

Per the Federal Facility Agreement for Iowa Army Ammunition Plant, Article X.B.1, the attached document is the final version of the submitted document.

**MODIFICATION TO THE
SAMPLING AND ANALYSIS PLAN
(SAP), REVISED
INVESTIGASTIONS RELATED
TO THE
ECOLOGICAL ASSESSMENT**

APRIL 10, 2000

April 10, 2000

Mr. Alvin Kam
USACE, Omaha District
Attn: CEMWO-PM-HB
215 North 17th Street
Omaha, Nebraska 68102-4978

Subject: Modifications to the Sampling and Analysis Plan (SAP), Revised
Investigations Related to the Ecological Assessment
Iowa Army Ammunition Plant (IAAAP)
Harza Project 5644.GN.1

Dear Mr. Kam:

Harza Engineering Company (Harza) will be sampling surface water and sediment as part of ecological assessments at the IAAAP. As discussed with Mr. Randy Sellers of your office, Harza will conduct this sampling in accordance with relevant provisions of the Work Plan (WP) and Sampling and Analysis Plan (SAP) prepared previously by Harza¹ for Offsite Groundwater Investigations at IAAAP. The previous SAP included a Quality Assurance Project Plan (QAPP), Field Sampling Plan (FSP), and Site Safety and Health Plan (SSHP) and had been reviewed and approved by the U. S. Army Corps of Engineers, Omaha District (USACE) and the U. S. Environmental Protection Agency, Region 7 (USEPA). Harza submitted specific modifications to the approved SAP in a letter dated December 17, 1999 to address differing data quality objectives, sampling methods, sample quantities and locations, and analytical parameters specific to the ecological risk assessment. Harza received comments from the USEPA on the SAP modifications. USACE, Harza, USEPA, and Techlaw (USEPA's contractor) personnel met on March 9, 2000 in Kansas City to select sample locations. In this letter, Harza submits revisions to the SAP for your review and approval.

The objectives of the water and sediment sampling include:

1. Delineation of the nature and extent of contamination for ecological receptors.
2. Collection of data for estimating the exposure of aquatic organisms to contaminants in streams at the IAAAP.
3. To estimate contaminant doses to terrestrial organisms preying on aquatic insects or fish.

¹ Harza Engineering Company, 1999: Work Plan and Sampling and Analysis Plan, Off-Site Groundwater Investigation (OU#3), Iowa Army Ammunition Plant, Middletown, Iowa.

Mr. Alvin Kam
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The sampling and analysis program for the ecological risk assessment is designed to meet these objectives through further characterization of surface water and sediment. Included in the data quality objectives is the distribution of two rare species of animals at the IAAAP: Indiana bat and orangethroat darter, and, the exposures of these animals to contaminants. Additional details on data quality objectives are presented in Technical Memorandum No. 2 by Harza²

The number and location of samples to be collected to meet the DQOs are identified in this modification. The contaminants to be measured are selected based on known contamination sources and effects on ecological receptors. Analytical methods and method detection limits, listed in the approved SAP are appropriate for meeting project objectives. Total organic carbon in sediment, necessary for application of partitioning models, was not included in the previous SAP. The analytical method and detection limit for TOC is Method 9060 and 0.02%, respectively. Modifications to the sediment sample collection methods have been made because aquatic organisms are only exposed to surficial stream sediment.

Sampling Locations and Procedures

Rationale for selection of sampling locations and analytical parameters are listed in Exhibit 1. Sampling locations are shown in Exhibit 2. Harza personnel conducted reconnaissance of the IAAAP property on November 1 and 2, 1999, to aid in identification of sample locations. Locations were selected based upon known or suspected sources of aquatic pollution, known locations of fine sediment deposition, and threatened or endangered species records. For example, locations immediately downgradient of NPDES discharges, tributaries, and groundwater discharge areas were identified. Similarly, locations with flow patterns that are favorable for sediment deposits were observed and noted in the field. The selected locations provide some coverage of all major streams across the plant property, including streams entering IAAAP on the west and east boundaries. The sampling locations also included several sites identified in the Long-Term Monitoring events³ of fall, 1999 and spring, 2000. Field staff may modify sampling locations locally in order to sample fine sediment (rather than gravels or sands).

Forty-eight sampling locations were identified (Exhibit 2). At each location, a sediment sample and a water sample will be collected. A second water sample will be taken at the same 48 locations later in summer of 2000.

The data quality completeness goal for this study consists of analytical and sampling goals, the first of which is described in the approved SAP. The completeness goal for sampling is 75%, as we

² Harza. 2000. Technical Memo No. 2 – Revised Draft. Collection of Water and Sediment Quality Data for Ecological Risk Assessment at the IAAAP.

³ Harza. 1999. Long-Term Monitoring Events: Fall 1999 and Spring 2000, Work Plan Addendum, IAAAP, Middletown, Iowa.

believe that sampling during low flow conditions may present difficult field conditions and/or no water flow.

Analytical Parameters

Tables 1 and 2 list the analytical parameters and number of water and sediment samples. All water samples will be analyzed for explosives and total and dissolved TAL (target analyte list) metals. All sediment samples will be analyzed for explosives, TAL metals and total organic carbon (TOC). Some of the water and sediment samples will also be analyzed for PCBs, pesticides, herbicides, and SVOCs. In addition, four water samples will be analyzed for sulfate. These samples are identified on Exhibits 1 and 2. Analytical parameters, matrix spike (MS) samples, and matrix spike duplicates are tabulated below.

**Table 1
NUMBERS OF SEDIMENT SAMPLES AND ANALYTICAL PARAMETERS**

Parameters	Number of Locations	MS (5%)	MSD (5%)	Total No. of Samples
TAL Metals (23)	48	3	3	54
Explosives	48	3	3	54
TOC	48	0	0	48
SVOCs	13	1	1	15
Herbicides	13	1	1	15
Pesticide/PCBs	13	1	1	15

**Table 2
NUMBERS OF SURFACE WATER SAMPLES ANALYTICAL PARAMETERS**

Parameters	Number of Locations	MS (5%)	MSD (5%)	Total No. of Samples
TAL Metals (23)- Dissolved	48	3	3	54
TAL Metals (23)- Total	48	3	3	54
Explosives	48	3	3	54
Pesticide/PCBs	13	1	1	15
Herbicides	13	1	1	15
SVOCs	13	1	1	15
Sulfate	4	0	0	4

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Sampling Procedures

There is an approved Work Plan/Sampling and Analysis Plan (SAP) for this project, containing a Quality Assurance Project Plan (QAPP), Field Sampling Plan and Site Health and Safety Plan (Harza 1999b). All portions of this approved SAP will be applicable to this water and sediment sampling exercise, except as amended specifically for this additional sampling.

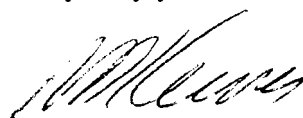
Sediment samples will be collected using an Ekman Dredge or a stainless steel scoop or trowel instead of coring devices. Care will be taken to collect sediment no deeper than two inches. Samples will generally be grab samples. However, composite samples may be collected at locations with multiple accumulation points or at locations with insufficient available sediment quantity. Samples for compositing will be collected from areas in the immediate vicinity of the intended sampling site (e.g. within the same pool).

Water samples will be collected consistent with the SAP. Water samples will be taken prior to disturbance of the sediment. Bottles will be filled manually, with minimal entrainment of surface films or bottom sediments. Water for analysis of dissolved metals will be filtered at the laboratory using acid-washed 0.45- μ m pore filters.

Sediment and water samples will be labeled and placed in a cooler with "blue ice", for next-day shipment to the contract laboratory.

If there are any questions, please contact Pinaki Banerjee at 312-831-3452 or David Pott at 312-831-3043.

Very truly yours,



R. P. Kewer
Senior Partner

cc: R. Allison, IAAAP
S. Marquess, USEPA

Exhibit 1
WATER AND SEDIMENT SAMPLING LOCATIONS
FOR ECOLOGICAL RISK ASSESSMENT

Watershed	Designation	Rationale	Analytical Parameters
Skunk River tributaries	SRT1	Rapid Bioassessment Protocol (RBP) site “unimpaired”, NPDES outfall 014, Indiana bat record	Explosives, metals
Skunk River tributaries	SRT2	RBP site “slightly impaired”, sediment sample 7P contained 23 mg/kg As, potential Indiana bat habitat	Explosives, metals
Long Creek	LC1 (IAAAP boundary)	West boundary of IAAAP, agricultural runoff/pollutants, RBP reference site	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Long Creek	LC2 (IAAAP boundary)	RBP site, potential Indiana bat habitats, downstream of uncharacterized demolition area (new site)	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Long Creek	LC3	Upstream from firing site	Explosives, metals [uranium, gross alpha, gross beta in LTM program]
Long Creek	LC4	Downstream from firing site and downstream from 14,000µg/g RDX in sediment found by JAYCOR near 3A-70-1. Downstream from IDA	Explosives, metals [uranium, gross alpha, gross beta in LTM program]
Long Creek	LC5	Between LC4 and LC2. Exact location (not shown on Exhibit 2) will be determined by field personnel based on identification of suitable depositional environment.	Explosives, metals
Long Creek tributary	LCT3	Downstream of flyash disposal area and Yard J. Sulfate in surface water found at a maximum concentration of 90,900 µg/L during the RI. Explosives were not detected	Explosives, metals, PCBs, pesticides, herbicides, SVOCs, sulfate
Long Creek tributary	LCT2	RBP site “slightly impaired”, potentially affected by Line 800 groundwater discharges	Explosives, metals
Long Creek tributary	LCT4	Further downstream of LCT3	Explosives, metals
Long Creek	LCT5	Downstream of line 4/4A	Explosives, metals, PCBs,

Exhibit 1
WATER AND SEDIMENT SAMPLING LOCATIONS
FOR ECOLOGICAL RISK ASSESSMENT

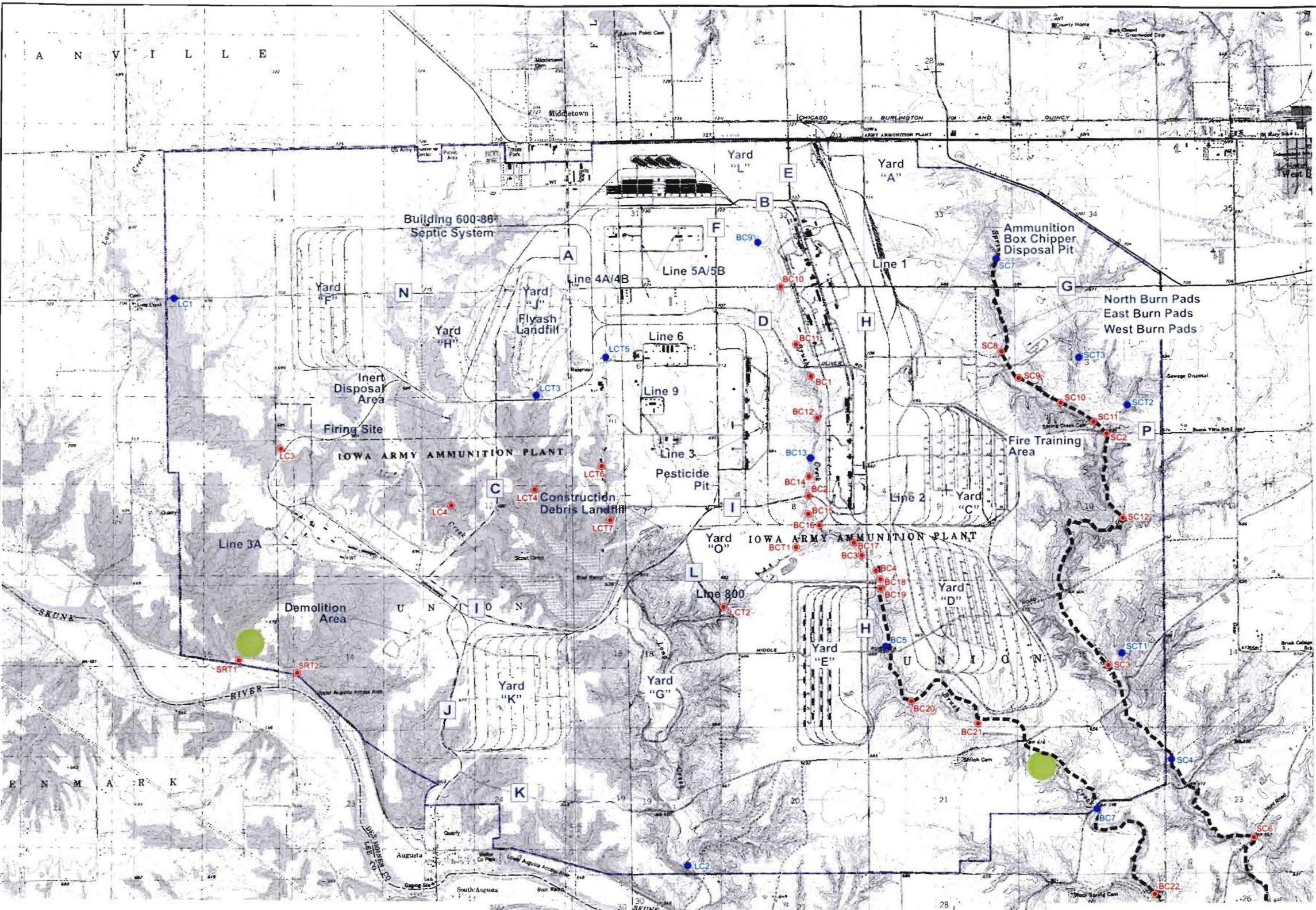
Watershed	Designation	Rationale	Analytical Parameters
tributary			pesticides, herbicides, SVOCs
Long Creek tributary	LCT6	In the immediate vicinity of Line 8 where RDX and HMX were detected in R09-SW-05 at 12.9 and 4.94 µg/L, respectively during the RI	Explosives, metals
Long Creek tributary	LCT7	Downstream of Line 8	Explosives, metals
Brush Creek	BC9	RBP reference site, upstream of discharges	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Brush Creek	BC10	Upstream of discharges, possibly influenced by Line 1/5A/4A discharges	Explosives, metals
Brush Creek	BC11	Downstream of several process outfalls, RBP “unimpaired” site (but stream has been relocated due to phytoremediation wetland construction)	Explosives, metals
Brush Creek	BC1	Immediately downstream of phytoremediation wetland, RBP “slightly impaired” site, sediment 7E contained 470 µg/kg RDX and 31 mg/kg arsenic, sediment RBW-SD-43 contained 5.8 mg/kg 2,6-DNT	Explosives, metals
Brush Creek	BC12	Sediment 7E contained 470 µg/kg RDX and 31 mg/kg arsenic, influenced by Line 1 and 2 discharges	Explosives, metals
Brush Creek	BC13	Downstream of sediment RBW-SD-39 containing 3 mg/kg PCB-1254. This area apparently increases in streamflow, noticed during Nov 1-2, 1999 drought reconnaissance	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Brush Creek	BC14	This area apparently increases in streamflow, noticed during Nov 1-2, 1999 drought reconnaissance	Explosives, metals
Brush Creek	BC2 (O Road)	Sediment 7F1 contained 400µg/kg RDX and 11 mg/kg As, RBP “unimpaired” site	Explosives, metals
Brush Creek	BC15	Muck and odors from sediment	Explosives, metals
Brush Creek	BC16	Deep hole on downstream side of RR culvert containing fine silt	Explosives, metals
Brush Creek	BC17	Leaf litter on sand and log jams with some fines. Downstream of Line 800 tributary and 7H sediment sample (330µg/kg RDX, 1.3 mg/kg Cd)	Explosives, metals

Exhibit 1
WATER AND SEDIMENT SAMPLING LOCATIONS
FOR ECOLOGICAL RISK ASSESSMENT

Watershed	Designation	Rationale	Analytical Parameters
Brush Creek	BC3	RBP site “slightly impaired”, upstream of WWTP, sediment sample 7I1 contained 9,900µg/kg RDX and other explosives	Explosives, metals
Brush Creek	BC4	RBP site “slightly impaired”, downstream of WWTP	Explosives, metals
Brush Creek	BC18	Silt deposits downstream of WWTP	Explosives, metals
Brush Creek	BC19	Deep hole below RR culvert containing fine silt, orangethroat darter range	Explosives, metals
Brush Creek	BC5 (Middle Augusta Rd)	Log jam with silt deposits, RBP site “unimpaired”, downstream of old fly ash waste pile by Yard E. Sediment RBW-SD-32 contained 2.6 mg/kg Ag	Explosives, metals, PCBs, pesticides, herbicides, SVOCs, sulfate
Brush Creek	BC20	Downstream of old fly ash waste pile. Sediment sample 7J1 contained 760µg/kg HMX, orangethroat darter habitat, deep pool with sand and leaf litter substrate	Explosives, metals, sulfate
Brush Creek	BC21	Deep run with leaf litter and silt, potential Indiana bat habitat, orangethroat darter habitat	Explosives, metals
Brush Creek	BC7 (IAAAP boundary)	Probable Indiana bat habitat, orangethroat darter, RBP site “slightly impaired”	Explosives, metals, SVOCs, PCBs, pesticides, herbicides
Brush Creek	BC22 (offsite)	Potential Indiana bat habitat, orangethroat darter, sediment sample 7L was clean	Explosives, metals, sulfate
Brush Creek	BC8 (Hunt Rd)	RBP site “unimpaired”, 8.8µg/kg dieldrin in darter tissue, orangethroat darter habitat	Explosives, metals
Brush Creek Tributary	BCT1	Tributary draining Line 800, pinkwater lagoon/phytoremediation wetland, collocated with Line 800 RI sample CK02 containing 1,100 µg/kg 2,4,6-TNT	Explosives, metals
Spring Creek	SC7	Upstream of all discharges (background), probable orangethroat darter habitat	Explosives, metals, SVOCs, PCBs, pesticides, herbicides
Spring Creek	SC8	Potentially affected by North Burn Pads, pool habitat with bedrock & sand substrate, orangethroat darter range	Explosives, metals

Exhibit 1
WATER AND SEDIMENT SAMPLING LOCATIONS
FOR ECOLOGICAL RISK ASSESSMENT

Watershed	Designation	Rationale	Analytical Parameters
Spring Creek	SC9	Downstream of EDA, West Burn Pad landfill, and West Burn Pads, orangethroat darter range, sandy substrate, downstream of sediment RBW-SD-15 containing 34 mg/kg Cu and 349 mg/kg Zn	Explosives, metals
Spring Creek	SC10, SC11	Downstream of EDA and West Burn Pads, downstream of sediment RBW-SD-15, orangethroat darter range, localized silt deposits in pools and oxbows	Explosives, metals
Spring Creek	SC2 (P Road)	Localized deposits of silt, RBP site "unimpaired", orangethroat darter range, 36µg/kg dieldrin in darter tissue, downstream of the confluence with West Burlington WWTP tributary	Explosives, metals
Spring Creek	SC12	Orangethroat darter range, probable silt deposits	Explosives, metals
Spring Creek	SC3	Orangethroat darter range, localized deposits of silt, RBP site "unimpaired", potential Indiana bat habitat	Explosives, metals
Spring Creek	SC4 (IAAAP boundary)	RBP site "slightly impaired", depressed EPT/chironomid ratio, orangethroat darter range, 23µg/kg dieldrin in darter tissue, potential Indiana bat habitat	Explosives, metals, SVOCs, PCBs, pesticides, herbicides
Spring Creek	SC6 (Hunt Road)	RBP site "slightly impaired", orangethroat darter range, 7D1 sediment sample was clean, 21µg/kg dieldrin in darter tissue, silty sand substrate	Explosives, metals
Spring Creek tributary	SCT1	Channel draining to Spring Creek to the east of SC3	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Spring Creek tributary	SCT2	Effluent from West Burlington WWTP, potential orangethroat darter and/or Indiana bat habitat, three household pesticide application bottles found in stream during Nov 2, 1999 reconnaissance	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Spring Creek tributary	SCT3	Channel draining to Spring Creek to the east of east burn pads	Explosives, metals, PCBs, pesticides, herbicides, SVOCs



LEGEND:

- SAMPLING LOCATIONS (See Note 2)
- SAMPLING LOCATIONS (See Note 3)
- A ROAD NAME
- PLANT PROPERTY BOUNDARY
- - - - - ORANGE THROAT DARTER DISTRIBUTION
- INDIANA BAT RECORD

NOTES:

1. ● BC8 - Brush Creek at Hunt Road, not shown on map.
2. Analysis for explosives and metals.
3. Analysis for explosives, metals, PCB, pesticides, herbicides and SVOC
4. Sites LC3 and LC4 will also be analyzed for uranium, gross water samples from alpha and gross beta under the Long Term Monitoring Program.

Scale 0 2000 4000 6000 8000 Feet

1997 ECOLOGICAL SAMPLING

	SRT1	SRT2	LC1	LC2	LCT2	BC1	BC2	BC3	BC4	BC5	BC7	BC8	BC9	BC10	SC2	SC3	SC4	SC6
MAMMALS			•	•				•	•				•	•	•		•	
SOILS			•	•				•	•				•	•	•		•	
BENTHOS	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
FISH				•								•					•	•

WATER AND SEDIMENT SAMPLING LOCATIONS
 ECOLOGICAL RISK ASSESSMENT
 IOWA ARMY AMMUNITION PLANT
 Middletown, Iowa

September 22, 2000

Mr. Alvin Kam
USACE, Omaha District
Attn: CENWO-PM-HB
215 North 17th Street
Omaha, Nebraska 68102-4978

Subject: Addendum to the Modifications to the Sampling and Analysis Plan (SAP),
Revised, dated April 10, 2000
Investigations Related to the Ecological Assessment
Iowa Army Ammunition Plant (IAAAP)
Harza Project 5644.GN.1

Dear Mr. Kam:

Harza Engineering Company (Harza) will commence the second phase of surface water and sediment sampling as part of ecological assessments at the IAAAP. The first phase of sampling was conducted during the week of May 22, 2000. The second phase of sampling will be conducted in accordance with the Modifications to the Sampling and Analysis Plan (SAP), Revised, dated April 10, 2000 (Modified SAP). This addendum proposes changes to the Modified SAP specific to the second phase of sampling. The modifications are based on comments received from U.S. EPA and USACE on the SAP memorandum related to the ecological risk assessment, dated August 17, 2000. The revised sampling locations are listed in Exhibit 3 and shown on Exhibit 4 (Exhibits 1 and 2 were submitted with the Modified SAP for the first phase of sampling). The second phase of sampling is scheduled during the week of September 25, 2000. In addition to the parameters listed in Exhibit 3, all sediment samples will be analyzed for Total Organic Carbon.

Surface water samples were collected during the first phase of sampling and analyzed for metals (total and dissolved) and explosives. In addition, selected samples were analyzed for semivolatile organic compounds (SVOC), pesticide/PCBs, and herbicides. Several metals were detected at low concentrations in some of the samples. Concentrations of most of the constituents are comparable to samples collected from locations upgradient from the IAAAP. Barium is one of the metals that were detected at an elevated level compared to background. The highest barium concentration was detected at SCT3. Two additional water and sediment sampling locations, downgradient (SCT4) and upgradient (SCT5) from SCT3, are proposed for second

Mr. Alvin Kam
USACE, Omaha District
September 22, 2000
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phase of sampling. Samples collected from these locations will be analyzed for explosives and metals.

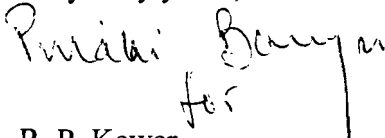
Explosive data show that RDX and HMX were detected in most of the samples collected from Brush Creek and Spring Creek. Several other explosives were detected at some locations at trace levels. RDX concentrations were higher at SC08 and SC09 compared to concentrations at other locations within Brush Creek and Spring Creek. An additional location (SC13), upgradient from SC08 and the North Burn Pad Landfill is proposed for the second phase of sampling.

USACE has identified two additional locations above and below an impoundment near Line 8. The impoundment is located in drainage south of the power plant. An outlet pipe was found in the drainage directly below the impoundment. Water and sediment samples will be collected from the impounded pool area and another location immediately below the outlet pipe. The locations are shown on Exhibit 4 as LCT8 and LCT9. Samples will be analyzed for explosives, metals, PCBs, pesticides, herbicides, and SVOCs.

During the first phase of sampling, the tributary with SCT2 as a sample point could not be located. This location is retained for sampling during the second phase.

If there are any questions, please contact Pinaki Banerjee at 312-831-3452 or David Pott at 312-831-3043.

Very truly yours,

Handwritten signature of Pinaki Banerjee in cursive script.

R. P. Kewer
Senior Partner

cc: R. Allison, IAAAP
K. Howe, USACE
J. Haffner, IAAAP
M. Bazar, CHPPM
M. Coffey, US Fish and Wildlife
P. Thomason, USACE
R. Sellers, USACE
S. Sorensen, USACE
S. Marquess, USEPA
R. Blackburn, Techlaw

Exhibit 3
WATER AND SEDIMENT SAMPLING LOCATIONS
FOR ECOLOGICAL RISK ASSESSMENT
SECOND PHASE OF SAMPLING

Watershed	Designation	Rationale	Analytical Parameters
Skunk River tributaries	SRT1	Rapid Bioassessment Protocol (RBP) site “unimpaired”, NPDES outfall 014, Indiana bat record	Explosives, metals
Skunk River tributaries	SRT2	RBP site “slightly impaired”, sediment sample 7P contained 23 mg/kg As, potential Indiana bat habitat	Explosives, metals
Long Creek	LC1 (IAAAP boundary)	West boundary of IAAAP, agricultural runoff/pollutants, RBP reference site	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Long Creek	LC2 (IAAAP boundary)	RBP site, potential Indiana bat habitats, downstream of uncharacterized demolition area (new site)	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Long Creek	LC3	Upstream from firing site	Explosives, metals [uranium, gross alpha, gross beta in LTM program]
Long Creek	LC4	Downstream from firing site and downstream from 14,000 ug/g RDX in sediment found by JAYCOR near 3A-70-1. Downstream from IDA.	Explosives, metals [uranium, gross alpha, gross beta in LTM program]
Long Creek	LC5	Between LC4 and LC2. Exact location will be determined by field personnel based on identification of suitable depositional environment.	Explosives, metals
Long Creek tributary	LCT3	Downstream of flyash disposal area and Yard J. Sulfate in surface water found at a maximum concentration of 90,900 µg/L during the RI. Explosives were not detected	Explosives, metals, PCBs, pesticides, herbicides, SVOCs, sulfate
Long Creek tributary	LCT2	RBP site “slightly impaired”, potentially affected by Line 800 groundwater discharges	Explosives, metals
Long Creek tributary	LCT4	Further downstream of LCT3	Explosives, metals
Long Creek	LCT5	Downstream of line 4/4A	Explosives, metals, PCBs,

Exhibit 3
WATER AND SEDIMENT SAMPLING LOCATIONS
FOR ECOLOGICAL RISK ASSESSMENT
SECOND PHASE OF SAMPLING

Watershed	Designation	Rationale	Analytical Parameters
tributary			pesticides, herbicides, SVOCs
Long Creek tributary	LCT6	In the immediate vicinity of Line 8 where RDX and HMX were detected in R09-SW-05 at 12.9 and 4.94 µg/L, respectively during the RI	Explosives, metals
Long Creek Tributary	LCT7	Downstream of Line 8	Explosives, metals
Long Creek Tributary	LCT8	Above the outlet pipe in the impoundment by the power plant near Line 8	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Long Creek Tributary	LCT9	Below the outlet pipe in the drainage by the power plant near Line 8	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Brush Creek	BC9	RBP reference site, upstream of discharges	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Brush Creek	BC10	Upstream of discharges, possibly influenced by Line 1/5A/4A discharges	Explosives, metals
Brush Creek	BC11	Downstream of several process outfalls, RBP "unimpaired" site (but stream has been relocated due to phytoremediation wetland construction)	Explosives, metals
Brush Creek	BC1	Immediately downstream of phytoremediation wetland, RBP "slightly impaired" site, sediment 7E contained 470 µg/kg RDX and 31 mg/kg arsenic, sediment RBW-SD-43 contained 5.8 mg/kg 2,6-DNT	Explosives, metals
Brush Creek	BC12	Sediment 7E contained 470 µg/kg RDX and 31 mg/kg arsenic, influenced by Line 1 and 2 discharges	Explosives, metals
Brush Creek	BC13	Downstream of sediment RBW-SD-39 containing 3 mg/kg PCB-1254. This area apparently increases in streamflow, noticed during Nov 1-2, 1999 drought reconnaissance	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Brush Creek	BC14	This area apparently increases in streamflow, noticed during Nov 1-2, 1999 drought reconnaissance	Explosives, metals
Brush Creek	BC2	Sediment 7F1 contained 400µg/kg RDX and 11 mg/kg As, RBP "unimpaired"	Explosives, metals

Exhibit 3
WATER AND SEDIMENT SAMPLING LOCATIONS
FOR ECOLOGICAL RISK ASSESSMENT
SECOND PHASE OF SAMPLING

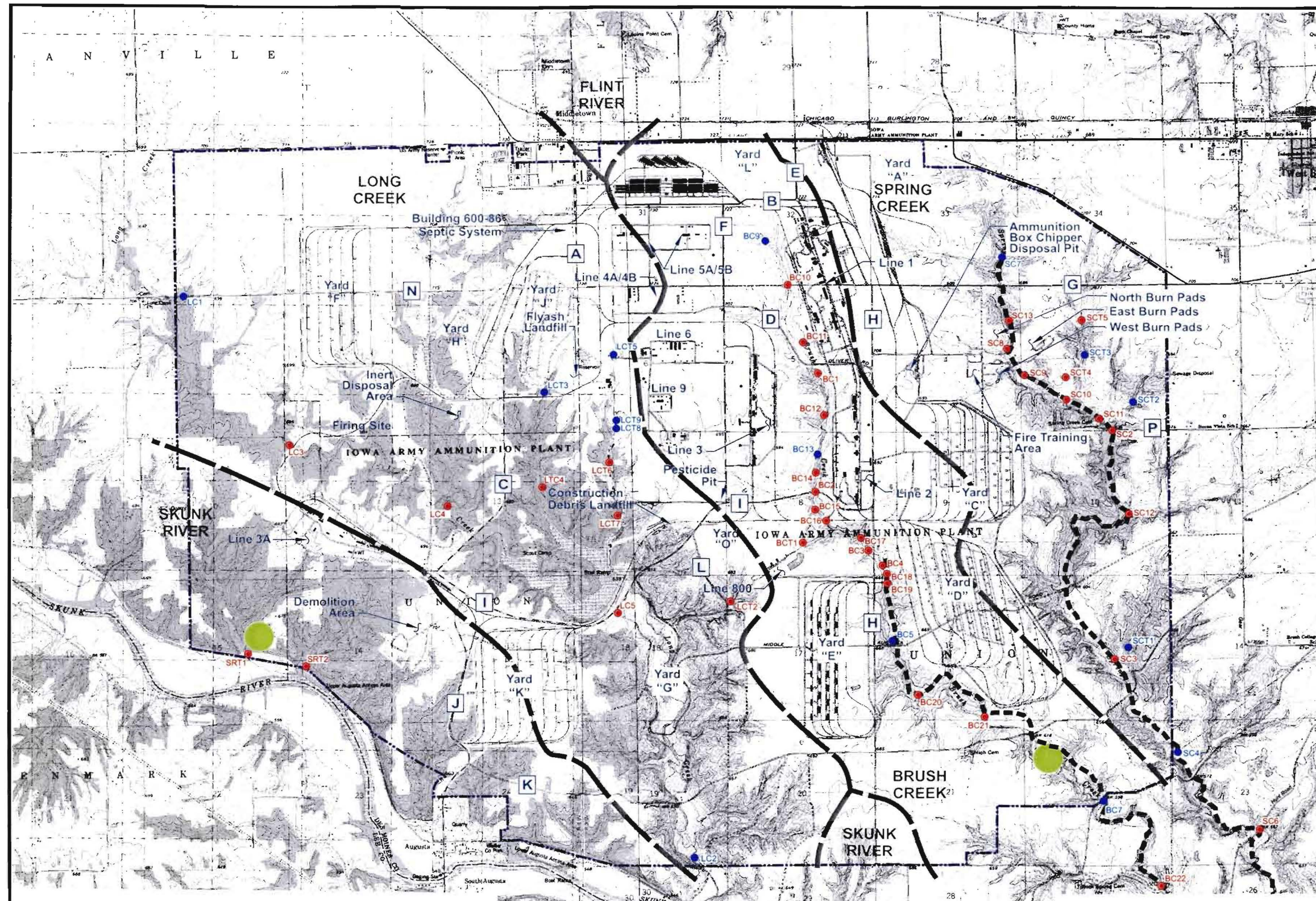
Watershed	Designation	Rationale	Analytical Parameters
	(O Road)	site	
Brush Creek	BC15	Muck and odors from sediment	Explosives, metals
Brush Creek	BC16	Deep hole on downstream side of RR culvert containing fine silt	Explosives, metals
Brush Creek	BC17	Leaf litter on sand and logjams with some fines. Downstream of Line 800 tributary and 7H sediment sample (330µg/kg RDX, 1.3 mg/kg Cd)	Explosives, metals
Brush Creek	BC3	RBP site "slightly impaired", upstream of WWTP, sediment sample 7I1 contained 9,900µg/kg RDX and other explosives	Explosives, metals
Brush Creek	BC4	RBP site "slightly impaired", downstream of WWTP	Explosives, metals
Brush Creek	BC18	Silt deposits downstream of WWTP	Explosives, metals
Brush Creek	BC19	Deep hole below RR culvert containing fine silt, orangethroat darter range	Explosives, metals
Brush Creek	BC5 (Middle Augusta Rd)	Logjam with silt deposits, RBP site "unimpaired", downstream of old fly ash waste pile by Yard E. Sediment RBW-SD-32 contained 2.6 mg/kg Ag	Explosives, metals, PCBs, pesticides, herbicides, SVOCs, sulfate
Brush Creek	BC20	Downstream of old fly ash waste pile. Sediment sample 7J1 contained 760µg/kg HMX, orangethroat darter habitat, deep pool with sand and leaf litter substrate	Explosives, metals, sulfate
Brush Creek	BC21	Deep run with leaf litter and silt, potential Indiana bat habitat, orangethroat darter habitat	Explosives, metals
Brush Creek	BC7 (IAAAP boundary)	Probable Indiana bat habitat, orangethroat darter, RBP site "slightly impaired"	Explosives, metals, SVOCs, PCBs, pesticides, herbicides
Brush Creek	BC22 (offsite)	Potential Indiana bat habitat, orangethroat darter, sediment sample 7L was clean	Explosives, metals, sulfate
Brush Creek	BC8 (Hunt Rd)	RBP site "unimpaired", 8.8µg/kg dieldrin in darter tissue, orangethroat darter habitat (NOT shown on Exhibit 4)	Explosives, metals

Exhibit 3
WATER AND SEDIMENT SAMPLING LOCATIONS
FOR ECOLOGICAL RISK ASSESSMENT
SECOND PHASE OF SAMPLING

Watershed	Designation	Rationale	Analytical Parameters
Brush Creek Tributary	BCT1	Tributary draining Line 800, pinkwater lagoon/phytoremediation wetland, collocated with Line 800 RI sample CK02 containing 1,100 µg/kg 2,4,6-TNT	Explosives, metals
Spring Creek	SC7	Upstream of all discharges (background), probable orangethroat darter habitat	Explosives, metals, SVOCs, PCBs, pesticides, herbicides
Spring Creek	SC13	Upgradient from high RDX levels in Spring Creek; Upgradient of North Burn Pads Landfill	Explosives, metals
Spring Creek	SC8	Potentially affected by North Burn Pads, pool habitat with bedrock & sand substrate, orangethroat darter range	Explosives, metals
Spring Creek	SC9	Downstream of EDA, West Burn Pad landfill, and West Burn Pads, orangethroat darter range, sandy substrate, downstream of sediment RBW-SD-15 containing 34 mg/kg Cu and 349 mg/kg Zn	Explosives, metals
Spring Creek	SC10, SC11	Downstream of EDA and West Burn Pads, downstream of sediment RBW-SD-15, orangethroat darter range, localized silt deposits in pools and oxbows	Explosives, metals
Spring Creek	SC2 (P Road)	Localized deposits of silt, RBP site “unimpaired”, orangethroat darter range, 36µg/kg dieldrin in darter tissue, downstream of the confluence with West Burlington WWTP tributary	Explosives, metals
Spring Creek	SC12	Orangethroat darter range, probable silt deposits	Explosives, metals
Spring Creek	SC3	Orangethroat darter range, localized deposits of silt, RBP site “unimpaired”, potential Indiana bat habitat	Explosives, metals
Spring Creek	SC4 (IAAAP boundary)	RBP site “slightly impaired”, depressed EPT/chironomid ratio, orangethroat darter range, 23µg/kg dieldrin in darter tissue, potential Indiana bat habitat	Explosives, metals, SVOCs, PCBs, pesticides, herbicides
Spring Creek	SC6 (Hunt Road)	RBP site “slightly impaired”, orangethroat darter range, 7D1 sediment sample was clean, 21µg/kg dieldrin in darter tissue, silty sand substrate	Explosives, metals
Spring Creek tributary	SCT1	Channel draining to Spring Creek to the east of SC3	Explosives, metals, PCBs, pesticides, herbicides, SVOCs

Exhibit 3
WATER AND SEDIMENT SAMPLING LOCATIONS
FOR ECOLOGICAL RISK ASSESSMENT
SECOND PHASE OF SAMPLING

Watershed	Designation	Rationale	Analytical Parameters
Spring Creek tributary	SCT2	Effluent from West Burlington WWTP, potential orangethroat darter and/or Indiana bat habitat, three household pesticide application bottles found in stream during Nov 2, 1999 reconnaissance	Explosives, metals, PCBs, pesticides, herbicides, SVOCs
Spring Creek tributary	SCT5	Channel draining to Spring Creek to the east of east burn pads, upgradient from SCT3	Explosives, metals
Spring Creek tributary	SCT4	Channel draining to Spring Creek to the east of east burn pads, downgradient from SCT3.	Explosives, metals
Spring Creek tributary	SCT3	Channel draining to Spring Creek to the east of east burn pads	Explosives, metals, PCBs, pesticides, herbicides, SVOCs



LEGEND:

- SAMPLING LOCATIONS (See Note 2)
- SAMPLING LOCATIONS (See Note 3)
- A ROAD NAME
- PLANT PROPERTY BOUNDARY
- ORANGE THROAT DARTER DISTRIBUTION
- INDIANA BAT RECORD

NOTES:

1. ● BC8 - Brush Creek at Hunt Road, not shown on map.
2. Analysis for explosives and metals.
3. Analysis for explosives, metals, PCB, pesticides, herbicides and SVOC
4. Water samples from sites LC3 and LC4 were analyzed for uranium, gross alpha and gross beta under the Long Term Monitoring Program.



1997 ECOLOGICAL SAMPLING

	SRT1	SRT2	LC1	LC2	LCT2	BC1	BC2	BC3	BC4	BC5	BC7	BC8	BC9	BC10	SC2	SC3	SC4	SC6
MAMMALS			•	•				•	•				•	•	•		•	
SOILS			•	•				•	•				•	•	•		•	
BENTHOS	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
FISH				•								•			•		•	•

**WATER AND SEDIMENT SAMPLING LOCATIONS
SECOND PHASE
ECOLOGICAL RISK ASSESSMENT
IOWA ARMY AMMUNITION PLANT
Middletown, Iowa**