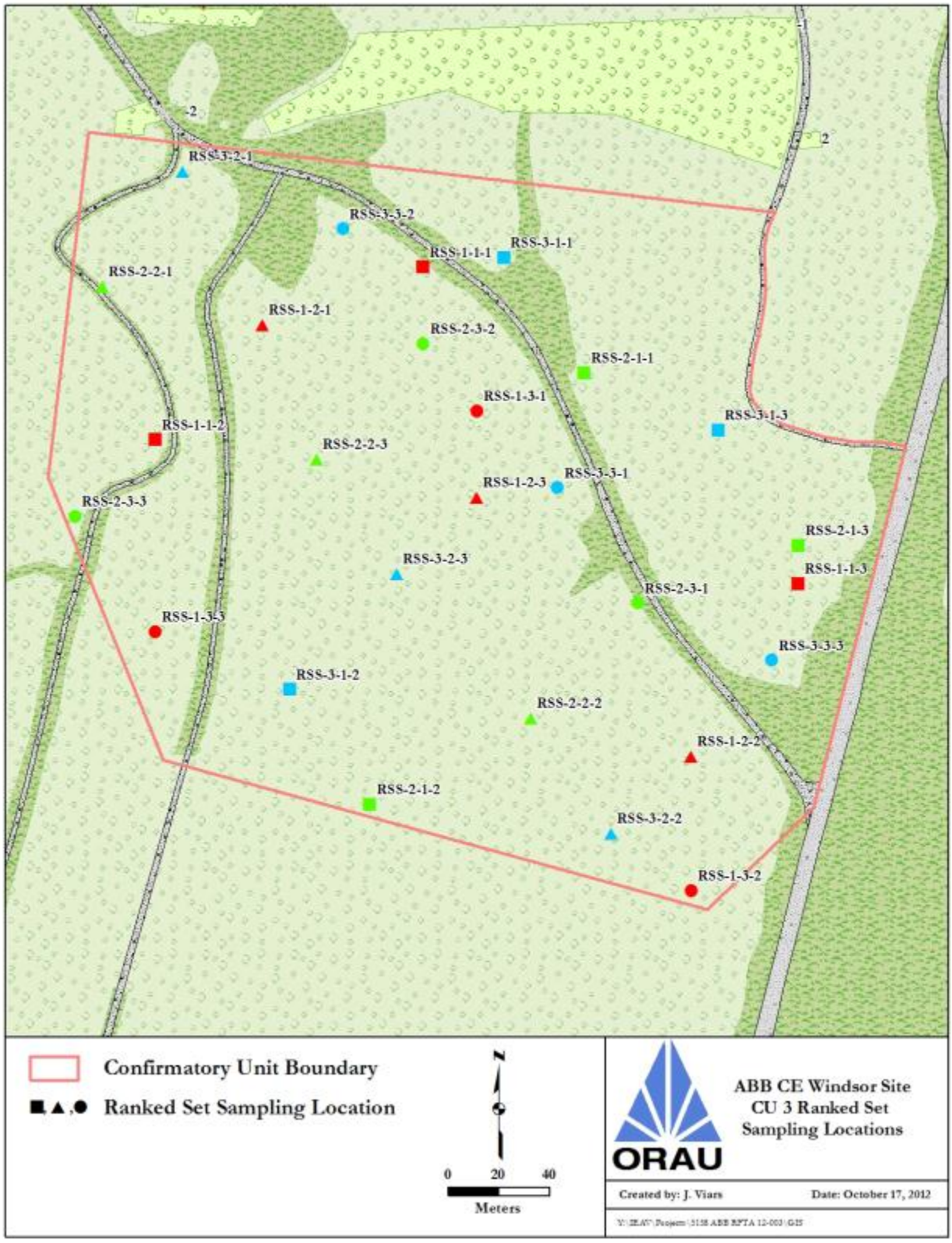

Fig. A-16. Confirmatory Unit 3, Drum Burial Pit and Woods Area – Ranked Set Sampling Locations

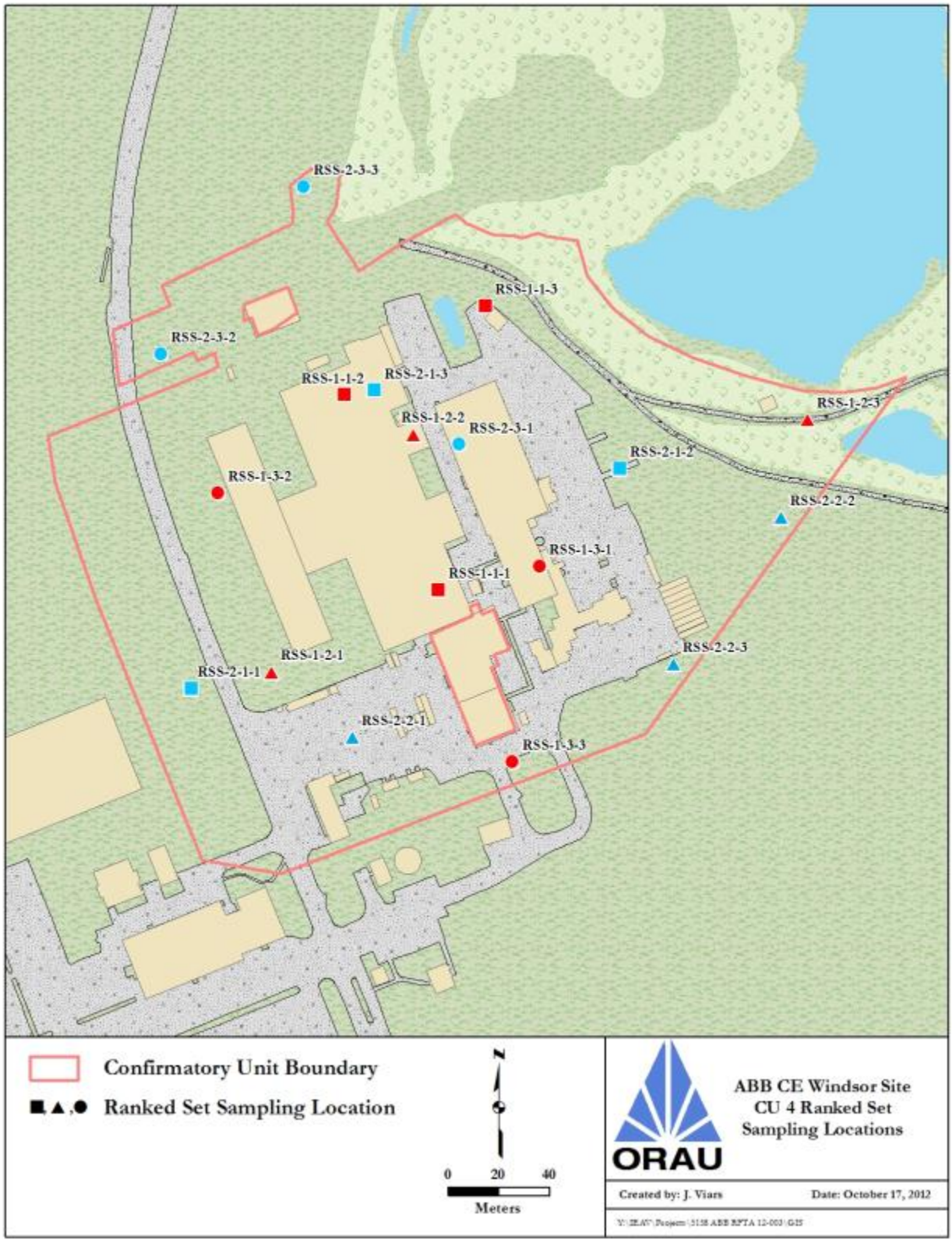

Fig. A-17. Confirmatory Unit 4, Buildings 3 and 6 Complexes – Ranked Set Sampling Locations

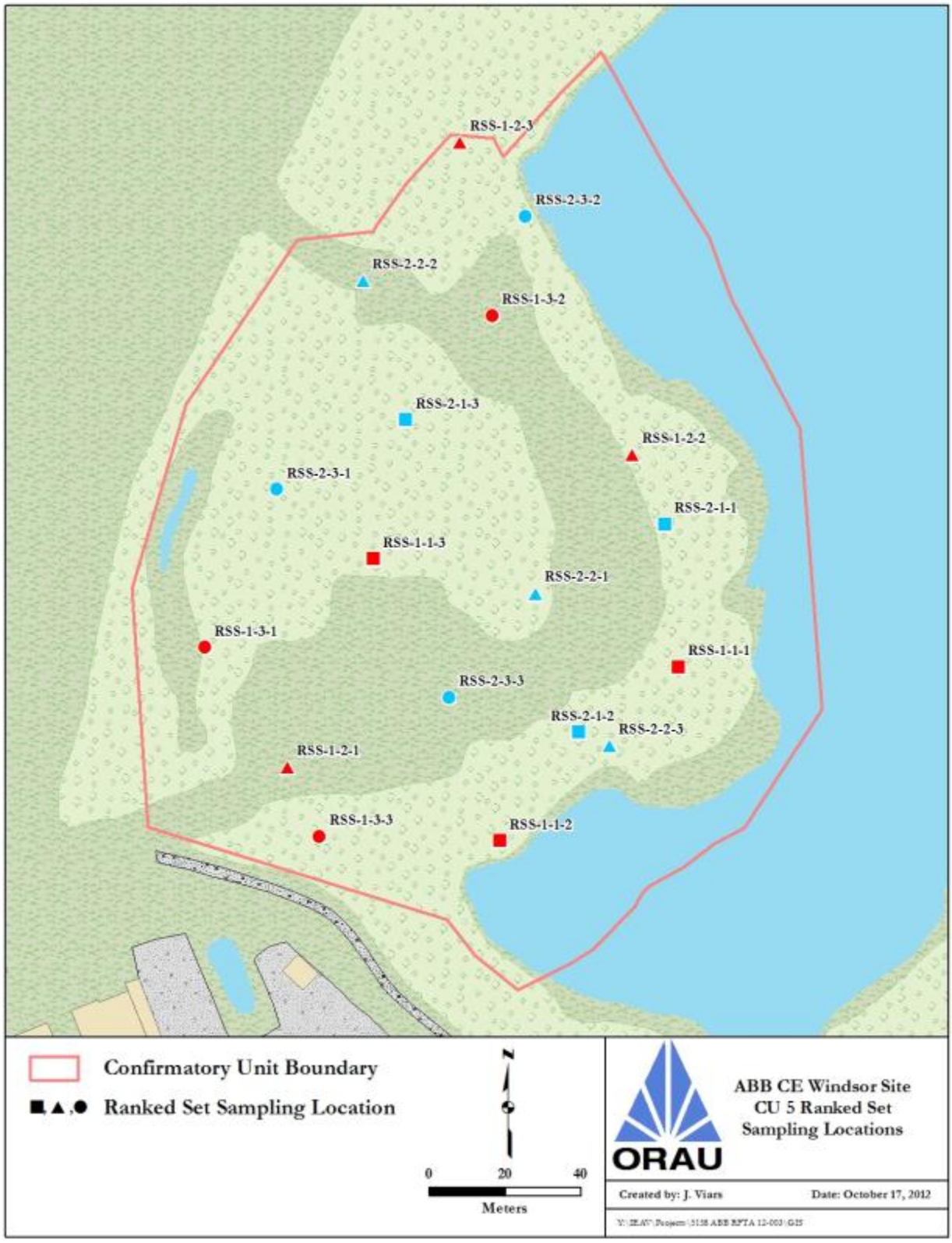

Fig. A-18. Confirmatory Unit 5, Equipment Storage Yard and Small Pond Buffer Area – Ranked Set Sampling Locations

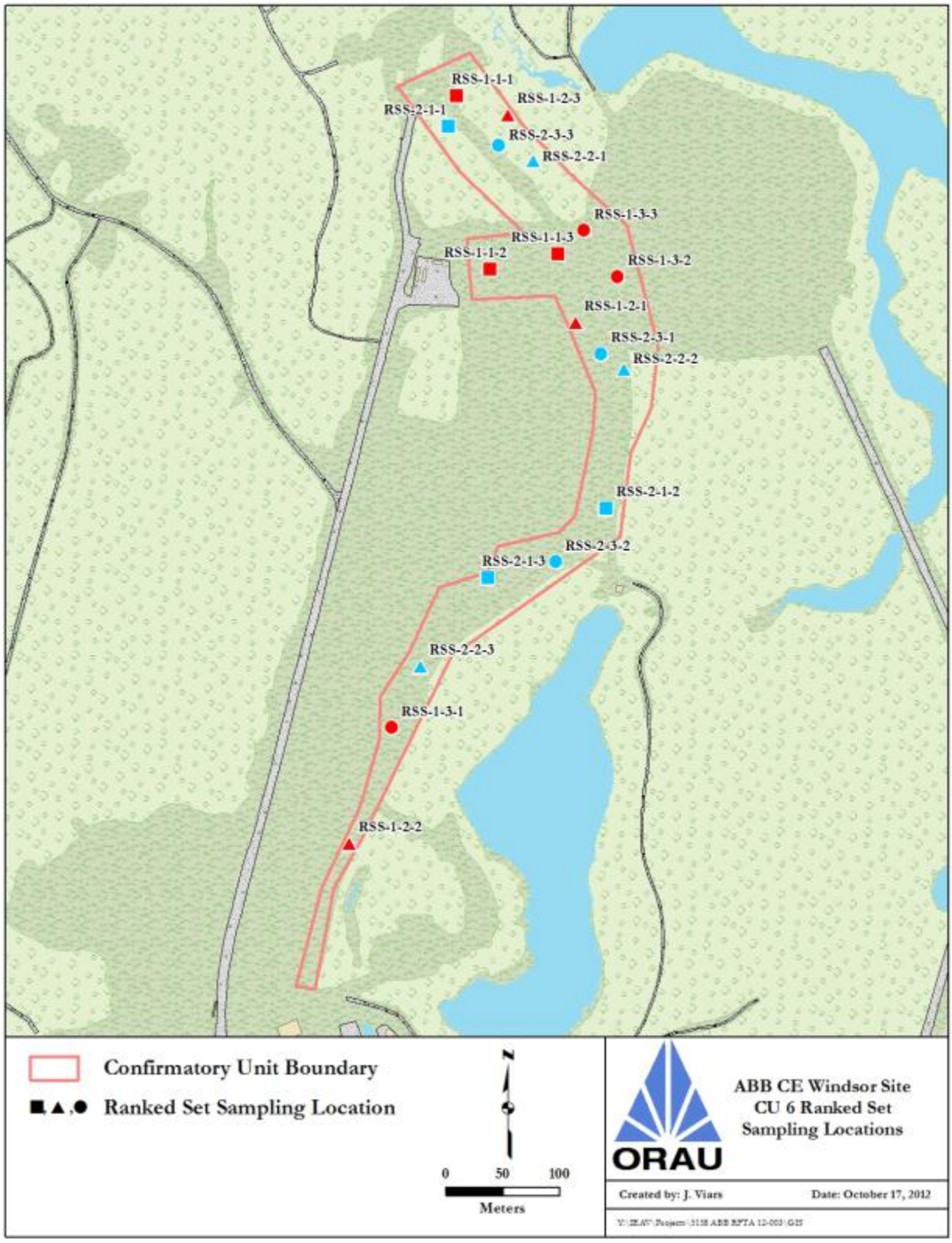

Fig. A-19. Confirmatory Unit 6, Industrial Waste Lines – Ranked Set Sampling Locations

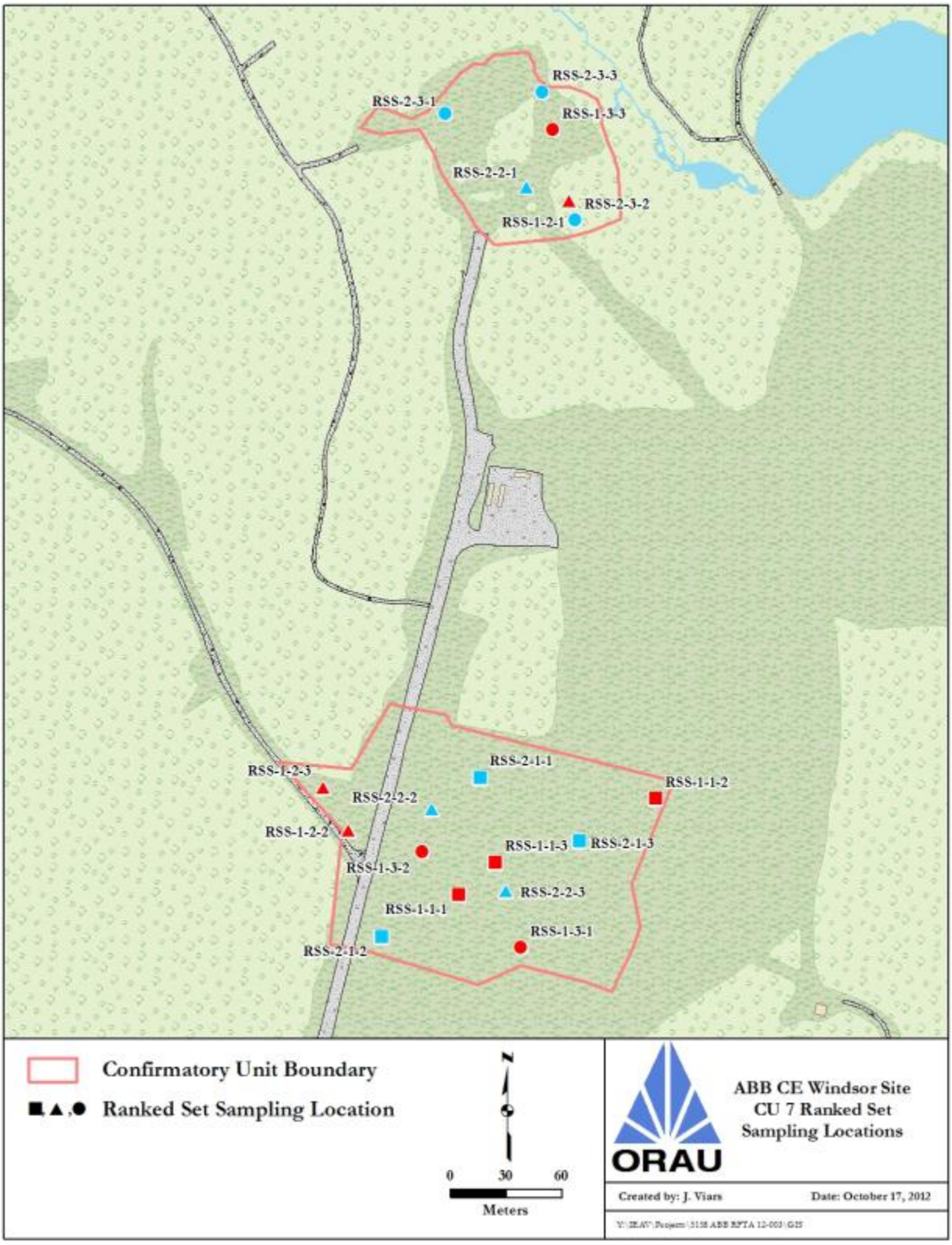

Fig. A-20. Confirmatory Unit 7, Waste Water Treatment Plant and Former Controlled Access Areas – Ranked Set Sampling Locations

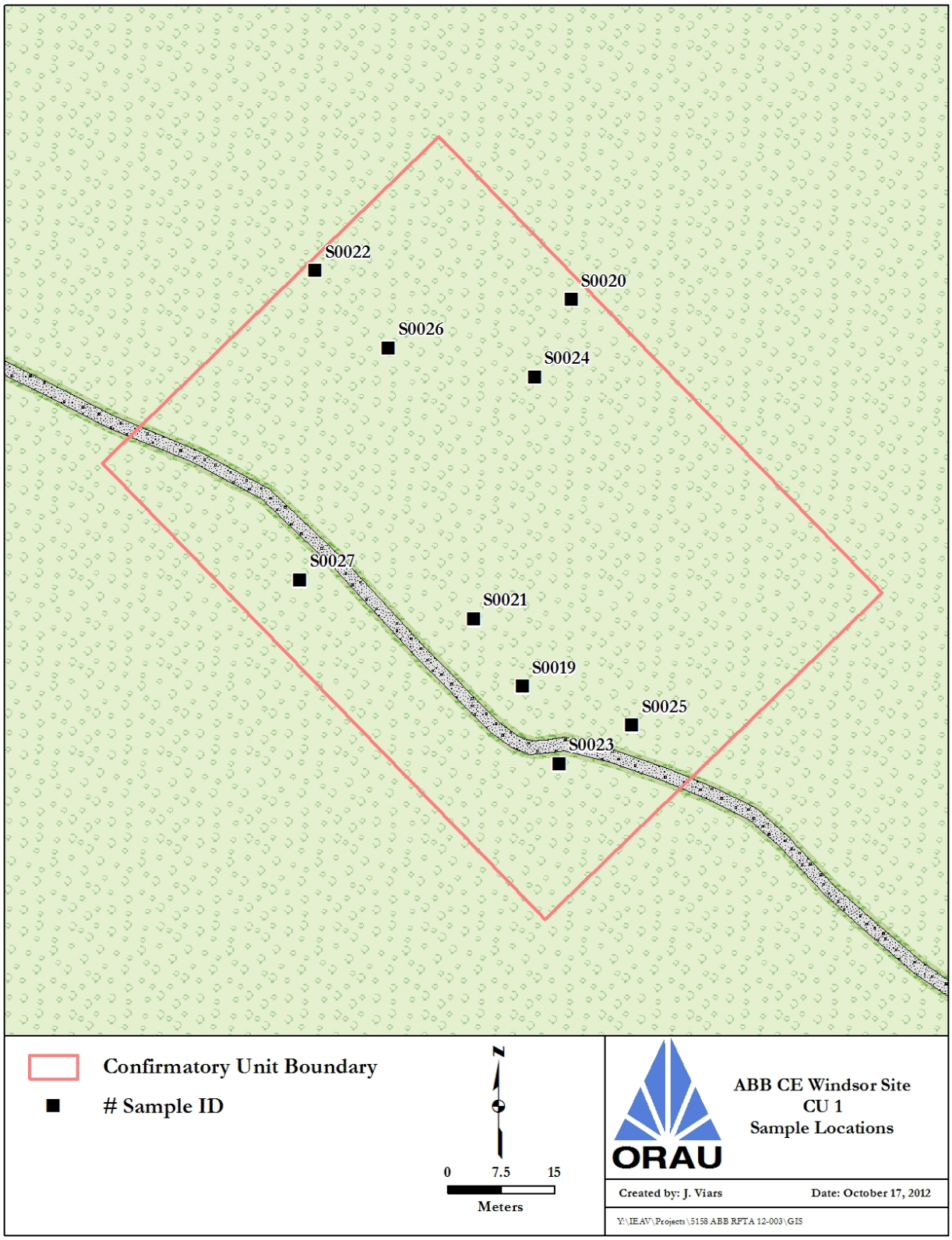

Fig. A-21. Confirmatory Unit 1, Clamshell Pile Area – Soil Sample Locations

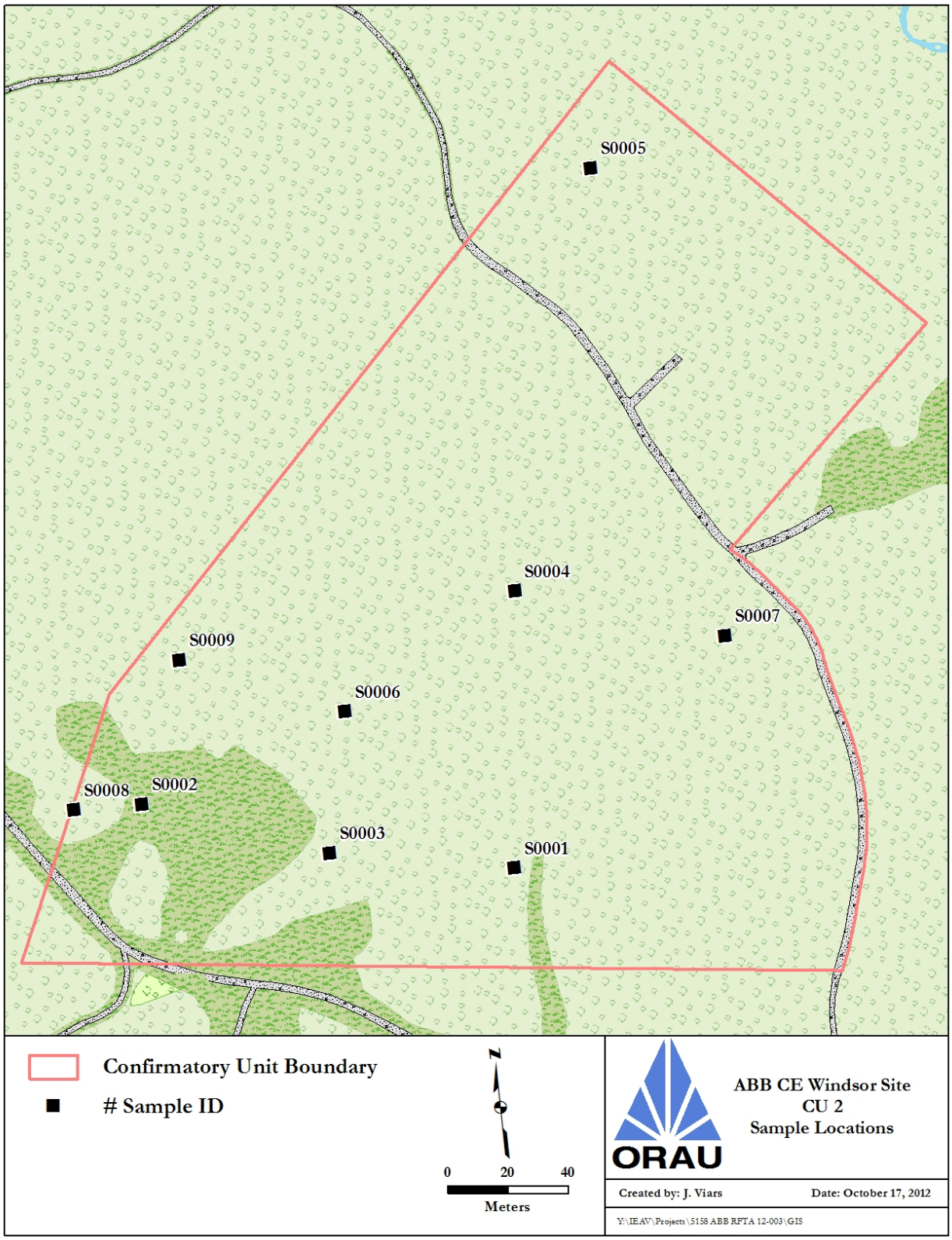

Fig. A-22. Confirmatory Unit 2, Burning Grounds – Soil Sample Locations

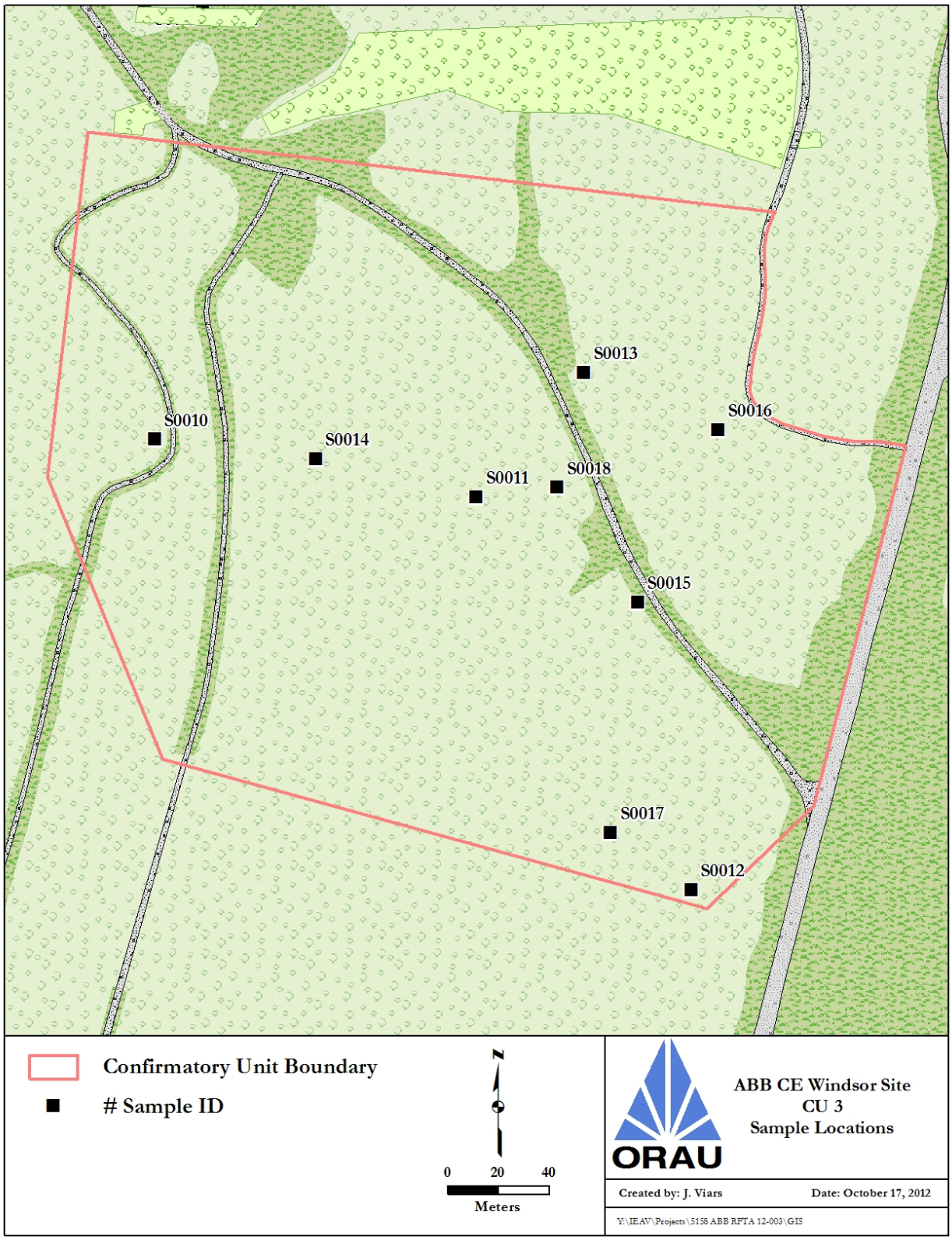

Fig. A-23. Confirmatory Unit 3, Drum Burial Pit and Woods Area – Soil Sample Locations

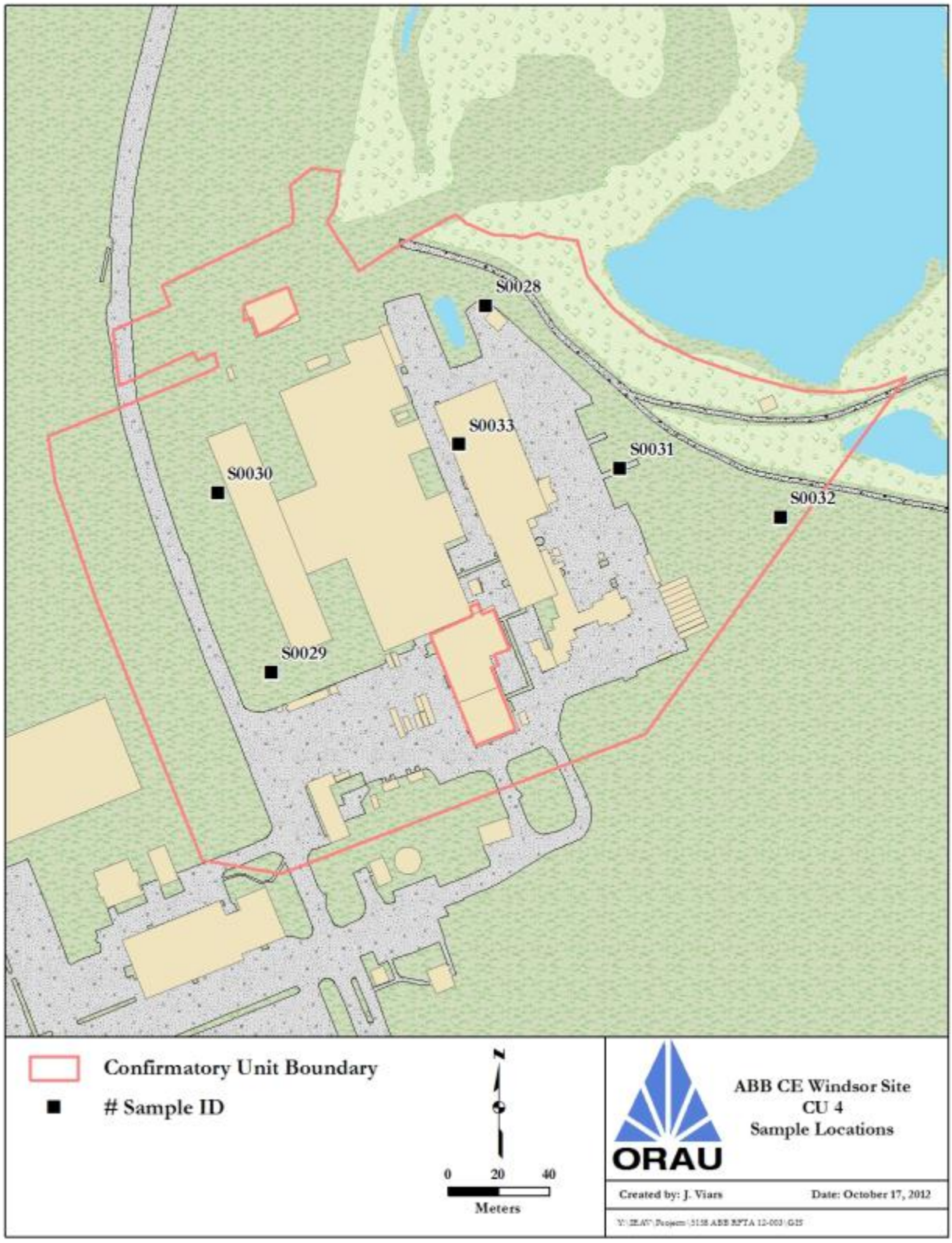

Fig. A-24. Confirmatory Unit 4, Buildings 3 and 6 Complexes – Soil Sample Locations

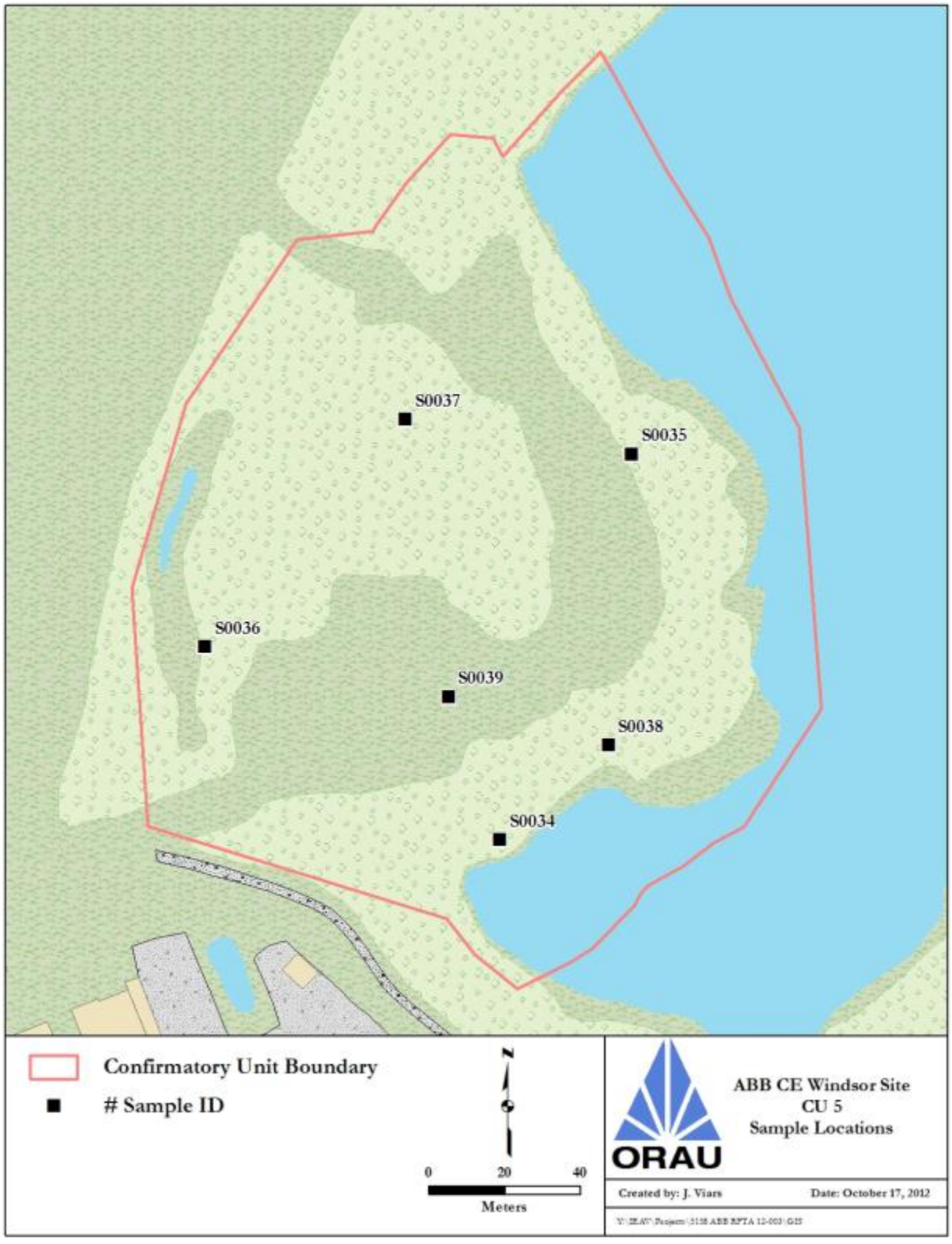

Fig. A-25. Confirmatory Unit 5, Equipment Storage Yard and Small Pond Buffer Areas – Soil Sample Locations

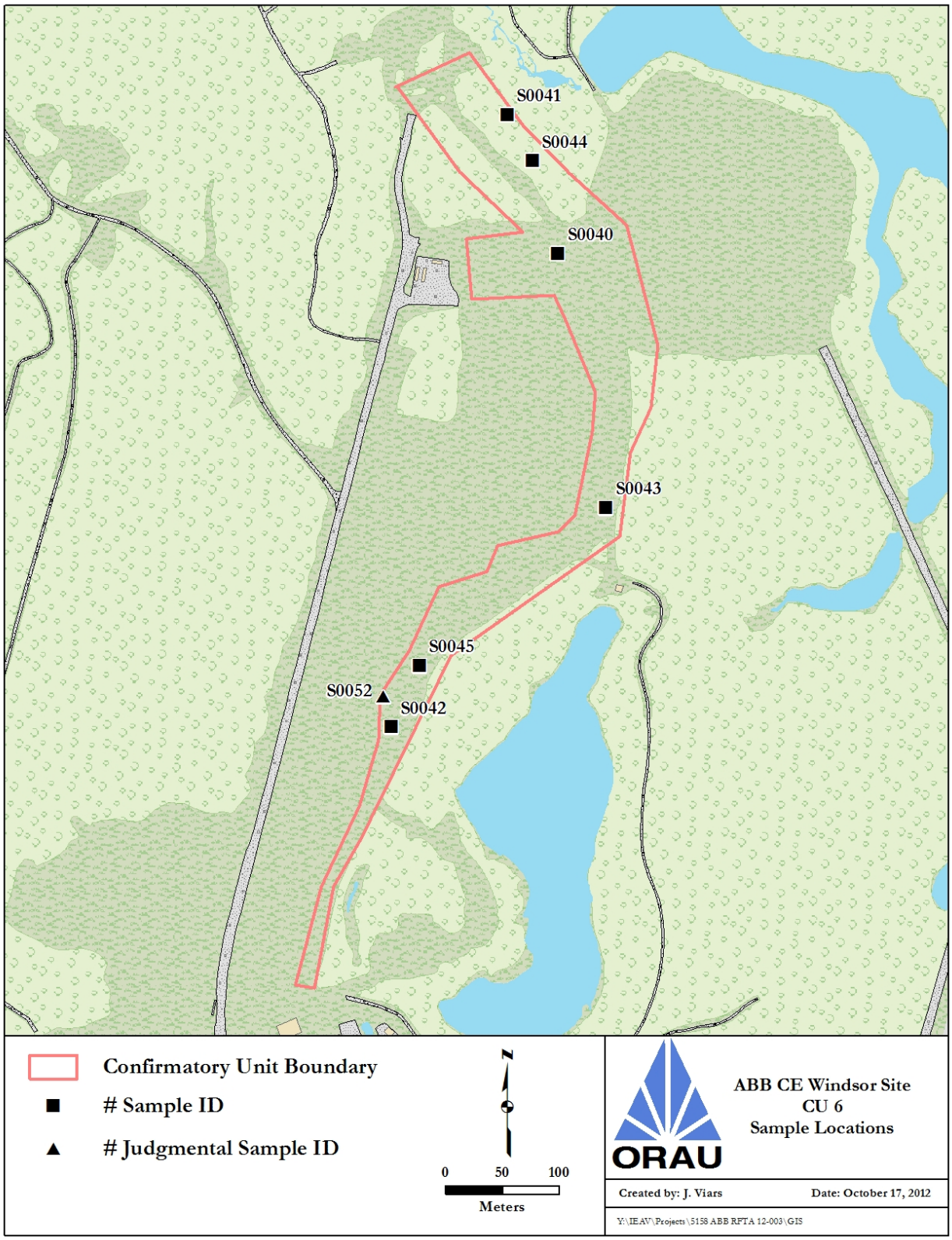

Fig. A-26. Confirmatory Unit 6, Industrial Waste Lines – Soil Sample Locations

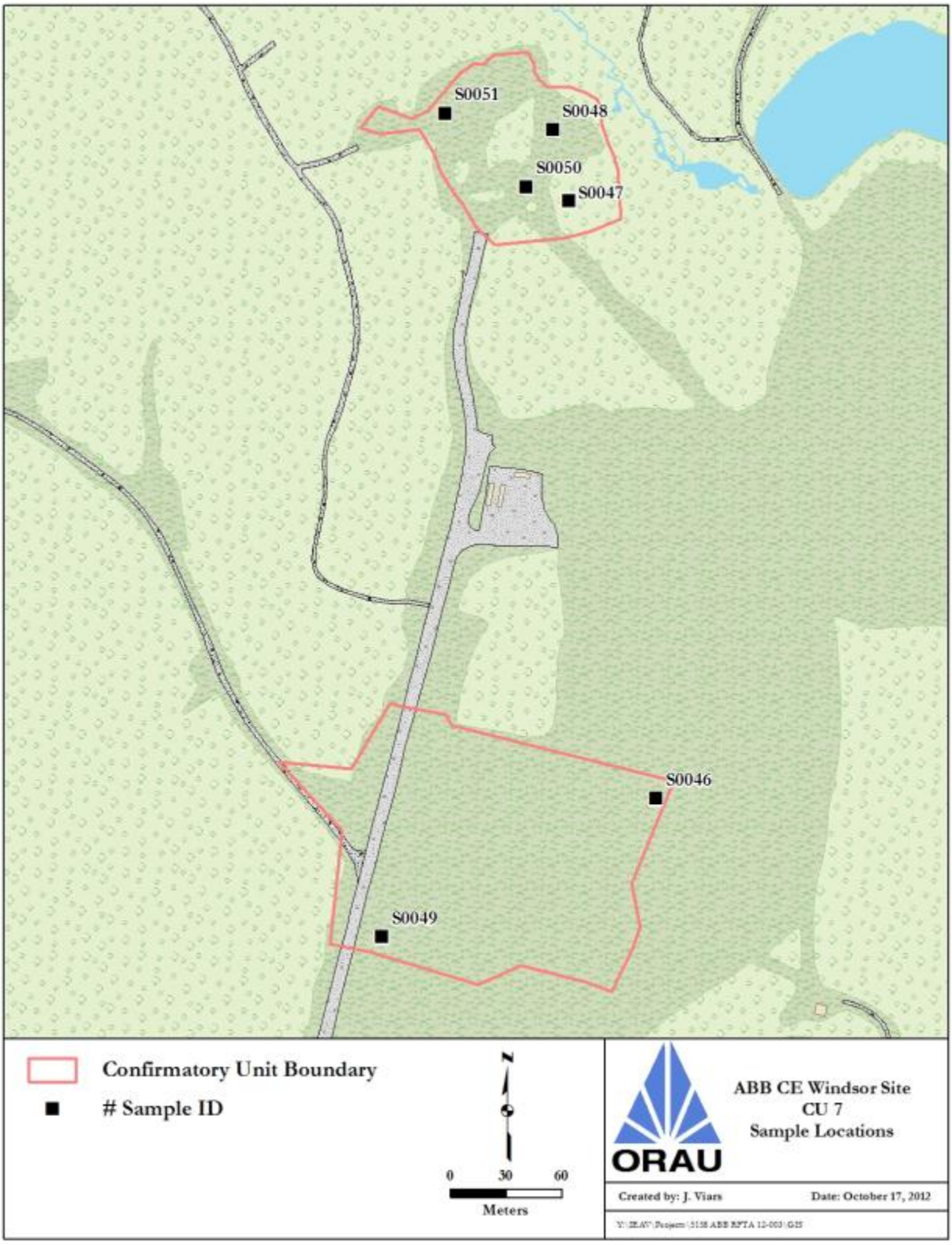

Fig. A-27. Confirmatory Unit 7, Waste Water Treatment Plant and Former Controlled Access Areas – Soil Sample Locations

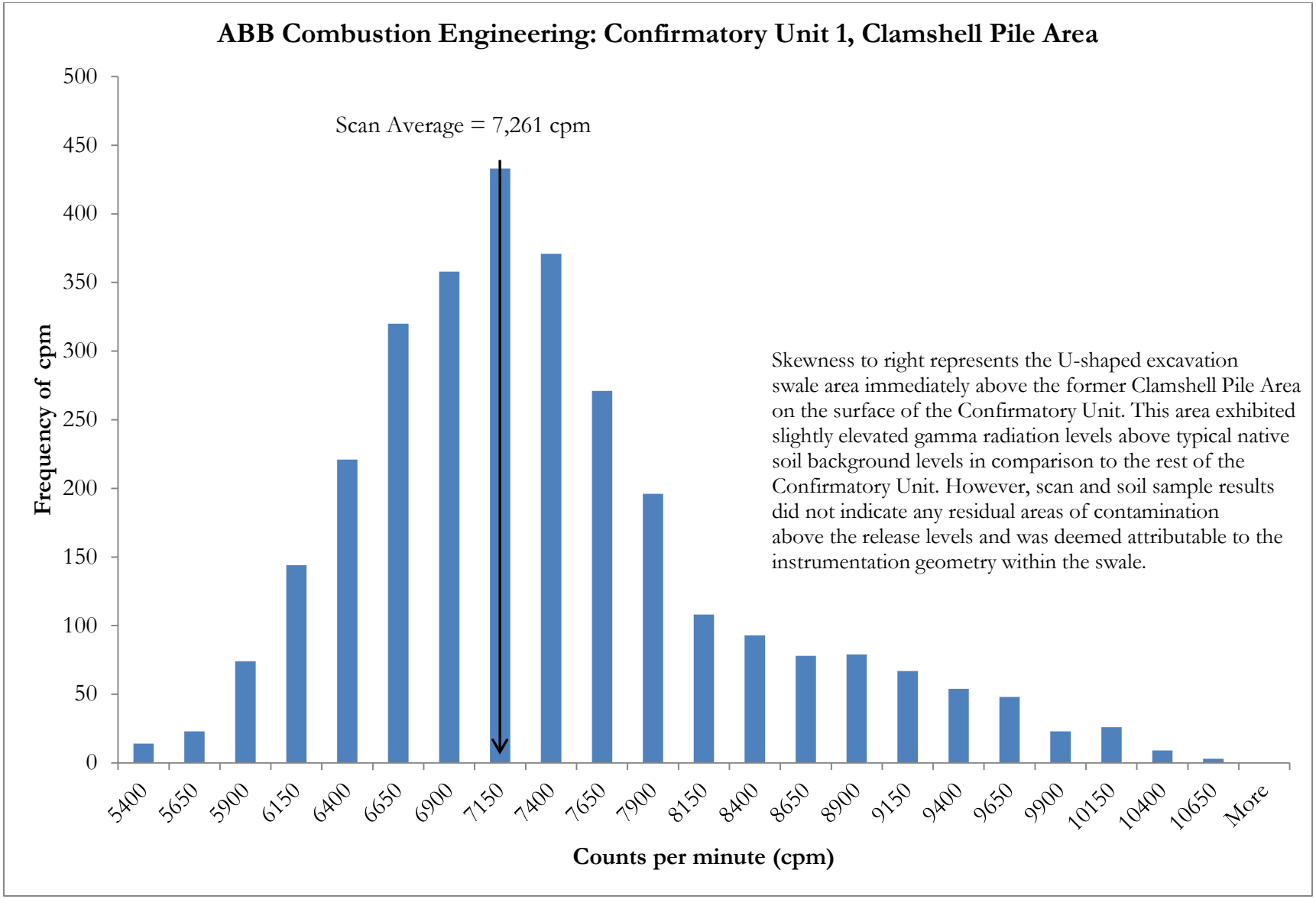

Fig. A-28. Confirmatory Unit 1, Clamshell Pile Area – Gamma Scan Count Rate Distribution

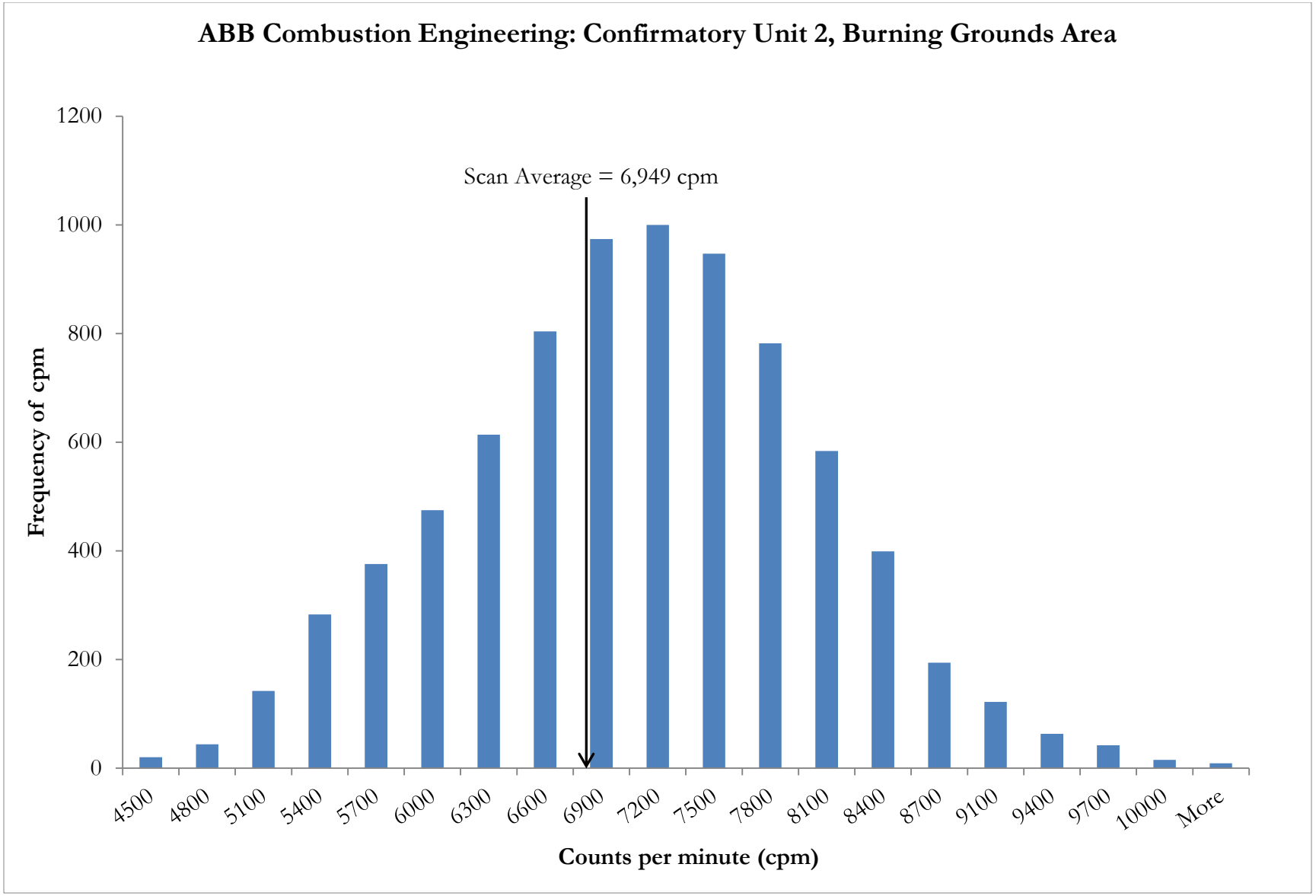

Fig. A-29. Confirmatory Unit 2, Burning Grounds Area – Gamma Scan Count Rate Distribution

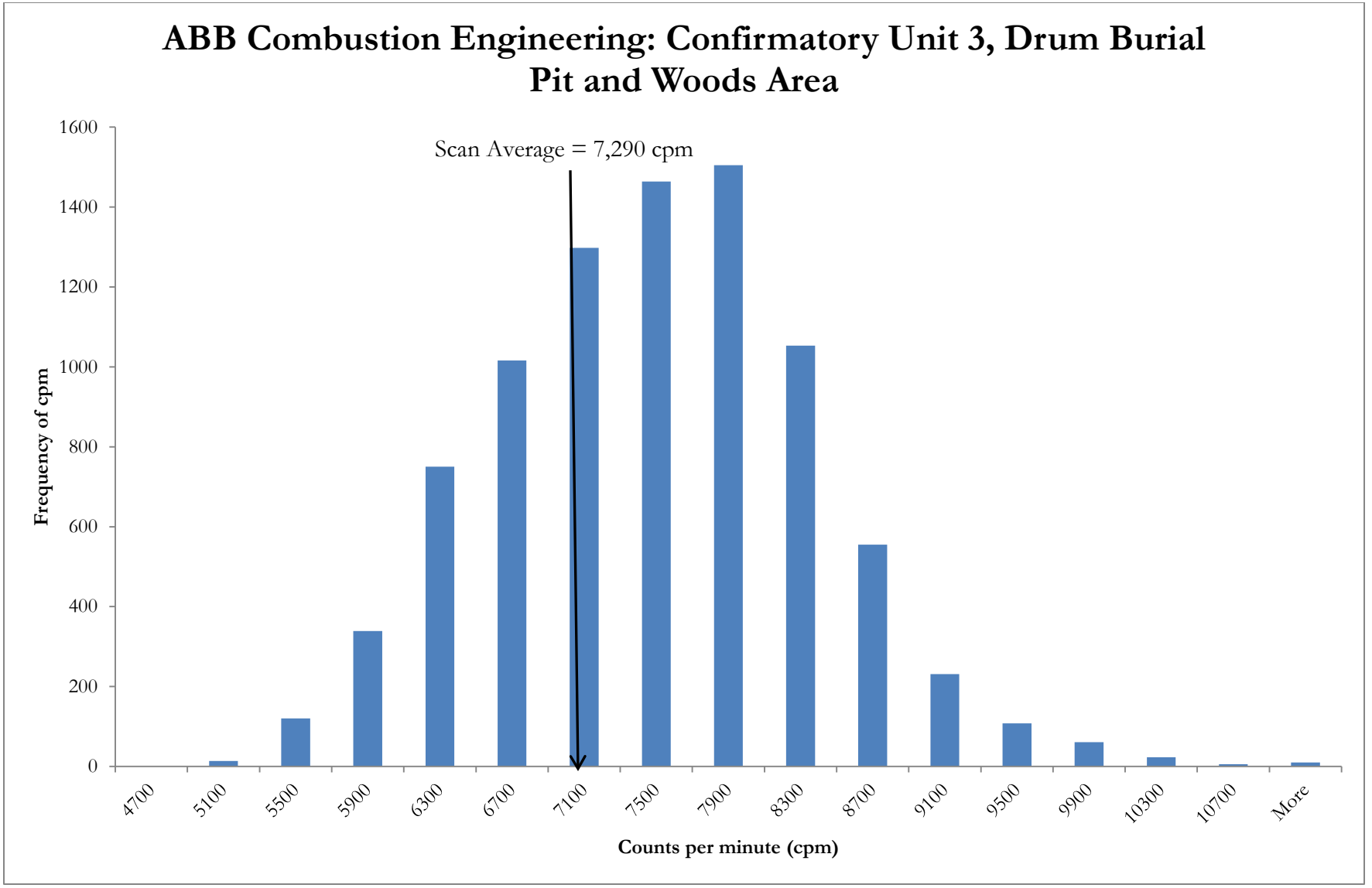

Fig. A-30. Confirmatory Unit 3, Drum Burial Pit and Woods Area – Gamma Scan Count Rate Distribution

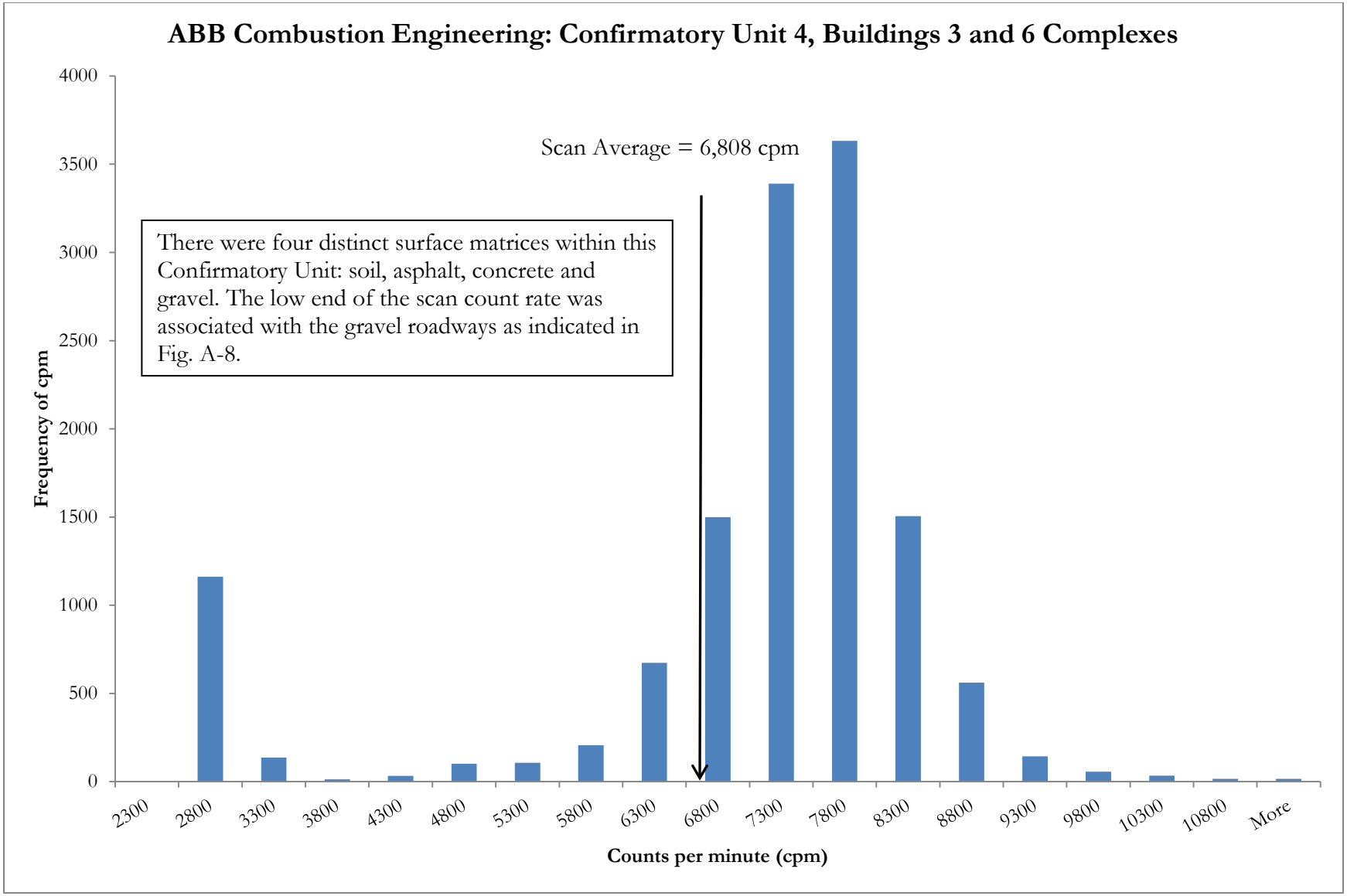

Fig. A-31. Confirmatory Unit 4, Buildings 3 and 6 Complexes – Gamma Scan Count Rate Distribution

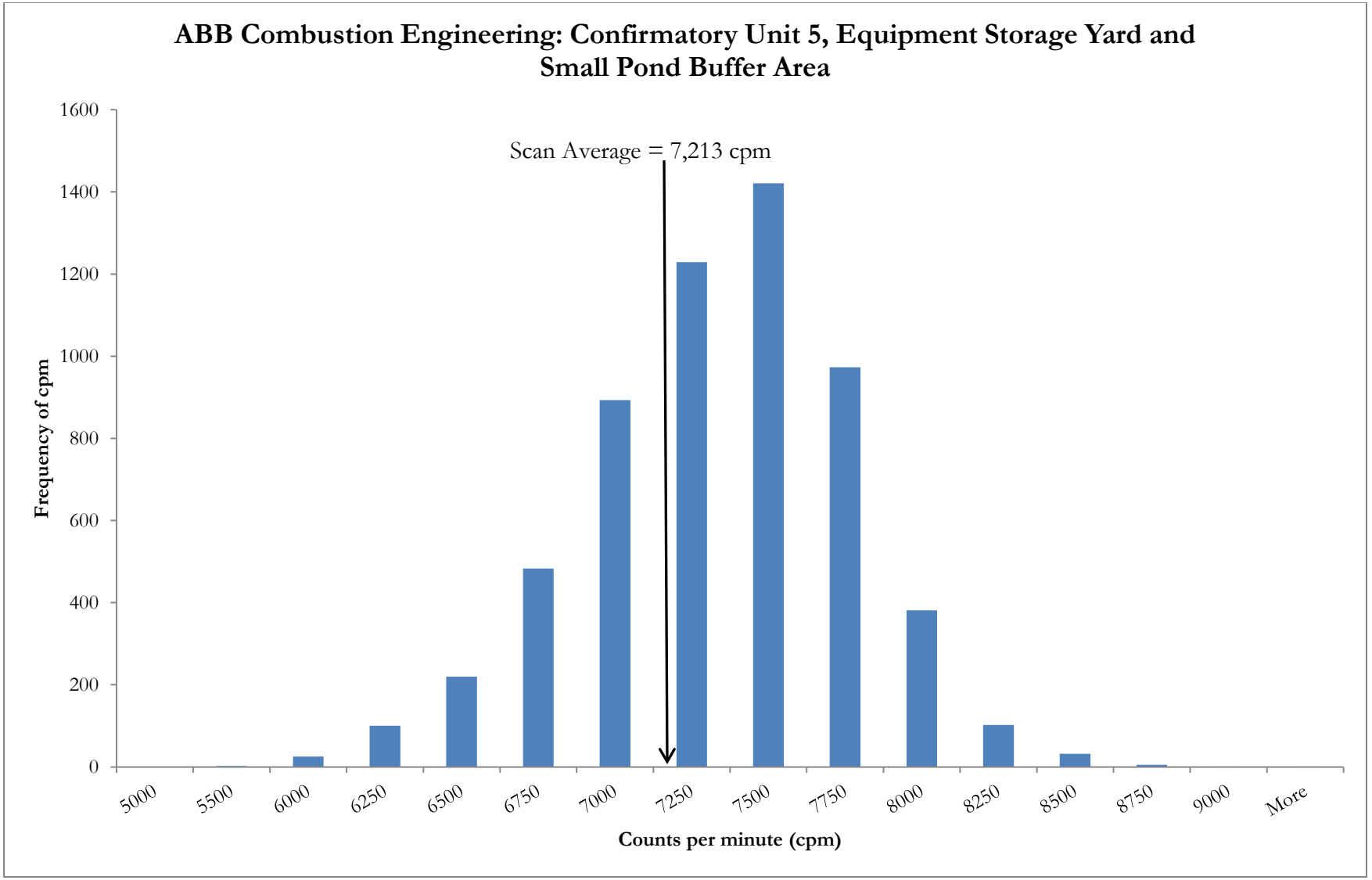

Fig. A-32. Confirmatory Unit 5, Equipment Storage Yard and Small Pond Buffer Area – Gamma Scan Count Rate Distribution

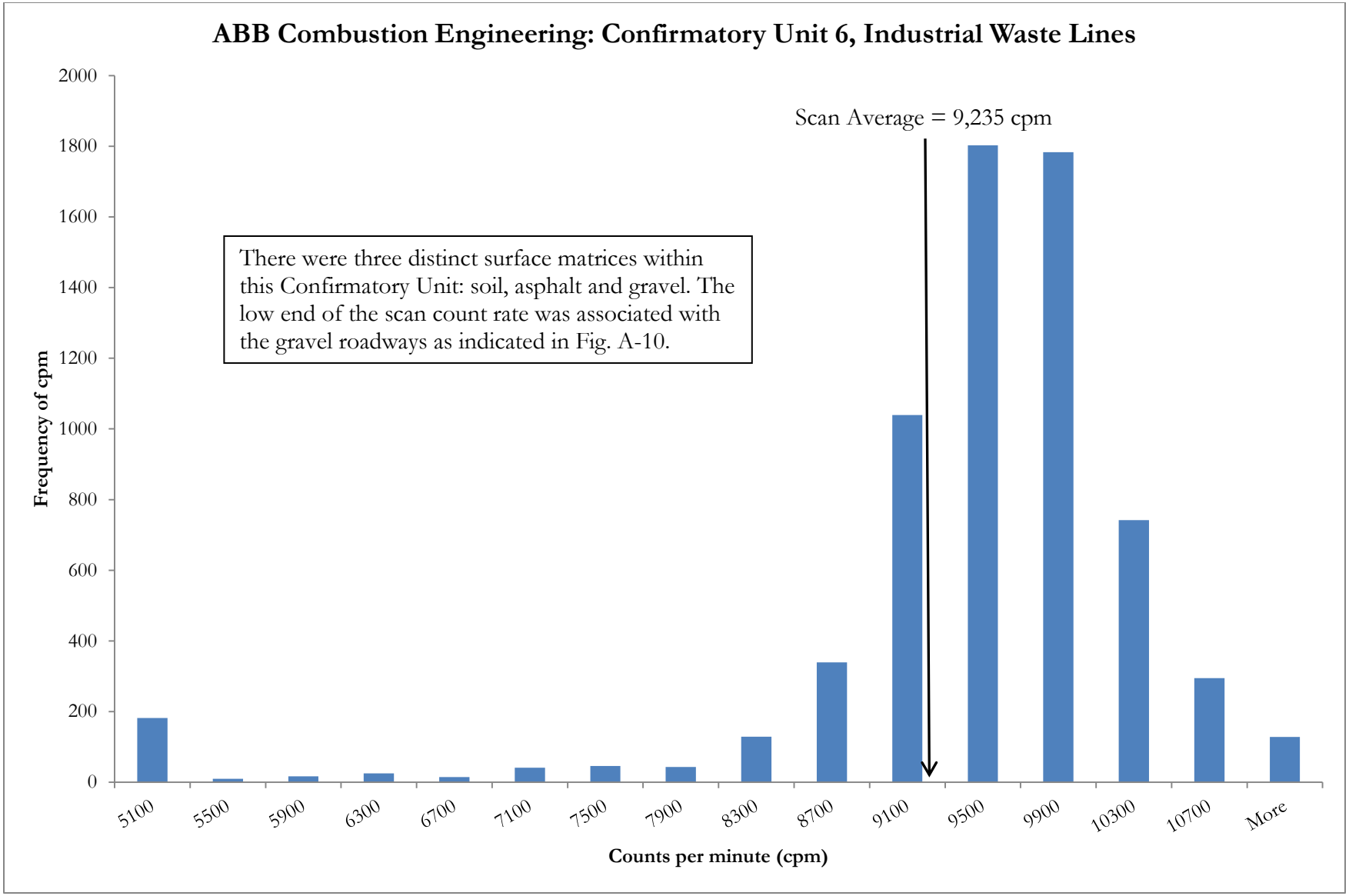

Fig. A-33. Confirmatory Unit 6, Industrial Waste Lines – Gamma Scan Count Rate Distribution

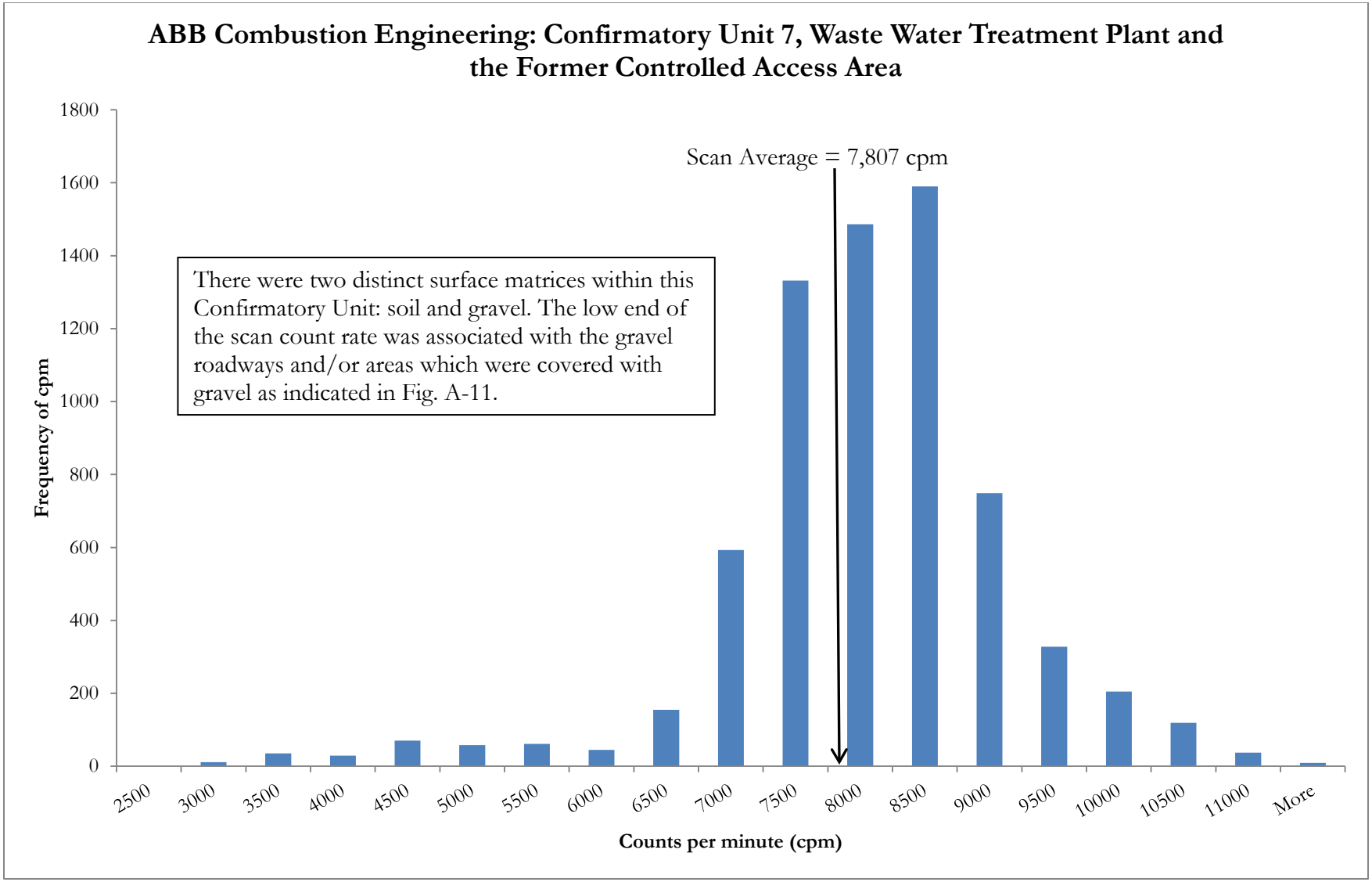

Fig. A-34. Confirmatory Unit 7, Waste Water Treatment Plant and the Former Controlled Access Area – Gamma Scan Count Rate Distribution

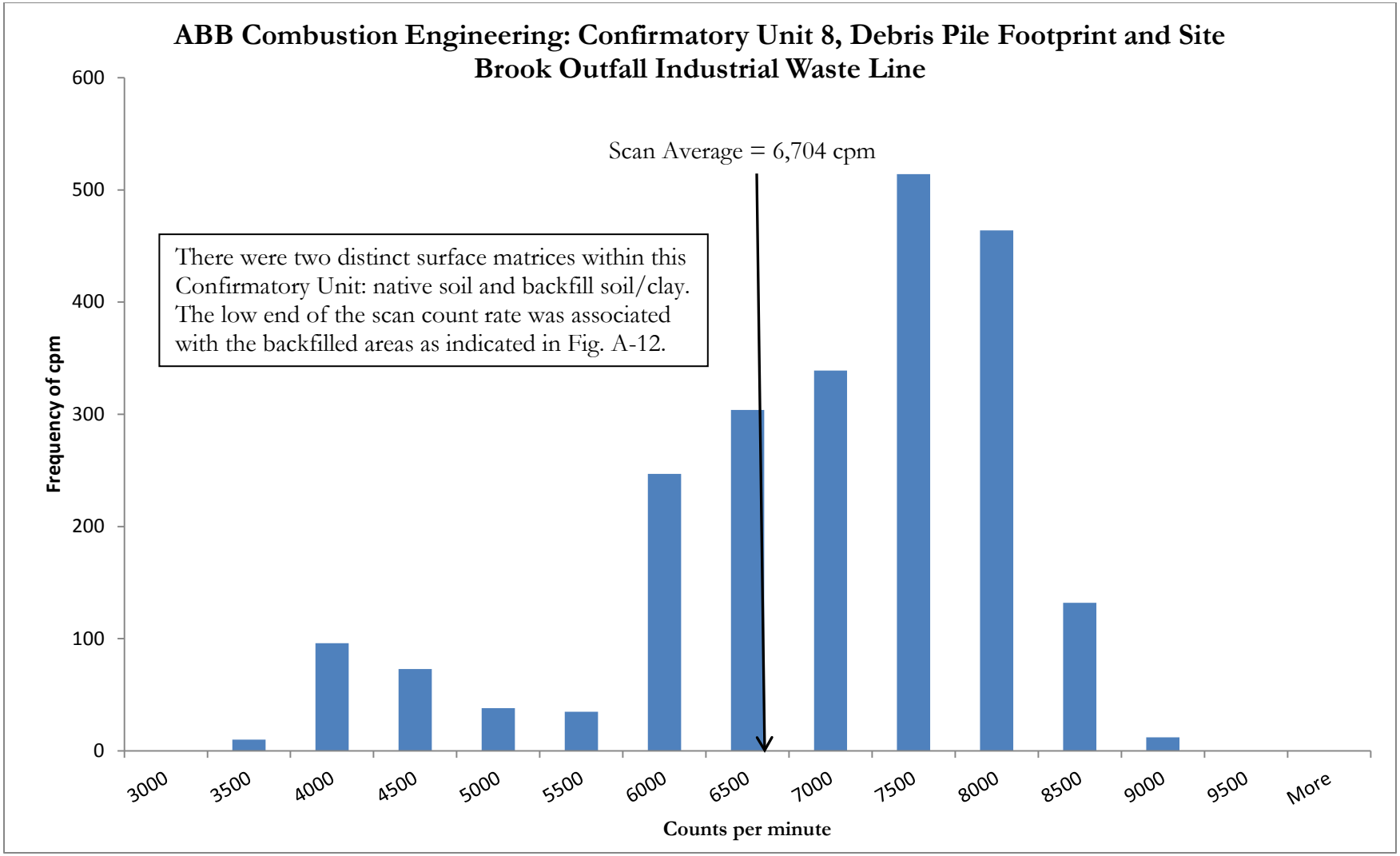

Fig. A-35. Confirmatory Unit 8, Debris Pile Footprint and Site Brook Outfall Industrial Waste Line – Gamma Scan Count Rate Distribution

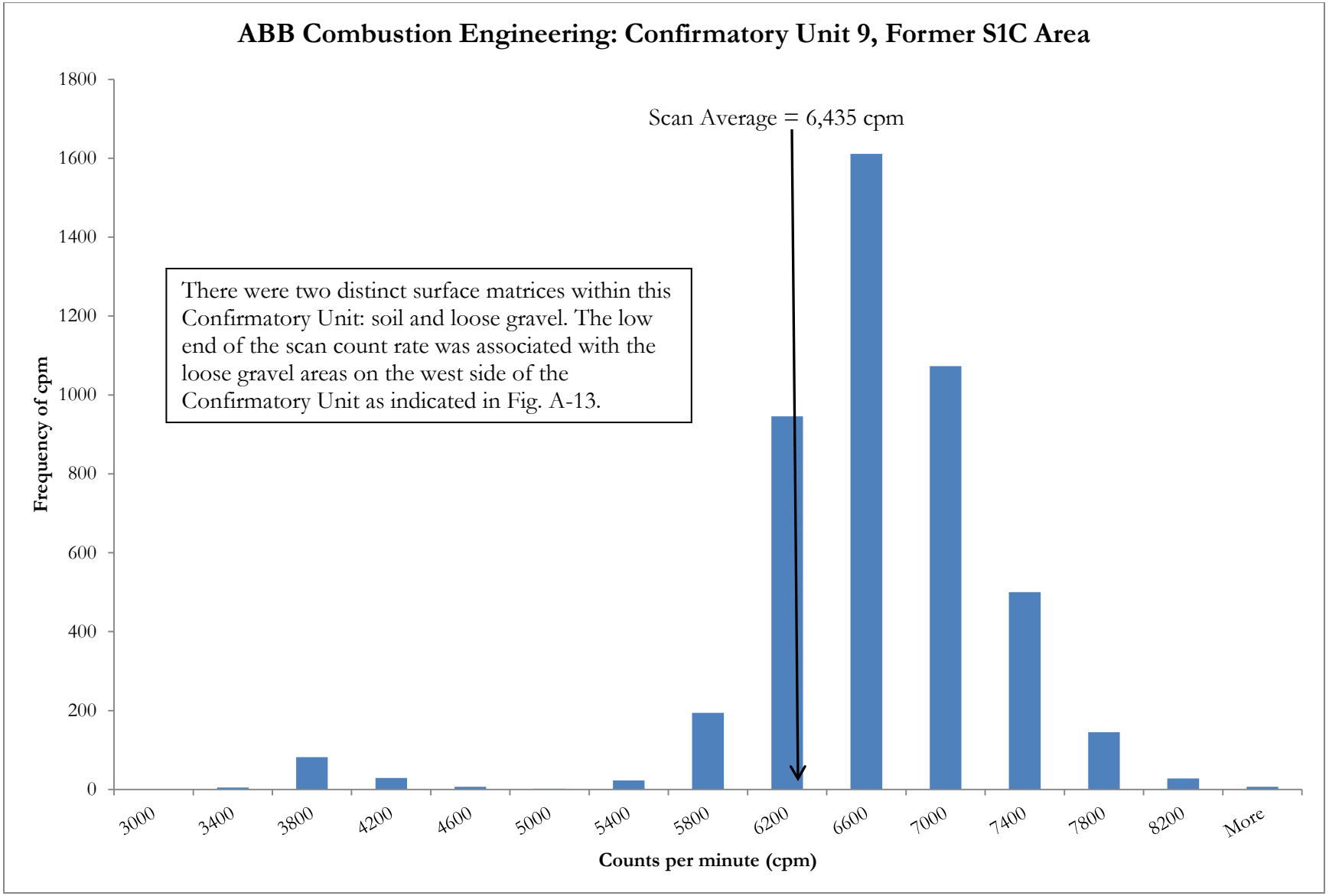

Fig. A-36. Confirmatory Unit 9, Former S1C Area – Gamma Scan Count Rate Distribution

APPENDIX B
TABLES

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Table B-1. Ranked Set Sampling Gamma Measurements Fall 2011 Confirmatory Survey Activities ABB Combustion Engineering Windsor, Connecticut									
East (ft)	North (ft)	RSS Measurement Location[a]				Gamma Count Rate (cpm)[b]	Code[c]	Surface Soil Sample ID[d]	Subsurface Gamma Counts (cpm)
		Cycle	Set	#	Symbol				
Confirmatory Unit 1: Clamshell Pile Area[e]									
1007974	886158	1	1	1	■	7,138	L	—[f]	—
1008008	886198	1	1	2	■	7,038	**L**	S0019	8,739
1007918	886318	1	1	3	■	7,657	L	—	—
1008053	886216	1	2	1	▲	6,894	M	—	—
1007963	886336	1	2	2	▲	7,433	M	—	—
1008030	886376	1	2	3	▲	7,097	**M**	S0020	8,234
1007940	886176	1	3	1	●	6,393	H	—	—
1008120	886296	1	3	2	●	5,972	H	—	—
1007985	886229	1	3	3	●	6,708	**H**	S0021	7,916
1008002	886269	2	1	1	■	8,485	L	—	—
1007912	886390	2	1	2	■	6,561	**L**	S0022	8,157
1008092	886189	2	1	3	■	6,623	L	—	—
1007867	886309	2	2	1	▲	7,018	M	—	—
1008137	886243	2	2	2	▲	5,596	M	—	—
1008025	886162	2	2	3	▲	6,953	**M**	S0023	7,258
1007935	886283	2	3	1	●	6,740	H	—	—
1008070	886323	2	3	2	●	6,488	H	—	—
1008013	886341	2	3	3	●	7,292	**H**	S0024	8,690
1008103	886260	3	1	1	■	6,696	L	—	—
1008058	886180	3	1	2	■	6,586	**L**	S0025	7,293
1007968	886301	3	1	3	■	8,152	L	—	—
1008036	886234	3	2	1	▲	6,765	M	—	—
1007946	886354	3	2	2	▲	7,218	**M**	S0026	8,582
1007901	886274	3	2	3	▲	7,819	M	—	—
1007991	886194	3	3	1	●	6,508	H	—	—
1007995	886127	3	3	2	●	6,786	H	—	—
1007905	886247	3	3	3	●	6,797	**H**	S0027	8,097

Table B-1. Ranked Set Sampling Gamma Measurements Fall 2011 Confirmatory Survey Activities ABB Combustion Engineering Windsor, Connecticut									
East (ft)	North (ft)	RSS Measurement Location[a]				Gamma Count Rate (cpm)[b]	Code[c]	Surface Soil Sample ID[d]	Subsurface Gamma Counts (cpm)
		Cycle	Set	#	Symbol				
Confirmatory Unit 2: Burning Grounds Area[e]									
1008779	884376	1	1	1	■	8,002	**L**	S0001	8,919
1008514	884713	1	1	2	■	8,155	L	---	---
1009043	885051	1	1	3	■	8,500	L	---	---
1008382	884488	1	2	1	▲	6,826	**M**	S0002	6,877
1008911	884826	1	2	2	▲	6,829	M	---	---
1008845	884976	1	2	3	▲	6,371	M	---	---
1008569	884395	1	3	1	●	6,930	**H**	S0003	7,039
1009109	884751	1	3	2	●	6,730	H	---	---
1008977	884526	1	3	3	●	6,753	H	---	---
1008713	884864	2	1	1	■	6,732	L	---	---
1008283	884338	2	1	2	■	6,840	L	---	---
1008812	884676	2	1	3	■	6,501	**L**	S0004	6,937
1009076	884451	2	2	1	▲	8,678	M	---	---
1008944	885126	2	2	2	▲	7,710	**M**	S0005	9,476
1008680	884563	2	2	3	▲	7,299	M	---	---
1009208	884901	2	3	1	●	7,457	H	---	---
1008613	884565	2	3	2	●	8,553	**H**	S0006	9,543
1009142	884903	2	3	3	●	8,179	H	---	---
1008501	884347	3	1	1	■	7,682	L	---	---
1009010	884678	3	1	2	■	7,454	L	---	---
1009035	884603	3	1	3	■	7,012	**L**	S0007	8,702
1008903	884378	3	2	1	▲	7,006	M	---	---
1008638	884715	3	2	2	▲	8,148	M	---	---
1008247	884496	3	2	3	▲	7,605	**M**	S0008	9,309
1008836	884828	3	3	1	●	5,885	H	---	---
1009101	884302	3	3	2	●	7,506	H	---	---
1008440	884640	3	3	3	●	8,426	**H**	S0009	9,584

Table B-1. Ranked Set Sampling Gamma Measurements Fall 2011 Confirmatory Survey Activities ABB Combustion Engineering Windsor, Connecticut									
East (ft)	North (ft)	RSS Measurement Location[a]				Gamma Count Rate (cpm)[b]	Code[c]	Surface Soil Sample ID[d]	Subsurface Gamma Counts (cpm)
		Cycle	Set	#	Symbol				
Confirmatory Unit 3: Drum Burial Pit and Woods Area[e]									
1008667	884155	1	1	1	■	8,216	L	—	—
1008320	883932	1	1	2	■	7,313	**L**	S0010	9,178
1009154	883746	1	1	3	■	8,500	L	—	—
1008459	884081	1	2	1	▲	8,993	M	—	—
1009015	883522	1	2	2	▲	7,679	M	—	—
1008737	883858	1	2	3	▲	8,665	**M**	S0011	9,365
1008737	883969	1	3	1	●	7,959	H	—	—
1009015	883348	1	3	2	●	7,984	**H**	S0012	9,666
1008320	883684	1	3	3	●	7,870	H	—	—
1008876	884019	2	1	1	■	8,064	**L**	S0013	10,232
1008598	883460	2	1	2	■	9,411	L	—	—
1009154	883795	2	1	3	■	8,527	L	—	—
1008251	884131	2	2	1	▲	8,988	M	—	—
1008807	883572	2	2	2	▲	7,604	M	—	—
1008529	883907	2	2	3	▲	8,139	**M**	S0014	8,492
1008946	883721	2	3	1	●	9,306	**H**	S0015	9,589
1008668	884056	2	3	2	●	8,695	H	—	—
1008216	883833	2	3	3	●	7,875	H	—	—
1008772	884168	3	1	1	■	8,810	L	—	—
1008494	883609	3	1	2	■	8,714	L	—	—
1009050	883944	3	1	3	■	5,791	**L**	S0016	6,939
1008355	884280	3	2	1	▲	7,775	M	—	—
1008911	883423	3	2	2	▲	8,016	**M**	S0017	8,937
1008633	883758	3	2	3	▲	9,572	M	—	—
1008841	883870	3	3	1	●	9,639	**H**	S0018	11,015
1008563	884205	3	3	2	●	8,672	H	—	—
1009119	883646	3	3	3	●	9,192	H	—	—

[a]RSS description, color and symbol codes explanation provided in Appendix E.
[b]Gamma counts represent the one-minute gamma count rate at the soil surface for the location.
[c]Sample select code specifies which location is sampled for a given cycle/set based on the gamma count rate.
[d]Soil sample locations are provided on Figs. A-21, A-22 and A-23 for Confirmatory Units 1, 2 and 3, respectively.
[e]For Confirmatory Unit 1 refer to Fig. A-14 and for Confirmatory Unit 2, refer to Fig. A-15, and for Confirmatory Unit 3 refer to Fig. A-16.
[f]Measurement/sample not required.

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Table B-2. Ranked Set Sampling Gamma Measurements Spring 2012 Confirmatory Survey Activities ABB Combustion Engineering Windsor, Connecticut										
East (ft)	North (ft)	RSS Measurement Location[a]				Surface Matrix	Net Surface Gamma Count Rate (cpm)[b]	Code[c]	Surface Soil Sample ID[d]	Net Subsurface Gamma Counts (cpm)
		Cycle	Set	#	Symbol					
Confirmatory Unit 4: Buildings 3 and 6 Complexes[e]										
1009245	881578	1	1	1	■	Soil	-85	L	—[f]	—
1009124	881831	1	1	2	■	Soil	-7	L	—	—
1009306	881946	1	1	3	■	Soil	-600	L	S0028	377
1009028	881472	1	2	1	▲	Soil	520	M	S0029	1,554
1009212	881779	1	2	2	▲	Soil	401	M	—	—
1009722	881798	1	2	3	▲	Soil	915	M	—	—
1009375	881609	1	3	1	●	Asphalt	-144	H	—	—
1008959	881703	1	3	2	●	Soil	769	H	S0030	1,393
1009341	881356	1	3	3	●	Asphalt	36	H	—	—
1008924	881451	2	1	1	■	Soil	517	L	—	—
1009480	881735	2	1	2	■	Soil	-808	L	S0031	223
1009161	881836	2	1	3	■	Soil	-55	L	—	—
1009133	881388	2	2	1	▲	Asphalt	896	M	—	—
1009688	881672	2	2	2	▲	Soil	241	M	S0032	1,523
1009549	881483	2	2	3	▲	Soil	-673	M	—	—
1009271	881767	2	3	1	●	Soil	607	H	S0033	1,995
1008886	881884	2	3	2	●	Soil	-18	H	—	—
1009070	882099	2	3	3	●	Soil	256	H	—	—

Table B-2. Ranked Set Sampling Gamma Measurements Spring 2012 Confirmatory Survey Activities ABB Combustion Engineering Windsor, Connecticut										
East (ft)	North (ft)	RSS Measurement Location[a]				Surface Matrix	Surface Gamma Count Rate (cpm)[b]	Code[c]	Surface Soil Sample ID[d]	Subsurface Gamma Counts (cpm)
		Cycle	Set	#	Symbol					
Confirmatory Unit 5: Equipment Storage Yard and Small Pond Buffer Area[e]										
1009646	882191	1	1	1	■	Soil	7,277	L	—	—
1009492	882041	1	1	2	■	Soil	7,224	**L**	S0034	8,332
1009383	882285	1	1	3	■	Soil	7,894	L	—	—
1009308	882105	1	2	1	▲	Soil	7,417	M	—	—
1009606	882374	1	2	2	▲	Soil	7,017	**M**	S0035	8,691
1009457	882644	1	2	3	▲	Soil	6,736	M	—	—
1009237	882208	1	3	1	●	Soil	8,236	**H**	S0036	9,456
1009485	882494	1	3	2	●	Soil	6,797	H	—	—
1009336	882045	1	3	3	●	Soil	7,658	H	—	—
1009634	882315	2	1	1	■	Soil	7,287	L	—	—
1009560	882135	2	1	2	■	Soil	7,482	L	—	—
1009410	882404	2	1	3	■	Soil	6,851	**L**	S0037	7,957
1009522	882255	2	2	1	▲	Soil	7,364	M	—	—
1009373	882524	2	2	2	▲	Soil	7,780	M	—	—
1009586	882123	2	2	3	▲	Soil	7,383	**M**	S0038	8,595
1009299	882344	2	3	1	●	Soil	7,212	H	—	—
1009514	882580	2	3	2	●	Soil	6,630	H	—	—
1009448	882165	2	3	3	●	Soil	7,681	**H**	S0039	9,111

Table B-2. Ranked Set Sampling Gamma Measurements Spring 2012 Confirmatory Survey Activities ABB Combustion Engineering Windsor, Connecticut										
East (ft)	North (ft)	RSS Measurement Location[a]				Surface Matrix	Surface Gamma Count Rate (cpm)[b]	Code[c]	Surface Soil Sample ID[d]	Subsurface Gamma Counts (cpm)
		Cycle	Set	#	Symbol					
Confirmatory Unit 6: Industrial Waste Lines[e]										
1009512	884631	1	1	1	■	Soil	10,346	L	—	—
1009610	884130	1	1	2	■	Soil	10,197	L	—	—
1009806	884175	1	1	3	■	Soil	9,159	**L**	S0040	7,809
1009855	883975	1	2	1	▲	Soil	10,122	M	—	—
1009202	882474	1	2	2	▲	Soil	9,705	M	—	—
1009659	884575	1	2	3	▲	Soil	9,845	**M**	S0041	9,267
1009325	882807	1	3	1	●	Soil	10,579	**H**	S0042	9,403
1009977	884108	1	3	2	●	Soil	9,275	H	—	—
1009880	884241	1	3	3	●	Soil	9,351	H	—	—
1009488	884542	2	1	1	■	Soil	9,804	L	—	—
1009945	883441	2	1	2	■	Soil	9,716	**L**	S0043	8,743
1009602	883241	2	1	3	■	Soil	10,906	L	—	—
1009733	884442	2	2	1	▲	Soil	9,823	**M**	S0044	8,267
1009994	883841	2	2	2	▲	Soil	9,499	M	—	—
1009406	882985	2	2	3	▲	Soil	10,164	M	—	—
1009929	883886	2	3	1	●	Soil	9,824	H	—	—
1009798	883285	2	3	2	●	Soil	9,932	H	—	—
1009635	884486	2	3	3	●	Soil	10,070	**H**	S0045	8,577

Table B-2. Ranked Set Sampling Gamma Measurements Spring 2012 Confirmatory Survey Activities ABB Combustion Engineering Windsor, Connecticut										
East (ft)	North (ft)	RSS Measurement Location[a]				Surface Matrix	Net Surface Gamma Count Rate (cpm)[b]	Code[c]	Surface Soil Sample ID[d]	Net Subsurface Gamma Counts (cpm)
		Cycle	Set	#	Symbol					
Confirmatory Unit 7: Waste Water Treatment Plant and Former Controlled Access Area[e]										
1009307	883431	1	1	1	■	Gravel	1228	L	—	—
1009456	883542	1	1	2	■	Soil	68	**L**	S0046	811
1009404	884661	1	1	3	■	Gravel	1218	L	—	—
1009572	884751	1	2	1	▲	Soil	1481	**M**	S0047	1,887
1009363	884841	1	2	2	▲	Soil	-193	M	—	—
1009493	883395	1	2	3	▲	Soil	2455	M	—	—
1009446	884781	1	3	1	●	Gravel	-47	H	—	—
1009447	883444	1	3	2	●	Gravel	634	H	—	—
1009372	883554	1	3	3	●	Soil	1753	**H**	S0048	2,884
1009521	883370	2	1	1	■	Gravel	763	L	—	—
1009352	884761	2	1	2	■	Soil	142	**L**	S0049	711
1009436	884701	2	1	3	■	Gravel	1089	L	—	—
1009559	883517	2	2	1	▲	Soil	1257	**M**	S0050	1,067
1009465	883346	2	2	2	▲	Gravel	1050	M	—	—
1009391	883456	2	2	3	▲	Gravel	2795	M	—	—
1009540	883566	2	3	1	●	Soil	1085	**H**	S0051	1,070
1009373	884681	2	3	2	●	Soil	841	H	—	—
1009540	884771	2	3	3	●	Soil	609	H	—	—

[a]RSS description, color and symbol codes explanation provided in Appendix E.
[b]Gamma counts represent the one-minute gamma count rate at the soil surface for the location. When a CU had more than one matrix, i.e., soil and asphalt/gravel, then the matrix background was subtracted to determine a net gamma count at that location so as to not bias the location based on the matrix background contribution.
[c]Sample select code specifies which location is sampled for a given cycle/set based on the gamma count rate.
[d]Soil sample locations are provided on Figs. A-24, A-25, A-26 and A-27 for Confirmatory Units 4, 5, 6 and 7, respectively.
[e]For Confirmatory Unit 4 refer to Fig. A-17; for Confirmatory Unit 5 refer to Fig. A-18; for Confirmatory Unit 6 refer to Fig. A-19; for Confirmatory Unit 7 refer to Fig. A-20.
[f]Measurement/sample not required.

Table B-3. Radionuclide Concentrations in RSS Soil Samples
Fall 2011 Confirmatory Survey Activities
ABB CE Windsor Site
Windsor, Connecticut

Sample ID[a]	East (ft)	North (ft)	Co-60	Ra-226	Th-232	U-235	U-238	Total U[b]	SOR[c]
CU1: Clamshell Pile Area									
S0019	1008008	886198	-0.01 ± 0.06[d]	0.60 ± 0.07	0.68 ± 0.13	-0.01 ± 0.16	0.54 ± 0.29	1.07 ± 0.60	0.00[e]
S0020	1008030	886376	-0.01 ± 0.05	0.69 ± 0.07	0.86 ± 0.20	0.07 ± 0.19	0.95 ± 0.61	2.23 ± 0.99	0.00
S0021	1007985	886229	0.02 ± 0.05	0.55 ± 0.06	0.69 ± 0.12	-0.06 ± 0.13	0.66 ± 0.28	1.26 ± 0.57	0.01
S0022	1007912	886390	0.01 ± 0.06	0.62 ± 0.08	0.82 ± 0.15	-0.04 ± 0.16	0.59 ± 0.33	1.14 ± 0.68	0.00
S0023	1008025	886162	-0.01 ± 0.04	0.58 ± 0.06	0.77 ± 0.12	0.16 ± 0.15	0.76 ± 0.25	1.68 ± 0.52	0.00
S0024	1008013	886341	0.02 ± 0.06	0.65 ± 0.08	0.79 ± 0.16	0.04 ± 0.16	0.83 ± 0.37	1.70 ± 0.76	0.01
S0025	1008058	886180	-0.03 ± 0.06	0.48 ± 0.07	0.73 ± 0.14	0.06 ± 0.15	0.70 ± 0.35	1.46 ± 0.72	0.00
S0026	1007946	886354	-0.01 ± 0.05	0.67 ± 0.07	0.98 ± 0.16	-0.10 ± 0.20	0.73 ± 0.29	1.36 ± 0.61	0.00
S0027	1007905	886247	0.01 ± 0.04	0.52 ± 0.06	0.76 ± 0.13	0.08 ± 0.12	0.62 ± 0.29	1.32 ± 0.59	0.00
CU1 Average			*0.00*	*0.60*	*0.79*	*0.02*	*0.71*	*1.47*	*0.00*
CU1 Standard Deviation			*0.02*	*0.07*	*0.09*	*0.08*	*0.13*	*0.36*	*0.00*
CU2: Burning Grounds Area									
S0001	1008779	884376	0.00 ± 0.06	0.62 ± 0.07	0.88 ± 0.14	-0.04 ± 0.14	0.61 ± 0.32	1.18 ± 0.66	0.36
S0002	1008382	884488	0.02 ± 0.04	0.52 ± 0.05	0.84 ± 0.12	0.19 ± 0.14	0.80 ± 0.26	1.79 ± 0.54	0.33
S0003	1008569	884395	0.01 ± 0.04	0.42 ± 0.05	0.63 ± 0.12	0.04 ± 0.12	0.49 ± 0.21	1.02 ± 0.44	0.25
S0004	1008812	884676	-0.01 ± 0.07	0.48 ± 0.08	1.16 ± 0.21	-0.08 ± 0.21	0.62 ± 0.41	1.16 ± 0.85	0.40
S0005	1008944	885126	0.02 ± 0.06	0.72 ± 0.08	1.03 ± 0.17	0.16 ± 0.21	1.25 ± 0.40	2.66 ± 0.83	0.43
S0006	1008613	884565	0.08 ± 0.06	0.79 ± 0.12	0.82 ± 0.19	0.23 ± 0.22	0.88 ± 0.51	2.0 ± 1.0	0.40
S0007	1009035	884603	0.01 ± 0.05	0.56 ± 0.06	0.76 ± 0.13	0.06 ± 0.13	0.71 ± 0.30	1.48 ± 0.61	0.32
S0008	1008247	884496	0.03 ± 0.04	0.60 ± 0.06	0.89 ± 0.14	-0.03 ± 0.18	1.09 ± 0.27	2.15 ± 0.57	0.37

Table B-3. Radionuclide Concentrations in RSS Soil Samples
Fall 2011 Confirmatory Survey Activities
ABB CE Windsor Site
Windsor, Connecticut

Sample ID[a]	East (ft)	North (ft)	Co-60	Ra-226	Th-232	U-235	U-238	Total U[b]	SOR[c]
S0009	1008440	884640	-0.01 ± 0.06	0.86 ± 0.09	1.22 ± 0.21	-0.14 ± 0.20	1.10 ± 1.10	2.1 ± 2.2	0.50
CU2 Average			*0.02*	*0.62*	*0.91*	*0.04*	*0.84*	*1.73*	*0.37*
CU2 Standard Deviation			*0.03*	*0.15*	*0.19*	*0.13*	*0.26*	*0.55*	*0.07*
CU3: Drum Burial Pit and Woods Area									
S0010	1008320	883932	0.03 ± 0.06	0.55 ± 0.07	0.65 ± 0.13	-0.09 ± 0.16	0.59 ± 0.38	1.09 ± 0.78	0.29
S0011	1008737	883858	-0.01 ± 0.06	0.69 ± 0.08	0.95 ± 0.16	-0.11 ± 0.24	0.60 ± 2.20	1.1 ± 4.4	0.39
S0012	1009015	883348	0.08 ± 0.05	0.90 ± 0.11	0.95 ± 0.19	0.00 ± 0.20	0.91 ± 0.39	1.82 ± 0.81	0.46
S0013	1008876	884019	-0.03 ± 0.06	0.64 ± 0.07	0.91 ± 0.15	0.02 ± 0.15	0.57 ± 0.45	1.16 ± 0.91	0.37
S0014	1008529	883907	0.04 ± 0.04	0.57 ± 0.06	0.69 ± 0.12	-0.02 ± 0.18	0.56 ± 0.26	1.10 ± 0.55	0.31
S0015	1008946	883721	0.01 ± 0.04	0.64 ± 0.07	0.89 ± 0.15	0.19 ± 0.02	1.29 ± 0.31	5.60 ± 0.53	0.38
S0016	1009050	883944	0.04 ± 0.05	0.35 ± 0.06	0.42 ± 0.11	0.01 ± 0.15	0.48 ± 0.33	0.97 ± 0.68	0.19
S0017	1008911	883423	0.01 ± 0.05	0.65 ± 0.07	0.83 ± 0.13	0.14 ± 0.18	1.17 ± 0.33	2.48 ± 0.68	0.36
S0018	1008841	883870	0.01 ± 0.04	0.83 ± 0.08	1.00 ± 0.16	0.13 ± 0.07	1.06 ± 0.68	2.2 ± 1.4	0.44
CU3 Average			*0.02*	*0.65*	*0.81*	*0.03*	*0.80*	*1.95*	*0.35*
CU3 Standard Deviation			*0.03*	*0.16*	*0.19*	*0.10*	*0.31*	*1.48*	*0.08*

[a]Refer to Figs. A-21 to A-23.
[b]Total Uranium calculations for natural uranium were 2*U-238 + U-235. For enriched uranium results (those in red text) the calculation was U-238 + U-235 + 21.7*U-235.
[c]SOR = sum of ratios. DCGLS were 5 pCi/g for Co-60; 4.5 pCi/g for Ra-226; 4.0 pCi/g for Th-232; and, 557 pCi/g for Total Uranium. For CU1, the radiological contaminants were Co-60 and Total Uranium. For CUs 2 and 3, the radiological contaminants were Co-60, Ra-226, Th-232 and Total Uranium.
[d]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.
[e]Zero values are due to rounding.

Table B-4. Radionuclide Concentrations in RSS Soil Samples
Spring 2012 Confirmatory Survey Activities
ABB CE Windsor Site
Windsor, Connecticut

Sample ID[a]	East (ft)	North (ft)	Co-60	Ra-226	Th-232	U-235	U-238	Total U[b]	SOR[c]
CU4: Buildings 3 & 6 Complexes Area									
S0028	1009306	881946	0.02 ± 0.04[d]	0.47 ± 0.06	0.63 ± 0.11	0.06 ± 0.08	0.63 ± 0.30	1.32 ± 0.61	0.01
S0029	1009028	881472	0.00[e] ± 0.03	0.54 ± 0.05	0.71 ± 0.10	0.12 ± 0.14	0.55 ± 0.27	1.22 ± 0.56	0.00
S0030	1008959	881703	0.01 ± 0.03	0.64 ± 0.07	0.92 ± 0.15	0.08 ± 0.07	0.34 ± 0.33	0.76 ± 0.66	0.00
S0031	1009480	881735	0.03 ± 0.04	0.58 ± 0.07	0.70 ± 0.13	0.16 ± 0.14	0.77 ± 0.38	1.70 ± 0.77	0.01
S0032	1009688	881672	0.01 ± 0.04	0.62 ± 0.07	0.82 ± 0.13	0.17 ± 0.18	0.89 ± 0.34	1.95 ± 0.70	0.01
S0033	1009271	881767	-0.01 ± 0.03	0.60 ± 0.06	0.91 ± 0.14	0.09 ± 0.07	0.37 ± 0.37	0.83 ± 0.74	0.00
CU4 Average			*0.01*	*0.58*	*0.78*	*0.11*	*0.59*	*1.30*	*0.00*
CU4 Standard Deviation			*0.01*	*0.06*	*0.12*	*0.04*	*0.22*	*0.47*	*0.00*
CU5: Equipment Storage Yard and Small Pond Buffer Area									
S0034	1009492	882041	0.00 ± 0.06	0.66 ± 0.08	0.84 ± 0.17	0.08 ± 0.11	0.64 ± 0.44	1.36 ± 0.89	0.36
S0035	1009606	882375	0.00 ± 0.05	0.70 ± 0.07	1.19 ± 0.17	0.06 ± 0.09	0.87 ± 0.43	1.80 ± 0.86	0.46
S0036	1009237	882208	-0.02 ± 0.05	0.80 ± 0.08	1.28 ± 0.20	0.14 ± 0.10	1.23 ± 0.54	2.60 ± 1.08	0.50
S0037	1009411	882404	0.02 ± 0.05	0.60 ± 0.08	0.74 ± 0.16	0.00 ± 0.13	0.92 ± 0.44	1.84 ± 0.89	0.33
S0038	1009586	882123	-0.01 ± 0.05	0.64 ± 0.06	0.97 ± 0.14	0.17 ± 0.08	0.65 ± 0.33	1.47 ± 0.66	0.39
S0039	1009448	882165	-0.01 ± 0.05	0.77 ± 0.08	1.10 ± 0.18	0.00 ± 0.15	1.09 ± 0.47	2.2 ± 1.0	0.45
CU5 Average			*0.00*	*0.70*	*1.02*	*0.08*	*0.90*	*1.88*	*0.41*
CU5 Standard Deviation			*0.01*	*0.08*	*0.21*	*0.07*	*0.24*	*0.46*	*0.07*

Table B-4. Radionuclide Concentrations in RSS Soil Samples
Spring 2012 Confirmatory Survey Activities
ABB CE Windsor Site
Windsor, Connecticut

Sample ID[a]	East (ft)	North (ft)	Co-60	Ra-226	Th-232	U-235	U-238	Total U[b]	SOR[c]
CU6: Industrial Waste Line Areas									
S0040	1009806	884175	0.00 ± 0.05	0.51 ± 0.06	0.80 ± 0.13	-0.08 ± 0.13	0.81 ± 0.40	1.54 ± 0.81	0.00
S0041	1009659	884575	-0.01 ± 0.04	0.71 ± 0.07	1.05 ± 0.15	0.03 ± 0.08	1.01 ± 0.39	2.05 ± 0.78	0.00
S0042	1009325	882807	-0.01 ± 0.04	0.69 ± 0.07	0.85 ± 0.14	0.05 ± 0.07	0.90 ± 0.38	1.85 ± 0.76	0.00
S0043	1009945	883441	-0.02 ± 0.05	0.46 ± 0.05	0.71 ± 0.13	-0.09 ± 0.13	0.82 ± 0.33	1.55 ± 0.67	0.00
S0044	1009733	884442	0.00 ± 0.04	0.46 ± 0.05	0.75 ± 0.11	0.12 ± 0.14	0.57 ± 0.41	1.26 ± 0.83	0.00
S0045	1009635	884486	-0.04 ± 0.04	0.49 ± 0.05	0.76 ± 0.13	0.15 ± 0.11	0.84 ± 0.35	1.83 ± 0.71	0.00
CU6 Average			*-0.01*	*0.55*	*0.82*	*0.03*	*0.83*	*1.68*	*0.00*
CU6 Standard Deviation			*0.02*	*0.12*	*0.12*	*0.10*	*0.15*	*0.28*	*0.00*
CU6 Judgmental Soil Sample									
S0052	1009305	882908	0.00 ± 0.05	0.75 ± 0.08	0.88 ± 0.14	0.10 ± 0.08	0.74 ± 0.35	1.58 ± 0.70	0.00
CU7: Waste Water Treatment Plant and Former Controlled Access Area									
S0046	1009456	883542	0.00 ± 0.04	0.55 ± 0.06	0.85 ± 0.13	0.09 ± 0.13	0.98 ± 0.37	2.05 ± 0.75	0.00
S0047	1009572	884751	0.00 ± 0.04	0.68 ± 0.06	1.03 ± 0.14	0.19 ± 0.08	1.24 ± 0.31	5.6 ± 1.8	0.01
S0048	1009372	883554	-0.03 ± 0.04	0.61 ± 0.06	0.90 ± 0.14	0.01 ± 0.12	0.85 ± 0.35	1.71 ± 0.71	0.00
S0049	1009352	884761	-0.03 ± 0.05	0.62 ± 0.06	0.73 ± 0.12	0.05 ± 0.09	0.51 ± 0.34	1.07 ± 0.69	0.00
S0050	1009559	883517	-0.01 ± 0.04	0.75 ± 0.07	1.14 ± 0.15	0.19 ± 0.09	1.01 ± 0.34	2.21 ± 0.69	0.00
S0051	1009540	883566	0.02 ± 0.03	0.66 ± 0.06	0.83 ± 0.13	0.16 ± 0.07	0.97 ± 0.38	2.10 ± 0.76	0.01
CU7 Average			*-0.01*	*0.65*	*0.91*	*0.12*	*0.93*	*2.45*	*0.00*
CU7 Standard Deviation			*0.02*	*0.07*	*0.15*	*0.08*	*0.24*	*1.57*	*0.01*

[a]Refer to Figs. A-24 to A-27.
[b]Total Uranium calculations for natural uranium were 2*U-238 + U-235. For enriched uranium results (those in red text) the calculation was U-238 + U-235 + 21.7*U-235.
[c]SOR = sum of ratios. DCGLS were 5 pCi/g for Co-60; 4.5 pCi/g for Ra-226; 4.0 pCi/g for Th-232; 557 pCi/g for Total Uranium. For CUs 4, 6, and 7, the radiological contaminants were Co-60 and Total Uranium. For CU5, the radiological contaminants were Co-60, Ra-226, Th-232, and Total Uranium.
[d]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.
[e]Zero values are due to rounding.

APPENDIX C
MAJOR INSTRUMENTATION

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The display of a specific product is not to be construed as an endorsement of the product or its manufacturer by the author or his employer.

C.1 SCANNING AND MEASUREMENT INSTRUMENT/DETECTOR COMBINATIONS

C.1.1 Gamma

Ludlum NaI Scintillation Detector Model 44-10, Crystal:2 in x 2 in
coupled to:
Ludlum Ratemeter-scaler Model 2221
(Ludlum Measurements, Inc., Sweetwater, TX)
coupled to:
Trimble GeoXH Receiver and Data Logger
(Trimble Navigation Limited, Sunnyvale, CA)

C.1.2 Laboratory Analytical Instrumentation

High Purity Extended Range Intrinsic Detector
CANBERRA/Tennelec Model No: ERVDS30-25195
(Canberra, Meriden, CT)
Used in conjunction with:
Lead Shield Model G-11
(Nuclear Lead, Oak Ridge, TN) and
Multichannel Analyzer
Canberra's Apex Gamma Software
Dell Workstation
(Canberra, Meriden, CT)

High Purity Extended Range Intrinsic Detector
Model No. GMX-45200-5
(AMETEK/ORTEC, Oak Ridge, TN)
used in conjunction with:
Lead Shield Model SPG-16-K8
(Nuclear Data)
Multichannel Analyzer
Canberra's Apex Gamma Software
Dell Workstation
(Canberra, Meriden, CT)

High-Purity Germanium Detector
Model GMX-30-P4, 30% Eff.
(AMETEK/ORTEC, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-16
(Gamma Products, Palos Hills, IL) and
Multichannel Analyzer
Canberra's Apex Gamma Software
Dell Workstation
(Canberra, Meriden, CT)

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APPENDIX D
SURVEY AND ANALYTICAL PROCEDURES

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D.1 PROJECT HEALTH AND SAFETY

The proposed survey and sampling procedures were evaluated to ensure that any hazards inherent to the procedures themselves were addressed in current Job Hazard Analyses. All survey and laboratory activities were conducted in accordance with Oak Ridge Associated Universities (ORAU) health and safety and radiation protection procedures (ORAU/ORISE 2012a and 2011).

Pre-survey activities included the evaluation and identification of potential health and safety issues. Survey work was performed per the ORAU generic health and safety plans and a site-specific Integrated Safety Management pre-job hazard checklist. ABB personnel also provided site-specific safety awareness training. An ORAU safety walk down of the site indicated that the land clearing activities and restoration activities by ABB personnel had left uneven terrain in some areas typical for outdoor survey activities.

D.2 CALIBRATION AND QUALITY ASSURANCE

Calibration of all field and laboratory instrumentation was based on sources/standards traceable to the National Institute of Standards and Technology (NIST).

Analytical and field survey activities were conducted in accordance with procedures from the following ORAU and ORAU/ORISE documents:

- *Survey Procedures Manual* (ORAU/ORISE 2012a)
- *Laboratory Procedures Manual* (ORAU/ORISE 2012b)
- *Quality Program Manual* (ORAU 2012)

The procedures contained in these manuals were developed to meet the requirements of 10 CFR 830 Subpart A, *Quality Assurance Requirements* and Department of Energy Order 414.1D *Quality Assurance* (CFR 2012 and DOE 2011).

Quality control procedures include:

- Daily instrument background and check-source measurements to confirm that equipment

operation is within acceptable statistical fluctuations

- Participation in Mixed-Analyte Performance Evaluation Program, NIST Radiochemistry Intercomparison Testing Program, and Intercomparison Testing Program Laboratory Quality Assurance Programs
- Training and certification of all individuals performing procedures
- Periodic internal and external audits

D.3 SURVEY PROCEDURES

D.3.1 SURFACE SCANS

A NaI(Tl) scintillation detector was used to scan for elevated gamma radiation. Identification of elevated radiation levels was based on increases in the audible signal from the recording and/or indicating instrument. Additionally, the detectors were coupled to GPS units with data loggers enabling real-time recording in one-second intervals of both geographic position and the gamma count rate. Positioning data files were downloaded from field data loggers for plotting using commercially available software (http://trl.trimble.com/docushare/dsweb/Get/Document-261826/GeoExpl2005_100A_GSG_ENG.pdf). Position and gamma count rate data files were transferred to a computer system, positions differentially corrected, and the results plotted on geo-referenced aerial photographs. Positional accuracy was within 0.5 meters at the 95th percentile.

ORAU Survey Procedures (ORAU/ORISE 2012a) require a minimum scan speed of 0.5 to 1 meter per second (m/s) based on the site contaminant and the DCGL for the primary contaminant of concern. A review of the gamma scan walkover data points relative to the scan area coverage indicate that the scan speed was less than 0.5 m/s (20,630 data points within an approximately 8,500 m^2 area with one data point recorded each second). The scan minimum detectable concentrations for the NaI scintillation detectors were 3.4 pCi/g for Co-60, 2.8 pCi/g for Ra-226, 2,120 pCi/g for Th-230 and 1.8 pCi/g for Th-232, and ranged from 80.0 pCi/g for natural uranium to 132 pCi/g for highly enriched uranium as provided in NUREG-1507 [Table 6.4 (NRC 1998)]. Any audible increase in radiation levels were investigated by ORAU. It is standard procedure for the ORAU staff to pause and investigate any locations where gamma radiation is distinguishable from background levels.

D.3.2 SOIL SAMPLING

Approximately 0.5 to 1.0 kg of soil was collected at each sample location. Collected samples were

placed in a plastic bag, sealed, and labeled in accordance with ORAU survey procedures. The RSS samples were collected as individual samples from the randomly selected soil sample locations as determined by the Visual Sample Plan.

D.4 RADIOLOGICAL ANALYSIS

D.4.1 GAMMA SPECTROSCOPY

Samples of soil were dried, mixed, crushed, and/or homogenized as necessary, and a portion sealed in a 0.5-liter Marinelli beaker or other appropriate container. The quantity placed in the beaker was chosen to reproduce the calibrated counting geometry. Net material weights and volumes were determined and the samples counted using intrinsic germanium detectors coupled to a pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. All total absorption peaks (TAPs) associated with the radionuclides of concern were reviewed for consistency of activity. TAPs used for determining the activities of radionuclides of concern and the typical associated minimum detectable concentration for a one-hour count time were:

Radionuclide	TAP[a] (MeV)	MDC[b] (pCi/g)
Co-60	1.173	0.09
Ra-226 by Pb-214	0.352	0.08
Th-232 by Ac-228	0.911	0.17
U-235	0.143	0.30
U-238 by Th-234	0.063	0.96

[a]Spectra were also reviewed for other identifiable total absorption peaks (TAPs) that would not be expected at this site.
[b]MDC = minimum detectable concentration.

D.4.2 UNCERTAINTIES

The uncertainties associated with the analytical data presented in the tables of this report represent the total propagated uncertainties for that data. These uncertainties were calculated based on both the gross sample count levels and the associated background count levels.

D.4.3 DETECTION LIMITS

Detection limits, referred to as minimum detectable concentrations, were based on 3 plus 4.65 times the standard deviation of the background count [$3 + (4.65\ (BKG)^{1/2})$]. Because of variations in

background levels, measurement efficiencies, and contributions from other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument.

References mentioned in Appendix D include:

10 CFR 830 Subpart A. *Quality Assurance Requirements.* U.S. Department of Energy Code of Federal Regulations. Accessible at http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr;sid=ed5895d29b2e304754f1b99ba774261b;rgn=div5;view=text;node=10%3A4.0.2.5.26;idno=10;cc=ecfr#10:4.0.2.5.26.1

DOE 2011. *Quality Assurance.* U.S. Department of Energy Order 414.1D. Washington, DC. April 25.

NRC 1998. *Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions.* U.S. Nuclear Regulatory Commission. Washington, DC. June.

ORAU 2012. *Quality Program Manual for the Independent Environmental Assessment and Verification Program.* Oak Ridge Associated Universities. Oak Ridge, Tennessee; June 28.

ORAU/ORISE 2011. *Radiation Protection Manual.* Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. December 3.

ORAU/ORISE 2012a. *Survey Procedures Manual for the Independent Environmental Assessment and Verification Program.* Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. June 1.

ORAU/ORISE 2012b. *Laboratory Procedures Manual for the Independent Environmental Assessment and Verification Program.* Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. October 30.

APPENDIX E
ORAU STATISTICAL SURVEY DESIGN FOR THE ABB COMBUSTION ENGINEERING SITE SURVEY ACTIVITIES IN WINDSOR, CONNECTICUT

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E.1 SURVEY DESIGN SUMMARY

ORAU used available preliminary final status survey data to develop a defensible statistical sampling and survey design for the ABB Combustion Engineering Site property in Windsor, Connecticut surveyed during the fall of 2011 and spring of 2012. A Ranked Set Sampling (RSS) design was selected using associated statistical assumptions as well as general guidelines for conducting post-sampling data analysis. The selected RSS statistical approach, as set forth in U.S. Environmental Protection Agency (EPA) QA/G-5S, calculates the number of samples required to determine a confidence interval for the mean that meets the boundaries provided by the user (EPA 2002). ORAU used the RSS data inputs, in conjunction with Visual Sample Plan (VSP), to determine how many sampling locations to choose and where within the sampling area to collect RSS gamma measurements and soil samples.

The following table summarizes the balanced RSS design developed for the fall of 2011.

Summary of Sampling Design for Fall 2011 Confirmatory Units	
Primary Objective of Design	Estimate the Population Mean
Sample placement (location) in the field	Simple random sampling
Formula for calculating number of sampling locations	Balanced ranked set sampling equations in EPA QA/G-5S (EPA 2002)
Number of ranks (m)(chosen set size)	3
Calculated number of cycles (r)	3
Number of samples to analyze (m x r)	9
Number of field locations to rRank(m^2 x r)	27
Number of selected sample areas[a]	3
Specified sampling area [b]	CU1: 65,340 ft^2
	CU2: 588,060 ft^2
	CU3: 810,216 ft^2

[a]The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[b]The sampling area is the total surface area of the selected colored sample areas on the map of the site.

Fig. E-1 demonstrates the detailed VSP measurement locations in the field for the three Confirmatory Units (CUs) from the Fall 2011 confirmatory survey activities. There were 27 RSS measurement locations within CUs 1 through 3 from which nine soil samples were collected. Table B-1 lists the sampling coordinates generated by VSP that were identified in the field for the fall of 2011.

The following table summarizes the balanced RSS design developed for the spring of 2012.

Summary of Sampling Design for Spring 2012 Confirmatory Units	
Primary Objective of Design	Estimate the Population Mean
Sample placement (location) in the field	Simple random sampling
Formula for calculating number of sampling locations	Balanced ranked set sampling equations in EPA QA/G-5S (EPA, 2002)
Number of ranks (m)(chosen set size)	3
Calculated number of cycles (r)	2
Number of samples to analyze (m x r)	6
Number of field locations to rank(m^2 x r)	18
Number of selected sample areas[a]	17
Specified sampling area [b]	CU4: 657,696 ft^2
	CU5: 324,723 ft^2
	CU6: 504,133 ft^2
	CU7: 129,037 ft^2

[a]The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.

[b]The sampling area is the total surface area of the selected colored sample areas on the map of the site.

Fig. E-2 demonstrates the detailed VSP measurement locations in the field for the four CUs from the Spring 2012 confirmatory survey activities. There were 18 RSS measurement locations within CUs 4 through 7 from which six soil samples were collected. Table B-2 lists the sampling coordinates generated by VSP that were identified in the field for the spring of 2012.

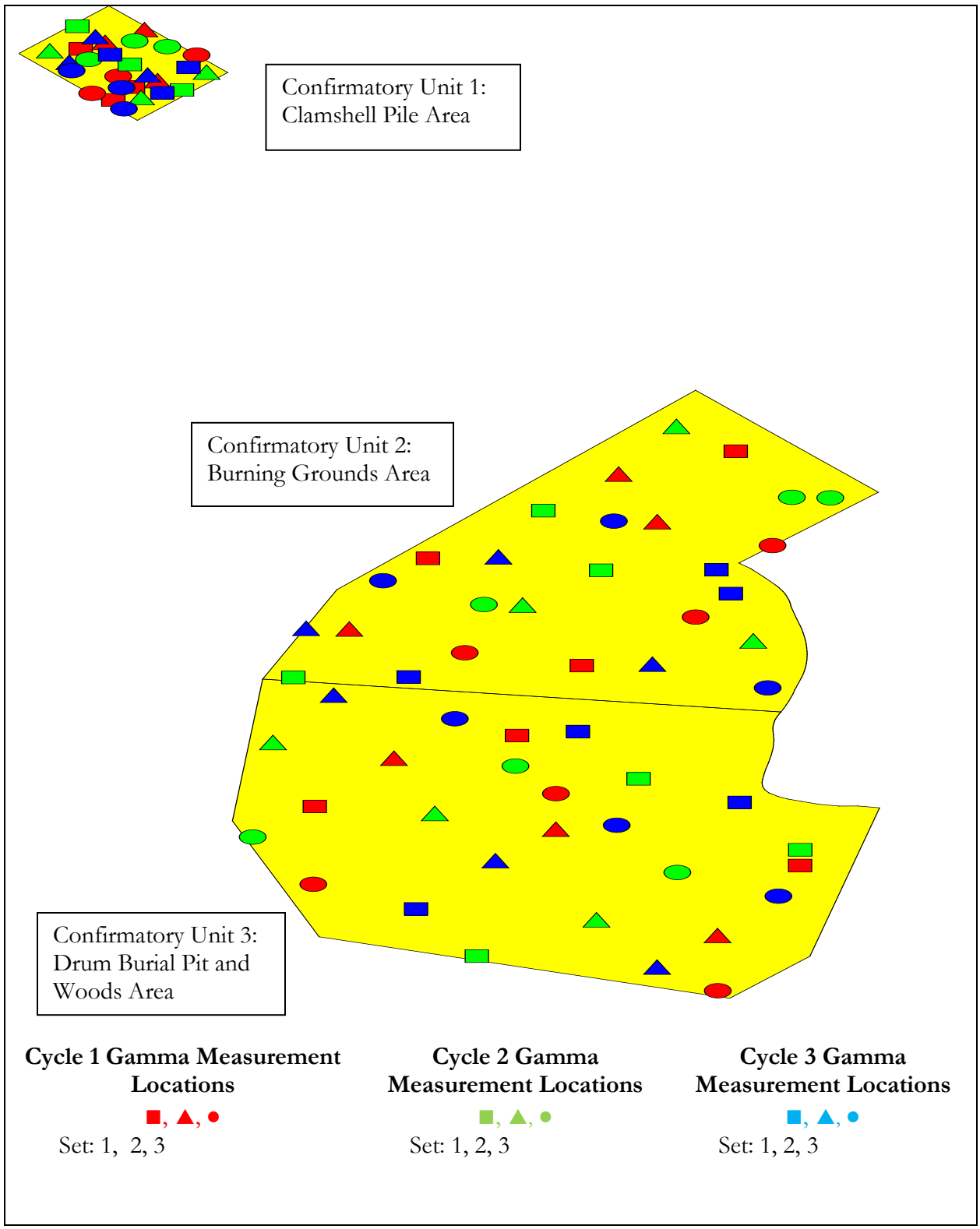

Fig. E-1. Example of the RSS Measurement/Sampling Plan for the ORAU Confirmatory Units for CUs 1, 2 and 3

Fig. E-2. Example of the RSS Measurement/Sampling Plan for the ORAU Confirmatory Units for CUs 4, 5, 6 and 7

APPENDIX F
NRC SPLIT SOIL SAMPLE ANALYTICAL RESULTS
ABB COMBUSTION ENGINEERING SITE
WINDSOR, CONNECTICUT

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APPENDIX F
NRC SPLIT SOIL SAMPLE ANALYTICAL RESULTS
ABB COMBUSTION ENGINEERING SITE
WINDSOR, CONNECTICUT

F.1 NRC SPLIT SOIL SAMPLES

During the final status surveys (FSS) by the licensee, the NRC and State of Connecticut personnel collected split soil samples from the FSS excavations prior to the backfilling of the FSS SUs. The NRC split soil samples were submitted to the ORAU/ORISE laboratory for processing and radiological analyses. A total of 328 soil samples were analyzed by the ORAU/ORISE lab and the analytical results were presented in eighteen separate letter reports to the NRC during the period of August 9, 2010 to June 7, 2012 (ORISE 2010a, b, c, and d; 2011a, b, c, d, e, f, g, h, i, j, k, and l; 2012a and b). At the request of the NRC, ORAU compiled all the split soil sample results into three data tables and generated sample location maps to indicate the FSS SUs for each split soil sample. To compile maps for the split soil samples, ORAU requested split sample GIS maps and data from ABB; the NRC split soil sample maps are provided in Figs. F-1 though F-18. These maps indicate the ABB FSS survey unit boundaries and the NRC split sample locations.

F.2 RADIONUCLIDE CONCENTRATIONS IN NRC SPLIT SOIL SAMPLES

The soil gamma radionuclide concentrations for the NRC split soil samples are provided in Table F-2. At the request of the NRC, the ORAU laboratory also performed gross alpha, gross beta, and alpha spectroscopy analyses on selected samples based on the initial gamma spectroscopy results. The gross alpha and gross beta results are provided in Table F-3 and the alpha spectroscopy results are provided in Table F-4.

Radionuclide concentrations in the NRC split soil samples were directly compared with the DCGLs provided in Table F-1. ORAU also applied the unity rule (SOR) in the activity calculations for each of the soil samples. Three of the 328 soil samples exceeded the DCGL for total uranium (Samples ABB-11-19-9, ABB-11-24-4 and ABB-11-26-1) and SOR and one sample (Sample ABB-11-12-1) exceeded the SOR without exceeded an individual DCGL; however, these samples were collected during the FSS activities and the remediation of these areas may not have been completed at the time. The ORAU laboratory results were reported back to ABB and the licensee's final data for those areas reported in the FSS Reports (ABB 2011a, b, c, and d; 2012a, b, and c) indicated that the FSS status of those areas met the release criteria.

Table F-1. ABB Soil DCGLs[a]	
Radionuclide	**DCGL (pCi/g)**
Total Uranium	557[b]
Co-60	5.0
Thorium (Th-232)	4.0
Radium (Ra-226)	4.5

[a]ABB soil DCGLs are from ABB CE's Derivation of Site-Specific Soil DCGL report (MACTEC 2003b) for uranium and cobalt and from the Addendum to the original Derivation of the Site-Specific Soil DCGL report (MACTEC 2010b).

[b]Total uranium DCGL regardless of enrichment (MACTEC 2004).

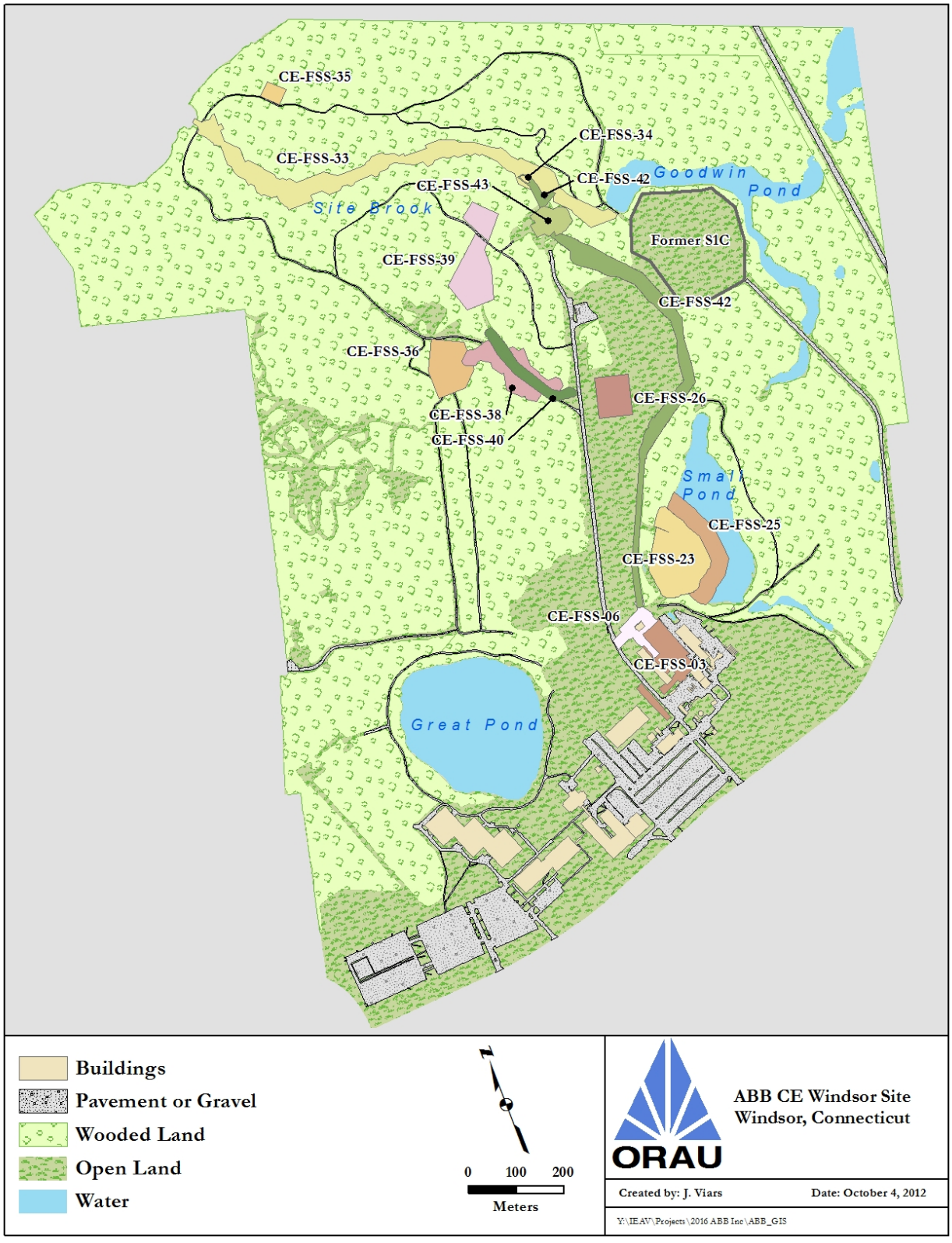

Fig. F-1. Plot Plan of ABB CE Windsor Site indicating ABB Final Status Survey Units

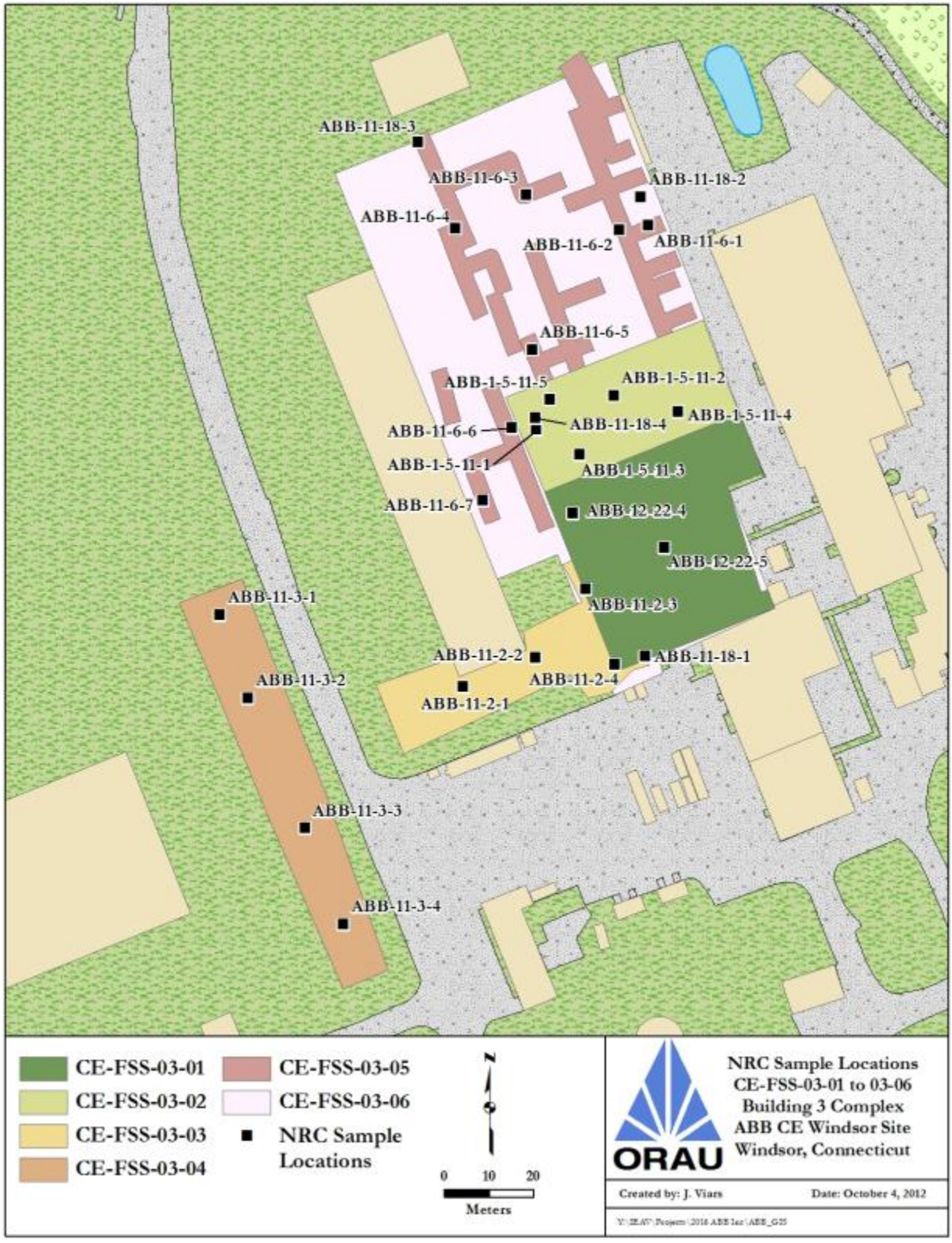

Fig. F-2. CE-FSS-03, Building 3 Complex - NRC Sample Locations

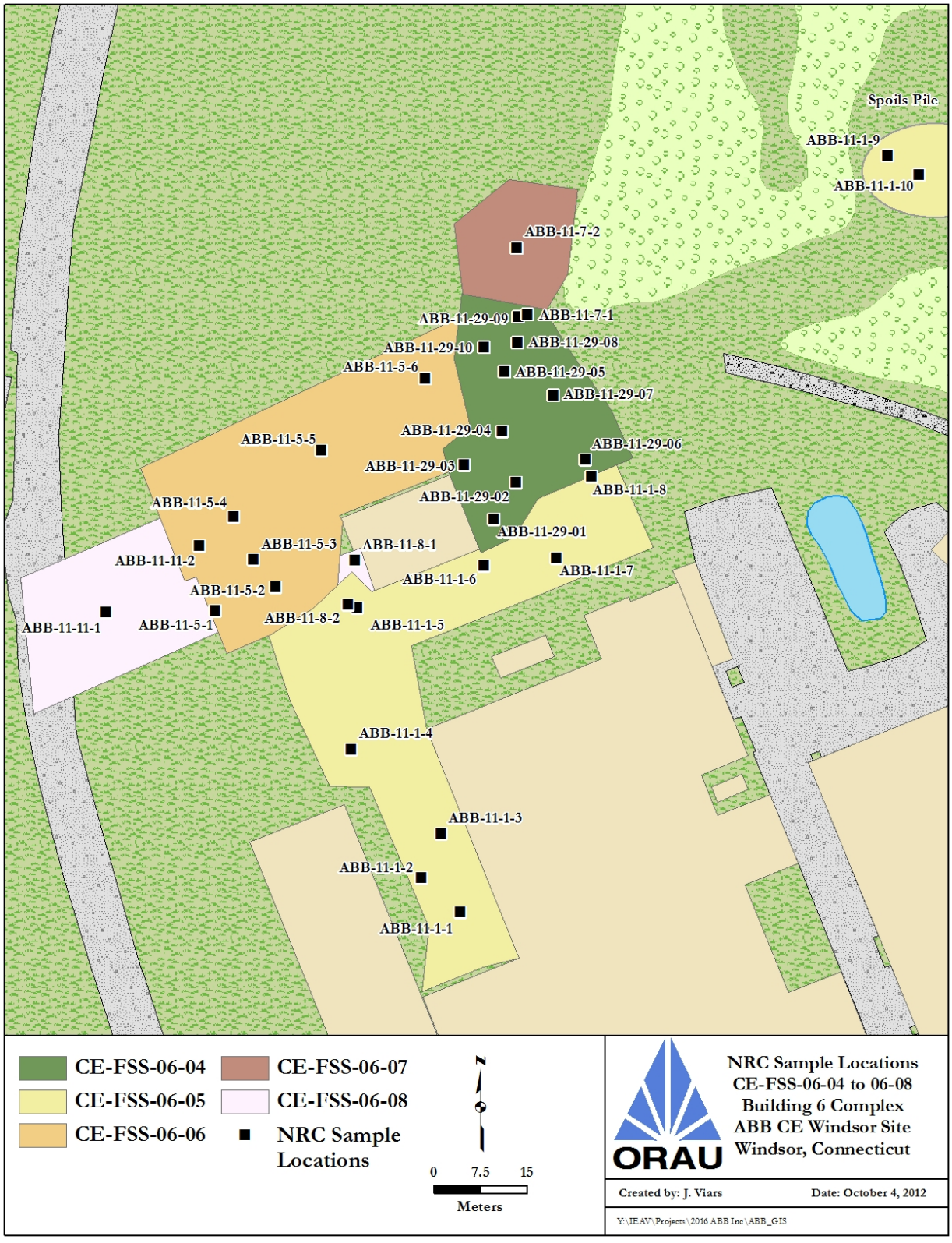

Fig. F-3. CE-FSS-06, Building 6 Complex - NRC Sample Locations

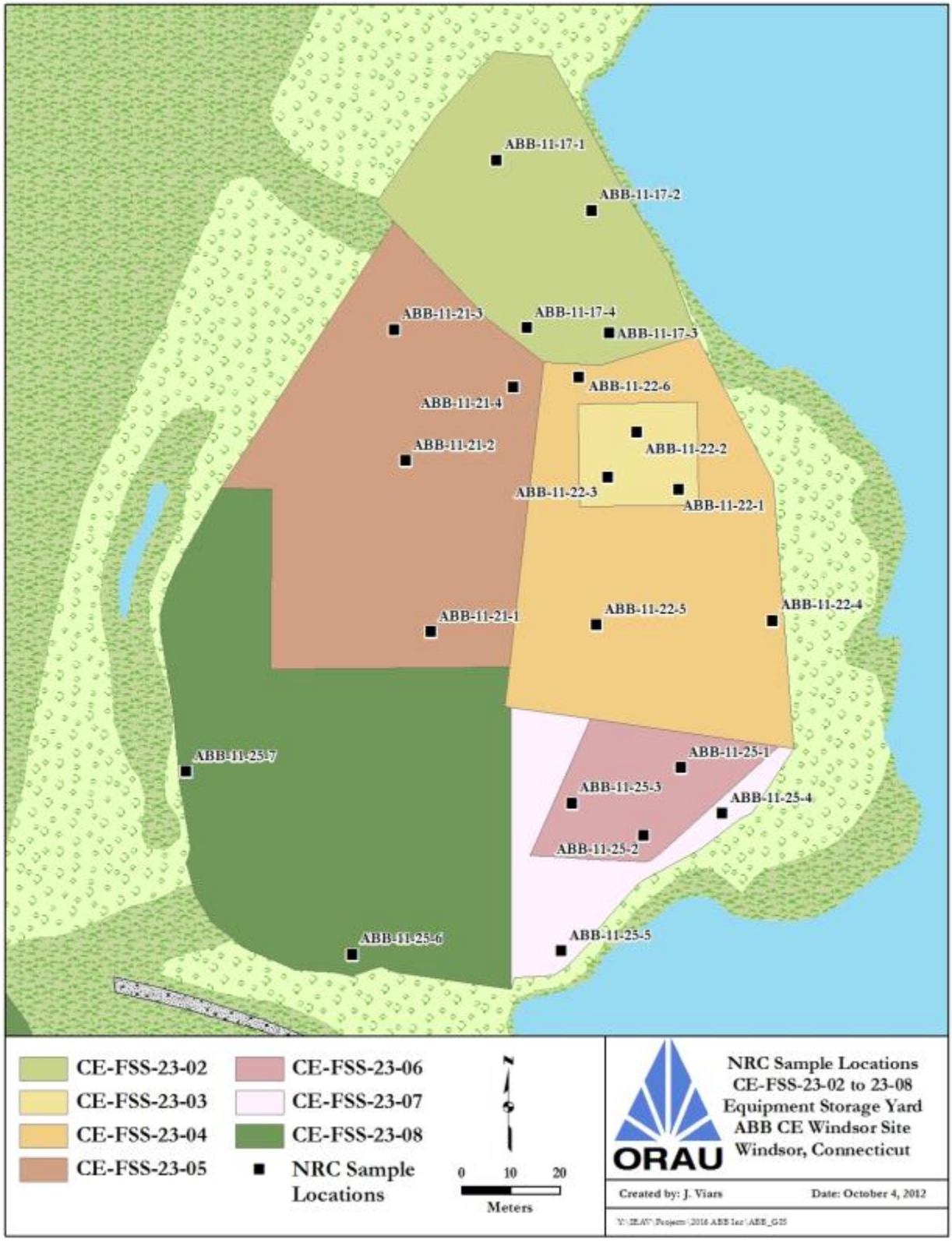

Fig. F-4. CE-FSS-23, Equipment Storage Yard - NRC Sample Locations

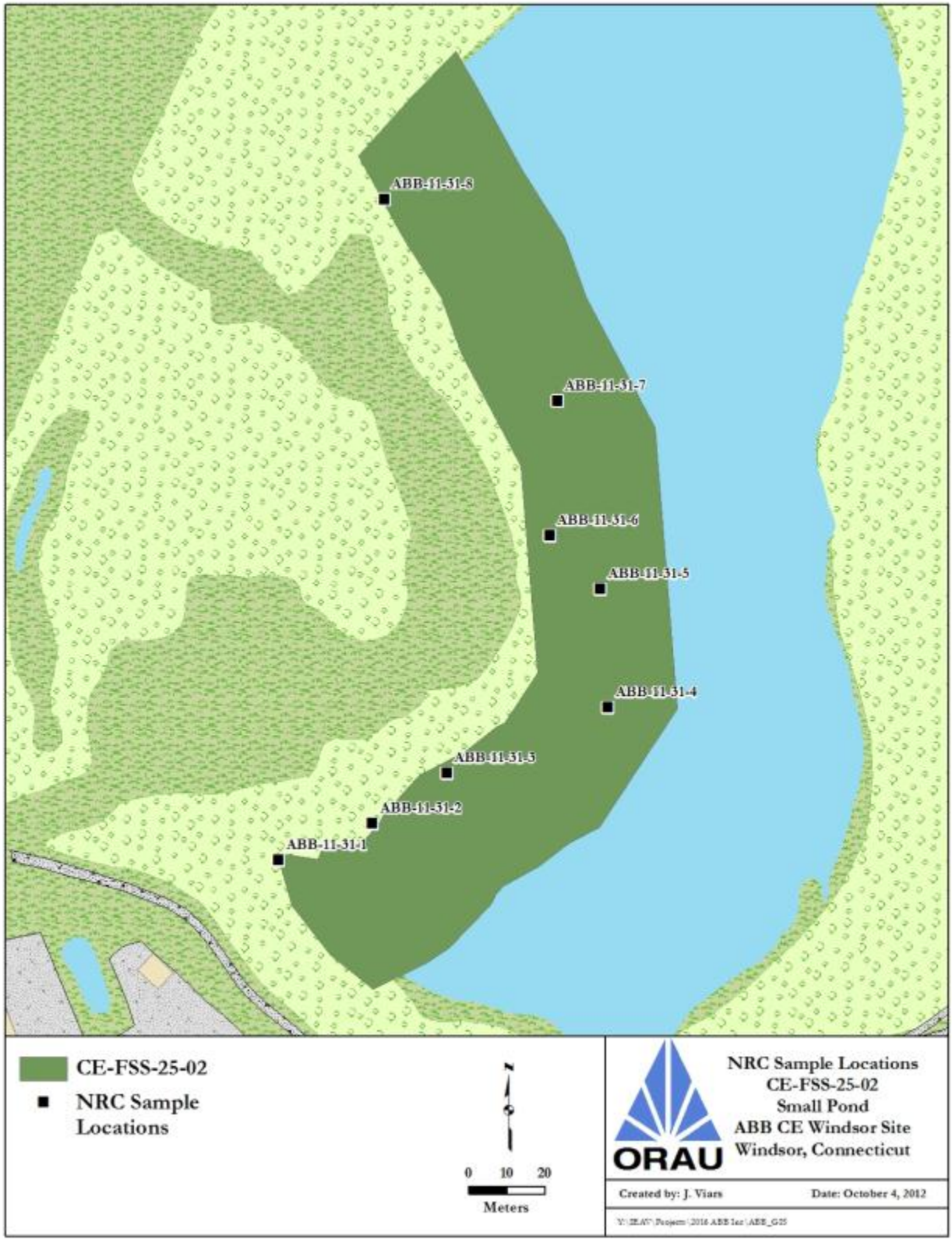

Fig. F-5. CE-FSS-25, Small Pond Buffer Area - NRC Sample Locations

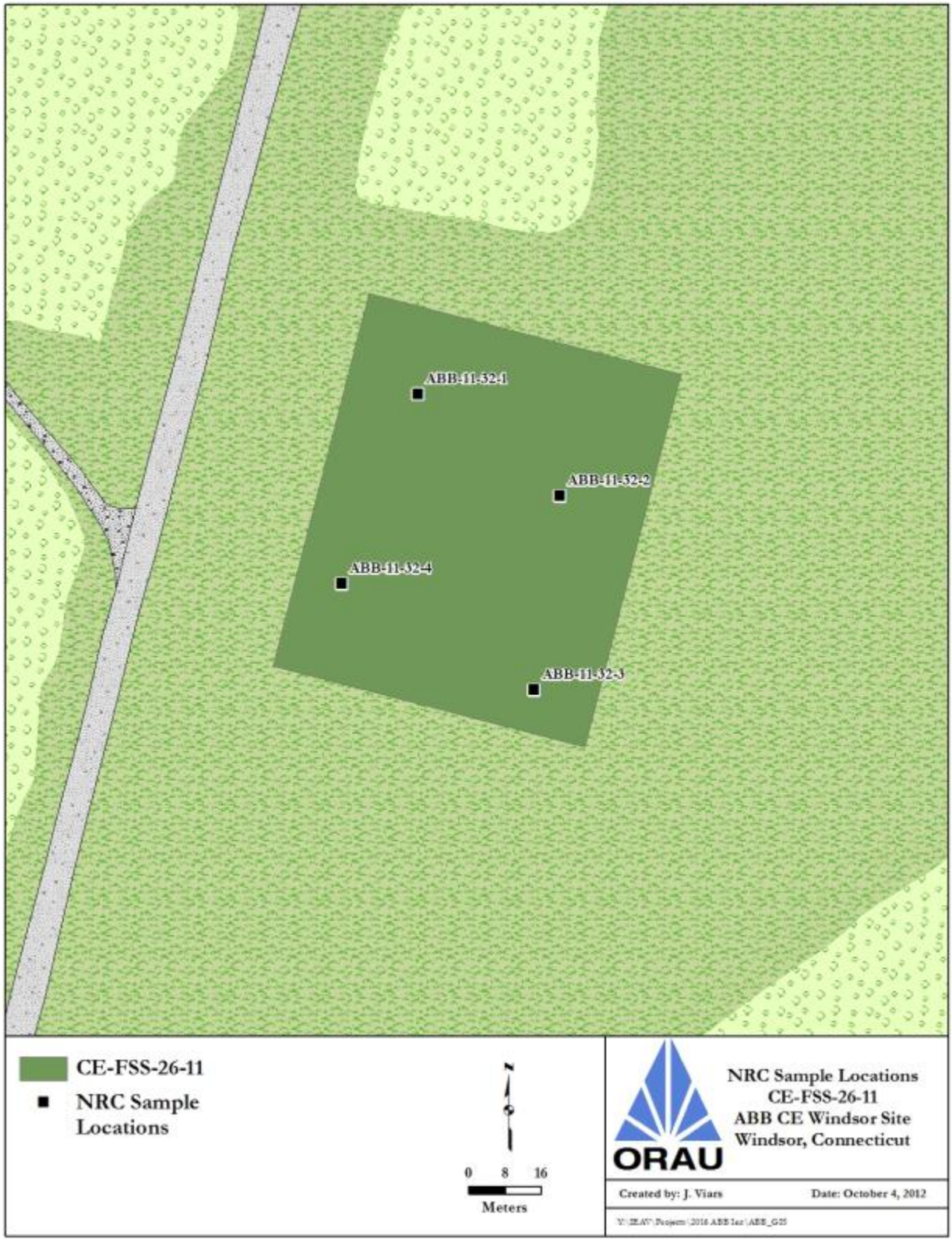

Fig. F-6. CE-FSS-26, Former Controlled Access Area Waste Staging/Storage Area – NRC Sample Locations

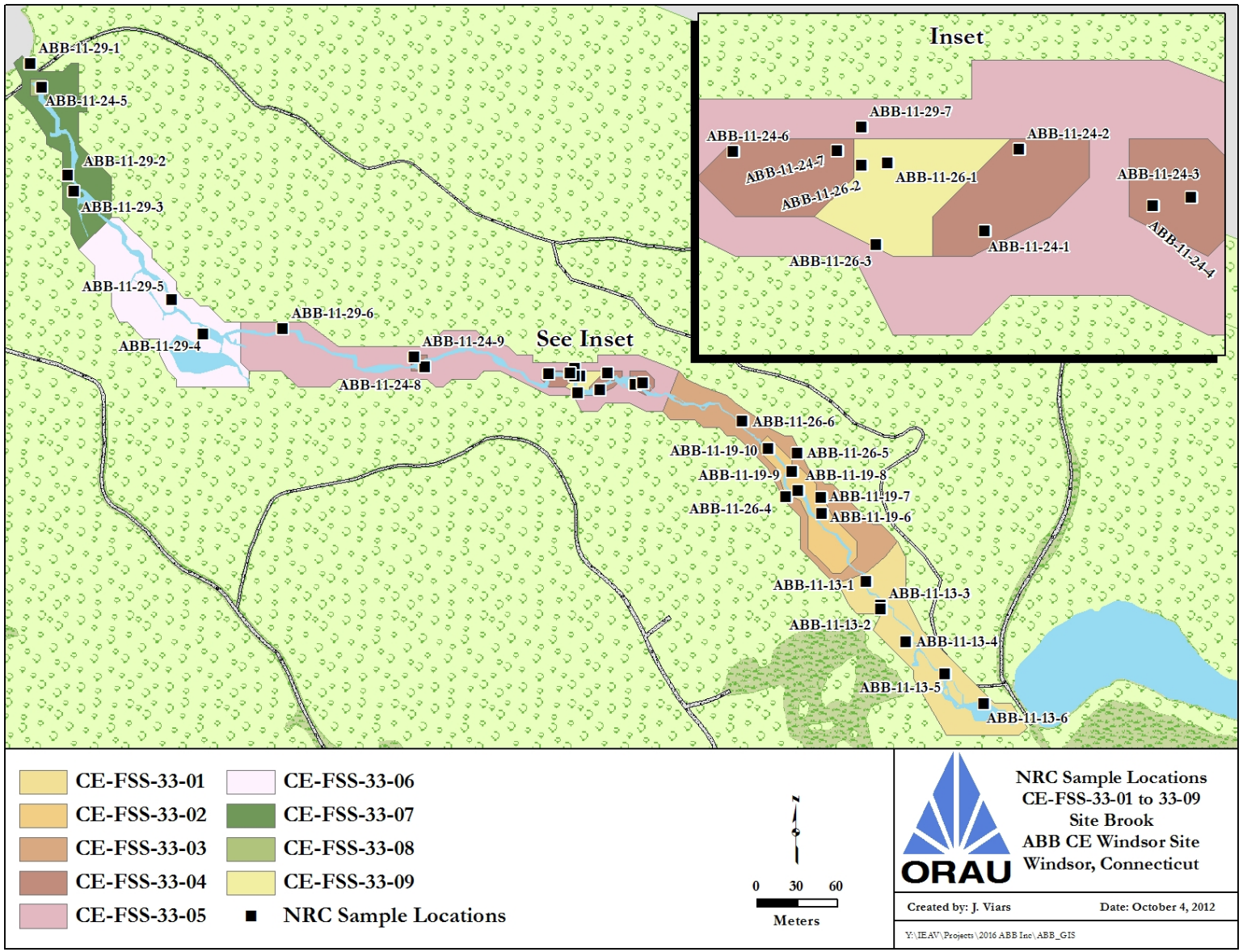

Fig. F-7. CE-FSS-33, Site Brook Area – NRC Sample Locations

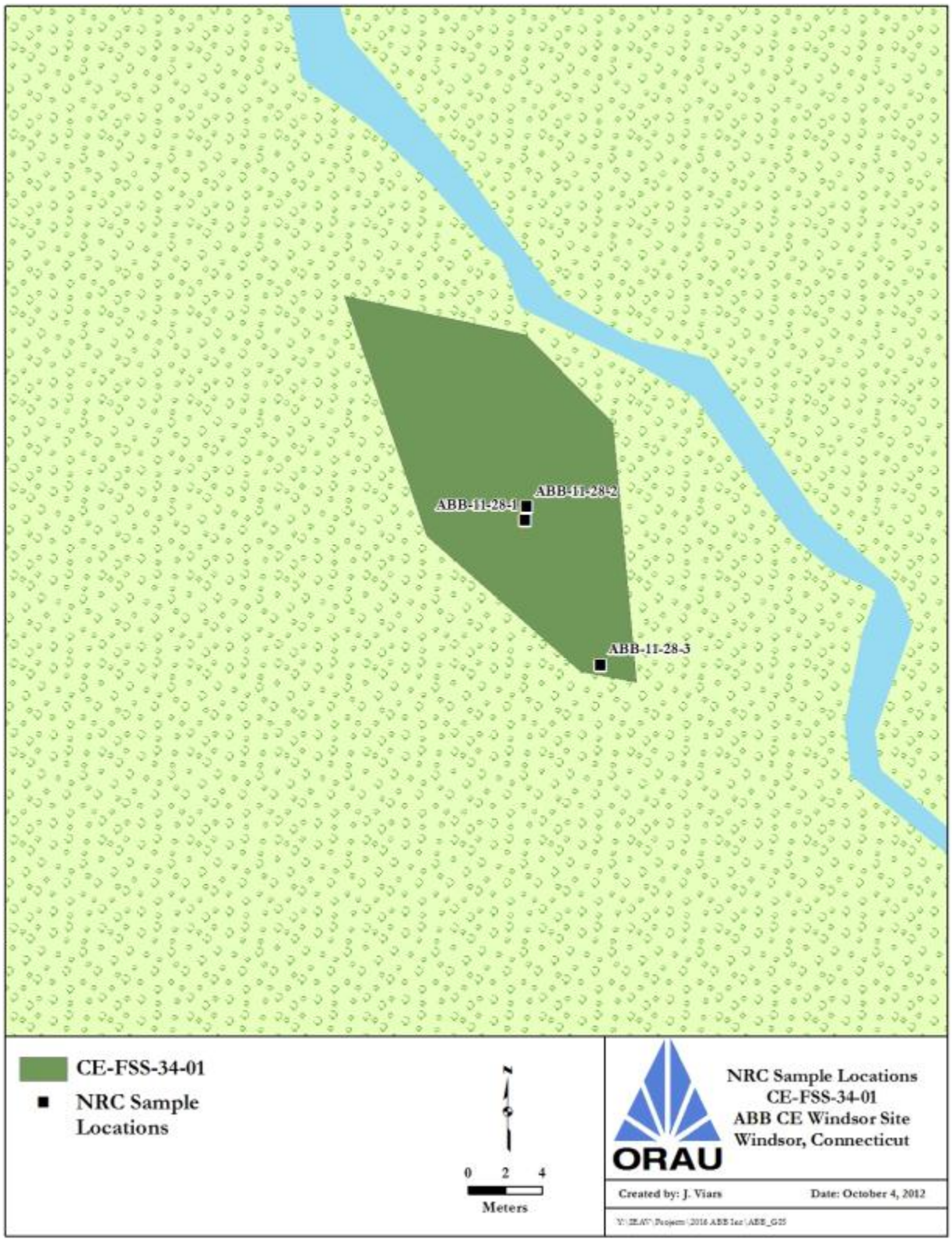

Fig. F-8. CE-FSS-34, Debris Pile Area – NRC Sample Locations

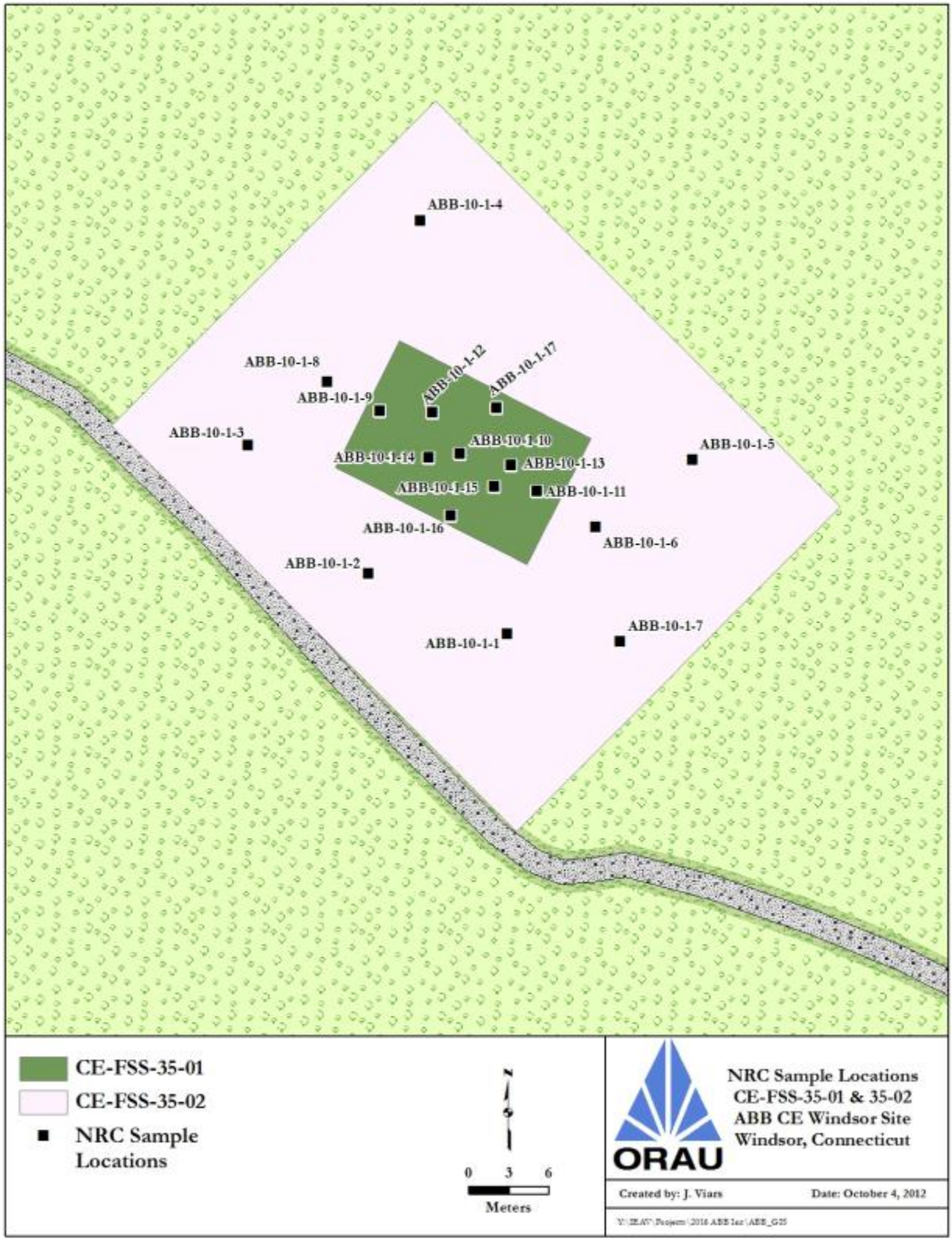

Fig. F-9. CE-FSS-35, Clamshell Pile Area – NRC Sample Locations

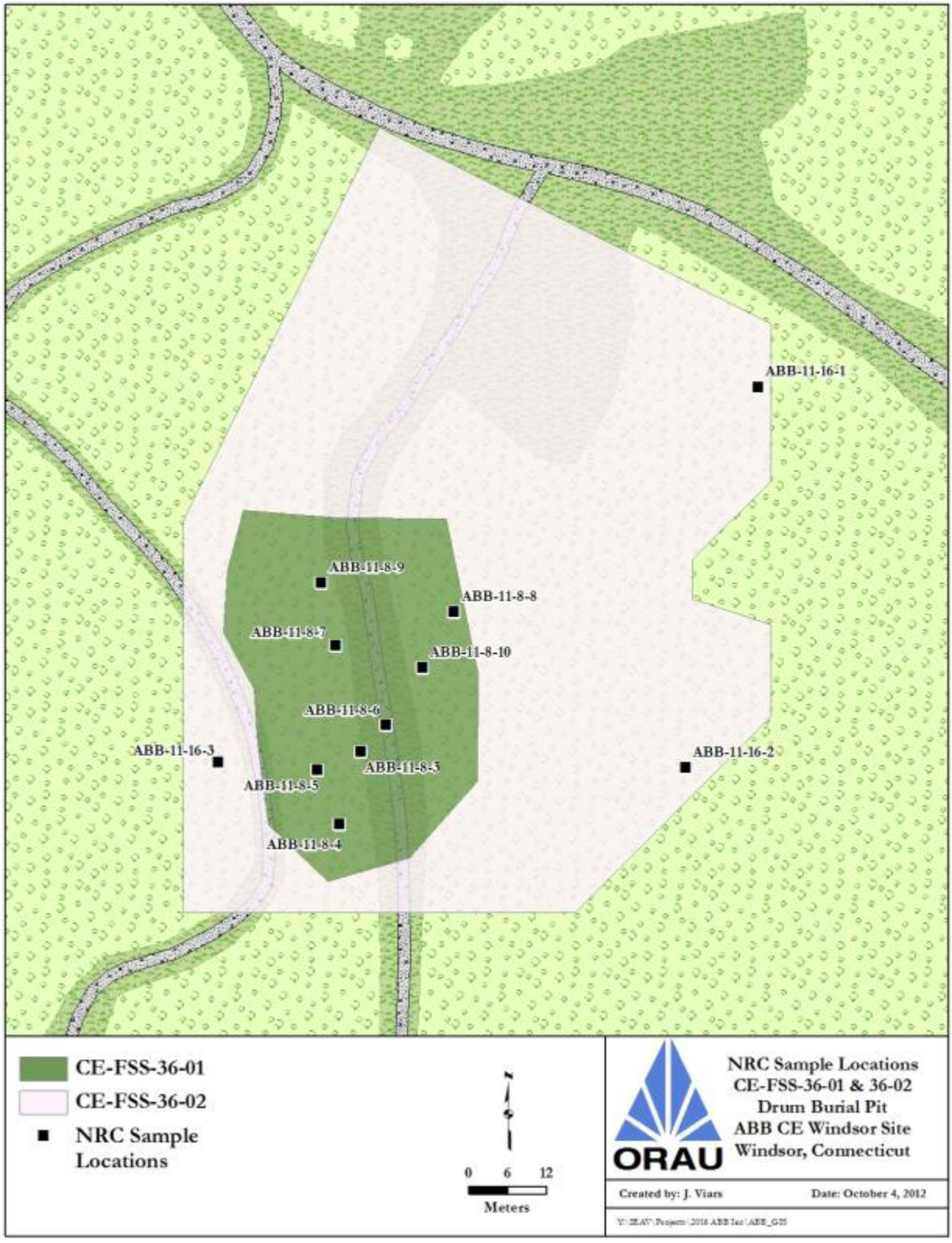

Fig. F-10. CE-FSS-36, Drum Burial Pit Area – NRC Sample Locations

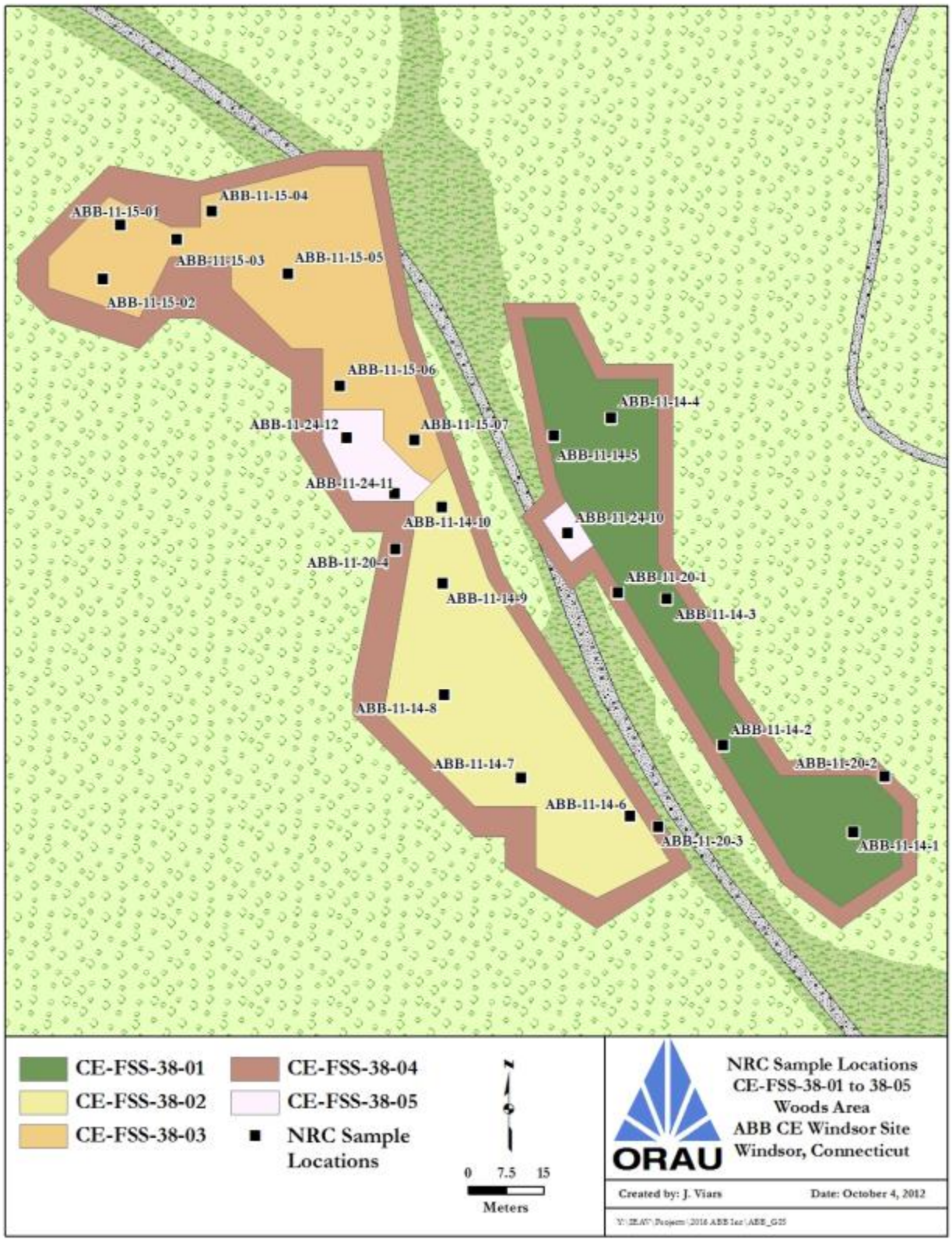

Fig. F-11. CE-FSS-38, Woods Area – NRC Sample Locations

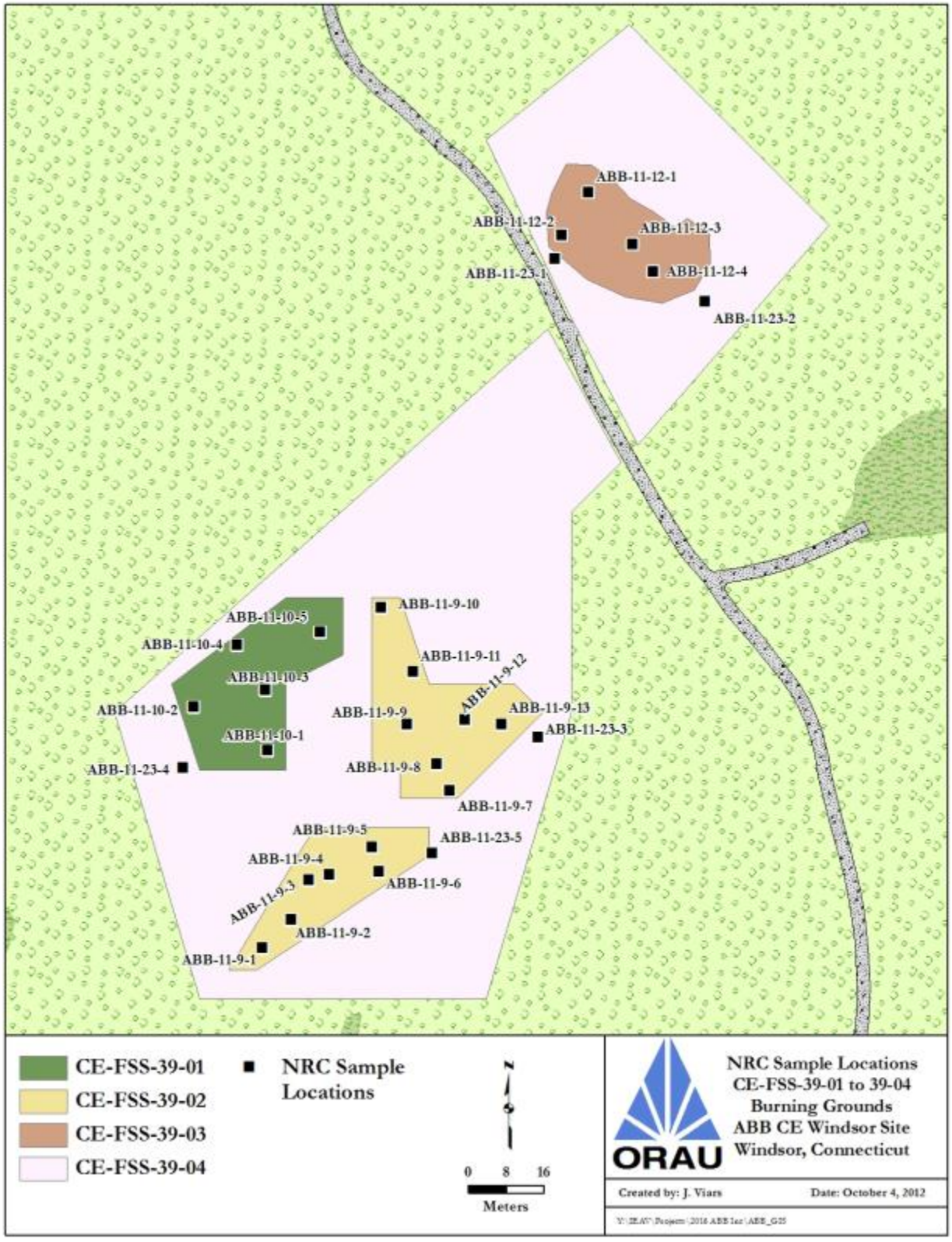

Fig. F-12. CE-FSS-39, Burning Grounds Area – NRC Sample Locations

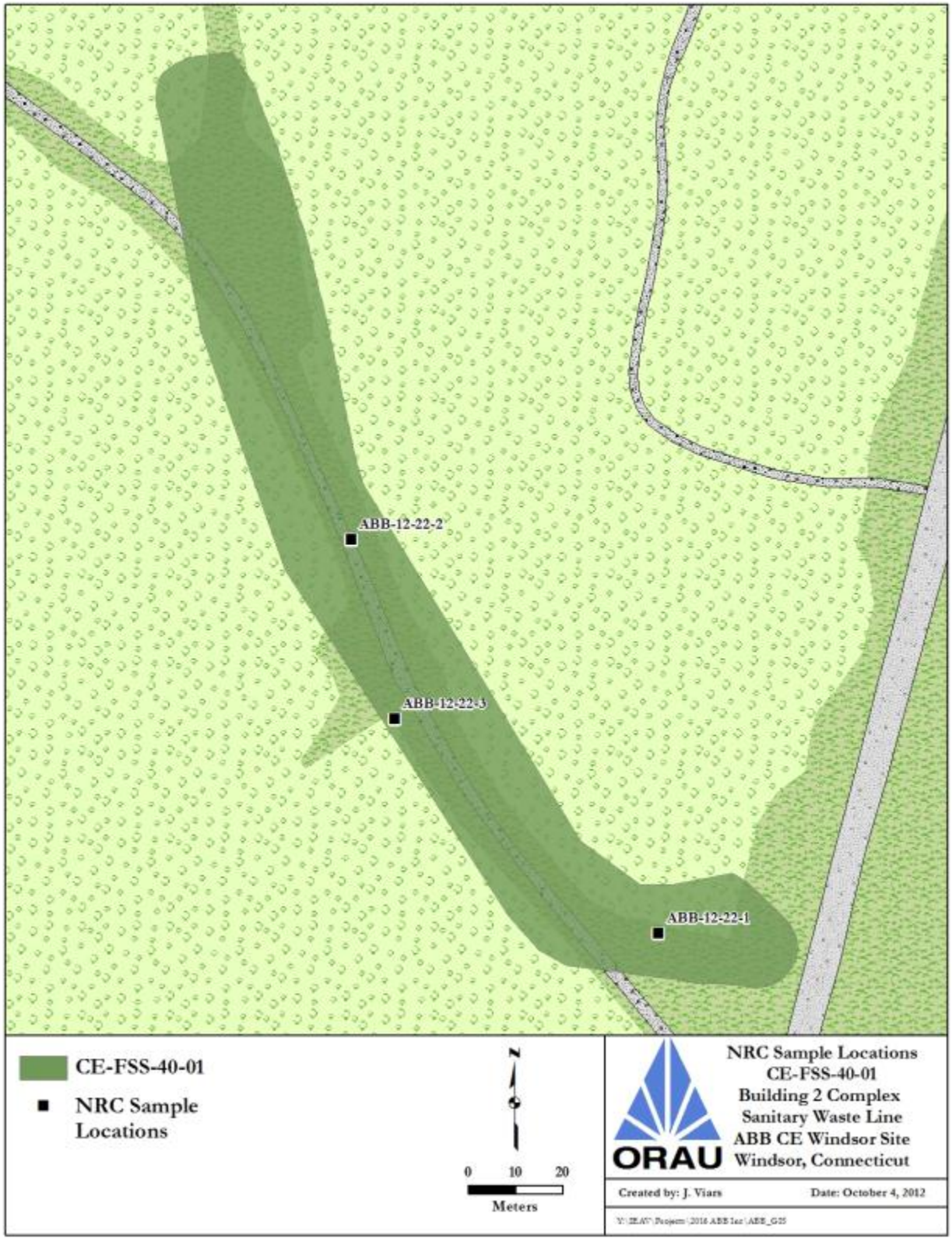

Fig. F-13. CE-FSS-40, Building 2 Complex Sanitary Waste Line – NRC Sample Locations

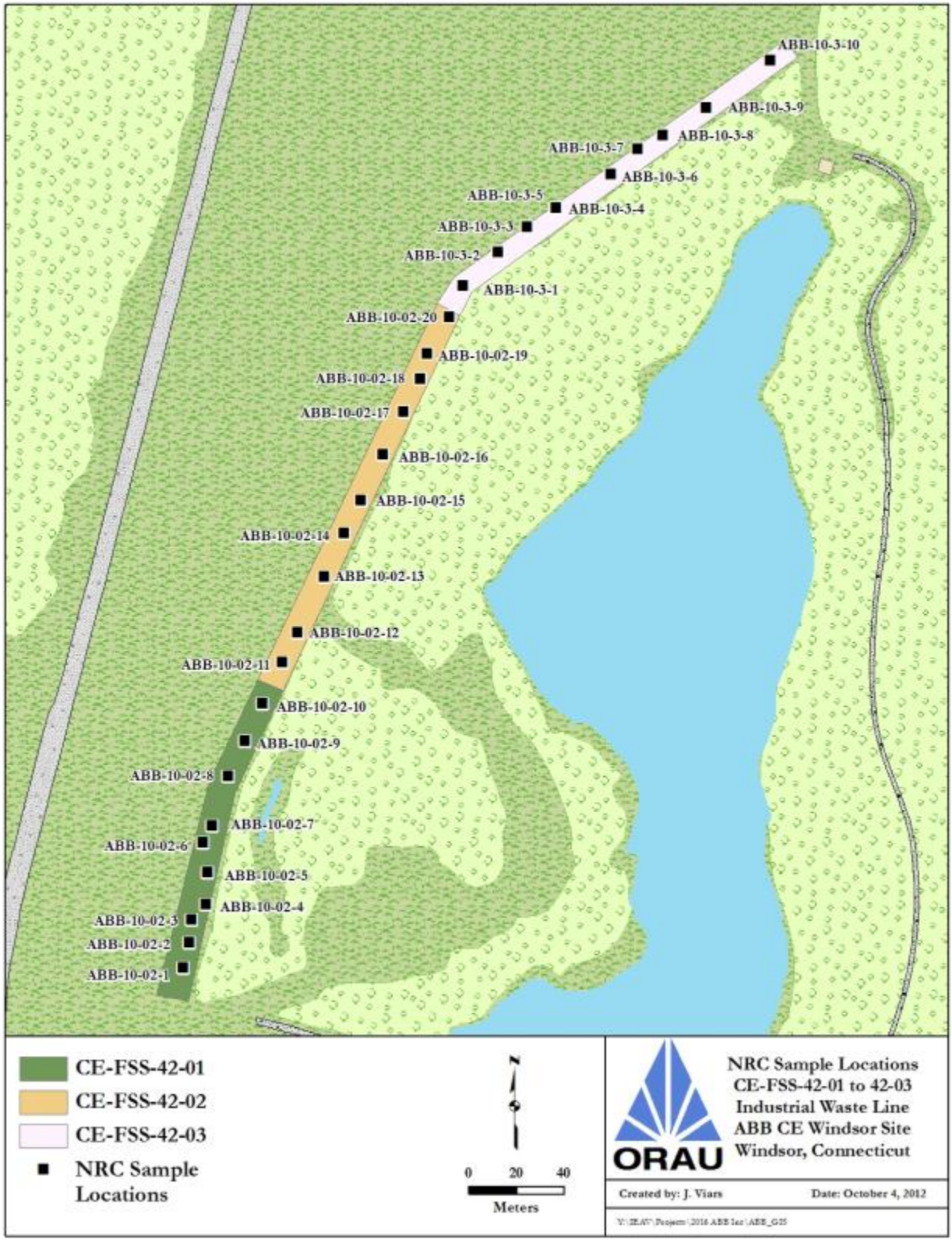

Fig. F-14. CE-FSS-42, Industrial Waste Lines, FSS-42-01 to FSS-42-03 – NRC Sample Locations

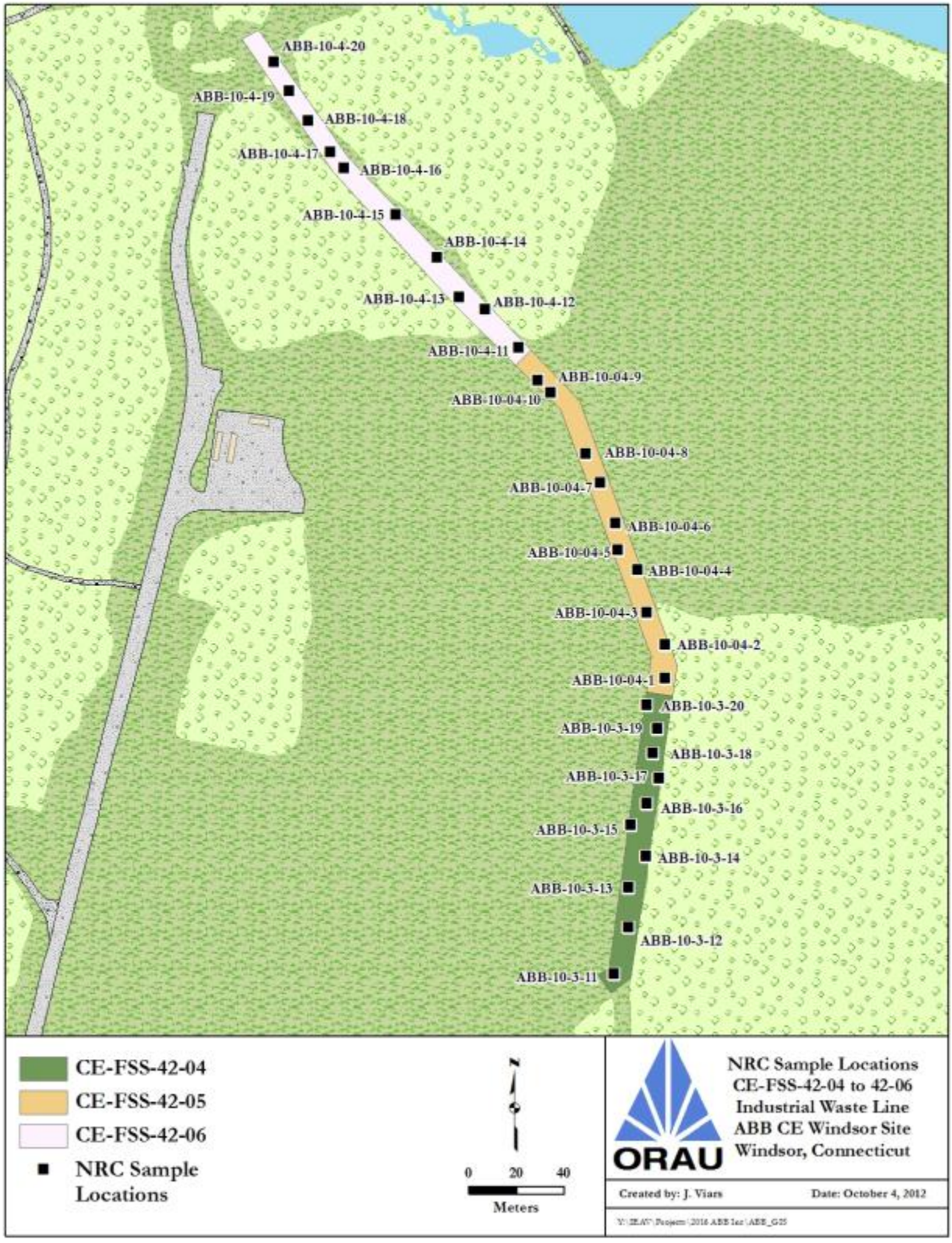

Fig. F-15. CE-FSS-42, Industrial Waste Lines, FSS-42-04 to FSS-42-06 – NRC Sample Locations

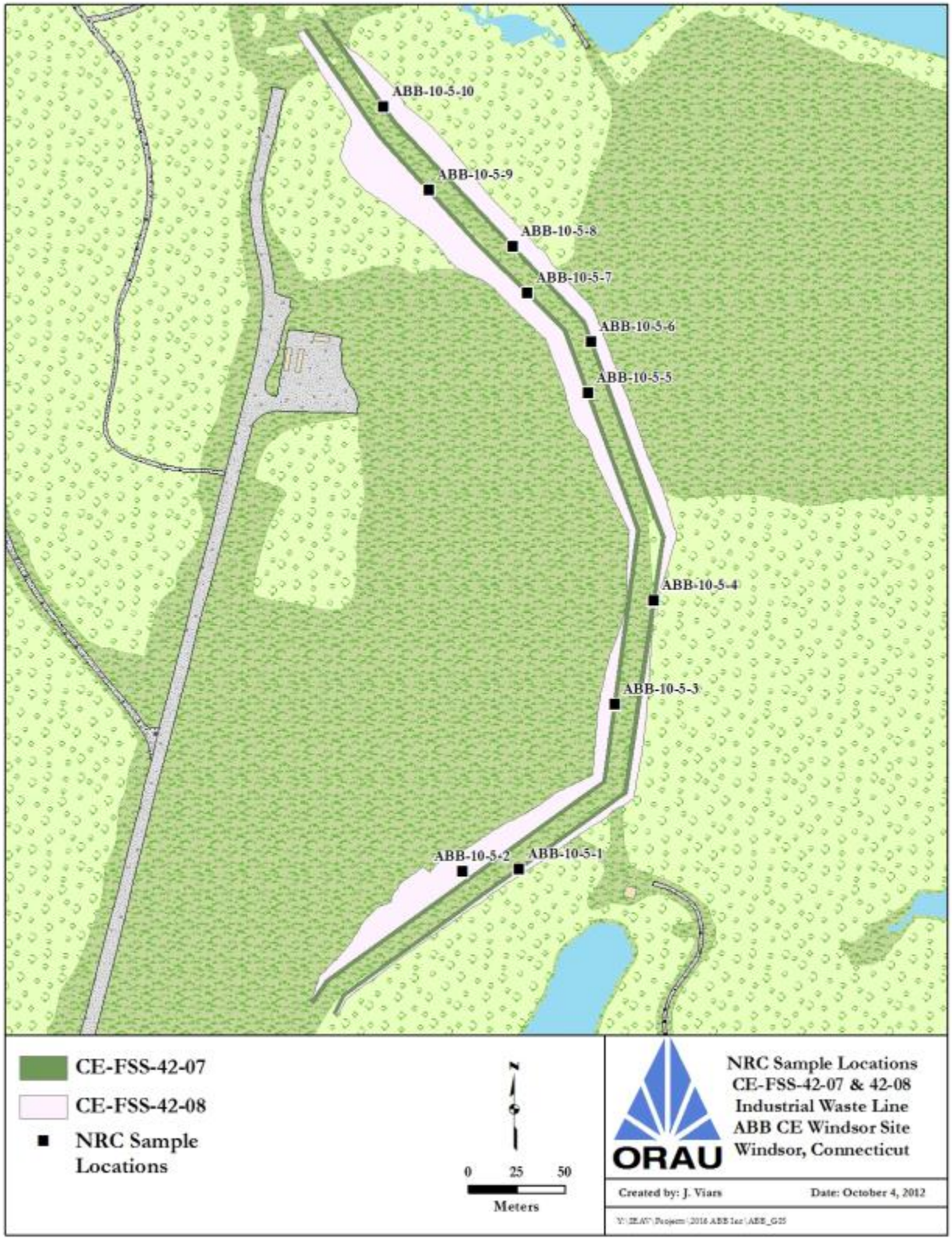

Fig. F-16. CE-FSS-42, Industrial Waste Lines, FSS-42-07 and FSS-42-08 – NRC Sample Locations

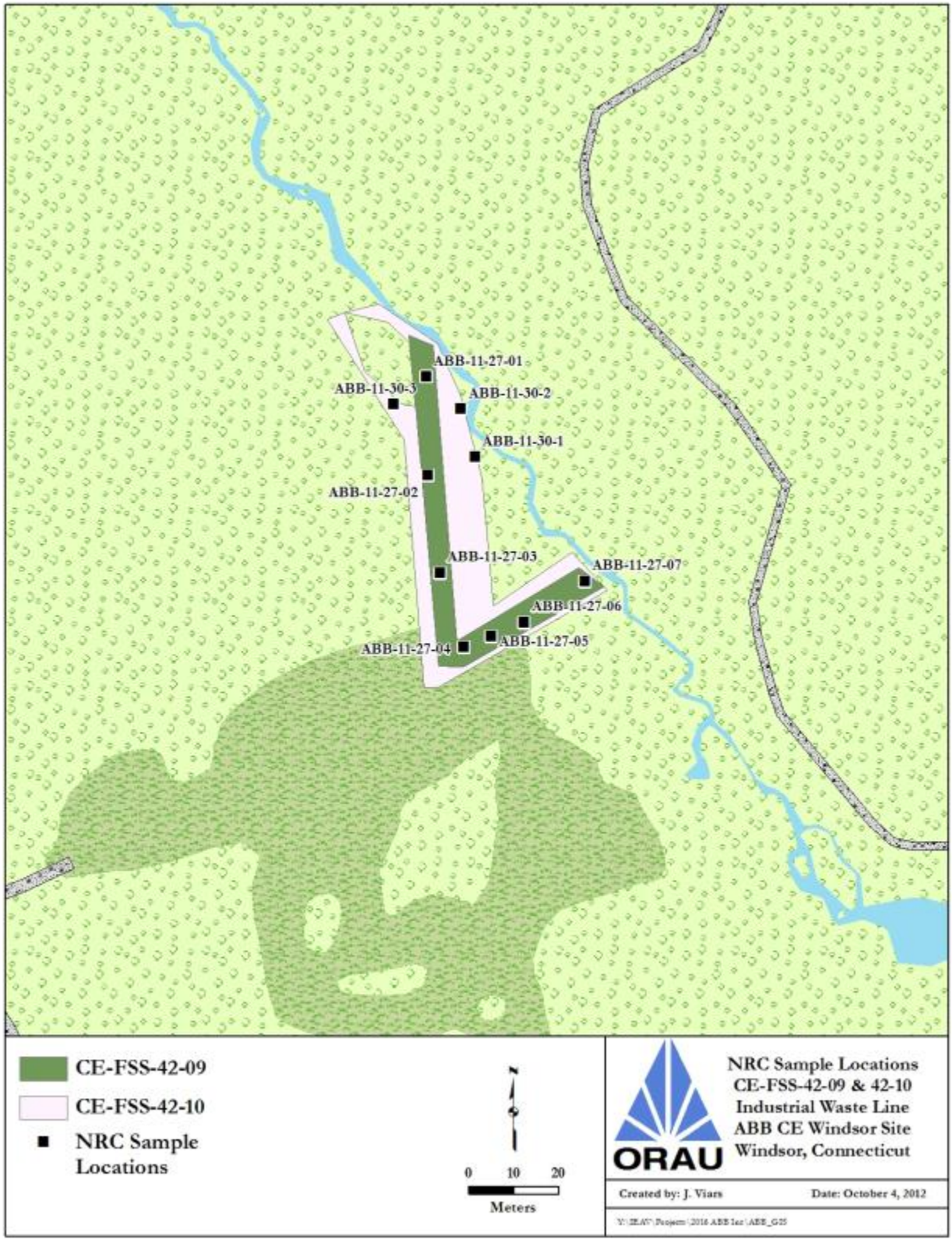

Fig. F-17. CE-FSS-42, Industrial Waste Lines, FSS-42-09 and FSS-42-10 – NRC Sample Locations

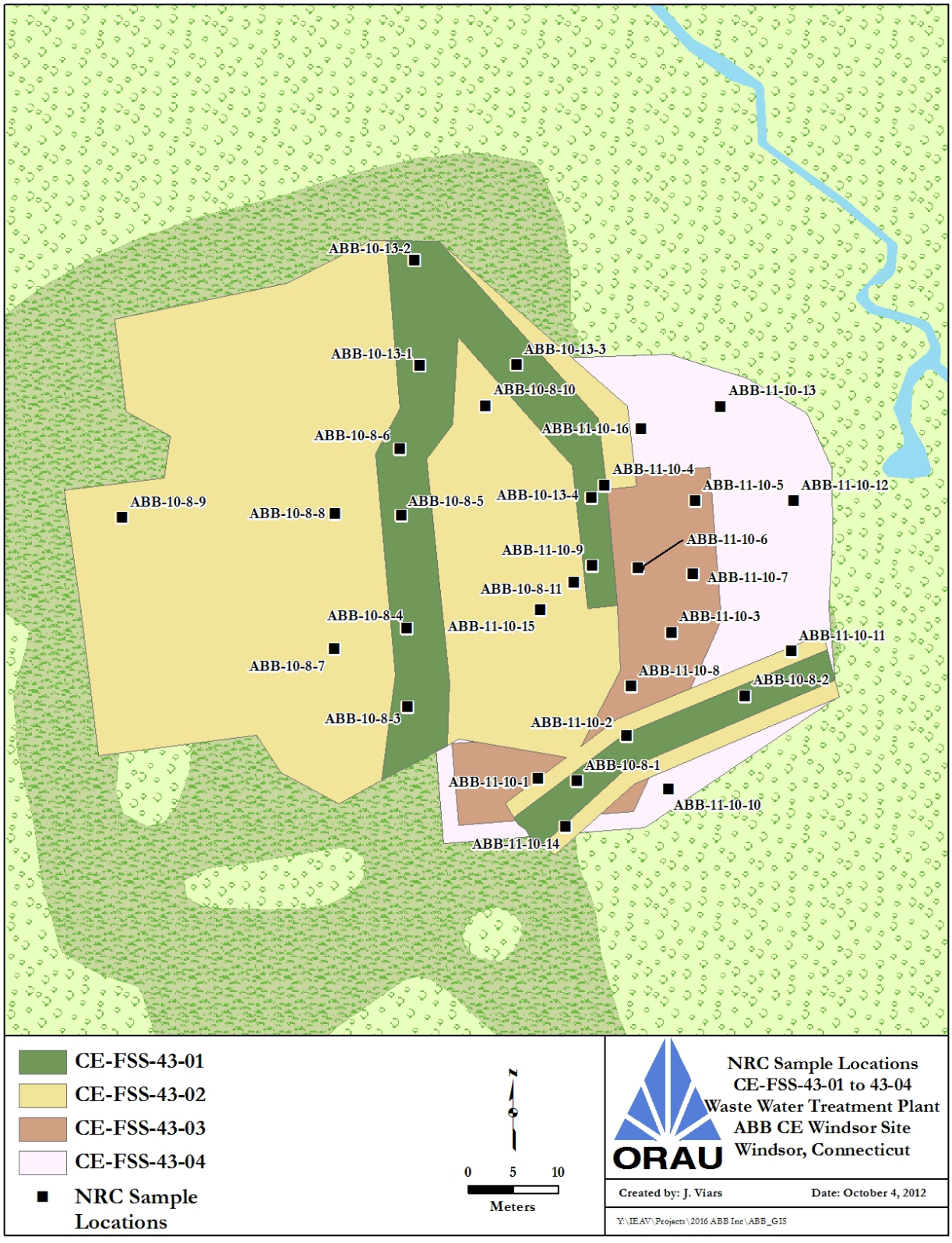

Fig. F-18. CE-FSS-43, Waste Water Treatment Plant – NRC Sample Locations

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
BUILDING 3 COMPLEX								
CE-FSS-03-01 (Part of ORAU Confirmatory Unit 4)								
2016S0132	ABB-12-22-4	1.02 ± 0.15[c]	0.76 ± 0.07	0.01 ± 0.04	1.07 ± 0.28	0.08 ± 0.13	2.22 ± 0.57	0.43
2016S0133	ABB-12-22-5	0.70 ± 0.12	0.51 ± 0.06	0[d] ± 0.05	0.19 ± 0.27	0.02 ± 0.18	0.40 ± 0.57	0.29
CE-FSS-03-02 (Part of ORAU Confirmatory Unit 4)								
2016S0134	ABB-1-5-11-1	1.03 ± 0.15	0.72 ± 0.07	0.02 ± 0.04	1.42 ± 0.52	0.00 ± 0.13	2.8 ± 1.0	0.43
2016S0135	ABB-1-5-11-2	0.76 ± 0.13	0.61 ± 0.07	0.00 ± 0.05	0.96 ± 0.30	0.09 ± 0.20	2.01 ± 0.63	0.33
2016S0136	ABB-1-5-11-3	0.85 ± 0.13	0.63 ± 0.05	-0.04 ± 0.04	0.71 ± 0.22	0.16 ± 0.14	1.58 ± 0.46	0.35
2016S0137	ABB-1-5-11-4	0.68 ± 0.11	0.50 ± 0.05	-0.02 ± 0.04	0.66 ± 0.25	0.06 ± 0.11	1.38 ± 0.51	0.28
2016S0138	ABB-1-5-11-5	0.89 ± 0.13	0.62 ± 0.05	-0.01 ± 0.04	0.89 ± 0.22	0.12 ± 0.14	1.90 ± 0.46	0.36
CE-FSS-03-03 (Part of ORAU Confirmatory Unit 4)								
2016S0149	ABB-11-2-1	0.84 ± 0.12	0.57 ± 0.06	0.03 ± 0.04	0.59 ± 0.22	0.05 ± 0.12	1.23 ± 0.46	0.34
2016S0150	ABB-11-2-2	0.59 ± 0.11	0.45 ± 0.06	0.03 ± 0.04	0.65 ± 0.27	0.08 ± 0.17	1.38 ± 0.57	0.26
2016S0151	ABB-11-2-3	0.68 ± 0.11	0.53 ± 0.05	-0.01 ± 0.04	0.55 ± 0.19	0.03 ± 0.14	1.13 ± 0.40	0.29
2016S0152	ABB-11-2-4	0.68 ± 0.11	0.58 ± 0.06	0.05 ± 0.04	0.51 ± 0.25	0.03 ± 0.13	1.05 ± 0.52	0.31
CE-FSS-03-04 (Part of ORAU Confirmatory Unit 4)								
2016S0153	ABB-11-3-1	1.03 ± 0.17	0.71 ± 0.08	0.01 ± 0.06	0.73 ± 0.32	0.18 ± 0.22	1.64 ± 0.68	0.42
2016S0154	ABB-11-3-2	0.88 ± 0.13	0.61 ± 0.05	0.00 ± 0.04	0.65 ± 0.21	0.14 ± 0.14	1.44 ± 0.44	0.36
2016S0155	ABB-11-3-3	0.74 ± 0.12	0.74 ± 0.07	-0.02 ± 0.05	0.59 ± 0.28	-0.11 ± 0.21	1.07 ± 0.60	0.35

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0156	ABB-11-3-4	0.84 ± 0.12	0.56 ± 0.05	0.01 ± 0.04	0.49 ± 0.20	-0.01 ± 0.14	0.97 ± 0.42	0.34
CE-FSS-03-05 (Part of ORAU Confirmatory Unit 4)								
2016S0166	ABB-11-6-1	0.90 ± 0.14	0.66 ± 0.07	0.01 ± 0.05	0.67 ± 0.27	0.10 ± 0.14	1.44 ± 0.56	0.38
2016S0167	ABB-11-6-2	0.82 ± 0.14	0.65 ± 0.08	-0.05 ± 0.06	0.93 ± 0.32	0.03 ± 0.21	1.89 ± 0.67	0.34
2016S0168	ABB-11-6-3	0.90 ± 0.13	0.66 ± 0.06	0.01 ± 0.04	0.90 ± 0.23	0.00 ± 0.16	1.80 ± 0.49	0.38
2016S0169	ABB-11-6-4	0.96 ± 0.15	0.63 ± 0.06	0.01 ± 0.05	0.64 ± 0.34	1.25 ± 0.13	**29.0 ± 2.8**	0.43
2016S0170	ABB-11-6-5	0.86 ± 0.15	0.60 ± 0.07	0.03 ± 0.05	0.59 ± 0.28	0.01 ± 0.21	1.19 ± 0.60	0.36
2016S0171	ABB-11-6-6	0.87 ± 0.12	0.61 ± 0.05	0.01 ± 0.04	0.60 ± 0.21	0.07 ± 0.15	1.27 ± 0.45	0.36
2016S0172	ABB-11-6-7	0.82 ± 0.13	0.58 ± 0.06	0.04 ± 0.05	0.93 ± 0.34	0.27 ± 0.19	2.13 ± 0.71	0.35
CE-FSS-03-06 (Part of ORAU Confirmatory Unit 4)								
2016S0239	ABB-11-18-1	0.88 ± 0.15	0.66 ± 0.07	0.02 ± 0.04	0.09 ± 0.43	0.00 ± 0.14	0.18 ± 0.87	0.37
2016S0240	ABB-11-18-2	0.63 ± 0.11	0.47 ± 0.06	-0.01 ± 0.05	0.91 ± 0.30	0.09 ± 0.13	1.91 ± 0.61	0.26
2016S0241	ABB-11-18-3	0.85 ± 0.13	0.52 ± 0.05	0.01 ± 0.04	0.88 ± 0.23	0.14 ± 0.05	**4.1 ± 1.4**	0.34
2016S0242	ABB-11-18-4	0.70 ± 0.12	0.52 ± 0.06	0.01 ± 0.04	0.65 ± 0.28	0.00 ± 0.13	1.30 ± 0.57	0.29
BUILDING 6 COMPLEX								
CE-FSS-06-04 (Part of ORAU Confirmatory Unit 4)								
2016S0119	ABB-11-29-1	0.73 ± 0.11	0.58 ± 0.05	0.02 ± 0.04	0.86 ± 0.24	0.41 ± 0.07	2.13 ± 0.49	0.32
2016S0120	ABB-11-29-2	0.92 ± 0.14	0.57 ± 0.06	0.00 ± 0.04	1.03 ± 0.58	-0.04 ± 0.13	2.0 ± 1.2	0.36
2016S0121	ABB-11-29-3	0.87 ± 0.14	0.65 ± 0.07	0.02 ± 0.04	0.85 ± 0.31	0.29 ± 0.07	1.99 ± 0.62	0.37

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0122	ABB-11-29-4	0.71 ± 0.12	0.57 ± 0.06	0.00 ± 0.05	0.62 ± 0.27	0.11 ± 0.07	1.35 ± 0.54	0.31
2016S0123	ABB-11-29-5	0.54 ± 0.09	0.49 ± 0.05	0.02 ± 0.03	0.52 ± 0.21	-0.09 ± 0.14	0.95 ± 0.44	0.25
2016S0124	ABB-11-29-6	0.90 ± 0.14	0.66 ± 0.06	0.05 ± 0.05	0.62 ± 0.29	0.05 ± 0.13	1.29 ± 0.59	0.38
2016S0125	ABB-11-29-7	0.69 ± 0.13	0.52 ± 0.06	-0.01 ± 0.06	0.95 ± 0.36	0.02 ± 0.20	1.92 ± 0.75	0.29
2016S0126	ABB-11-29-8	0.59 ± 0.09	0.49 ± 0.05	0.01 ± 0.03	0.64 ± 0.21	0.08 ± 0.05	1.36 ± 0.42	0.26
2016S0127	ABB-11-29-9	0.81 ± 0.13	0.70 ± 0.07	0.00 ± 0.04	1.22 ± 0.57	0.12 ± 0.05	2.6 ± 1.1	0.36
2016S0128	ABB-11-29-10	0.32 ± 0.08	0.26 ± 0.04	-0.02 ± 0.05	0.27 ± 0.20	0.04 ± 0.16	0.58 ± 0.43	0.13
CE-FSS-06-05 (Part of ORAU Confirmatory Unit 4)								
2016S0139	ABB-11-1-1	0.80 ± 0.13	0.64 ± 0.06	0.01 ± 0.05	0.83 ± 0.29	0.00 ± 0.14	1.66 ± 0.60	0.35
2016S0140	ABB-11-1-2	1.01 ± 0.16	0.76 ± 0.07	-0.02 ± 0.06	1.13 ± 0.37	0.29 ± 0.22	2.55 ± 0.77	0.42
2016S0141	ABB-11-1-3	0.95 ± 0.14	0.57 ± 0.06	0.02 ± 0.05	0.82 ± 0.30	0.11 ± 0.13	1.75 ± 0.61	0.37
2016S0142	ABB-11-1-4	0.80 ± 0.13	0.57 ± 0.06	-0.01 ± 0.06	0.76 ± 0.31	0.16 ± 0.20	1.68 ± 0.65	0.33
2016S0143	ABB-11-1-5	0.77 ± 0.13	0.51 ± 0.06	-0.06 ± 0.06	0.46 ± 0.39	-0.03 ± 0.14	0.89 ± 0.79	0.30
2016S0144	ABB-11-1-6	0.78 ± 0.13	0.51 ± 0.06	0.02 ± 0.05	0.52 ± 0.27	0.02 ± 0.19	1.06 ± 0.57	0.31
2016S0145	ABB-11-1-7	0.93 ± 0.14	0.64 ± 0.07	0.03 ± 0.05	0.86 ± 0.29	0.13 ± 0.07	1.85 ± 0.58	0.38
2016S0146	ABB-11-1-8	0.92 ± 0.15	0.68 ± 0.08	-0.01 ± 0.05	0.42 ± 0.27	0.16 ± 0.21	1.00 ± 0.58	0.38
2016S0147	ABB-11-1-9	0.75 ± 0.11	0.58 ± 0.05	0.01 ± 0.03	0.67 ± 0.19	-0.04 ± 0.14	1.30 ± 0.40	0.32
2016S0148	ABB-11-1-10	0.92 ± 0.14	0.66 ± 0.07	0.04 ± 0.04	0.36 ± 0.23	-0.03 ± 0.14	0.69 ± 0.48	0.39

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
CE-FSS-06-06 (Part of ORAU Confirmatory Unit 4)								
2016S0160	ABB-11-5-1	0.67 ± 0.11	0.51 ± 0.05	0.00 ± 0.03	0.41 ± 0.16	0.12 ± 0.13	0.94 ± 0.35	0.28
2016S0161	ABB-11-5-2	0.85 ± 0.14	0.61 ± 0.06	0.04 ± 0.06	0.70 ± 0.40	-0.06 ± 0.22	1.34 ± 0.83	0.36
2016S0162	ABB-11-5-3	0.81 ± 0.12	0.55 ± 0.05	-0.03 ± 0.04	0.90 ± 0.23	0.05 ± 0.14	1.85 ± 0.48	0.32
2016S0163	ABB-11-5-4	0.86 ± 0.13	0.59 ± 0.06	0.02 ± 0.05	0.69 ± 0.27	0.04 ± 0.13	1.42 ± 0.56	0.35
2016S0164	ABB-11-5-5	0.69 ± 0.12	0.55 ± 0.07	0.03 ± 0.05	0.92 ± 0.31	0.06 ± 0.19	1.90 ± 0.65	0.30
2016S0165	ABB-11-5-6	0.89 ± 0.13	0.57 ± 0.05	0.00 ± 0.04	0.69 ± 0.22	0.06 ± 0.15	1.44 ± 0.46	0.35
2016S0157	ABB-11-4-1	0.85 ± 0.13	0.63 ± 0.07	-0.02 ± 0.05	0.75 ± 0.88	-0.04 ± 0.14	1.5 ± 1.8	0.35
2016S0158	ABB-11-4-2	0.69 ± 0.11	0.57 ± 0.06	0.04 ± 0.04	0.71 ± 0.25	0.14 ± 0.12	1.56 ± 0.51	0.31
2016S0159	ABB-11-4-3	0.77 ± 0.14	0.54 ± 0.07	0.01 ± 0.05	0.62 ± 0.32	0.20 ± 0.20	1.44 ± 0.67	0.32
CE-FSS-06-07 (Part of ORAU Confirmatory Unit 4)								
2016S0173	ABB-11-7-1	0.78 ± 0.13	0.63 ± 0.06	-0.02 ± 0.05	0.98 ± 0.29	0.12 ± 0.06	2.08 ± 0.58	0.33
2016S0174	ABB-11-7-2	0.63 ± 0.10	0.45 ± 0.05	-0.02 ± 0.04	0.51 ± 0.21	0.09 ± 0.14	1.11 ± 0.44	0.26
CE-FSS-06-08 (Part of ORAU Confirmatory Unit 4)								
2016S0203	ABB-11-11-1	0.71 ± 0.15	0.45 ± 0.05	0.02 ± 0.04	0.57 ± 0.24	0.03 ± 0.12	1.17 ± 0.49	0.28
2016S0204	ABB-11-11-2	0.68 ± 0.12	0.48 ± 0.06	0.00 ± 0.05	0.63 ± 0.30	0.06 ± 0.19	1.32 ± 0.63	0.28
2016S0175	ABB-11-8-1	0.79 ± 0.13	0.57 ± 0.06	-0.03 ± 0.05	0.90 ± 0.33	1.22 ± 0.13	**28.6 ± 2.8**	0.37
2016S0176	ABB-11-8-2	0.89 ± 0.14	0.65 ± 0.07	0.00 ± 0.05	0.47 ± 0.31	0.20 ± 0.20	1.14 ± 0.65	0.37

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
EQUIPMENT STORAGE YARD								
CE-FSS-23-02 (Part of ORAU Confirmatory Unit 5)								
2016S0235	ABB-11-17-1	0.90 ± 0.13	0.62 ± 0.06	-0.03 ± 0.04	0.67 ± 0.20	0.01 ± 0.16	1.35 ± 0.43	0.36
2016S0236	ABB-11-17-2	0.88 ± 0.14	0.64 ± 0.06	0.01 ± 0.04	1.14 ± 0.56	0.16 ± 0.12	2.4 ± 1.1	0.37
2016S0237	ABB-11-17-3	0.89 ± 0.14	0.58 ± 0.06	-0.04 ± 0.06	0.99 ± 0.32	0.11 ± 0.14	2.09 ± 0.66	0.35
2016S0238	ABB-11-17-4	0.74 ± 0.11	0.55 ± 0.05	0.00 ± 0.04	0.54 ± 0.26	0.06 ± 0.14	1.14 ± 0.54	0.31
CE-FSS-23-03 (Part of ORAU Confirmatory Unit 5)								
2016S0261	ABB-11-22-1	0.78 ± 0.13	0.54 ± 0.06	0.04 ± 0.05	0.67 ± 0.29	0.08 ± 0.13	1.42 ± 0.59	0.33
2016S0262	ABB-11-22-2	0.86 ± 0.14	0.59 ± 0.06	0.01 ± 0.05	0.71 ± 0.28	0.07 ± 0.13	1.49 ± 0.57	0.35
2016S0263	ABB-11-22-3	0.86 ± 0.13	0.68 ± 0.06	-0.02 ± 0.04	1.04 ± 0.26	0.05 ± 0.16	2.13 ± 0.54	0.37
CE-FSS-23-04 (Part of ORAU Confirmatory Unit 5)								
2016S0264	ABB-11-22-4	0.78 ± 0.13	0.64 ± 0.06	0.00 ± 0.04	0.58 ± 0.29	0.17 ± 0.12	**4.4 ± 2.6**	0.35
2016S0265	ABB-11-22-5	0.68 ± 0.11	0.48 ± 0.06	0.03 ± 0.04	0.61 ± 0.27	0.03 ± 0.11	1.25 ± 0.55	0.28
2016S0266	ABB-11-22-6	0.92 ± 0.13	0.65 ± 0.05	0.01 ± 0.04	0.68 ± 0.22	0.05 ± 0.15	1.41 ± 0.46	0.38
CE-FSS-23-05 (Part of ORAU Confirmatory Unit 5)								
2016S0257	ABB-11-21-1	0.94 ± 0.14	0.64 ± 0.06	0.01 ± 0.04	1.10 ± 0.56	0.15 ± 0.13	2.4 ± 1.1	0.38
2016S0258	ABB-11-21-2	0.62 ± 0.11	0.59 ± 0.06	0.01 ± 0.05	1.04 ± 0.31	0.05 ± 0.13	2.13 ± 0.63	0.29
2016S0259	ABB-11-21-3	0.80 ± 0.12	0.61 ± 0.06	0.03 ± 0.04	0.80 ± 0.23	0.06 ± 0.15	1.66 ± 0.48	0.34
2016S0260	ABB-11-21-4	0.87 ± 0.13	0.66 ± 0.06	0.01 ± 0.04	0.75 ± 0.53	0.11 ± 0.05	**3.2 ± 1.2**	0.37

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
CE-FSS-23-06 (Part of ORAU Confirmatory Unit 5)								
2016S0284	ABB-11-25-1	0.69 ± 0.10	0.45 ± 0.04	0.00[d] ± 0.04	0.60 ± 0.20	0.13 ± 0.13	**3.6 ± 2.8**	0.28
2016S0285	ABB-11-25-2	0.78 ± 0.13	0.50 ± 0.06	0.04 ± 0.04	0.51 ± 0.06	0.33 ± 0.08	**8.0 ± 1.7**	0.33
2016S0286	ABB-11-25-3	0.76 ± 0.12	0.58 ± 0.05	-0.03 ± 0.04	0.58 ± 0.22	-0.02 ± 0.15	1.14 ± 0.46	0.31
CE-FSS-23-07 (Part of ORAU Confirmatory Unit 5)								
2016S0287	ABB-11-25-4	0.86 ± 0.13	0.54 ± 0.06	-0.03 ± 0.04	0.72 ± 0.28	0.13 ± 0.12	**3.7 ± 2.6**	0.34
2016S0288	ABB-11-25-5	0.96 ± 0.14	0.61 ± 0.05	0.00 ± 0.04	0.87 ± 0.24	0.17 ± 0.15	**4.7 ± 3.3**	0.38
CE-FSS-23-08 (Part of ORAU Confirmatory Unit 5)								
2016S0289	ABB-11-25-6	0.84 ± 0.13	0.53 ± 0.06	0.00 ± 0.04	0.53 ± 0.26	0.15 ± 0.12	**3.9 ± 2.6**	0.33
2016S0290	ABB-11-25-7	0.66 ± 0.12	0.40 ± 0.05	0.02 ± 0.04	0.80 ± 0.27	-0.10 ± 0.12	1.50 ± 0.55	0.26
SMALL POND AREA								
CE-FSS-25-02 (Part of ORAU Confirmatory Unit 5)								
2016S0317	ABB-11-31-1	0.69 ± 0.13	0.48 ± 0.06	-0.02 ± 0.06	0.57 ± 0.43	0.04 ± 0.14	1.18 ± 0.87	0.28
2016S0318	ABB-11-31-2	0.90 ± 0.14	0.62 ± 0.06	-0.01 ± 0.05	0.90 ± 0.33	0.06 ± 0.08	1.86 ± 0.66	0.36
2016S0319	ABB-11-31-3	0.59 ± 0.12	0.46 ± 0.06	-0.02 ± 0.04	0.44 ± 0.32	0.07 ± 0.07	**2.0 ± 1.6**	0.25
2016S0320	ABB-11-31-4	0.12 ± 0.08	0.01 ± 0.04	0.00 ± 0.04	0.27 ± 0.31	0.02 ± 0.13	0.56 ± 0.63	0.03
2016S0321	ABB-11-31-5	0.09 ± 0.08	0.04 ± 0.05	-0.03 ± 0.04	0.70 ± 0.33	-0.07 ± 0.18	1.33 ± 0.68	0.03
2016S0322	ABB-11-31-6	0.98 ± 0.15	0.73 ± 0.07	0.01 ± 0.04	0.70 ± 0.39	0.00 ± 0.13	1.40 ± 0.79	0.41
2016S0323	ABB-11-31-7	0.25 ± 0.11	0.13 ± 0.05	0.04 ± 0.02	0.27 ± 0.43	0.07 ± 0.10	**1.9 ± 2.2**	0.10

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0324	ABB-11-31-8	0.63 ± 0.10	0.48 ± 0.05	0.00 ± 0.04	0.62 ± 0.23	0.06 ± 0.06	1.30 ± 0.46	0.27
FORMER CONTROLLED ACCESS AREA								
CE-FSS-26-11 (Part of ORAU Confirmatory Unit 7)								
2016S0325	ABB-11-32-1	0.97 ± 0.14	0.71 ± 0.07	-0.02 ± 0.04	0.90 ± 0.40	0.09 ± 0.07	1.89 ± 0.80	0.40
2016S0326	ABB-11-32-2	0.87 ± 0.14	0.62 ± 0.06	0.02 ± 0.05	0.89 ± 0.41	0.09 ± 0.13	1.87 ± 0.83	0.36
2016S0327	ABB-11-32-3	0.87 ± 0.12	0.56 ± 0.05	-0.01 ± 0.04	0.79 ± 0.29	0.09 ± 0.15	1.67 ± 0.60	0.34
2016S0328	ABB-11-32-4	0.76 ± 0.13	0.61 ± 0.06	-0.01 ± 0.04	0.23 ± 0.35	0.07 ± 0.12	**1.8 ± 2.6**	0.33
SITE BROOK AREAS								
CE-FSS-33-01 (This FSS Unit was not not part of an ORAU Confirmatory Unit)								
2016S0209	ABB-11-13-1	0.66 ± 0.10	0.45 ± 0.04	0.01 ± 0.04	0.52 ± 0.18	-0.01 ± 0.12	1.03 ± 0.38	0.27
2016S0210	ABB-11-13-2	0.55 ± 0.09	0.47 ± 0.05	0.08 ± 0.02	1.04 ± 0.24	0.51 ± 0.07	**12.6 ± 1.5**	0.28
2016S0211	ABB-11-13-3	0.63 ± 0.19	0.47 ± 0.06	0.32 ± 0.07	4.50 ± 0.52	3.04 ± 0.26	**73.5 ± 5.7**	0.46
2016S0212	ABB-11-13-4	0.38 ± 0.11	0.36 ± 0.06	0.08 ± 0.03	4.90 ± 0.63	0.29 ± 0.11	10.1 ± 1.3	0.21
2016S0213	ABB-11-13-5	0.48 ± 0.10	0.31 ± 0.05	0.17 ± 0.03	8.64 ± 0.77	0.34 ± 0.09	17.6 ± 1.5	0.25
2016S0214	ABB-11-13-6	0.49 ± 0.09	0.32 ± 0.04	0.04 ± 0.03	0.86 ± 0.23	0.10 ± 0.04	1.82 ± 0.46	0.20
CE-FSS-33-02 (This FSS Unit was not not part of an ORAU Confirmatory Unit)								
2016S0243	ABB-11-19-1	0.83 ± 0.13	0.55 ± 0.06	0.01 ± 0.05	0.98 ± 0.37	6.40 ± 0.43	**146 ± 10**	0.59
2016S0244	ABB-11-19-2	0.92 ± 0.14	0.74 ± 0.06	0.00 ± 0.04	0.74 ± 0.24	1.02 ± 0.11	**23.9 ± 2.7**	0.44
2016S0245	ABB-11-19-3	0.92 ± 0.14	0.65 ± 0.06	0.07 ± 0.03	0.58 ± 0.66	2.60 ± 0.21	**59.6 ± 5.4**	0.50

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0246	ABB-11-19-4	0.85 ± 0.13	0.52 ± 0.06	0.04 ± 0.04	1.10 ± 0.35	1.43 ± 0.15	**33.6 ± 3.8**	0.40
2016S0247	ABB-11-19-5	0.75 ± 0.12	0.63 ± 0.05	0.01 ± 0.03	0.69 ± 0.20	0.15 ± 0.05	**4.1 ± 1.3**	0.34
2016S0248	ABB-11-19-6	0.52 ± 0.11	0.50 ± 0.06	0.08 ± 0.03	1 ± 13	8.30 ± 0.53	**189 ± 25**	0.60
2016S0249	ABB-11-19-7	0.31 ± 0.08	0.31 ± 0.04	0.03 ± 0.05	1.42 ± 0.32	0.19 ± 0.06	3.03 ± 0.64	0.16
2016S0250	ABB-11-19-8	0.45 ± 0.09	0.34 ± 0.04	0.04 ± 0.02	1.98 ± 0.32	1.56 ± 0.14	**37.4 ± 3.5**	0.26
2016S0251	ABB-11-19-9	0.98 ± 0.22	0.69 ± 0.10	0.15 ± 0.05	8.9 ± 1.7	81.1 ± 4.6	**1850 ± 110**	3.75
2016S0252	ABB-11-19-10	0.71 ± 0.14	0.46 ± 0.06	0.69 ± 0.08	7.70 ± 0.91	13.54 ± 0.84	**315 ± 20**	0.98
CE-FSS-33-03 (This FSS Unit was not not part of an ORAU Confirmatory Unit)								
2016S0294	ABB-11-26-4	0.51 ± 0.09	0.37 ± 0.05	0.01 ± 0.04	0.13 ± 0.04	0.04 ± 0.14	**1.0 ± 3.0**	0.21
2016S0295	ABB-11-26-5	0.72 ± 0.14	0.50 ± 0.06	0.00 ± 0.04	0.91 ± 0.35	0.05 ± 0.14	1.87 ± 0.71	0.29
2016S0296	ABB-11-26-6	0.73 ± 0.21	0.56 ± 0.10	0.14 ± 0.05	8.1 ± 1.1	2.60 ± 0.33	**67.1 ± 7.3**	0.46
CE-FSS-33-04 (This FSS Unit was not not part of an ORAU Confirmatory Unit)								
2016S0272	ABB-11-24-1	0.96 ± 0.14	0.75 ± 0.06	0.00 ± 0.04	1.06 ± 0.27	0.46 ± 0.08	**11.5 ± 1.8**	0.43
2016S0273	ABB-11-24-2	0.35 ± 0.12	0.44 ± 0.08	0.08 ± 0.03	5.86 ± 0.75	3.65 ± 0.33	**88.7 ± 7.2**	0.36
2016S0274	ABB-11-24-3	0.60 ± 0.13	0.43 ± 0.06	0.55 ± 0.07	5.16 ± 0.76	11.58 ± 0.76	**268 ± 17**	0.84
2016S0275	ABB-11-24-4	0.72 ± 0.16	0.54 ± 0.08	1.13 ± 0.11	20.1 ± 1.8	34.2 ± 2.1	**796 ± 46**	1.96
2016S0277	ABB-11-24-6	0.86 ± 0.14	0.68 ± 0.07	0.03 ± 0.06	1.76 ± 0.40	0.87 ± 0.13	**21.5 ± 2.9**	0.41
2016S0278	ABB-11-24-7	0.98 ± 0.15	0.77 ± 0.07	0.01 ± 0.06	1.09 ± 0.37	0.14 ± 0.07	2.32 ± 0.74	0.42
2016S0279	ABB-11-24-8	0.67 ± 0.12	0.51 ± 0.06	0.06 ± 0.05	3.50 ± 0.44	2.05 ± 0.18	**50.0 ± 3.9**	0.38

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0280	ABB-11-24-9	0.78 ± 0.14	0.59 ± 0.07	0.02 ± 0.05	9.19 ± 0.86	0.51 ± 0.10	18.9 ± 1.7	0.36
CE-FSS-33-05 (This FSS Unit was not not part of an ORAU Confirmatory Unit)								
2016S0312	ABB-11-29-6	0.82 ± 0.16	0.75 ± 0.08	0.05 ± 0.05	1.06 ± 0.44	0.13 ± 0.10	2.25 ± 0.89	0.39
2016S0313	ABB-11-29-7	0.77 ± 0.16	0.66 ± 0.08	0.10 ± 0.03	1.47 ± 0.56	2.40 ± 0.22	**56.0 ± 4.8**	0.46
CE-FSS-33-06 (This FSS Unit was not not part of an ORAU Confirmatory Unit)								
2016S0310	ABB-11-29-4	0.74 ± 0.12	0.55 ± 0.06	-0.02 ± 0.04	0.40 ± 0.36	0.18 ± 0.07	**4.5 ± 1.6**	0.31
2016S0311	ABB-11-29-5	0.83 ± 0.12	0.49 ± 0.05	0.02 ± 0.02	1.10 ± 0.30	0.25 ± 0.08	**6.8 ± 1.8**	0.33
CE-FSS-33-07 (This FSS Unit was not not part of an ORAU Confirmatory Unit)								
2016S0307	ABB-11-29-1	1.08 ± 0.16	0.83 ± 0.08	0.02 ± 0.04	1.37 ± 0.44	-0.08 ± 0.15	2.66 ± 0.89	0.46
2016S0308	ABB-11-29-2	1.35 ± 0.17	0.86 ± 0.07	0.00 ± 0.05	0.76 ± 0.35	0.21 ± 0.18	**5.5 ± 3.9**	0.54
2016S0309	ABB-11-29-3	0.69 ± 0.12	0.46 ± 0.06	0.03 ± 0.04	0.56 ± 0.32	0.14 ± 0.08	**3.7 ± 1.8**	0.29
CE-FSS-33-08 (This FSS Unit was not not part of an ORAU Confirmatory Unit)								
2016S0276	ABB-11-24-5	1.21 ± 0.23	0.67 ± 0.09	0.07 ± 0.07	2.06 ± 0.58	1.59 ± 0.22	**38.2 ± 4.8**	0.53
CE-FSS-33-09 (This FSS Unit was not not part of an ORAU Confirmatory Unit)								
2016S0291	ABB-11-26-1	0.73 ± 0.14	0.45 ± 0.06	0.02 ± 0.05	2.62 ± 0.72	28.6 ± 1.7	**652 ± 37**	1.46
2016S0292	ABB-11-26-2	0.57 ± 0.13	0.40 ± 0.07	0.13 ± 0.03	2.66 ± 0.54	2.84 ± 0.25	**67.1 ± 5.5**	0.38
2016S0293	ABB-11-26-3	0.59 ± 0.13	0.46 ± 0.07	0.05 ± 0.02	3.94 ± 0.59	1.95 ± 0.20	**48.2 ± 4.4**	0.35

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
DEBRIS PILE AREA								
CE-FSS-34-01 (Part of ORAU Confirmatory Unit 8)								
2016S0304	ABB-11-28-1	0.94 ± 0.13	0.60 ± 0.06	0.02 ± 0.04	0.35 ± 0.26	0.02 ± 0.15	0.72 ± 0.54	0.37
2016S0305	ABB-11-28-2	0.73 ± 0.13	0.52 ± 0.06	0.02 ± 0.02	1.02 ± 0.42	0.89 ± 0.12	**21.2 ± 2.6**	0.34
2016S0306	ABB-11-28-3	0.48 ± 0.11	0.32 ± 0.05	0.00 ± 0.05	0.72 ± 0.30	0.01 ± 0.12	1.45 ± 0.61	0.19
CLAMSHELL PILE AREA								
CE-FSS-35-01 (Part of ORAU Confirmatory Unit 1)								
2016S0008	ABB-10-1-8	0.94 ± 0.17	0.70 ± 0.08	0.02 ± 0.06	0.54 ± 0.38	0.22 ± 0.09	**5.5 ± 2.0**	0.40
2016S0009	ABB-10-1-9	0.88 ± 0.15	0.61 ± 0.07	0.06 ± 0.05	0.92 ± 0.40	1.04 ± 0.13	**24.5 ± 2.9**	0.41
2016S0010	ABB-10-1-10	0.87 ± 0.12	0.63 ± 0.05	0.01 ± 0.03	0.85 ± 0.25	0.93 ± 0.10	**22.0 ± 2.2**	0.40
2016S0011	ABB-10-1-11	0.57 ± 0.19	0.69 ± 0.07	-0.01 ± 0.05	0.77 ± 0.98	1.57 ± 0.16	**36.4 ± 3.6**	0.36
2016S0012	ABB-10-1-12	0.93 ± 0.15	0.71 ± 0.07	0.02 ± 0.05	0.75 ± 0.30	0.10 ± 0.14	1.60 ± 0.62	0.40
2016S0013	ABB-10-1-13	0.85 ± 0.14	0.63 ± 0.07	0.03 ± 0.05	0.91 ± 0.31	0.26 ± 0.20	2.08 ± 0.65	0.36
2016S0014	ABB-10-1-14	1.07 ± 0.15	0.74 ± 0.06	0.02 ± 0.04	0.81 ± 0.27	0.10 ± 0.16	1.72 ± 0.56	0.44
2016S0015	ABB-10-1-15	1.04 ± 0.16	0.73 ± 0.07	0.02 ± 0.03	0.82 ± 0.29	0.89 ± 0.10	**21.0 ± 2.2**	0.46
2016S0016	ABB-10-1-16	0.90 ± 0.15	0.62 ± 0.07	0.00 ± 0.05	0.82 ± 0.30	0.08 ± 0.21	1.72 ± 0.64	0.37
2016S0017	ABB-10-1-17	0.86 ± 0.14	0.70 ± 0.07	-0.03 ± 0.06	0.92 ± 0.33	0.31 ± 0.09	**8.0 ± 2.0**	0.38
CE-FSS-35-02 (Part of ORAU Confirmatory Unit 7)								
2016S0001	ABB-10-1-1	0.65 ± 0.13	0.62 ± 0.07	-0.04 ± 0.06	0.80 ± 0.35	-0.03 ± 0.22	1.57 ± 0.73	0.30

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0002	ABB-10-1-2	0.62 ± 0.10	0.46 ± 0.05	0.01 ± 0.04	0.51 ± 0.23	0.04 ± 0.14	1.06 ± 0.48	0.26
2016S0003	ABB-10-1-3	0.66 ± 0.12	0.52 ± 0.05	0.01 ± 0.03	0.87 ± 0.26	-0.01 ± 0.10	1.73 ± 0.53	0.29
2016S0004	ABB-10-1-4	0.74 ± 0.12	0.51 ± 0.06	0.03 ± 0.04	0.77 ± 0.31	-0.05 ± 0.13	1.49 ± 0.63	0.31
2016S0005	ABB-10-1-5	0.70 ± 0.12	0.56 ± 0.06	0.02 ± 0.04	0.62 ± 0.29	0.02 ± 0.19	1.26 ± 0.61	0.31
2016S0006	ABB-10-1-6	0.63 ± 0.11	0.46 ± 0.05	-0.02 ± 0.05	0.51 ± 0.05	-0.08 ± 0.16	0.94 ± 0.19	0.26
2016S0007	ABB-10-1-7	0.65 ± 0.12	0.52 ± 0.06	-0.03 ± 0.05	0.62 ± 0.07	-0.02 ± 0.13	1.22 ± 0.19	0.27
DRUM BURIAL PIT AREA								
CE-FSS-36-01 (Part of ORAU Confirmatory Unit 3)								
2016S0177	ABB-11-8-3	0.85 ± 0.13	0.77 ± 0.08	0.01 ± 0.06	0.56 ± 0.30	0.22 ± 0.08	1.34 ± 0.61	0.39
2016S0178	ABB-11-8-4	0.57 ± 0.09	0.56 ± 0.05	-0.04 ± 0.04	0.62 ± 0.18	0.11 ± 0.12	1.35 ± 0.38	0.26
2016S0179	ABB-11-8-5	0.87 ± 0.14	0.72 ± 0.07	0.03 ± 0.05	1.06 ± 0.34	0.14 ± 0.15	2.26 ± 0.70	0.39
2016S0180	ABB-11-8-6	0.85 ± 0.15	0.69 ± 0.07	0.03 ± 0.06	0.59 ± 0.37	0.85 ± 0.12	**19.9 ± 2.6**	0.41
2016S0181	ABB-11-8-7	0.88 ± 0.13	0.76 ± 0.06	0.02 ± 0.04	0.78 ± 0.25	-0.07 ± 0.17	1.49 ± 0.53	0.40
2016S0182	ABB-11-8-8	1.20 ± 0.18	0.89 ± 0.09	-0.01 ± 0.06	1.06 ± 0.35	0.15 ± 0.16	2.27 ± 0.72	0.50
2016S0183	ABB-11-8-9	0.93 ± 0.15	0.67 ± 0.07	0.00 ± 0.06	0.70 ± 0.36	0.95 ± 0.13	**22.3 ± 2.8**	0.42
2016S0184	ABB-11-8-10	0.90 ± 0.13	0.74 ± 0.06	0.00 ± 0.04	1.00 ± 0.27	0.03 ± 0.16	2.03 ± 0.56	0.39
CE-FSS-36-02 (Part of ORAU Confirmatory Unit 3)								
2016S0232	ABB-11-16-01	1.12 ± 0.17	0.81 ± 0.08	0.02 ± 0.05	1.39 ± 0.34	0.00 ± 0.21	2.78 ± 0.71	0.47
2016S0233	ABB-11-16-02	0.74 ± 0.13	0.65 ± 0.07	0.01 ± 0.04	0.64 ± 0.32	0.08 ± 0.14	1.36 ± 0.66	0.33

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0234	ABB-11-16-03	0.62 ± 0.11	0.52 ± 0.06	-0.01 ± 0.05	0.68 ± 0.29	0.02 ± 0.12	1.38 ± 0.59	0.27
WOODS AREA								
CE-FSS-38-01 (Part of ORAU Confirmatory Unit 3)								
2016S0215	ABB-11-14-1	1.25 ± 0.22	0.69 ± 0.07	0.05 ± 0.05	1.15 ± 0.35	0.02 ± 0.16	2.32 ± 0.72	0.48
2016S0216	ABB-11-14-2	0.67 ± 0.13	0.54 ± 0.06	-0.01 ± 0.05	1.23 ± 0.45	5.60 ± 0.39	**128.4 ± 8.5**	0.52
2016S0217	ABB-11-14-3	0.68 ± 0.11	0.53 ± 0.05	-0.04 ± 0.04	0.74 ± 0.23	0.13 ± 0.06	**3.7 ± 1.3**	0.29
2016S0218	ABB-11-14-4	0.79 ± 0.13	0.66 ± 0.07	0.01 ± 0.04	0.83 ± 0.27	-0.03 ± 0.13	1.63 ± 0.56	0.35
2016S0219	ABB-11-14-5	1.50 ± 0.21	0.74 ± 0.08	-0.05 ± 0.07	0.91 ± 0.46	7.17 ± 0.50	**164 ± 11**	0.82
CE-FSS-38-02 (Part of ORAU Confirmatory Unit 3)								
2016S0220	ABB-11-14-6	0.79 ± 0.11	0.63 ± 0.05	0.00 ± 0.04	1.03 ± 0.22	0.11 ± 0.05	2.2 ± 0.44	0.34
2016S0221	ABB-11-14-7	1.05 ± 0.21	0.61 ± 0.08	0.02 ± 0.06	1.13 ± 0.40	0.18 ± 0.09	**5.2 ± 2.0**	0.41
2016S0222	ABB-11-14-8	0.87 ± 0.16	0.76 ± 0.09	0.00 ± 0.07	1.10 ± 0.43	0.40 ± 0.25	**10.2 ± 5.4**	0.40
2016S0223	ABB-11-14-9	1.08 ± 0.16	0.85 ± 0.08	0.05 ± 0.04	1.38 ± 0.36	2.55 ± 0.21	**59.3 ± 4.6**	0.58
2016S0224	ABB-11-14-10	1.20 ± 0.19	0.84 ± 0.08	0.04 ± 0.04	0.97 ± 0.37	0.14 ± 0.06	**4.1 ± 1.4**	0.50
CE-FSS-38-03 (Part of ORAU Confirmatory Unit 3)								
2016S0225	ABB-11-15-01	1.01 ± 0.15	0.74 ± 0.07	0.04 ± 0.04	0.65 ± 0.27	-0.06 ± 0.15	1.24 ± 0.56	0.43
2016S0226	ABB-11-15-02	0.88 ± 0.13	0.63 ± 0.05	-0.02 ± 0.04	0.53 ± 0.20	-0.01 ± 0.15	1.05 ± 0.43	0.36
2016S0227	ABB-11-15-03	1.01 ± 0.17	0.76 ± 0.08	0.01 ± 0.05	1.18 ± 0.37	0.08 ± 0.16	2.44 ± 0.76	0.43
2016S0228	ABB-11-15-04	0.88 ± 0.14	0.72 ± 0.07	-0.01 ± 0.05	0.68 ± 0.31	0.21 ± 0.07	**5.4 ± 1.9**	0.39

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0229	ABB-11-15-05	1.16 ± 0.16	0.82 ± 0.07	-0.01 ± 0.04	0.94 ± 0.26	0.00 ± 0.17	1.88 ± 0.55	0.47
2016S0230	ABB-11-15-06	0.95 ± 0.17	0.80 ± 0.08	0.02 ± 0.04	0.43 ± 0.37	0.14 ± 0.15	**3.6 ± 3.8**	0.43
2016S0231	ABB-11-15-07	1.09 ± 0.17	0.76 ± 0.07	-0.02 ± 0.05	1.11 ± 0.37	0.06 ± 0.16	2.28 ± 0.76	0.44
CE-FSS-38-04 (Part of ORAU Confirmatory Unit 3)								
2016S0253	ABB-11-20-1	0.92 ± 0.15	0.54 ± 0.06	0.02 ± 0.05	0.7 ± 1.5	0.11 ± 0.07	**3.2 ± 2.1**	0.36
2016S0254	ABB-11-20-2	0.87 ± 0.15	0.59 ± 0.07	0.02 ± 0.04	0.28 ± 0.06	0.17 ± 0.14	**4.1 ± 3.0**	0.36
2016S0255	ABB-11-20-3	0.96 ± 0.13	0.73 ± 0.06	-0.01 ± 0.04	1.25 ± 0.27	2.92 ± 0.21	**67.5 ± 4.6**	0.52
2016S0256	ABB-11-20-4	0.91 ± 0.15	0.70 ± 0.08	-0.07 ± 0.06	0.82 ± 0.35	0.12 ± 0.16	**3.5 ± 3.5**	0.38
CE-FSS-38-05 (Part of ORAU Confirmatory Unit 3)								
2016S0281	ABB-11-24-10	0.74 ± 0.12	0.52 ± 0.06	-0.01 ± 0.05	1.15 ± 0.31	0.30 ± 0.08	**8.0 ± 1.8**	0.31
2016S0282	ABB-11-24-11	1.01 ± 0.15	0.79 ± 0.07	0.00 ± 0.05	1.11 ± 0.31	0.13 ± 0.19	2.35 ± 0.65	0.43
2016S0283	ABB-11-24-12	1.15 ± 0.18	0.78 ± 0.08	-0.02 ± 0.05	1.10 ± 0.34	0.08 ± 0.14	2.28 ± 0.69	0.46
BURNING GROUNDS AREA								
CE-FSS-39-01 (Part of ORAU Confirmatory Unit 2)								
2016S0190	ABB-11-9-1	1.11 ± 0.17	0.83 ± 0.08	0.03 ± 0.06	0.81 ± 0.33	0.20 ± 0.24	1.82 ± 0.70	0.47
2016S0191	ABB-11-9-2	0.76 ± 0.12	0.52 ± 0.05	0.02 ± 0.04	0.54 ± 0.24	0.00 ± 0.16	1.08 ± 0.51	0.31
2016S0192	ABB-11-9-3	0.66 ± 0.12	0.49 ± 0.06	0.05 ± 0.04	0.67 ± 0.27	0.08 ± 0.13	1.42 ± 0.56	0.29
2016S0193	ABB-11-9-4	0.60 ± 0.10	0.52 ± 0.06	0.00 ± 0.05	0.59 ± 0.25	0.00 ± 0.12	1.18 ± 0.51	0.27
2016S0194	ABB-11-9-5	1.47 ± 0.22	0.54 ± 0.07	0.01 ± 0.05	0.45 ± 0.31	1.03 ± 0.14	**23.8 ± 3.1**	0.53

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0195	ABB-11-9-6	0.97 ± 0.14	0.62 ± 0.06	-0.02 ± 0.05	1.00 ± 1.30	0.16 ± 0.06	2.20 ± 2.6	0.38
2016S0196	ABB-11-9-7	0.79 ± 0.14	0.51 ± 0.06	-0.02 ± 0.06	0.69 ± 0.35	0.03 ± 0.14	1.41 ± 0.71	0.31
2016S0197	ABB-11-9-8	0.42 ± 0.09	0.30 ± 0.04	0.00 ± 0.04	0.31 ± 0.23	0.07 ± 0.14	0.69 ± 0.48	0.17
2016S0198	ABB-11-9-9	1.14 ± 0.16	0.60 ± 0.06	-0.04 ± 0.04	0.75 ± 0.30	0.12 ± 0.06	1.62 ± 0.60	0.41
2016S0199	ABB-11-9-10	0.81 ± 0.14	0.51 ± 0.06	0.01 ± 0.05	0.46 ± 0.29	0.03 ± 0.14	0.95 ± 0.60	0.32
2016S0200	ABB-11-9-11	1.54 ± 0.22	0.52 ± 0.06	-0.07 ± 0.06	0.90 ± 0.42	0.16 ± 0.25	1.96 ± 0.88	0.49
2016S0201	ABB-11-9-12	1.03 ± 0.15	0.69 ± 0.06	-0.04 ± 0.05	0.94 ± 0.26	0.03 ± 0.16	1.91 ± 0.54	0.41
2016S0202	ABB-11-9-13	1.01 ± 0.15	0.76 ± 0.08	-0.01 ± 0.05	0.52 ± 0.26	0.06 ± 0.14	1.10 ± 0.54	0.42
CE-FSS-39-02 (Part of ORAU Confirmatory Unit 2)								
2016S0185	ABB-11-10-1	1.01 ± 0.17	0.71 ± 0.08	0.02 ± 0.06	0.77 ± 0.37	0.11 ± 0.16	1.65 ± 0.76	0.42
2016S0186	ABB-11-10-2	0.86 ± 0.16	0.64 ± 0.08	-0.03 ± 0.06	0.62 ± 0.39	0.03 ± 0.25	1.27 ± 0.82	0.35
2016S0187	ABB-11-10-3	0.95 ± 0.14	0.61 ± 0.06	0.02 ± 0.04	0.52 ± 0.23	0.06 ± 0.15	1.10 ± 0.48	0.38
2016S0188	ABB-11-10-4	0.70 ± 0.13	0.54 ± 0.06	0.01 ± 0.05	0.42 ± 0.29	0.08 ± 0.14	0.92 ± 0.60	0.30
2016S0189	ABB-11-10-5	0.72 ± 0.11	0.60 ± 0.05	0.00 ± 0.03	0.54 ± 0.20	0.01 ± 0.14	1.09 ± 0.42	0.32
CE-FSS-39-03 (Part of ORAU Confirmatory Unit 2)								
2016S0205	ABB-11-12-1	2.54 ± 0.36	1.84 ± 0.13	0.00 ± 0.06	2.18 ± 0.41	-0.07 ± 0.18	4.29 ± 0.84	1.05
2016S0206	ABB-11-12-2	0.97 ± 0.14	0.70 ± 0.07	0.01 ± 0.05	0.79 ± 0.29	0.09 ± 0.18	1.67 ± 0.61	0.40
2016S0207	ABB-11-12-3	1.49 ± 0.19	1.06 ± 0.08	0.01 ± 0.04	1.34 ± 0.29	0.26 ± 0.18	**7.2 ± 3.9**	0.62
2016S0208	ABB-11-12-4	1.52 ± 0.20	1.11 ± 0.09	-0.01 ± 0.04	0.96 ± 0.29	0.08 ± 0.15	2.00 ± 0.60	0.63

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
CE-FSS-39-04 (Part of ORAU Confirmatory Unit 2)								
2016S0267	ABB-11-23-1	1.19 ± 0.18	0.83 ± 0.08	-0.02 ± 0.04	1.03 ± 0.67	-0.03 ± 0.15	2.0 ± 1.3	0.48
2016S0268	ABB-11-23-2	1.10 ± 0.17	0.70 ± 0.08	0.05 ± 0.05	1.5 ± 2.3	0.07 ± 0.16	3.1 ± 4.6	0.45
2016S0269	ABB-11-23-3	1.04 ± 0.16	0.71 ± 0.07	-0.03 ± 0.05	1.14 ± 0.33	-0.05 ± 0.15	2.23 ± 0.68	0.42
2016S0270	ABB-11-23-4	0.80 ± 0.14	0.46 ± 0.06	-0.02 ± 0.05	0.83 ± 0.29	0.22 ± 0.17	**5.8 ± 3.7**	0.31
2016S0271	ABB-11-23-5	0.87 ± 0.14	0.57 ± 0.06	0.01 ± 0.04	0.64 ± 0.31	0.15 ± 0.15	**4.0 ± 3.3**	0.35
B2 SANITARY WASTE LINE								
CE-FSS-40-01 (Part of ORAU Confirmatory Unit 3)								
2016S0129	ABB-12-22-1	1.07 ± 0.20	0.76 ± 0.07	0.02 ± 0.05	1.05 ± 0.29	0.15 ± 0.07	2.25 ± 0.58	0.44
2016S0130	ABB-12-22-2	0.98 ± 0.15	0.73 ± 0.07	-0.01 ± 0.06	0.44 ± 0.31	0.13 ± 0.22	1.01 ± 0.66	0.41
2016S0131	ABB-12-22-3	0.72 ± 0.10	0.54 ± 0.05	0.00 ± 0.03	0.76 ± 0.19	0.22 ± 0.05	1.74 ± 0.38	0.30
INDUSTRIAL WASTE LINE AREA								
CE-FSS-42-01 (Part of ORAU Confirmatory Unit 6)								
2016S0018	ABB-10-2-1	0.68 ± 0.10	0.51 ± 0.05	0.00 ± 0.03	0.60 ± 0.18	0.05 ± 0.09	1.25 ± 0.37	0.29
2016S0019	ABB-10-2-2	0.53 ± 0.09	0.40 ± 0.04	-0.01 ± 0.03	0.53 ± 0.17	0.01 ± 0.12	1.07 ± 0.36	0.22
2016S0020	ABB-10-2-3	0.74 ± 0.10	0.53 ± 0.04	0.01 ± 0.02	0.56 ± 0.14	0.01 ± 0.10	1.13 ± 0.30	0.31
2016S0021	ABB-10-2-4	0.98 ± 0.12	0.60 ± 0.05	0.02 ± 0.02	0.98 ± 0.37	0.04 ± 0.08	2.00 ± 0.74	0.39
2016S0022	ABB-10-2-5	0.72 ± 0.10	0.56 ± 0.05	-0.03 ± 0.03	0.70 ± 0.19	0.05 ± 0.08	1.45 ± 0.39	0.30
2016S0023	ABB-10-2-6	0.73 ± 0.10	0.56 ± 0.05	0.01 ± 0.03	0.84 ± 0.19	0.05 ± 0.09	1.73 ± 0.39	0.31

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0024	ABB-10-2-7	0.75 ± 0.10	0.52 ± 0.04	0.00 ± 0.02	0.72 ± 0.15	0.10 ± 0.10	1.54 ± 0.32	0.31
2016S0025	ABB-10-2-8	0.84 ± 0.12	0.64 ± 0.05	0.02 ± 0.04	0.75 ± 0.23	0.27 ± 0.06	1.77 ± 0.46	0.36
2016S0026	ABB-10-2-9	0.88 ± 0.11	0.64 ± 0.05	0.00 ± 0.03	1.07 ± 0.39	0.08 ± 0.04	2.22 ± 0.78	0.37
2016S0027	ABB-10-2-10	0.89 ± 0.14	0.61 ± 0.06	0.04 ± 0.04	0.84 ± 0.28	0.04 ± 0.13	1.72 ± 0.57	0.37
CE-FSS-42-02 (Part of ORAU Confirmatory Unit 6)								
2016S0028	ABB-10-2-11	0.85 ± 0.14	0.63 ± 0.07	-0.02 ± 0.06	0.99 ± 0.34	-0.07 ± 0.22	1.91 ± 0.71	0.35
2016S0029	ABB-10-2-12	0.78 ± 0.11	0.46 ± 0.05	0.01 ± 0.03	0.59 ± 0.22	0.01 ± 0.13	1.19 ± 0.46	0.30
2016S0030	ABB-10-2-13	0.74 ± 0.12	0.57 ± 0.06	0.00 ± 0.04	0.78 ± 0.27	0.08 ± 0.12	1.64 ± 0.55	0.31
2016S0031	ABB-10-2-14	0.80 ± 0.11	0.55 ± 0.05	-0.01 ± 0.03	0.89 ± 0.19	0.14 ± 0.04	1.92 ± 0.38	0.32
2016S0032	ABB-10-2-15	0.73 ± 0.10	0.52 ± 0.05	-0.01 ± 0.04	0.49 ± 0.20	0.08 ± 0.13	1.06 ± 0.42	0.30
2016S0033	ABB-10-2-16	0.75 ± 0.10	0.51 ± 0.04	-0.01 ± 0.03	0.66 ± 0.15	0.03 ± 0.10	1.35 ± 0.32	0.30
2016S0034	ABB-10-2-17	0.59 ± 0.08	0.43 ± 0.04	0.00 ± 0.02	0.58 ± 0.15	0.04 ± 0.07	1.20 ± 0.31	0.25
2016S0035	ABB-10-2-18	0.70 ± 0.10	0.58 ± 0.05	0.00 ± 0.03	0.71 ± 0.18	0.11 ± 0.09	1.53 ± 0.37	0.31
2016S0036	ABB-10-2-19	0.48 ± 0.08	0.33 ± 0.04	0.03 ± 0.03	0.48 ± 0.16	0.07 ± 0.04	1.03 ± 0.32	0.20
2016S0037	ABB-10-2-20	0.67 ± 0.09	0.49 ± 0.04	-0.01 ± 0.02	0.50 ± 0.13	0.01 ± 0.09	1.01 ± 0.28	0.28
CE-FSS-42-03 (Part of ORAU Confirmatory Unit 6)								
2016S0038	ABB-10-3-1	0.67 ± 0.11	0.45 ± 0.05	-0.04 ± 0.04	0.68 ± 0.22	0.10 ± 0.12	1.46 ± 0.46	0.26
2016S0039	ABB-10-3-2	0.34 ± 0.08	0.31 ± 0.05	0.04 ± 0.04	0.53 ± 0.22	0.03 ± 0.16	1.09 ± 0.47	0.16
2016S0040	ABB-10-3-3	0.70 ± 0.11	0.45 ± 0.04	0.01 ± 0.04	0.70 ± 0.21	-0.09 ± 0.14	1.31 ± 0.44	0.28

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0041	ABB-10-3-4	1.02 ± 0.16	0.72 ± 0.07	-0.03 ± 0.04	0.98 ± 0.29	0.06 ± 0.13	2.02 ± 0.59	0.41
2016S0042	ABB-10-3-5	1.03 ± 0.15	0.70 ± 0.07	-0.03 ± 0.05	0.75 ± 0.30	0.00 ± 0.14	1.50 ± 0.62	0.41
2016S0043	ABB-10-3-6	0.45 ± 0.09	0.35 ± 0.05	0.02 ± 0.04	0.87 ± 0.59	-0.12 ± 0.17	1.6 ± 1.2	0.20
2016S0044	ABB-10-3-7	1.16 ± 0.16	0.80 ± 0.07	0.02 ± 0.05	0.89 ± 0.28	-0.02 ± 0.18	1.76 ± 0.59	0.47
2016S0045	ABB-10-3-8	1.24 ± 0.17	0.89 ± 0.08	-0.01 ± 0.04	1.15 ± 0.62	-0.12 ± 0.14	2.2 ± 1.2	0.51
2016S0046	ABB-10-3-9	0.54 ± 0.10	0.45 ± 0.05	-0.04 ± 0.05	0.64 ± 0.23	0.06 ± 0.11	1.34 ± 0.47	0.23
2016S0047	ABB-10-3-10	0.85 ± 0.14	0.70 ± 0.07	0.00 ± 0.06	0.78 ± 0.35	0.07 ± 0.21	1.63 ± 0.73	0.37
CE-FSS-42-04 (Part of ORAU Confirmatory Unit 6)								
2016S0048	ABB-10-3-11	0.77 ± 0.11	0.61 ± 0.05	0.03 ± 0.04	0.45 ± 0.19	0.07 ± 0.14	0.97 ± 0.40	0.34
2016S0049	ABB-10-3-12	0.46 ± 0.08	0.38 ± 0.05	-0.01 ± 0.03	0.80 ± 0.40	0.04 ± 0.10	1.64 ± 0.81	0.20
2016S0050	ABB-10-3-13	0.91 ± 0.14	0.72 ± 0.07	-0.04 ± 0.05	0.80 ± 0.28	0.10 ± 0.14	1.70 ± 0.58	0.38
2016S0051	ABB-10-3-14	0.83 ± 0.14	0.65 ± 0.07	0.00 ± 0.05	0.71 ± 0.25	-0.03 ± 0.20	1.39 ± 0.54	0.35
2016S0052	ABB-10-3-15	0.65 ± 0.11	0.47 ± 0.05	-0.03 ± 0.04	0.73 ± 0.21	-0.06 ± 0.14	1.40 ± 0.44	0.26
2016S0053	ABB-10-3-16	0.78 ± 0.12	0.59 ± 0.06	-0.01 ± 0.04	0.45 ± 0.05	0.08 ± 0.12	0.98 ± 0.16	0.33
2016S0054	ABB-10-3-17	1.19 ± 0.18	0.90 ± 0.08	0.00 ± 0.06	1.18 ± 0.34	0.11 ± 0.16	2.47 ± 0.70	0.50
2016S0055	ABB-10-3-18	0.56 ± 0.10	0.43 ± 0.06	0.02 ± 0.04	0.38 ± 0.23	0.14 ± 0.16	0.90 ± 0.49	0.24
2016S0056	ABB-10-3-19	0.53 ± 0.09	0.35 ± 0.04	-0.01 ± 0.03	0.36 ± 0.16	0.08 ± 0.04	0.80 ± 0.32	0.21
2016S0057	ABB-10-3-20	0.45 ± 0.08	0.34 ± 0.04	0.01 ± 0.03	0.27 ± 0.19	0.04 ± 0.09	0.58 ± 0.39	0.19

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
CE-FSS-42-05 (Part of ORAU Confirmatory Unit 6)								
2016S0058	ABB-10-4-1	0.38 ± 0.08	0.31 ± 0.04	0.02 ± 0.04	0.44 ± 0.19	-0.01 ± 0.10	0.87 ± 0.39	0.17
2016S0059	ABB-10-4-2	0.43 ± 0.09	0.28 ± 0.04	-0.04 ± 0.04	0.42 ± 0.22	0.08 ± 0.14	0.92 ± 0.46	0.16
2016S0060	ABB-10-4-3	0.45 ± 0.08	0.27 ± 0.03	-0.01 ± 0.03	0.35 ± 0.15	0.09 ± 0.10	0.79 ± 0.32	0.17
2016S0061	ABB-10-4-4	0.51 ± 0.09	0.35 ± 0.04	0.00 ± 0.03	0.30 ± 0.18	0.00 ± 0.10	0.60 ± 0.37	0.21
2016S0062	ABB-10-4-5	0.77 ± 0.12	0.52 ± 0.06	0.01 ± 0.04	0.53 ± 0.23	0.03 ± 0.12	1.09 ± 0.48	0.31
2016S0063	ABB-10-4-6	0.45 ± 0.09	0.34 ± 0.05	0.03 ± 0.04	0.31 ± 0.21	0.02 ± 0.17	0.64 ± 0.45	0.20
2016S0064	ABB-10-4-7	0.41 ± 0.07	0.32 ± 0.03	0.02 ± 0.03	0.20 ± 0.18	0.04 ± 0.11	0.44 ± 0.38	0.18
2016S0065	ABB-10-4-8	0.44 ± 0.08	0.28 ± 0.04	-0.01 ± 0.03	0.39 ± 0.18	0.01 ± 0.09	0.79 ± 0.37	0.17
2016S0066	ABB-10-4-9	0.68 ± 0.11	0.50 ± 0.06	-0.01 ± 0.04	0.67 ± 0.25	0.06 ± 0.12	1.40 ± 0.51	0.28
2016S0067	ABB-10-4-10	0.94 ± 0.15	0.77 ± 0.07	0.02 ± 0.05	0.62 ± 0.31	-0.01 ± 0.23	1.23 ± 0.66	0.41
CE-FSS-42-06 (Part of ORAU Confirmatory Unit 6)								
2016S0068	ABB-10-4-11	0.58 ± 0.10	0.47 ± 0.05	0.02 ± 0.03	0.46 ± 0.18	-0.08 ± 0.13	0.84 ± 0.38	0.25
2016S0069	ABB-10-4-12	0.66 ± 0.10	0.54 ± 0.05	-0.04 ± 0.03	0.65 ± 0.20	0.00 ± 0.10	1.30 ± 0.41	0.28
2016S0070	ABB-10-4-13	1.04 ± 0.15	0.74 ± 0.07	-0.03 ± 0.06	0.94 ± 0.29	0.13 ± 0.14	2.01 ± 0.60	0.42
2016S0071	ABB-10-4-14	0.71 ± 0.12	0.53 ± 0.06	-0.01 ± 0.05	0.74 ± 0.28	0.13 ± 0.19	1.61 ± 0.59	0.30
2016S0072	ABB-10-4-15	0.91 ± 0.13	0.67 ± 0.06	0.02 ± 0.04	0.61 ± 0.23	0.02 ± 0.15	1.24 ± 0.48	0.38
2016S0073	ABB-10-4-16	0.88 ± 0.13	0.64 ± 0.06	0.02 ± 0.04	0.62 ± 0.21	0.06 ± 0.11	1.30 ± 0.43	0.37
2016S0074	ABB-10-4-17	0.77 ± 0.13	0.46 ± 0.06	0.00 ± 0.06	0.50 ± 0.26	0.00 ± 0.13	1.00 ± 0.54	0.30

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0075	ABB-10-4-18	0.57 ± 0.11	0.40 ± 0.05	0.01 ± 0.05	0.35 ± 0.25	0.22 ± 0.18	**0.92 ± 0.53**	0.24
2016S0076	ABB-10-4-19	0.80 ± 0.12	0.56 ± 0.05	-0.02 ± 0.04	0.68 ± 0.25	-0.06 ± 0.16	1.30 ± 0.52	0.32
2016S0077	ABB-10-4-20	0.81 ± 0.11	0.58 ± 0.05	0.02 ± 0.03	0.54 ± 0.18	0.06 ± 0.13	1.14 ± 0.38	0.34
CE-FSS-42-07 (Part of ORAU Confirmatory Unit 6)								
2016S0078	ABB-10-5-1	0.69 ± 0.10	0.48 ± 0.04	-0.01 ± 0.03	0.40 ± 0.18	0.04 ± 0.09	0.84 ± 0.37	0.28
2016S0080	ABB-10-5-3	0.59 ± 0.10	0.47 ± 0.05	0.03 ± 0.03	0.52 ± 0.20	0.00 ± 0.13	1.04 ± 0.42	0.26
2016S0081	ABB-10-5-4	1.02 ± 0.14	0.68 ± 0.07	0.02 ± 0.04	0.66 ± 0.34	0.07 ± 0.12	1.39 ± 0.69	0.41
2016S0082	ABB-10-5-5	0.34 ± 0.07	0.28 ± 0.04	-0.02 ± 0.04	0.35 ± 0.18	0.05 ± 0.09	0.75 ± 0.37	0.14
2016S0083	ABB-10-5-6	0.43 ± 0.07	0.31 ± 0.03	0.01 ± 0.03	0.36 ± 0.14	0.12 ± 0.10	0.84 ± 0.30	0.18
2016S0084	ABB-10-5-7	0.86 ± 0.13	0.63 ± 0.06	0.04 ± 0.04	0.62 ± 0.26	0.00 ± 0.18	1.24 ± 0.55	0.37
2016S0085	ABB-10-5-8	0.73 ± 0.10	0.48 ± 0.05	0.00 ± 0.03	0.40 ± 0.17	0.06 ± 0.09	0.86 ± 0.35	0.29
2016S0086	ABB-10-5-9	0.75 ± 0.11	0.56 ± 0.05	0.02 ± 0.04	0.53 ± 0.23	-0.10 ± 0.16	0.96 ± 0.49	0.32
2016S0087	ABB-10-5-10	0.77 ± 0.10	0.59 ± 0.05	-0.02 ± 0.03	0.70 ± 0.20	0.06 ± 0.13	1.46 ± 0.42	0.32
CE-FSS-42-08 (Part of ORAU Confirmatory Unit 6)								
2016S0079	ABB-10-5-2	0.90 ± 0.13	0.73 ± 0.07	-0.01 ± 0.05	0.77 ± 0.23	-0.12 ± 0.13	1.42 ± 0.48	0.39
CE-FSS-42-09 (Part of ORAU Confirmatory Unit 6)								
2016S0297	ABB-11-27-01	0.72 ± 0.12	0.55 ± 0.06	-0.02 ± 0.05	0.74 ± 0.32	0.09 ± 0.08	1.57 ± 0.64	0.30
2016S0298	ABB-11-27-02	0.79 ± 0.11	0.62 ± 0.05	-0.01 ± 0.04	0.94 ± 0.27	0.08 ± 0.08	1.96 ± 0.55	0.34
2016S0299	ABB-11-27-03	0.81 ± 0.13	0.62 ± 0.06	0.00 ± 0.04	0.61 ± 0.35	0.07 ± 0.06	1.29 ± 0.70	0.34

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0300	ABB-11-27-04	0.89 ± 0.14	0.63 ± 0.07	-0.03 ± 0.05	0.92 ± 0.32	0.01 ± 0.13	1.85 ± 0.65	0.36
2016S0301	ABB-11-27-05	0.68 ± 0.10	0.50 ± 0.05	0.00 ± 0.03	0.62 ± 0.23	0.05 ± 0.06	1.29 ± 0.46	0.28
2016S0302	ABB-11-27-06	0.70 ± 0.12	0.52 ± 0.06	0.00 ± 0.04	0.82 ± 0.38	-0.03 ± 0.12	1.61 ± 0.77	0.29
2016S0303	ABB-11-27-07	0.85 ± 0.14	0.55 ± 0.06	0.05 ± 0.03	0.72 ± 0.38	0.12 ± 0.09	1.56 ± 0.77	0.35
CE-FSS-42-10 (Part of ORAU Confirmatory Unit 6)								
2016S0314	ABB-11-30-1	0.82 ± 0.19	0.57 ± 0.09	0.03 ± 0.07	1.18 ± 0.61	0.10 ± 0.20	2.5 ± 1.2	0.34
2016S0315	ABB-11-30-2	0.76 ± 0.13	0.54 ± 0.06	0.03 ± 0.05	0.86 ± 0.34	0.20 ± 0.08	**5.4 ± 1.8**	0.33
2016S0316	ABB-11-30-3	0.48 ± 0.11	0.35 ± 0.05	0.00 ± 0.04	0.30 ± 0.33	0.09 ± 0.11	**2.3 ± 2.4**	0.20
WASTE WATER TREATMENT PLANT AREAS								
CE-FSS-43-01 (Part of ORAU Confirmatory Unit 7)								
2016S0088	ABB-10-8-1	0.85 ± 0.13	0.68 ± 0.07	0.02 ± 0.05	0.74 ± 0.27	0.03 ± 0.13	1.51 ± 0.56	0.37
2016S0089	ABB-10-8-2	0.77 ± 0.13	0.66 ± 0.07	-0.04 ± 0.05	0.64 ± 0.28	0.27 ± 0.19	1.55 ± 0.59	0.33
2016S0090	ABB-10-8-3	0.77 ± 0.11	0.64 ± 0.05	0.00 ± 0.04	1.03 ± 0.25	0.22 ± 0.06	2.28 ± 0.50	0.34
2016S0091	ABB-10-8-4	0.78 ± 0.12	0.57 ± 0.06	0.03 ± 0.03	0.86 ± 0.25	0.08 ± 0.11	1.80 ± 0.51	0.33
2016S0092	ABB-10-8-5	0.73 ± 0.12	0.56 ± 0.06	-0.01 ± 0.05	0.65 ± 0.26	0.04 ± 0.12	1.34 ± 0.53	0.31
2016S0093	ABB-10-8-6	0.86 ± 0.14	0.70 ± 0.08	-0.01 ± 0.05	0.73 ± 0.27	0.20 ± 0.19	1.66 ± 0.57	0.37
2016S0099	ABB-10-13-1	1.58 ± 0.21	0.89 ± 0.08	-0.02 ± 0.06	0.86 ± 0.31	0.15 ± 0.10	1.87 ± 0.63	0.59
2016S0100	ABB-10-13-2	0.91 ± 0.13	0.55 ± 0.06	0.03 ± 0.04	0.63 ± 0.34	0.02 ± 0.12	1.28 ± 0.69	0.36
2016S0101	ABB-10-13-3	0.94 ± 0.14	0.78 ± 0.07	0.03 ± 0.05	0.73 ± 0.30	0.11 ± 0.14	1.57 ± 0.62	0.42

TABLE F-2

CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0102	ABB-10-13-4	0.96 ± 0.16	0.61 ± 0.07	0.01 ± 0.05	0.70 ± 0.28	-0.02 ± 0.21	1.38 ± 0.60	0.38
CE-FSS-43-02 (Part of ORAU Confirmatory Unit 7)								
2016S0094	ABB-10-8-7	0.90 ± 0.14	0.62 ± 0.05	-0.01 ± 0.04	0.85 ± 0.24	0.01 ± 0.15	1.71 ± 0.50	0.36
2016S0095	ABB-10-8-8	0.69 ± 0.11	0.58 ± 0.06	0.03 ± 0.03	0.38 ± 0.70	0.07 ± 0.12	0.8 ± 1.4	0.31
2016S0096	ABB-10-8-9	0.74 ± 0.12	0.56 ± 0.06	-0.03 ± 0.05	0.58 ± 0.24	0.06 ± 0.13	1.22 ± 0.50	0.31
2016S0097	ABB-10-8-10	0.76 ± 0.13	0.58 ± 0.07	0.02 ± 0.05	0.40 ± 0.26	0.13 ± 0.19	0.93 ± 0.55	0.32
2016S0098	ABB-10-8-11	0.78 ± 0.12	0.66 ± 0.06	0.01 ± 0.04	0.64 ± 0.22	0.05 ± 0.15	1.33 ± 0.46	0.35
CE-FSS-43-03 (Part of ORAU Confirmatory Unit 7)								
2016S0103	ABB-11-10-1	0.77 ± 0.13	0.64 ± 0.07	0.04 ± 0.05	0.77 ± 0.27	0.12 ± 0.13	1.66 ± 0.56	0.35
2016S0104	ABB-11-10-2	0.57 ± 0.11	0.46 ± 0.06	0.07 ± 0.04	0.59 ± 0.25	0.02 ± 0.18	1.20 ± 0.53	0.26
2016S0105	ABB-11-10-3	0.81 ± 0.13	0.63 ± 0.06	0.02 ± 0.04	0.92 ± 0.53	-0.01 ± 0.12	1.8 ± 1.1	0.35
2016S0106	ABB-11-10-4	0.66 ± 0.11	0.50 ± 0.06	0.03 ± 0.04	0.54 ± 0.23	0.06 ± 0.12	1.14 ± 0.48	0.28
2016S0107	ABB-11-10-5	0.75 ± 0.14	0.55 ± 0.07	0.00 ± 0.05	0.45 ± 0.25	0.20 ± 0.20	1.10 ± 0.54	0.31
2016S0108	ABB-11-10-6	0.79 ± 0.12	0.63 ± 0.06	0.00 ± 0.04	0.80 ± 0.25	0.01 ± 0.12	1.61 ± 0.51	0.34
2016S0109	ABB-11-10-7	0.91 ± 0.14	0.66 ± 0.07	-0.02 ± 0.05	0.66 ± 0.27	0.08 ± 0.13	1.40 ± 0.56	0.37
2016S0110	ABB-11-10-8	0.67 ± 0.12	0.54 ± 0.06	0.00 ± 0.05	0.48 ± 0.27	0.12 ± 0.18	1.08 ± 0.57	0.29
CE-FSS-43-04 (Part of ORAU Confirmatory Unit 7)								
2016S0111	ABB-11-10-9	0.65 ± 0.10	0.56 ± 0.05	0.00 ± 0.04	0.63 ± 0.21	0.07 ± 0.14	1.33 ± 0.44	0.29
2016S0112	ABB-11-10-10	0.86 ± 0.13	0.62 ± 0.06	-0.01 ± 0.04	0.60 ± 0.54	0.08 ± 0.12	1.3 ± 1.1	0.35

TABLE F-2
CONCENTRATIONS OF SELECTED GAMMA EMITTERS IN NRC SPLIT SOIL SAMPLES BY GAMMA SPECTROSCOPY CP1, REVISION 17 ABB COMBUSTION ENGINEERING SITE. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)						SOR[b]
		Th-232 by Ac-228	Ra-226 by Pb-214	Co-60	U-238 by Th-234	U-235	Total U[a]	
2016S0113	ABB-11-10-11	0.66 ± 0.11	0.41 ± 0.05	0.04 ± 0.04	0.64 ± 0.25	0.07 ± 0.11	1.35 ± 0.51	0.27
2016S0114	ABB-11-10-12	0.80 ± 0.13	0.63 ± 0.06	0.01 ± 0.05	0.45 ± 0.31	0.07 ± 0.20	0.97 ± 0.65	0.34
2016S0115	ABB-11-10-13	0.74 ± 0.12	0.55 ± 0.05	-0.03 ± 0.04	0.67 ± 0.23	0.07 ± 0.14	1.41 ± 0.48	0.30
2016S0116	ABB-11-10-14	0.99 ± 0.15	0.65 ± 0.06	0.00 ± 0.04	0.84 ± 0.28	-0.08 ± 0.13	1.60 ± 0.57	0.39
2016S0117	ABB-11-10-15	0.96 ± 0.15	0.64 ± 0.06	-0.01 ± 0.05	0.58 ± 0.27	0.00 ± 0.13	1.16 ± 0.56	0.38
2016S0118	ABB-11-10-16	0.83 ± 0.13	0.59 ± 0.06	-0.01 ± 0.05	0.66 ± 0.32	-0.12 ± 0.20	1.20 ± 0.67	0.34

[a]Natural total uranium is calculated using U-238*2 + U-235. Enriched uranium values (shaded green) were calculated using U-238 + U-235 + (21.7 * U-235). Red shaded values indicate samples that exceeded the release criteria.

[b]SOR = Sum of Ratios.

[c]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

[d]Zero values are due to rounding or sample and background being equal.

TABLE F-3
CONCENTRATIONS OF URANIUM IN SOIL SAMPLES BY ALPHA SPECTROSCOPY AP11, REVISION 5; CP2, REVISION 15 ABB, INC. WINDSOR, CONNECTICUT

ORISE Sample ID	NRC Region I Sample ID	Radionuclide Concentrations (pCi/g dry weight)				
		U-234	U-235	U-238	Total U[a]	Total U by Gamma Spectroscopy[b]
2016S0009	ABB-10-1-9	22.5 ± 1.8[c] , 0.0[d,e]	0.77 ± 0.10 , 0.01	0.77 ± 0.10 , 0.02	24.0 ± 1.8	24.5 ± 2.9
2016S0010	ABB-10-1-10	27.4 ± 2.2 , 0.0	1.02 ± 0.13 , 0.02	1.02 ± 0.12 , 0.03	29.4 ± 2.2	22.0 ± 2.2
2016S0011	ABB-10-1-11	45.3 ± 3.7 , 0.0	1.61 ± 0.18 , 0.03	0.88 ± 0.11 , 0.02	47.8 ± 3.7	36.4 ± 3.6
2016S0013	ABB-10-1-13	2.01 ± 0.20 , 0.01	0.07 ± 0.03 , 0.01	0.79 ± 0.10 , 0.01	2.87 ± 0.23	2.08 ± 0.65
2016S0015	ABB-10-1-15	22.5 ± 1.8 , 0.0	0.77 ± 0.10 , 0.01	0.83 ± 0.10 , 0.02	24.1 ± 1.8	21.0 ± 2.2
2016S0017	ABB-10-1-17	6.33 ± 0.55 , 0.03	0.25 ± 0.05 , 0.03	0.69 ± 0.09 , 0.02	7.28 ± 0.56	8.0 ± 2.0
2016S0275	ABB-11-24-4	797 ± 54 , 1	24.4 ± 3.4 , 1.7	18.0 ± 2.6 , 0.2	839 ± 54	796 ± 46
2016S0275 Duplicate	ABB-11-24-4 Duplicate	821 ± 57 , 2	30.9 ± 4.1 , 1.3	16.7 ± 2.6 , 1.1	868 ± 58	NA[f]
2016S0251	ABB-11-19-9	2,350 ± 180 , 14	81 ± 18 , 3	17.5 ± 7.7 , 7.6	2,500 ± 180	1,850 ± 106
2016S0251 Duplicate	ABB-11-19-9	2,360 ± 180 , 10	82 ± 19 , 3	17.0 ± 8.6 , 12.0	2,500 ± 180	NA[f]

[a]Total uranium by alpha spectroscopy is calculated using U-234 + U-235 + U-238.

[b]Total uranium by gamma spectroscopy is calculated using U-238 + U-235 + U235*(21.7) for enriched uranium.

[c]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

[d]MDCs are after the commas.

[e]Zero values are due to rounding.

[f]Total U by gamma spectroscopy not performed for these duplicate samples

TABLE F-4

CONCENTRATIONS OF GROSS ALPHA AND GROSS BETA IN SOIL SAMPLES BY GAS FLOW PROPORTIONAL COUNTING AP1, REVISION 17; CP3, REVISION 2 ABB, INC. WINDSOR, CONNECTICUT

ORISE Sample ID[a]	NRC Region I Sample ID	Radionuclide Concentrations, TPUs[b], and MDCs[c] (pCi/g)	
		Gross Alpha	Gross Beta
2016S0157	ABB-11-4-1	1.1 ± 3.0 , 5.4	17.6 ± 3.0 , 4.2
2016S0167	ABB-11-6-2	3.1 ± 3.2 , 5.3	17.1 ± 3.1 , 4.2
2016S0177	ABB-11-8-3	1.2 ± 3.0 , 5.3	18.4 ± 3.1 , 4.2
2016S0187	ABB-11-10-3	2.0 ± 3.0 , 5.1	17.6 ± 3.0 , 4.2
2016S0197	ABB-11-9-8	3.8 ± 3.3 , 5.3	18.4 ± 3.1 , 4.2
2016S0202	ABB-11-9-13	2.2 ± 3.1 , 5.2	18.7 ± 3.1 , 4.1
2016S0203	ABB-11-11-1	4.9 ± 2.4 , 3.0	17.9 ± 3.0 , 4.1
2016S0206	ABB-11-12-2	12.7 ± 3.4 , 3.0	21.4 ± 3.2 , 4.3
2016S0210	ABB-11-13-2	15.7 ± 3.8 , 3.1	20.1 ± 3.5 , 4.7
2016S0212	ABB-11-13-4	10.9 ± 3.1 , 2.9	18.5 ± 3.2 , 4.4
2016S0216	ABB-11-14-2	132.8 ± 9.9 , 3.0	18.6 ± 3.3 , 4.3
2016S0223	ABB-11-14-9	34.5 ± 5.2 , 3.0	16.4 ± 3.1 , 4.3
2016S0229	ABB-11-15-05	14.9 ± 3.6 , 3.3	22.0 ± 3.0 , 3.8
2016S0234	ABB-11-16-03	7.1 ± 3.0 , 3.7	17.5 ± 2.9 , 3.9
2016S0235	ABB-11-17-1	12.4 ± 3.2 , 3.0	23.0 ± 3.1 , 3.9
2016S0238	ABB-11-17-4	8.9 ± 3.2 , 3.6	21.3 ± 3.2 , 4.2
2016S0245	ABB-11-19-3	92.2 ± 8.3 , 3.4	23.7 ± 3.2 , 3.9
2016S0250	ABB-11-19-8	26.9 ± 4.7 , 3.4	14.9 ± 2.9 , 3.9
2016S0257	ABB-11-21-1	9.3 ± 3.4 , 4.2	19.2 ± 3.1 , 4.1
2016S0262	ABB-11-22-2	8.0 ± 3.4 , 4.4	19.4 ± 3.2 , 4.4
2016S0263	ABB-11-22-3	3.8 ± 2.9 , 4.5	19.3 ± 3.2 , 4.3
2016S0265	ABB-11-22-5	49.7 ± 6.3 , 4.2	19.9 ± 3.1 , 4.1
2016S0267	ABB-11-23-1	7.8 ± 3.2 , 4.2	21.3 ± 3.2 , 4.2
2016S0269	ABB-11-23-3	11.6 ± 3.7 , 4.2	22.4 ± 3.3 , 4.2
2016S0273	ABB-11-24-2	58.7 ± 6.8 , 3.9	16.7 ± 3.1 , 4.2
2016S0274	ABB-11-24-3	257 ± 14 , 4	28.2 ± 3.8 , 4.4
2016S0276	ABB-11-24-5	30.1 ± 5.2 , 4.1	19.9 ± 3.3 , 4.4
2016S0281	ABB-11-24-10	14.6 ± 3.8 , 3.8	15.0 ± 3.1 , 4.3
2016S0282	ABB-11-24-11	12.2 ± 3.5 , 3.8	15.5 ± 3.0 , 4.2
2016S0283	ABB-11-24-12	12.0 ± 3.5 , 3.8	15.7 ± 2.9 , 4.1
2016S0285	ABB-11-25-2	7.4 ± 2.9 , 3.4	13.1 ± 2.8 , 4.0
2016S0286	ABB-11-25-3	13.4 ± 3.5 , 3.3	16.3 ± 2.9 , 3.9

TABLE F-4

CONCENTRATIONS OF GROSS ALPHA AND GROSS BETA IN SOIL SAMPLES BY GAS FLOW PROPORTIONAL COUNTING AP1, REVISION 17; CP3, REVISION 2 ABB, INC. WINDSOR, CONNECTICUT

ORISE Sample ID[a]	NRC Region I Sample ID	Radionuclide Concentrations, TPUs[b], and MDCs[c] (pCi/g)	
		Gross Alpha	Gross Beta
2016S0288	ABB-11-25-5	11.6 ± 3.4 , 3.4	16.5 ± 3.0 , 4.1
2016S0291	ABB-11-26-1	312 ± 14 , 3	37.5 ± 3.7 , 3.7
2016S0293	ABB-11-26-3	37.9 ± 5.2 , 3.1	20.5 ± 2.8 , 3.6
2016S0295	ABB-11-26-5	5.5 ± 2.6 , 3.4	13.5 ± 3.1 , 4.4
2016S0298	ABB-11-27-02	5.8 ± 3.0 , 4.1	21.5 ± 3.1 , 4.0
2016S0299	ABB-11-27-03	3.6 ± 2.7 , 4.2	14.7 ± 2.9 , 4.0
2016S0301	ABB-11-27-05	3.3 ± 2.7 , 4.2	15.1 ± 2.9 , 4.0
2016S0304	ABB-11-28-1	8.6 ± 3.4 , 4.2	29.0 ± 3.3 , 4.0
2016S0306	ABB-11-28-3	9.3 ± 3.4 , 4.1	21.3 ± 3.1 , 4.0
2016S0310	ABB-11-29-4	26.7 ± 4.9 , 4.1	21.2 ± 3.1 , 4.0
2016S0314	ABB-11-30-1	14.4 ± 3.4 , 2.9	23.2 ± 3.1 , 3.8
2016S0317	ABB-11-31-1	6.7 ± 2.6 , 3.0	21.0 ± 2.9 , 3.7
2016S0320	ABB-11-31-4	1.7 ± 1.4 , 2.1	4.8 ± 2.3 , 3.6
2016S0323	ABB-11-31-7	4.5 ± 1.9 , 2.3	8.5 ± 2.5 , 3.7
2016S0326	ABB-11-32-2	9.4 ± 3.0 , 3.0	25.5 ± 3.1 , 3.7
2016S0328	ABB-11-32-4	7.7 ± 2.8 , 3.1	21.1 ± 3.0 , 3.8

[a]These samples were randomly selected for gross alpha and gross beta analyses by the NRC site representative.

[b]Uncertainties represent the 95% confidence level, based on total propagated uncertainties.

[c]The MDCs are after the comma.

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APPENDIX F – REFERENCES

The following ABB submittals were reviewed by ORAU in documenting the NRC split soil sample results:

ABB 2011a. *Final Status Survey Report Submittal Number 1. CE Windsor Site, Windsor, Connecticut. Volume 1.* Windsor, Connecticut. July.

ABB 2011b. *Final Status Survey Report Submittal Number 2, Building 3 High Bay. CE Windsor Site, Windsor, Connecticut.* Windsor, Connecticut. September.

ABB 2011c. *Final Status Survey Report Submittal Number 3, Burning Grounds, Drum Burial Pit, Woods Area, Building 2 Sanitary Waste Line, and Clam Shell Pile. CE Windsor Site, Windsor, Connecticut.* Volume I. Windsor, Connecticut. December.

ABB 2011d. *Final Status Survey Report Submittal Number 4, Building Complexes 3 & 6. CE Windsor Site, Windsor, Connecticut.* Volume I. Windsor, Connecticut. December.

ABB 2012a. *Final Status Survey Report Submittal Number 5, Site Brook, Goodwin Pond, Debris Pile, and Industrial Waste Line Outfalls. CE Windsor Site, Windsor, Connecticut.* Volume I. Windsor, Connecticut. March.

ABB 2012b. *Final Status Survey Report Submittal Number 6, Equipment Storage Yard and Small Pond. CE Windsor Site, Windsor, Connecticut.* Windsor, Connecticut. April.

ABB 2012c. *Final Status Survey Report Submittal Number 7, General Areas. CE Windsor Site, Windsor, Connecticut.* Windsor, Connecticut. May.

The following ORAU letter reports were submitted to the NRC documenting the NRC split soil sample results:

ORISE 2010a. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Seventeen Soil Samples from ABB, Inc., Windsor, Connecticut [Inspection Report No. 060021706/2010003] (RFTA No. 10-001).* DCN: 2016-LR-01-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. August 9.

ORISE 2010b. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Twenty Soil Samples from ABB, Inc., Windsor, Connecticut [Inspection Report No. 060021706/2010003] (RFTA No. 10-001).* DCN: 2016-LR-02-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. September 29.

ORISE 2010c. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Fifty Soil Samples from ABB, Inc., Windsor, Connecticut [Inspection Report No. 060021706/2010003] (RFTA No. 10-001).* DCN: 2016-LR-03-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. November 3.

ORISE 2010d. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Fifteen Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-04-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. November 9.

ORISE 2011a. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Twenty-Six Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-05-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. January 5.

ORISE 2011b. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Ten Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-06-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. February 4.

ORISE 2011c. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Eighteen Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-07-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. April 20.

ORISE 2011d. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Forty-Six Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-08-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. July 22.

ORISE 2011e. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Twenty-Two Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-09-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. August 9.

ORISE 2011f. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Twenty-Eight Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-10-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. September 16.

ORISE 2011g. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Nineteen Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-11-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. October 5.

ORISE 2011h. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Twelve Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-12-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. October 6.

ORISE 2011i. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Isotopic Uranium Results for One Soil Sample from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 12-001).* DCN: 2016-LR-13-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. October 24.

ORISE 2011j. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Thirteen Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 12-001).* DCN: 2016-LR-14-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. October 5.

ORISE 2011k. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Isotopic Uranium Results for*

One Soil Sample from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 12-001). DCN: 2016-LR-15-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. November 9.

ORISE 2011l. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Seventeen Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 12-001).* DCN: 2016-LR-16-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. December 20.

ORISE 2012a. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Fifteen Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 12-001).* DCN: 2016-LR-17-0. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. January 11.

ORISE 2012b. *ORISE Contract No. DE-AC-05-06OR23100. Letter Report for Analytical Results for Forty-Six Soil Samples from ABB, Inc., Windsor, Connecticut [TAC No. U01836/U01837] (RFTA No. 11-001).* DCN: 2016-LR-08-1. Oak Ridge Institute for Science and Education, managed and operated by Oak Ridge Associated Universities. Oak Ridge, Tennessee. June 5.