Final

RVAAP's Facility Wide Surface Water Assessment Workplan

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ABBREVIATIONS

AOC	Area of Concern
bgs	Below Ground Surface
BRACO	Base Realignment and Closure Office
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DERR	Division of Emergency and Remedial Response
EPA	U.S. Environmental Protection Agency
GOCO	Government-Owned, Contractor-Operated
ODOW	Ohio Department of Wildlife
OEPA	Ohio Environmental Protection Agency
RCRA	Resource Conservation and Recovery Act
RVAAP	Ravenna Army Ammunition Plant
SVOC	Semivolatile Organic Compound
USACE	U.S. Army Corps of Engineers

1 INTRODUCTION

The Ravenna Army Ammunition Plant (RVAAP) has command organization from US Army Materiel Command; Engineering, Housing, Environmental and Installation Logistics, Environmental Quality Division as well as US Army Operations Support Command. Said command utilizes an Installation Action Plan (IAP) to cover remedial investigations and clean up needed for environmental closure of the RVAAP. The purpose of the IAP is to outline the total multi-year restoration program for an installation. The plan defines Installation Restoration Program (IRP) requirements and proposes a comprehensive approach and associated costs to conduct future investigations and remedial actions at each Area of Concern (AOC) at the installation.

The IAP for the former RVAAP coordinates planning information between the IRP manager, major army commands (MACOMs), installations, executing agencies, regulatory agencies (OhioEPA), and the public. The IAP is used to track requirements, schedules, and tentative budgets for RVAAP IRP.

This project was planned under the IAP to investigate the surface waters entering and leaving the RVAAP facility, specifically targeting surface waters that might be impacted due to military activities. This project is being planned and executed by team partnering with AEC, OHARNG, USACHPPM, USACE, and the Ohio EPA. This ecological evaluation can then be utilized in an ecological risk assessment if warranted.

1.1 Facility Wide Description

The Ravenna Army Ammunition Plant (RVAAP) is located in the northeastern Ohio within Portage and Trumbull counties, approximately 4.8 km (3 miles) east-northeast of the City of Ravenna and approximately 1.6 km (1 mile) northwest of the town of Newton Falls. The installation consists of 8668.3 ha (21,419 acres) contained in a 17.7-km (11-mile)-long, 5.6-km (3.5-mile)-wide tract bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; State Route 534 on the east; Garrettsville and Berry Roads on the west; and the CONRAIL Railroad on the north. The land use surrounding the installation is primarily farmland with sparse private residences. The installation is surrounded by several local communities: Windham, which borders on the installation to the north; Garrettsville, located 9.6 km (6 miles) to the northwest; Newton Falls, 1.6 km (1 mile) to the east; Charleston, bordering the southwest; and Wayland, 4.8 km (3 miles) to the southeast.

The RVAAP was established on August 26, 1940 for the primary purpose of loading medium- and major-caliber artillery ammunition; bombs, mines; fuze and boosters; primers and percussion elements; and for the storage of finished ammunition components. Originally, the installation was divided into two separate units; one was designated as Portage Ordnance Depot with the primary mission of the depot's storage activity, and the other was designated as the Ravenna Ordnance Plant with the primary mission of the ammunition-loading activities.

Over the years, the RVAAP handled and stored strategic and critical materials for various government agencies and received, stored, maintained, transported, and demilitarized military ammunition and explosive items. The RVAAP maintained the capabilities to load, assemble, and pack military ammunition; however, these operations are inactive. As part of the RVAAP mission, the inactive facilities were maintained in a standby status by keeping equipment in a condition to permit resumption of production within the prescribed time limitations.

The RVAAP is a Government-Owned, Contractor-Operated (GOCO) U.S. Army Operations Support Command (OSC) facility. Currently, the RVAAP is an inactive facility maintained by a contractor caretaker, Tol-Test, Inc. of Toledo, Ohio. The Atlas Powder Company was the original GOCO manager of the Ravenna Ordnance Depot and operated the plant from 1940-1945; the government operated the Portage Ordnance Depot. The last production for World War II was in August 1945. The government assumed operations of both areas from 1945 to 1951 when Ravenna Arsenal Inc. (RAI), a subsidiary of the Firestone Tire and Rubber Co., Akron, Ohio, was contracted to operate the entire facility. In 1982, Physics International Co., a subsidiary of Rockcor Inc., purchased RAI from Firestone. Olin Corporation purchased Rockcor Inc. in June 1985. In May 1999, the Ohio Army National Guard (OHARNG) assumed administrative control over all but 1,481 acres at RVAAP. These 1,481 acres encompass the Areas of Concern (AOCs) and munitions storage areas remain under control of the U.S. Army BRACO (Base Realignment and Closure Office).

A 2001 Memorandum of Agreement (MOA) concerning conditions for transfer of acreage was signed between OHARNG and Department of Army. In March of 2002 Amendment 1 to this MOA was signed by Army and OHARNG ratifying the agreement for transfer of remaining property.

The Preliminary Assessment for RVAAP identified past military /industrial activities including

Melt/pour load lines
Fuze & booster burn pits
Burning grounds
Demolition areas
Quarry landfill
Sewage treatment plants
Landfills
Maintenance areas & waste oil tanks
Buildings where PCB or pesticide storage occurred
Buildings with sumps
Fuze and booster lines
Ranges (e.g., pistol and 40 mm Ranges)
Scrap areas
Burn pits and burn grounds, and
Various dump areas.

1.2 Environmental Setting (Hydrologic)

The water-bearing characteristics for the sand and gravel aquifers in the vicinity of the RVAAP installation are poorly documented. Wells that penetrate these aquifers can yield up to 6080 liters per minute (LPM) [1600 gallons per minute (GPM)]. However, yields from wells penetrating silty or clay till materials are significantly lower. In general, the Kent and Hiram tills are too thin and impermeable to produce useful quantities of water.

1.2.1 Surface Water

The entire RVAAP facility is situated within the Ohio River Basin, with the West Branch of the Mahoning River representing the major surface stream in the area. The West Branch flows adjacent to the west end of the facility, generally in a north to south direction, before flowing into the M.J. Kirwan Reservoir, which is located to the south of State Route 5. The West Branch flows out of the reservoir along the southern facility boundary before joining the Mahoning River east of RVAAP.

The western and northern portions of the RVAAP facility display low hills and a dendritic surface drainage pattern. The eastern and southern portions are characterized by an undulating to moderately level surface, with less dissection of the surface drainage. The facility is marked with marshy areas and flowing and intermittent streams whose headwaters are located in the facility's hills. Three primary watercourses drain RVAAP: (1) the South Fork of Eagle Creek, (2) Sand Creek, and (3) Hinkley Creek. All of these water courses have many associated tributaries.
Sand Creek, with a drainage area of 36 km^2 (13.9 $miles^2$), flows generally in a northeast direction to its confluence with the South Fork of Eagle Creek. In turn, the South Fork of Eagle Creek then continues in a northerly direction for 4.3 km (2.7 miles) to its confluence with Eagle Creek. The drainage area of the South Fork of Eagle Creek is 67.8 km^2 (26.2 $miles^2$), including the area drained by Sand Creek. Hinkley Creek originates just southeast of the intersection between State Routes 88 and 303 to the north of the facility. Hinkley Creek, with a drainage area of 28.5 km^2 (11.0 $miles^2$), flows in a southerly direction through the installation to its confluence with the West Branch of the Mahoning River south of the facility.

Approximately 50 ponds are scattered throughout the installation. Many were built within natural drainage ways to function as settling ponds or basins for process effluent and runoff. Others are natural in origin, resulting from glacial action or beaver activity. Most water bodies at RVAAP appear to support an abundance of aquatic vegetation and fish. Some ponds on the RVAAP have been stocked with fish for recreational or conservation purposes. This practice has been discontinued for a number of years. None of the ponds within the installation is used as a water supply source.

Storm water runoff is controlled primarily by natural drainage except in facility operations areas where an extensive storm sewer network helps to direct runoff to drainage ditches and settling ponds. In addition, the storm sewer system was one of the primary drainage mechanisms for process effluent during the period that production facilities were in operation.

1.2.1.1 Surface Water Utilization

Past and present surface water utilization at RVAAP generally was limited to use by wildlife and recreational users. Although some surface water may have been used intermittently for various facility operations, the vast majority of process water was provided by on-site groundwater production wells. There is no available documentation that indicates any past irrigation or other agricultural use of surface water sources on facility property. It is likely, however, that some agricultural use of surface water was conducted in this area before facility construction due to the presence of homesteads and farms, with the assumption that surface water uses may have included livestock water sources at that time. On-site recreational surface water use was limited to managed fishing programs conducted in the past. Due to access limitations fishing is no

longer permitted at RVAAP. Based on conversations with site personnel, it is likely that some recreational trespasser use of surface water does occur on a limited basis, primarily for fishing.

The major surface water drainages at RVAAP all exit facility property and eventually flow into the Mahoning River to the east. Surface water from Sand Creek, which flows to the northeast across the facility, joins the South Fork of Eagle Creek, which flows to the east inside the northern property boundary. The South Fork of Eagle Creek continues to the east until it eventually discharges to the Mahoning River. It is possible that limited agricultural and recreational use of the South Fork of Eagle Creek does occur off of facility property, although no data are available to allow a more detailed study. Hinkley Creek, which enters facility property from the north and flows to the south across the western portion of RVAAP, eventually discharges to the West Branch Reservoir south of State Route 5. It is doubtful that the Hinkley Creek is used for any agricultural purposes, although limited recreational use may occur.

2 Determination of the Scope of the Assessment

: The assessment of the aquatic habitats at RVAAP will follow the specific guidance published by the state of Ohio:

- Ohio Environmental Protection Agency. 1987a. Biological criteria for the protection of aquatic life: Volume I. The role of biological data in water quality assessment. Div. Water Qual. Monit. & Assess., Surface Water Section, Columbus, Ohio.

- Ohio Environmental Protection Agency. 1987b. Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Div. Water Qual. Monit. & Assess., Surface Water Section, Columbus, Ohio.

- Ohio Environmental Protection Agency. 1989b. Addendum to Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Div. Water Qual. Plan. & Assess., Ecological Assessment Section, Columbus, Ohio.

- Ohio Environmental Protection Agency. 1989c. Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Div. Water Quality Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

- Ohio Environmental Protection Agency. 1990. The use of biological criteria in the Ohio EPA surface water monitoring and assessment program. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

- Rankin, E.T. 1989. The qualitative habitat evaluation index (QHEI): rationale, methods, and application. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

Since the publication of the preceding guidance documents, the following new publications by the Ohio EPA have become available. These publications should also be consulted as they represent the latest information and analyses used by the Ohio EPA to implement the biological criteria.

- DeShon, J.D. 1995. Development and application of the invertebrate community index (ICI), pp. 217-243. in W.S. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Risk-based Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

- Rankin, E. T. 1995. The use of habitat assessments in water resource management programs, pp. 181-208. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

- Yoder, C.O. and E.T. Rankin. 1995. Biological criteria program development and implementation in Ohio, pp. 109-144. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

- Yoder, C.O. and E.T. Rankin. 1995. Biological response signatures and the area of degradation value: new tools for interpreting multimetric data, pp. 263-286. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

- Yoder, C.O. 1995. Policy issues and management applications for biological criteria, pp. 327-344. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

- Yoder, C.O. and E.T. Rankin. 1995. The role of biological criteria in water quality monitoring, assessment, and regulation. Environmental Regulation in Ohio: How to Cope With the Regulatory Jungle. Inst. of Business Law, Santa Monica, CA. 54 pp.

2.1 Objectives

- Establish the present biological conditions throughout representative surface water bodies (creeks, streams and ponds) at the RVAAP, Ravenna, Ohio by evaluating fish communities, Miwb (IBI), physical stream habitat (QHEI), and macroinvertebrate communities (ICI).
- Measure the relative levels of energetic, semi-volatile organic and inorganic contaminants in the sediments and surface water of the creeks, streams and ponds within the RVAAP.
- Complete a report summarizing the sediment, surface water, and aquatic chemical and biological results.

3 Physical Habitat Evaluation – Lotic (Streams)

To evaluate stream physical habitat quality, a Qualitative Habitat Evaluation Index (QHEI) score is calculated. The QHEI, developed by Ohio EPA, is a physical habitat index, which provides an evaluation of the lotic macro habitat characteristics important to biotic communities. Assigning scores calculate the QHEI for each of the following six metrics:Quality of Substrate
Type of In-Stream Cover
Channel Morphology
Riparian Zone and Bank Erosion

Pool/Glide and Riffle/Run Quality
Gradient

The sum of the scores from these metrics yields a total score that numerically rates the habitat of a particular stream reach. The highest score represents a high quality, undisturbed habitat and a low score indicates low quality or highly disturbed habitat.

3.1 State Specifications

Physical habitat is evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989). Various attributes of the available habitat are scored based on their overall importance to the establishment of viable, diverse aquatic faunas. Evaluations of type and quality of substrate, amount of in-stream cover, channel morphology, extent of riparian canopy, pool and riffle development and quality, and stream gradient are among the metrics used to evaluate the characteristics of a stream segment, not just the characteristics of a single sampling site. As such, individual sites may have much poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. A score between 45 and 60 suggests some habitat limitations and falls into a range between Modified Warmwater Habitat and Warmwater Habitat. The appropriate aquatic life use designation assigned, will depend on the habitat characteristics, which are most limiting to aquatic life. QHEI scores from hundreds of segments around the state have indicated that values higher than 60 were generally conducive to the establishment of warm water faunas while those which scored in excess of 75-80 often typify habitat conditions which have the ability to support exceptional faunas.

3.1.1 Habitat Evaluation- Lentic (Ponds)

Although there is currently no specific guidance for habitat evaluation of ponds and lakes, A lake/pond QHEI evaluation form in development at Ohio EPA (by Roger Thoma, NEDO DSW, personal communication) will be used to assess physical habitat features at all pond sampling locations.

3.2 Fish (Lotic and Lentic)

For those aquatic areas that would be considered as possible habitat for fish, the Index of Biotic Integrity (IBI)- for streams and ponds, and the Modified Index of Well Being (MIWB) – for ponds are the indices for evaluation.

The IBI is a multi-metric index originally described by Karr (1981) and Fausch et al. (1984) and further developed by the Ohio EPA. Each of the twelve metrics is scored as one, three, or five with a maximum additive score of 60. A higher metric score is considered more favorable and the sum of the metrics becomes the IBI score. The overall IBI score is compared to biocriteria values listed in the Ohio water quality standards, in addition to narrative ranges developed by the Ohio EPA for the appropriate ecoregion.

The twelve IBI metrics for headwater sites (less than 20 mi^2 drainage areas) are as follows:

Number of headwater species,
Number of minnow species,
Number sensitive species,
Percent pioneering species,

Number of simple lithophilic species

Additionally, for lentic (pond) situations, the MIwb is also used to evaluate fish populations. The MIwb incorporates four measures of fish communities: numbers of individuals, fish biomass, and the Shannon Diversity Index based on both numbers and weights (Ohio EPA, 1987). Relative numbers and relative weights are adjusted to represent a 0.3 km sampling reach for headwater and wading sites and 1.0 km for boat sampling sites. The MIwb is based on a scoring range of 0 to12, with 0-5 being "very poor" and greater than 9.5 being "exceptional" quality.

3.2.1 State Specifications

All biological field, EPA laboratory, data processing, and data analysis methods and procedures adhere to those specified in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio Environmental Protection Agency 1991), Biological Criteria for the Protection of Aquatic Life, Volumes II - III (Ohio Environmental Protection Agency 1987, 1989b, 1989c), The Qualitative Habitat Evaluation Index (QHEI); Rationale, Methods, and Application (Rankin 1989) for habitat assessment and Ohio EPA Sediment Sampling Guide and Methodologies (Ohio EPA 2001).

Fish will be sampled twice at the pond sampling locations with pulsed DC boat electrofishing gear. RVAAP creek and stream sampling locations will be sampled twice using wading electrofishing methods. Detailed biological sampling protocols are documented in the Ohio EPA manual Biological Criteria for the Protection of Aquatic Life, Volume III (1989).

Use Attainment

Attainment/non-attainment of aquatic life uses in streams will be determined by using biological criteria codified in Ohio Administrative Code (OAC) 3745-1-07, Table 7-15. Numerical biological criteria are based on multimetric biological indices including the Index of Biotic Integrity (IBI) and modified Index of Well-Being (MIWB), indices measuring the response of the fish community, and the Invertebrate Community Index (ICI), which indicates the response of the macroinvertebrate community.

Performance expectations for the basic aquatic life uses (Warmwater Habitat [WWH], Exceptional Warmwater Habitat [EWH], and Modified Warmwater Habitat [MWH] were developed using the regional reference site approach (Hughes et al. 1986; Omernik 1988). This fits the practical definition of biological integrity as the biological performance of the natural habitats within a region (Karr and Dudley 1981). Attainment of an aquatic life use is FULL if all three indices (or those available) meet the applicable criteria, PARTIAL if at least one of the indices did not attain and performance did not fall below the fair category, and NON if all indices either fail to attain or any index indicates poor or very poor performance. The creek results will be compared to applicable biocriteria for the Eastern-Ontario Lake Plain ecoregion.

Ponds

Attainment/non-attainment of aquatic life uses for ponds have not been developed by Ohio EPA. However, fish communities will be sampled using boat electro-fishing techniques similar to rivers. Within each pond, a 500-meter distance (if possible) along the shoreline will be sampled. Comparable to river sampling sites, an effort will be made to collect all available stunned fish. Fish will be counted, weighed, identified to species, and evaluated for external anomalies. Fish results will be used to calculate IBI and MIwb scores at each pond sampling location, along with

the specific metrics that comprise the IBI. The metrics used for the calculation of the IBI will include those, which are used for boat elctro-fishing sites. Results from potentially contaminated pond locations will be compared to physically similar, on-site reference ponds.

3.3 Benthic Macroinvertebrates (Lotic and Lentic)

The Ohio EPA uses a combination of quantitative and qualitative sampling methods to collect data on benthic diversity, relative abundances, and distribution. The principal measure of overall macroinvertebrate community condition is the Invertebrate Community Index (ICI; Ohio EPA, 1987). The ICI is a modification of the IBI described above and consists of the ten structural community metrics:

Total Number of Taxa
Total Number of Mayfly Taxa
Total Number of Caddisfly Taxa
Total Number of Dipteran Taxa
Percent Mayfly Composition
Percent Caddisfly Composition
Percent Tribe Tanytarsini Midge Composition
Percent Other Dipteran and Non-insect Composition
Percent Tolerant Organisms
Total Number of Qualitative Ephemeroptera/Plecoptera/Trichoperta (EPT) Taxa

Metrics 1-9 are generated from artificial substrate data while metric 10 (number EPT taxa) uses only qualitative data. The point system associated with each metric is based on drainage area and allows a sample to be evaluated against a database of 247 relatively undisturbed reference sites throughout Ohio. Points are assigned based comparability to exceptional, good, and slight deviation from good. Zero points are assigned for major deviation from good values. The maximum additive ICI score possible is 60 with higher scores being indicative of a healthier benthic community. The sum of the individual metric scores is the overall ICI score, which is then compared to Ohio EPA criteria.

Not all lotic (stream) sites will be suitable for ICI determination, but decisions as to their suitability will be made at the time of sampling.

Additionally, ICI-related measurements will be made at lentic (pond) sites, but use of these measurements will be determined at the time of sampling by the RVAAP Environmental Team.

3.3.1 State Specifications

The macroinvertebrate community at the RVAAP sampling locations will be sampled qualitatively, and where flow conditions permit, quantitatively. The quantitative sample consists of a composite sample of 5 modified Hester-Dendy multiple plate samplers. The samplers are placed in flowing water and allowed to colonize for six weeks. The samplers are then collected and all the macroinvertebrates colonizing the Hester-Dendy samplers are identified to the lowest practical level and counted. When the quantitative samples are collected, a qualitative sample will also be collected. At sites where insufficient flow prevents collecting a quantitative sample,

a qualitative sample will be collected. The qualitative sample consists of an inventory of all the observed macroinvertebrate taxa collected from all the available habitat types at a sampling location. The RVAAP pond sampling locations will be sampled qualitatively and quantitatively using Hester-Dendy samplers. Activity traps will also be used to sample the macroinvertebrate and amphibian community of the ponds. The activity (funnel) traps are similar to minnow traps only made of window screening. The trap consists of an aluminum screen cylinder with fiberglass screen funnels facing the inside of the trap from each open end. Macroinvertebrates, amphibians, and fish enter the trap through the funnel ends and are unable to escape. Ten traps will be used for one 24-hour sampling period in each pond. The traps will be spaced uniformly around the perimeter of the pond at a depth sufficient to almost submerge the trap. After 24 hours the traps are emptied and the contents preserved for later identification and counting. The contents of each trap are processed separately.

3.4 Evaluations

3.4.1 Comparisons to State Criteria

The results of the IBI, MIWB, and ICI will be compared to biociteria (for streams only). Ohio EPA has set an overall goal of "marginally good" to be in full attainment of the warm water habitat. Partial attainment of WWH is achieved if any of the three scores are in the "marginally good" range with the remaining indices scoring in the 'fair' category, which may require some remedial action. If all of the measured indices are in the fair range or any of the index scores are in the 'poor' or 'very poor' range, the site will be considered in non-attainment, thus requiring some remedial action. Prior to remedial action decisions, determination will be made as to the source of chemical impact. Impacts due to up-gradient, off-installation activities that may influence RVAAP sampling locations are usually not the target for remedial activity.

3.4.2 Comparisons to Previous (1993 and 1999) Studies

The results of the IBIs will be qualitatively compared to similar results of the OHARNG 1993 and 1999 studies. Meteorological data for three months prior to the study will be included qualitatively as an indicator of water flow conditions.

3.4.3 Comparisons Along a Given Stream

The results of the IBIs, QHEIs, and ICIs will be compared within a given surface water basin, comparing results from upsteam most sampling stations proceeding downgradient to the downstream most sampling stations.

3.4.4 Comparison of Lentic (Pond) Study Data to Lentic (Pond) Reference Data

The results of the IBI, and MIwb fish data, as well as the qualitative, quantitative and activity trap data for macroinvertebrates from the study sites will be compared to corresponding data from the facility reference ponds..

3.5 Chemical Analysis

Chemical analysis of constituents identified in Table 1, below will conform to Facility-Wide Sampling and Analysis Plan for Environmental Investigations at Ravenna Army Ammunition Plant, Ravenna, OH. USACE. March 2001.

- Sediment

Fine-grained sediment grab samples will be collected in the upper 4 inches of bottom material using either decontaminated stainless steel scoops, Ekman dredges or Ponar dredges. Collected

sediment will be placed into appropriate sampling containers, placed on ice (to maintain 4°C) and shipped to the USACE contract lab. Sampling and decontamination protocols will follow those listed in the Ohio EPA Sediment Sampling Guide and Methodologies, November 2001. Additionally, chemical analysis of the sediment will conform to Facility-Wide Sampling and Analysis Plan for Environmental Investigations at RVAAP, Ravenna, Ohio, USACE. March 2001 and the Louisville Chemistry Guidelines (version 5; USACE 2002).

- **Surface Water**

Surface water grab samples will be collected from the upper 12 inches of stream/[pond water and sampled directly into appropriate containers. The RVAAP stream and pond sampling locations will be sampled twice, with the first pass occurring when the Hester/Dendy samplers are set, and the second pass occurring when the Hester/Dendy samplers are retrieved. Collected water will be preserved using appropriate methods, as outlined in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 1991) and the Louisville Chemistry Guidelines (version 5; USACE 2002), and shipped to the USACE contract lab. Additionally, chemical analysis of the surface water will conform to Facility-Wide Sampling and Analysis Plan for Environmental Investigations at RVAAP, Ravenna, Ohio, USACE. March 2001.

3.5.1 Quality Control Samples

Quality Control sample will be collected as directed by the LCG (version 5, USACE 2002) and will be submitted to a Corps contract lab different from the primary lab as a split blind field duplicate.

Table 1. List of chemical parameters to be analyzed in sediment and surface water samples. Sediment samples will be collected once, water samples twice (except for PCBs and pesticides, which will be sampled once), as discussed above.

Parameters	Sediment	Water
Metals: TAL	all samples	all samples
Cyanide (free or total)	all samples	all samples
BNAs (SVOCs)	all samples	all samples
PCBs	all samples	all samples
Pesticides	all samples	all samples
Explosives	all samples	all samples
Total Organic Carbon	all samples	none
Nitrates/Nitrites	all samples	all samples
Grain Size	all samples	none
Ammonia-N	none	all samples
Phosphorus	none	all samples

4 Sampling Locations

The creek, stream or pond (with the exception of upstream sample and reference ponds) must be known or suspected to be impacted by activities specific to the RVAAP. This could be due to possible drainage ways from areas of concern, location within the boundaries of an AOC or facility specific use. Creeks and streams that are not located in the above conditions were not selected for sampling. Reference ponds were selected on-site in areas not expected to be impacted by facility activities with consideration to habitat, depth, and size. Additionally, no primary streams (streams with drainage areas less than 1 square mile, will be evaluated.

The lotic sampling locations were selected in places where water flow was estimated to be adequate for biotic assessment. In some cases, sampling locations may be slightly altered if better conditions are available in an appropriate direction. Locations will be further evaluated in the field during sampling to ensure the most appropriate sites are sampled.

A listing of the proposed surface water sampling locations is shown on Table 2, and the locations of these sampling sites are shown on Enclosure A. Based on two sets of on-site meetings between the RVAAP Environmental Team members, 25 stream sampling locations have been identified (and an additional 3 added for contingency), and 9 pond sampling locations (and an additional 1 added for contingency) selected. Detailed maps of the sampling sites selected are provided as Enclosures B(1-30).

These sites were selected in August and October 2002. The exact locations of sampling will be based on conditions at the time of sampling (anticipated June- August 2003), and may be adjusted slightly from those shown on the enclosures. GPS coordinates of the actual sampling locations will be taken and reported.

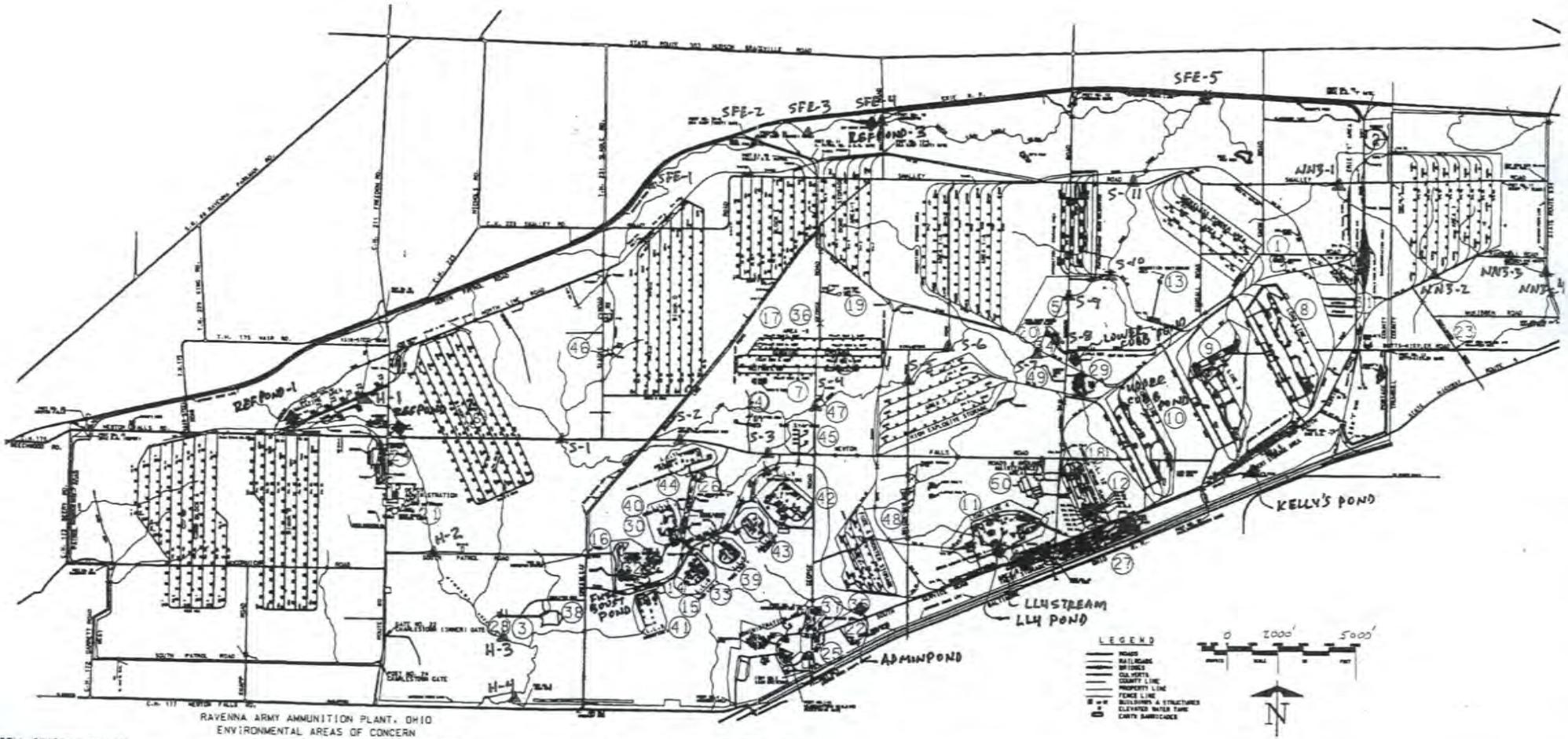
Table 1	Chemical Analyses
Table 2	Facility-Wide Surface Water Sampling Locations
Enclosure A	Facility-Wide Surface Water Sampling Locations
Enclosure B(1 – 30)	Individual Surface Water Sampling Location Maps

TABLE 2 RVAAP- SCOPE OF WORK FACILITY-WIDE SURFACE WATER SAMPLING LOCATIONS (STREAMS)

*FINAL SITE NAME	SITE LOCATION	GPS NAME	1993 SAMPL STA	1999 SAMPL STA	WATERSHED	APPROX POSITION IN WATERSHED	SURFACE WATER TYPE	RELEVANCE TO AOCs	DESCRIPTION
	HINCKLEY CREEK BASIN (4)								
H-1	HINKLEY @ MAGAZINE RD	W-4	30		HINKLEY CR	UPPER	STREAM	Upgradient of AOCs	FREE- FLOWING
H-2	HINKLEY CR @ S PATROL RD	W-8	28	58	HINKLEY CR	INTERMED	STREAM		FREE-FLOWING
H-3	HINKLEY CR				HINKLEY CR	INTERMED	STREAM	NACA, DEMO #1	FREE-FLOWING
H-4	HINKLEY CR @ S PERIMETER RD	W-9	27	57	HINKLEY CR	DS LIMIT IN FACILITY	STREAM		FREE-FLOWING; IS ALSO NPDES SITE BUILT AS DELUXE GAGING STA
	SAND CREEK BASIN (11)								
S-1	SAND CR W OF SLAGLE RD		20	50	SAND CR	UPPER	STREAM	Upgradient of AOCs	FREE-FLOWING
S-2	SAND CR TRIB AT NEWTON FALLS RD	W-11	18	48	SAND CR	INTERMED	STREAM	DS OF WEST FUZE BOOSTER LL's	FREE-FLOWING
S-3	SAND CR TRIB AT NEWTON FALLS RD	W-10	26	56	SAND CR	INTERMED	STREAM	DS OF EAST FUZE BOOSTER LL's	FREE-FLOWING
S-4	SAND CR AT GEORGE RD	W-12	17	47	SAND CR	INTERMED	STREAM	DS OF DEMO AREA #2	FREE-FLOWING HAS ROCK BOTTOM
S-5	SAND CR @ WILCOX-WAYLAND		16	46	SAND CR	INTERMED	STREAM	DS OF WINKL BURN GROUND	FREE-FLOWING
S-6	SAND CR TRIB WINKLE ROAD		23	53	SAND CR	INTERMED	STREAM	DS OF N WINKLE LAND FILL	LOW FLOW, BUT DOABLE
S-7	SAND CR AT RR W OF PARIS WINDHAM RD	W-13			SAND CR	INTERMED	STREAM	DS OF CENTRAL BURN PITS	FREE FLOWING UPSTREAM OF LARGE SUPERSPAN; ADJACENT TO US END OF SAND CR LANDFILL
S-8	OUTFALL FROM LOWER COBBS	W-14			SAND CR	INTERMED	CREEK	DS OF LOWER COBBS POND	FREE-FLOWING, BUT SMALL FLOW
S-9	SAND CR AT PARIS-WINDHAM RD	W-16	12	42	SAND CR	INTERMED	STREAM	DS OF PARIS-WINDHAM DUMP	FREE-FLOWING
S-10	SAND CR SE OF AREA 2/ Down Stream of RR		11	41	SAND CR	LOWER	STREAM		FREE-FLOWING
S-11	SAND CR AT AT SMALLEY RD	W-17	9,10	40	SAND CR	DOWN STREAM	STREAM		FREE-FLOWING
	SOUTH FORK EAGLE CREEK BASIN (5)								
SFE-1	Trib to S. FORK EAGLE CR (WHERE ENTERS)		7	37	S. FORK EAGLE CR	UPPER	STREAM	Upgradient of AOCs	FREE-FLOWING
SFE-2	Trib to S. FORK EAGLE CR		6	36	S. FORK EAGLE CR	UPPER	STREAM		FREE-FLOWING BELOW DAM / BRIDGE
SFE-3	S. FORK EAGLE CR		5		S. FORK EAGLE CR	INTERMED STREAM	STREAM		FREE-FLOWING
SFE-4	S. FORK EAGLE CR		4	34	S. FORK EAGLE CR	INTERMED	STREAM	DS OF BOY SCOUT DAM	FREE-FLOWING
SFE-5	S. FORK EAGLE CR		1	31	S. FORK EAGLE CR	LOWER	STREAM	WHERE EXITS FACILITY	SOMEWHAT STILL, BUT ACCEPTABLE DS OF SAND CR CONFLUENCE
	NO NAME #3 CREEK BASIN (4)								
NN3-1	DRAINAGE FR ERIE AT SMALLEY ROAD				NO NAME #3	INTERMED	STREAM	DS OF ERIE US OF LL-1	PONDED BY BEAVER DAM FURTHER DOWNSTREAM
NN3-2	DRAINAGE FR ERIE S OF AREA 7			64	NO NAME #3	INTERMED	STREAM	DS OF ERIE US OF LL-1	FREE-FLOWING
NN3-3	BAILEY BRIDGE SITE		33		NO NAME #3	INTERMED	STREAM	DS OF ERIE, LL-1 OHARNG ACTIVITY	FREE-FLOWING MUCH OHARNG ACTIVITY
NN3-4	N0 NAME #3 AT ST RT 534				NO NAME #3	DS LIMIT IN FACILITY	STREAM	AT FACILITY OUTFALL	FREE-FLOWING MUCH SAMPLING HAS BEEN DONE IN PAST; IS NPDES LOCATION
	LOAD LINE 4								
LL4STREAM	STREAM FROM LL-4	W-20			NO NAME #5	DOWN STREAM	STREAM	DS OF LL-4	FREE-FLOWING; LL-4 IS AREA WHERE COMPOSTING IS TO BE DONE

TABLE 2 RVAAP- SCOPE OF WORK FACILITY-WIDE SURFACE WATER SAMPLING LOCATIONS (PONDS)

MAP SITE NUMBER	SITE LOCATION	GPS NAME	1993 SAMPL STA	1999 SAMPL STA	WATERSHED	APPROX POSITION IN WATERSHED	SURFACE WATER TYPE	RELEVANCE TO AOCs	DESCRIPTION
	REFERENCE PONDS (3)								
REFPOND-1	BEAVER IMP	W-4	42	21	HINKLEY CR	UPPER	POND	POSSIBLE	400' x 900'
	BUNDLING RD							REF POND	
REFPOND-2	RT 80 TROUT		54	13	HINCKLEY CR	UPPER	POND	POSSIBLE	200' x 300'
	POND							REF POND	
REFPOND-3	BOY SCOUT			17	S. FORK	INTERMED	LAKE	BOY SCOUT	
	LAKE				EAGLE CR			LAKE	
	STUDY PONDS (6)								
FUZE/BOOST	FUZE/BOOSTER		51,52	11,14	HINCKLEY CR	INTERMED	PONDS	FUZE/BOOSTER	USE DOWNSTREAM-MOST POND
POND	QUARRY PONDS		53					QUARRY PONDS	
UPPERCOBB	UPPER COBBS			1	SAND CR	INTERMED	POND	DS OF LL-3, 12	
POND	POND								
LOWCOBB	LOWER COBBS	W-15	45	9	SAND CR	INTERMED	POND	IS AN AOC	FISH TISSUE SAMPLING DONE IN 1997
POND	POND								
LL4POND	LL-4 POND			10	NO NAME #5		POND	DS OF LL-4	CATCHES DRAINAGE FROM FUTURE
									EXPLOSIVES COMPOSTING
ADMINPOND	POND E OF ADMIN		48	15			POND	DS OF ADMIN	
	AREA							AREA	
KELLY'S	KELLY'S POND	W-19	44	8	NO NAME #4	DOWN	POND	DS OF LL-2	SEDIMENT BASIN FOR LL-2
POND						STREAM			



RAVENNA ARMY AMMUNITION PLANT, OHIO
ENVIRONMENTAL AREAS OF CONCERN

1. RAMSDELL QUARRY LANDFILL
2. ERIE BURNING GROUNDS
3. DEMOLITION AREA #1
4. DEMOLITION AREA #2
5. WINKLEPECK BURNING GROUNDS
6. C BLOCK QUARRY
7. BLDG 1601 HAZ WASTE STORAGE
8. LOAD LINE 1
9. LOAD LINE 2
10. LOAD LINE 3
11. LOAD LINE 4
12. LOAD LINE 12
13. BUILDING 1200
14. LOAD LINE 6, EVAPORATION UNIT
15. LOAD LINE 6, PINK WATER TREATMENT FACILITY
16. FUZE & BOOSTER BURN PITS/LANDFILL
17. DEACTIVATION FURNACE
18. LOAD LINE 12 PINK WATER TRT PLANT
19. LANDFILL NORTH OF WINKLEPECK BG
20. SAND CREEK SEWAGE TRT PLANT
21. DEPOT SEWAGE TRT PLANT
22. GEORGE ROAD SEWAGE TRT PLANT
23. UNIT TRANING SITE- WASTE OIL TANK
24. RESERVE UNIT MAINT AREA WASTE OIL TANK
25. BLDG 1034 MOTOR POOL WASTE OIL TANK
26. FUZE & BOOSTER AREA SETTLING TANKS
27. BLDG 654 – PCB STORAGE
28. MUSTARD AGENT BURIAL SITE
29. UPPER & LOWER COBBS POND COMPLEX
30. LOAD LINE 7 PINK WATER TREATEMENT PLANT
31. ORE PILE RETENTION POND
32. 40 & 60 MM FIRING RANGE
33. LOAD LINE 8
34. SAND CREEK DISPOSAL ROAD LANDFILL
35. BLDG 1037 – LAUNDRY WASTEWATER SUMP
36. PISTOL RANGE
37. BLDG T – 4452 PESTICIDE STORAGE
38. NACA TEST AREA
39. LOAD LINE 5 / FUZE LINE 1
40. LOAD LINE 7 / BOOSTER LINE 1
41. LOAD LINE 8 / BOOSTER LINE 2
42. LOAD LINE 9 / DETONATOR LINE
43. LOAD LINE 10 / PERCUSSION ELEMENT
44. LOAD LINE 11 / ARTILLERY PRIMER
45. WET STORAGE AREA
46. BLDG'S F-15 AND F-16
47. BLDG T-5301 DECONTAMINATION
48. ANCHOR TEST AREA
49. CENTRAL BURN PITS
50. ATLAS SCRAP YARD
51. DUMP ALONG PARIS-WINDHAM ROAD

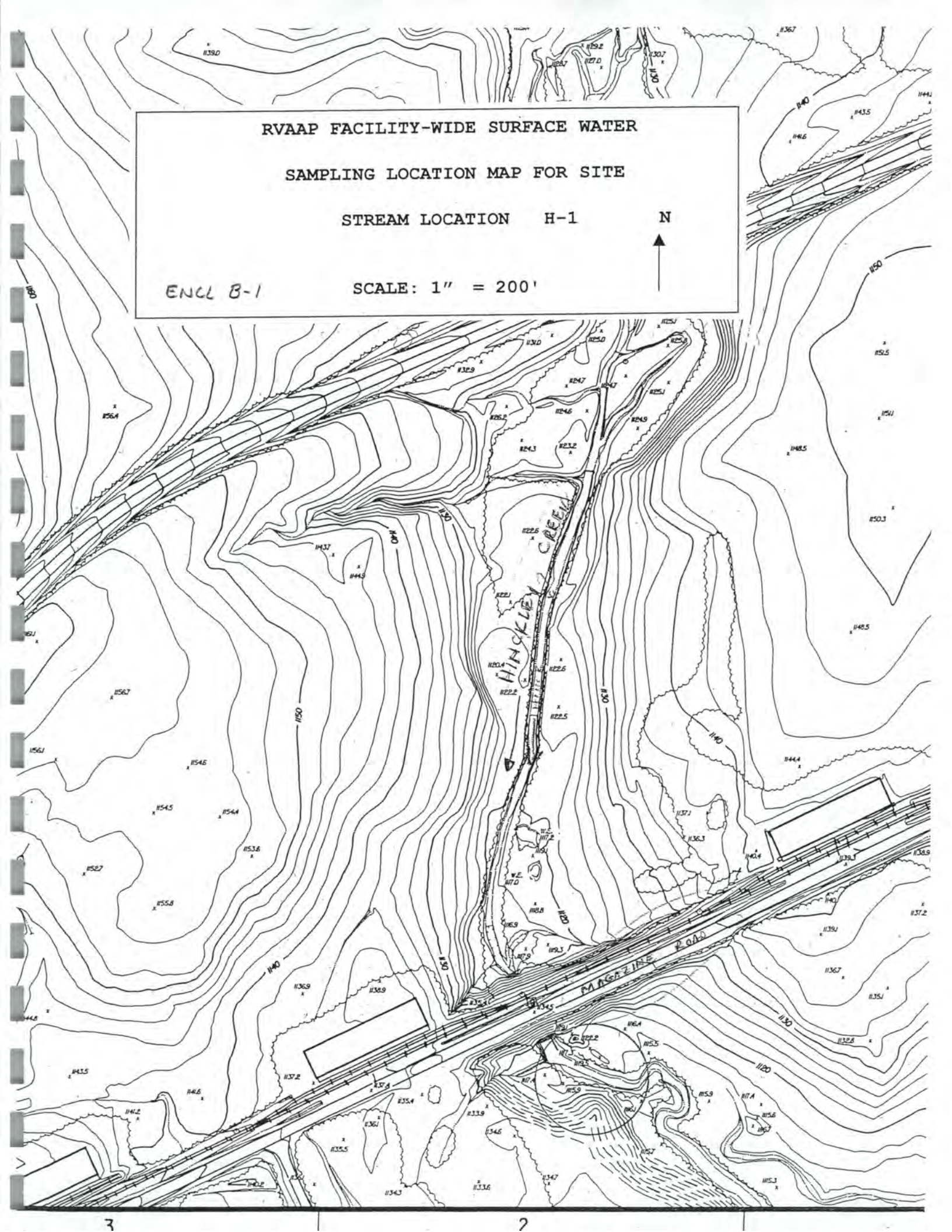
RVAAP FACILITY-WIDE SURFACE WATER SAMPLING LOCATIONS

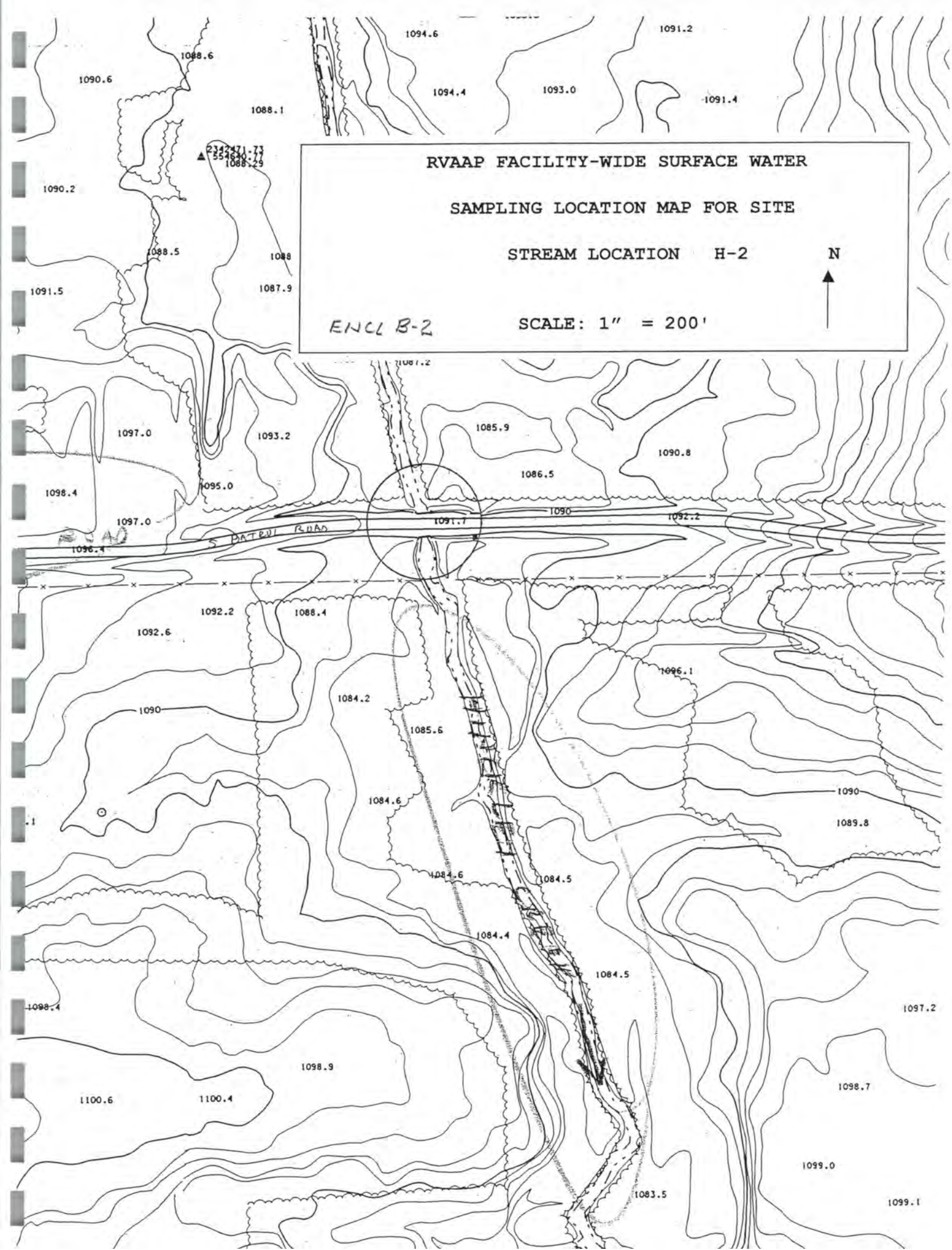
(DRAFT) SCOPE OF WORK

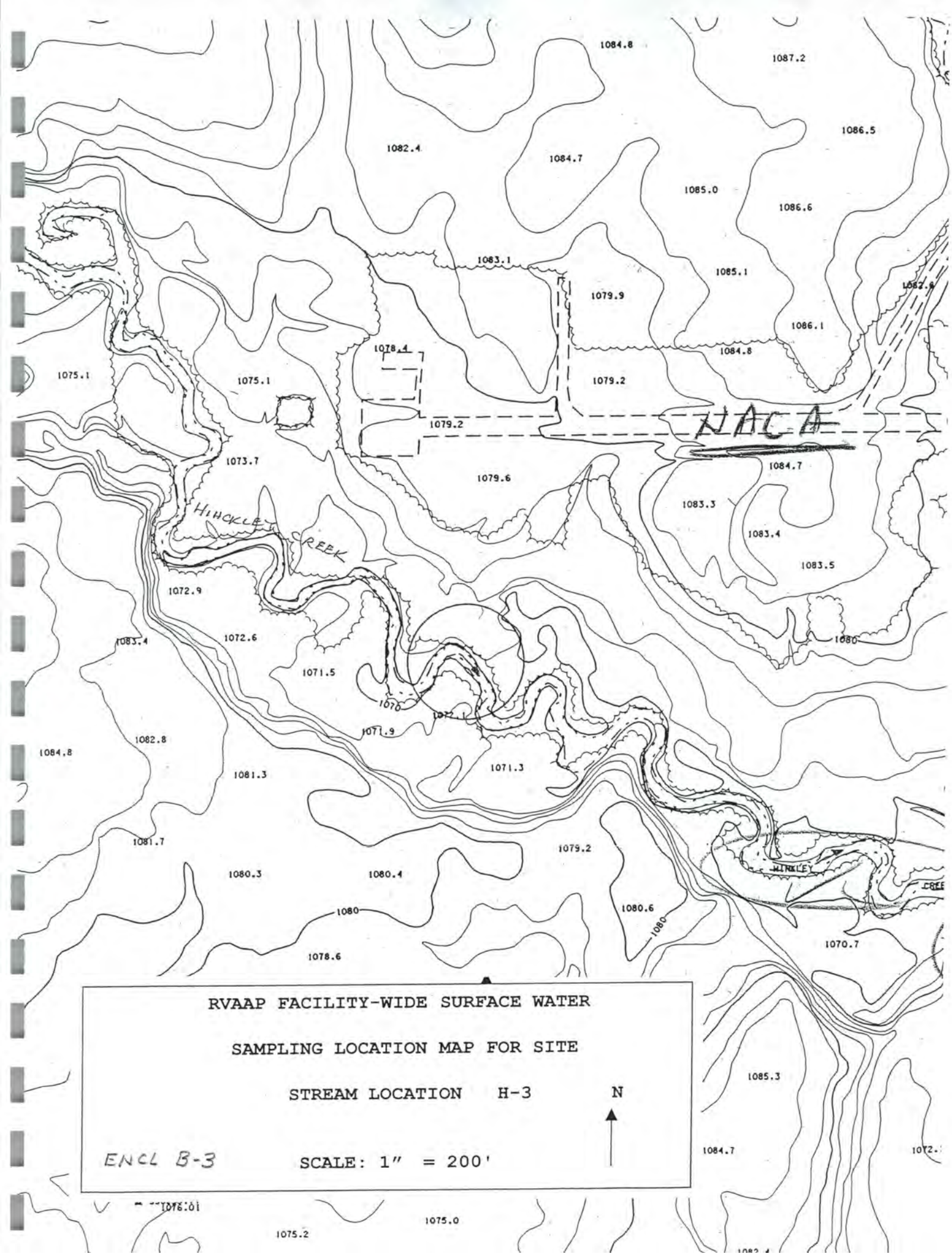
● = STREAM SAMPLING LOCATON

◆ = POND SAMPLING LOCATION

ENCL A


RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION H-1
N
ENCL B-1
SCALE: 1" = 200'
HINCKLEY CREEK
MAGAZINE ROAD


RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION H-2
N
ENCL B-2
SCALE: 1" = 200'
S PATRUI ROAD
1094.6
1091.2
1088.6
1090.6
1094.4
1093.0
1091.4
1088.1
1090.2
1088.5
1088
1091.5
1087.9
1097.0
1093.2
1085.9
1090.8
1086.5
1098.4
1095.0
1090
1092.2
1091.7
1096.4
1092.2
1088.4
1092.6
1096.1
1084.2
1090
1085.6
1084.6
1090
1089.8
1084.6
1084.5
1084.4
1084.5
1098.4
1097.2
1098.9
1098.7
1100.6
1100.4
1099.0
1083.5
1099.1



RVAAP FACILITY-WIDE SURFACE WATER

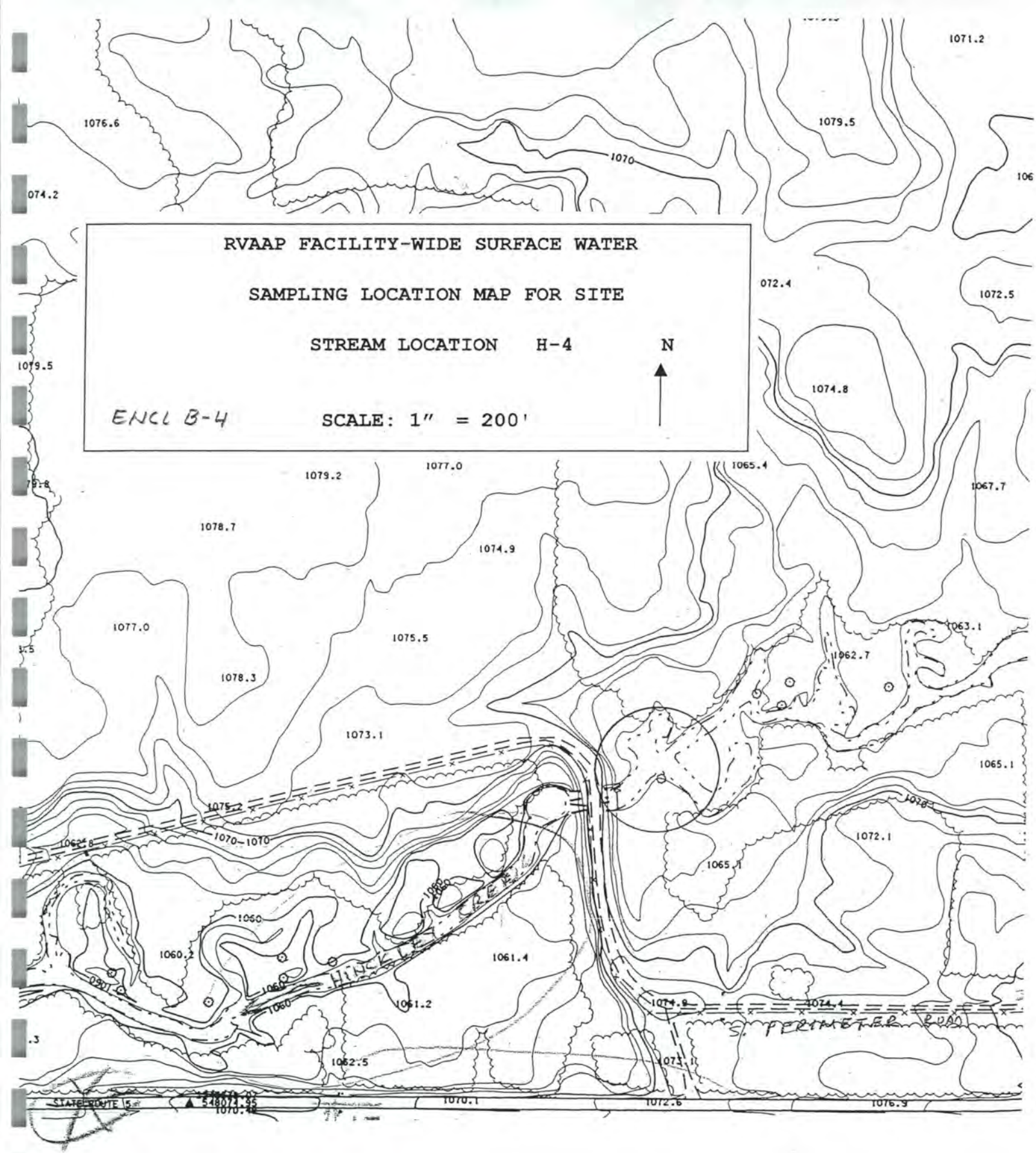
SAMPLING LOCATION MAP FOR SITE

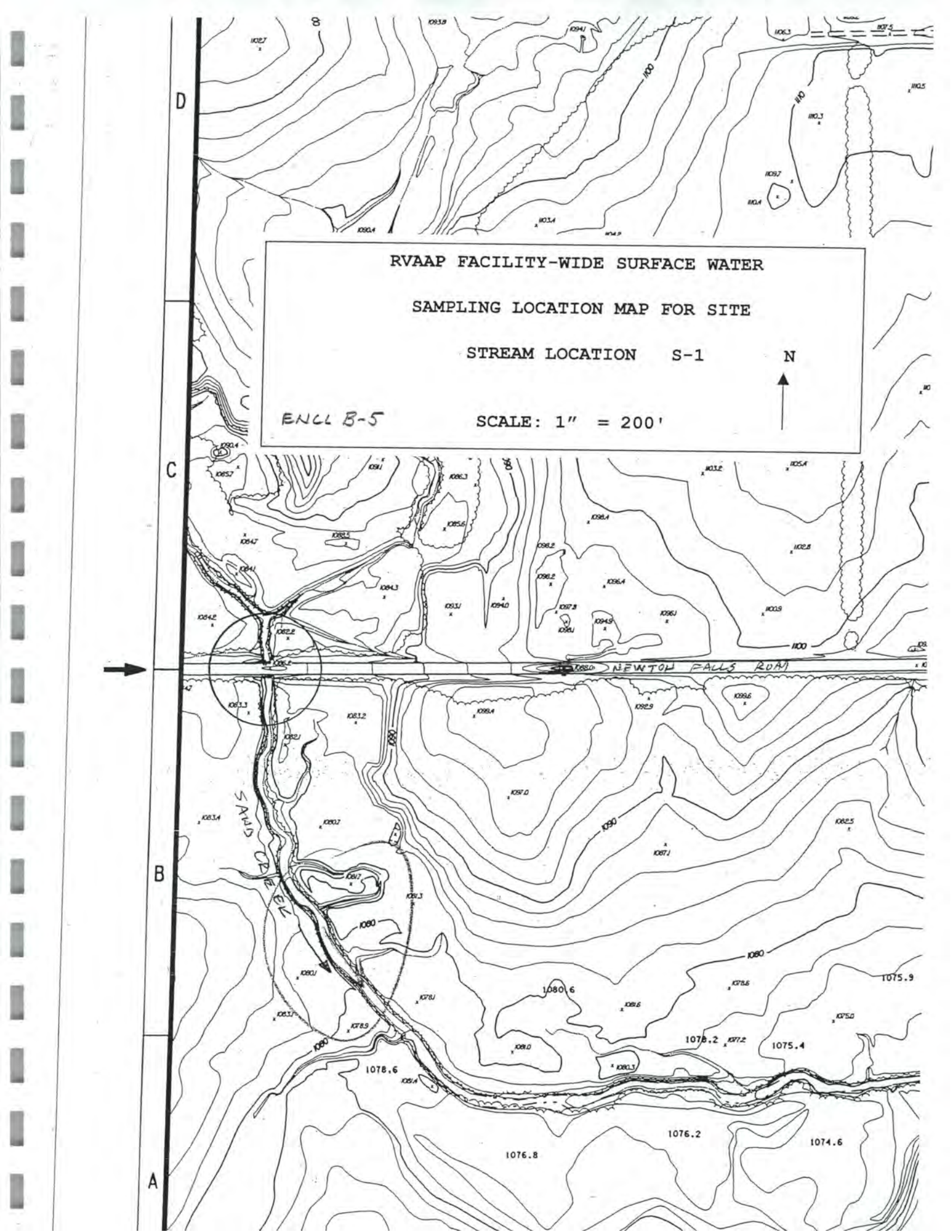
STREAM LOCATION H-3

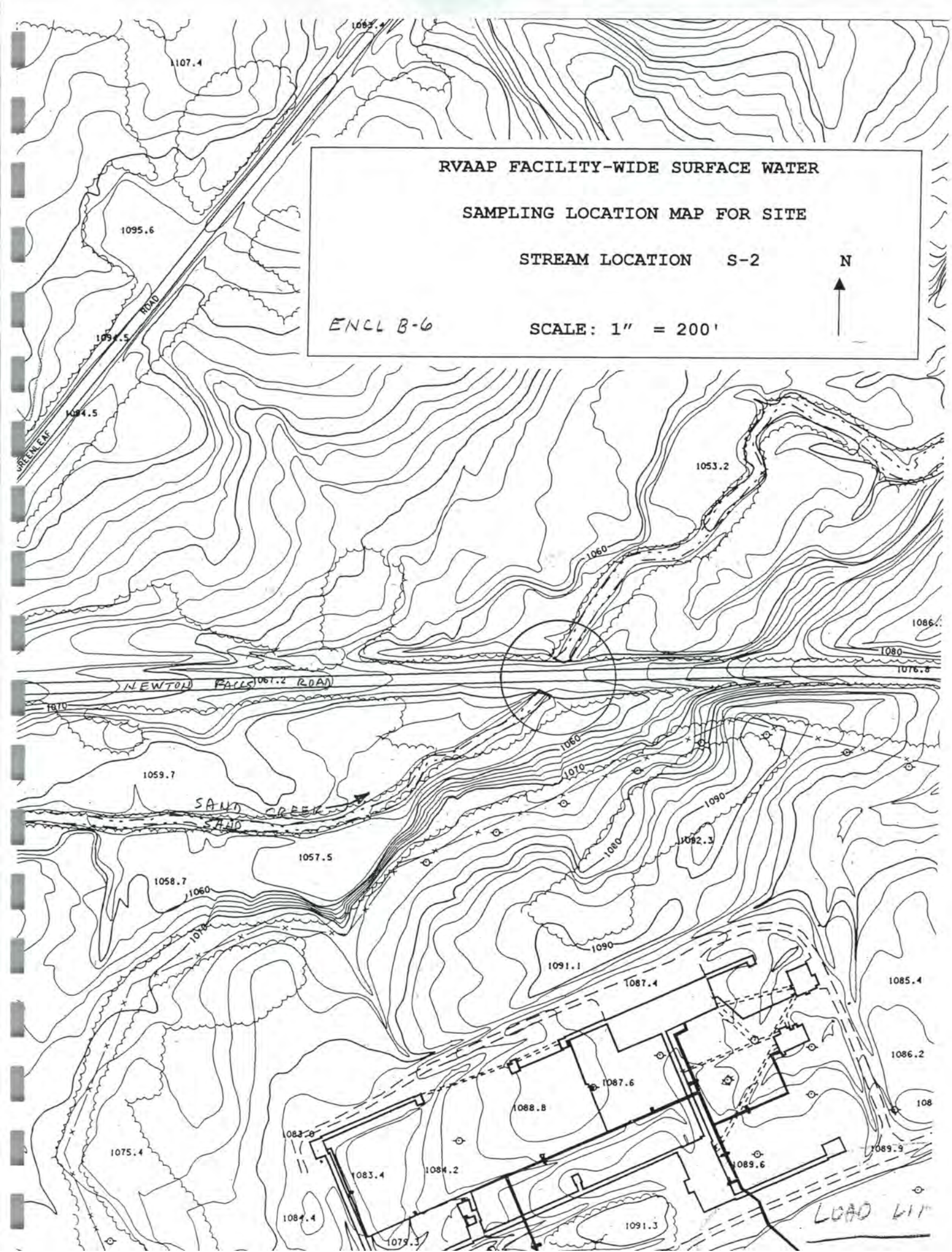
N

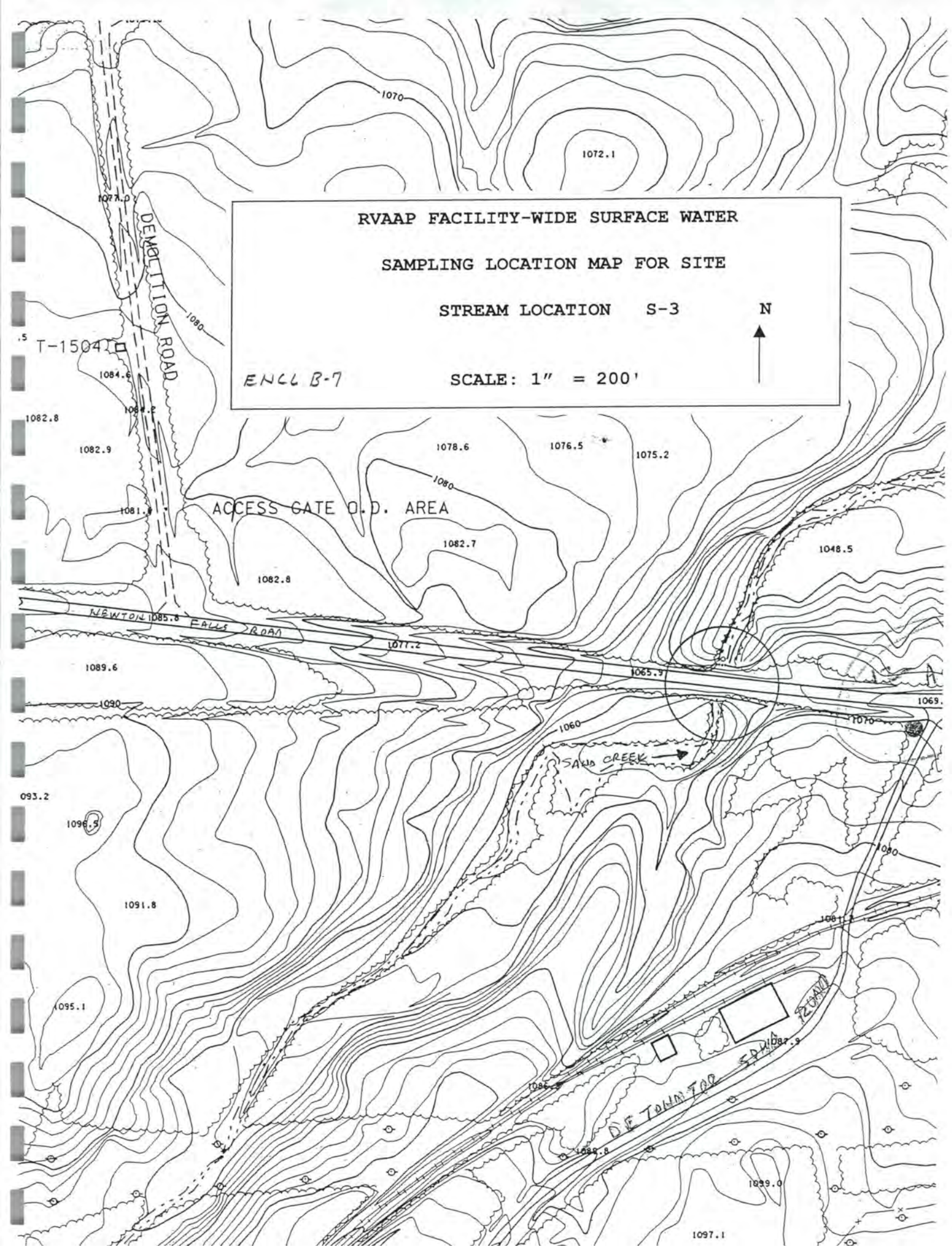
ENCL B-3

SCALE: 1" = 200'


RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION H-4
N
ENCL B-4
SCALE: 1" = 200'
1071.2
1076.6
1079.5
1070
1074.2
1072.4
1072.5
1074.8
1077.0
1079.2
1065.4
1067.7
1078.7
1074.9
1077.0
1075.5
1063.1
1062.7
1078.3
1073.1
1065.1
1072.1
1065.1
1060
1060.2
1061.4
1060
1061.2
1074.9
1062.5
1073.1
STATE ROUTE 5
1070.1
1072.6
1076.9


RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION S-1
N
ENCL B-5
SCALE: 1" = 200'
NEWTON FALLS ROAD
SAND CREEK
D
C
B
A
1100
1090
1080
1080.6
1078.6
1076.8
1076.2
1075.4
1075.9
1074.6


RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION S-2
N
ENCL B-6
SCALE: 1" = 200'
GREENLEAF ROAD
NEWTON FALLS RDAD
SAND CREEK
SAND
LOAD


RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION S-3
N
ENCL B-7
SCALE: 1" = 200'
DEMOLITION ROAD
T-1504
ACCESS GATE O.D. AREA
NEWTON FALLS ROAD
SAND CREEK
1070
1072.1
1080
1084.6
1082.8
1082.9
1078.6
1076.5
1075.2
1082.7
1048.5
1085.8
1089.6
1090
1060
1069.
1093.2
1096.5
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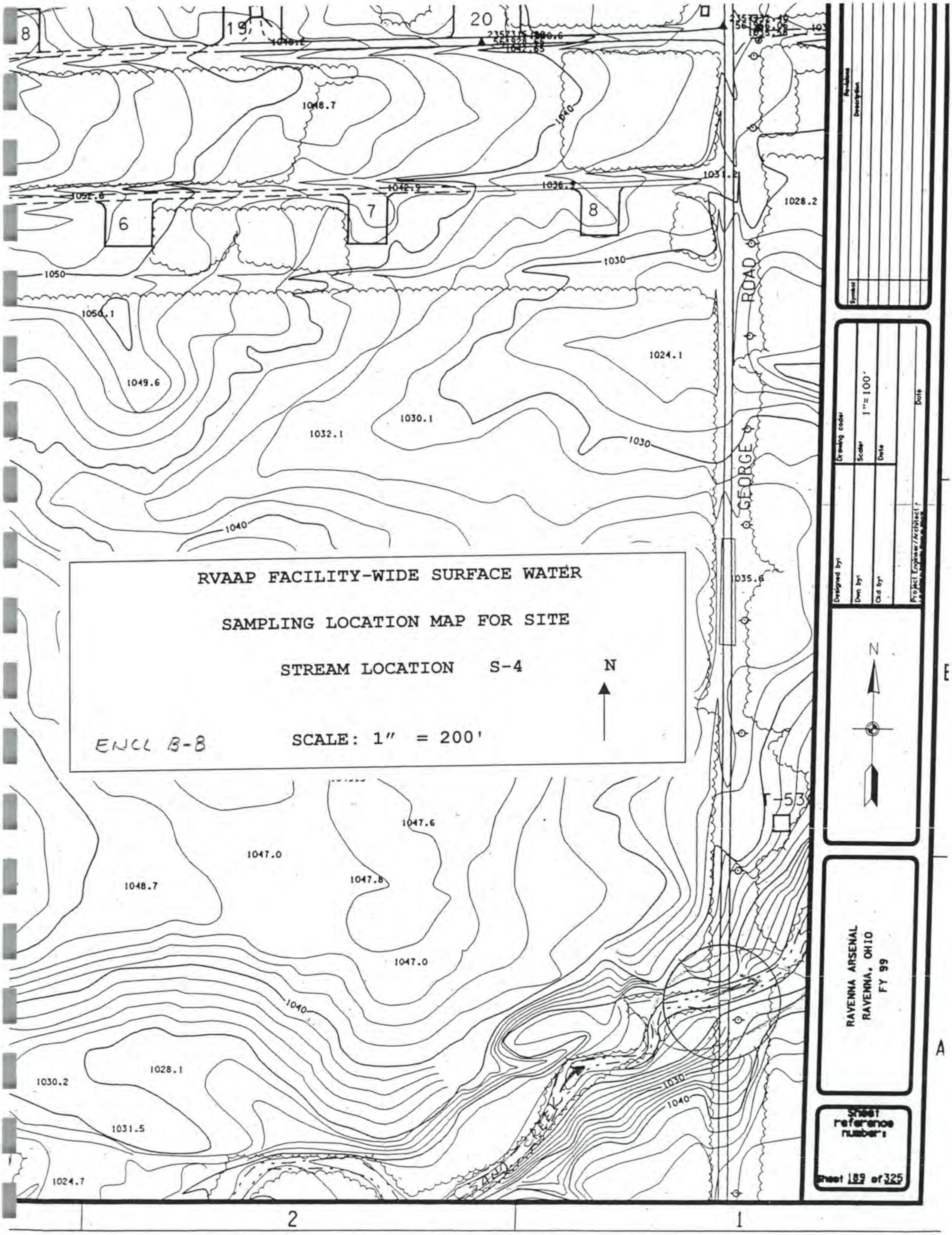
1095.1
1087.9
1086.8
1089.8
1089.0
1097.1


RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION S-4
N
SCALE: 1" = 200'
ENCL B-8
GEORGE ROAD
1048.7
1040
1031.2
1028.2
1052.8
1042.9
1036.2
6
7
8
1050
1030
1050.1
1024.1
1049.6
1030.1
1032.1
1035.6
T-53
1047.6
1047.0
1048.7
1047.8
1047.0
1028.1
1030.2
1031.5
1024.7
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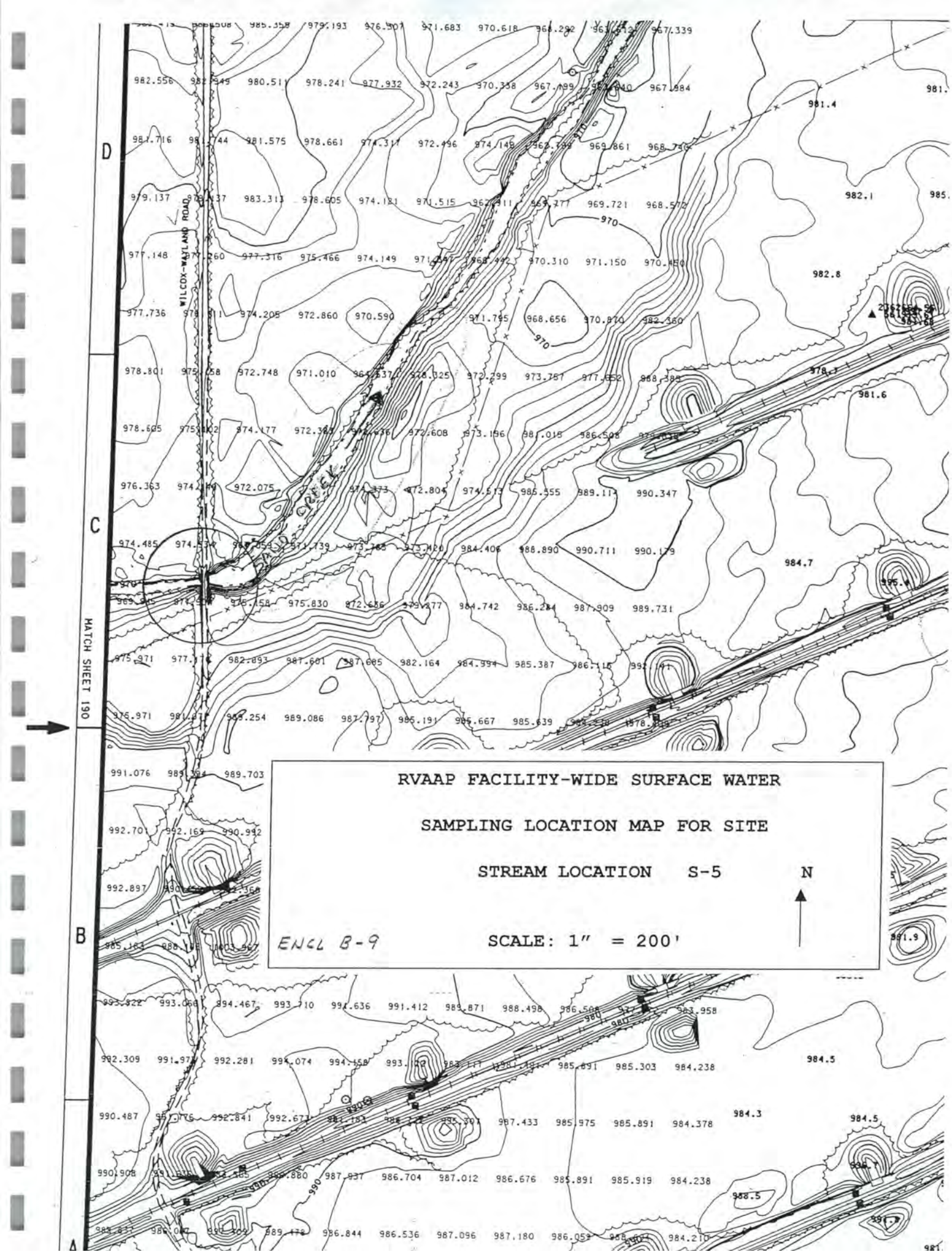
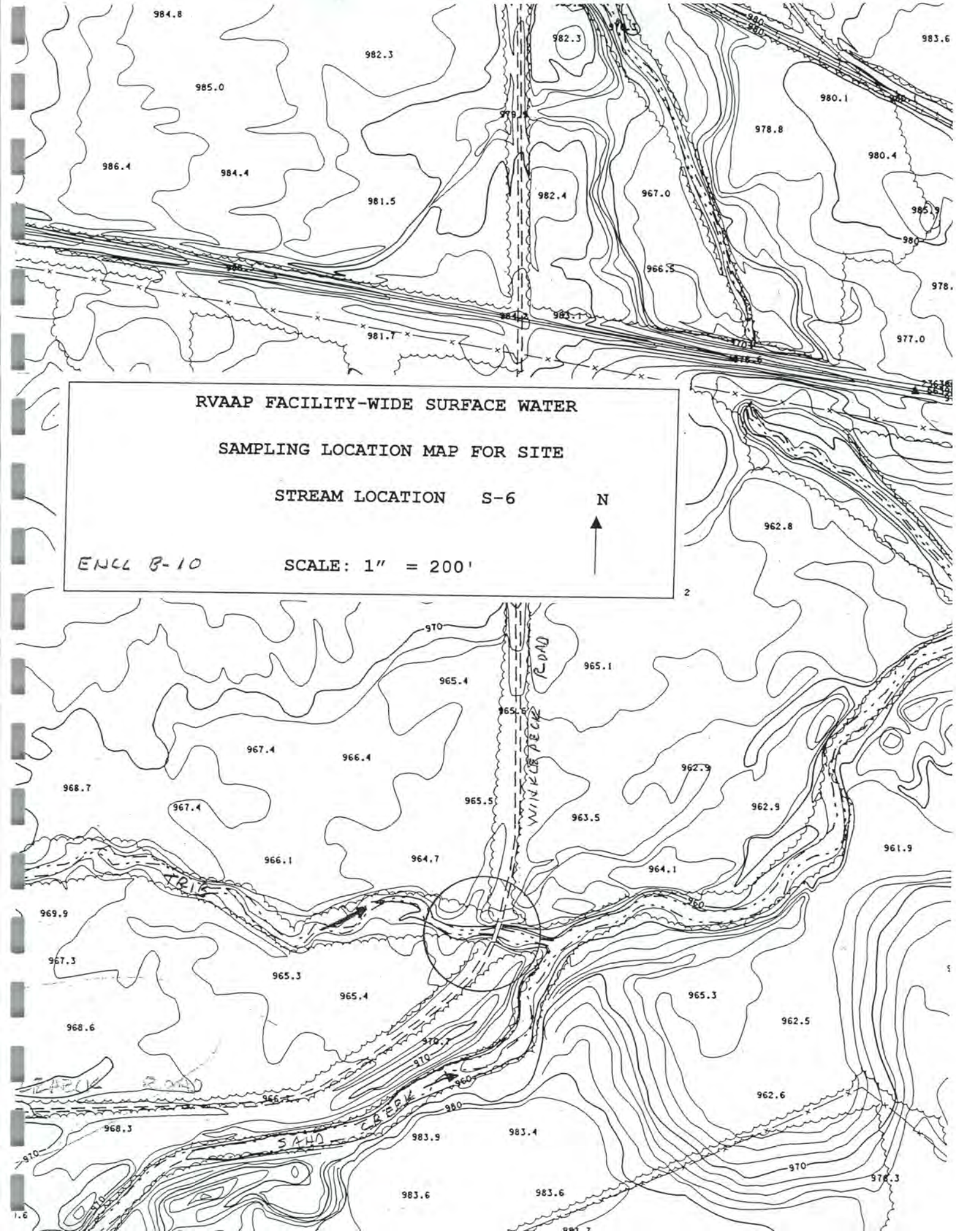
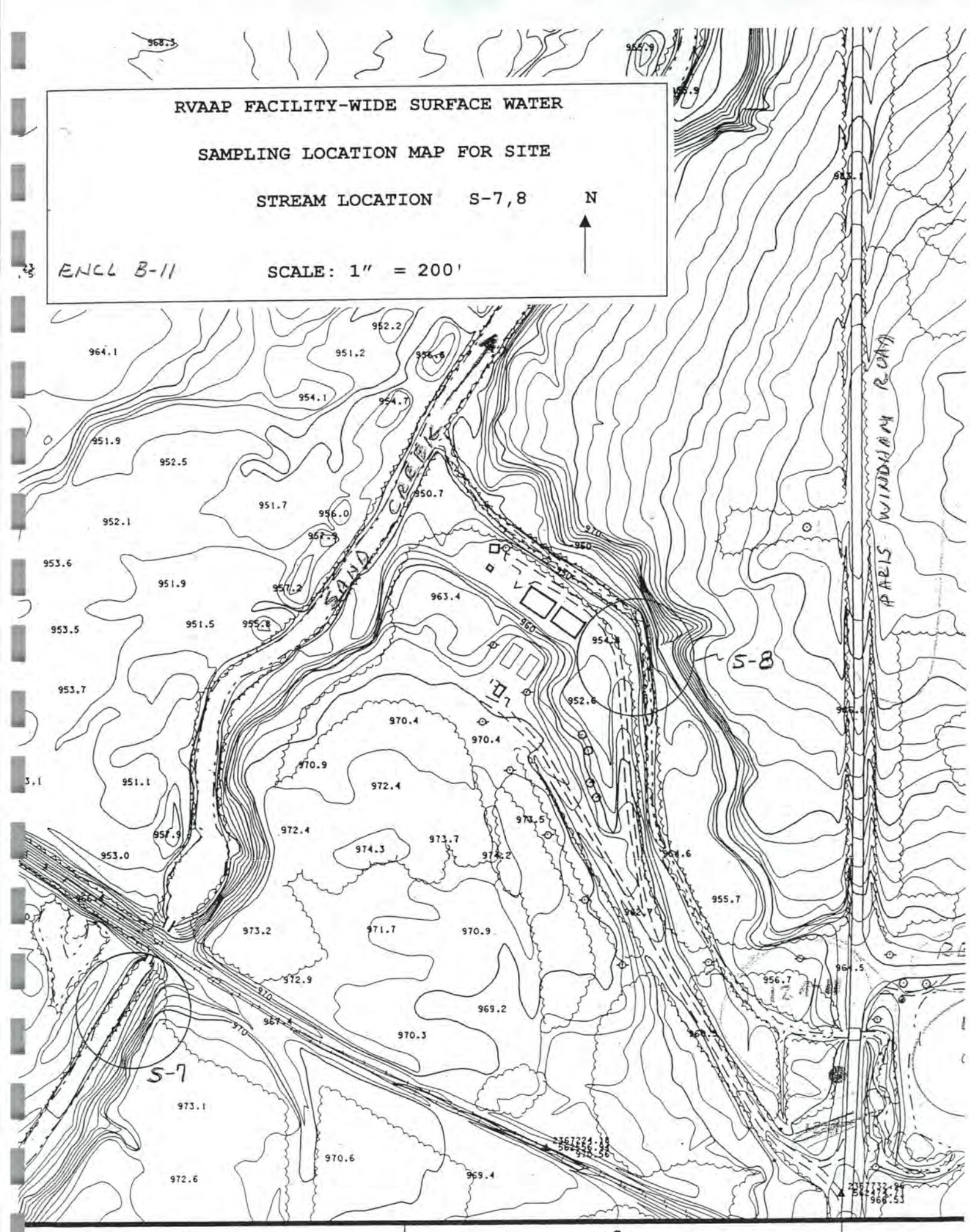
RAVENNA ARSENAL
RAVENNA, OHIO
FY 99
Sheet reference number:
Sheet 189 of 325
2
1
A


WILCOX-WALLAND ROAD
MATCH SHEET 190
D
C
B
A
RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION S-5
N
ENCL B-9
SCALE: 1" = 200'


RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION S-6
N
ENCL B-10
SCALE: 1" = 200'
WINKEL ROAD
CREEK
984.8
982.3
985.0
983.6
980.1
978.8
986.4
984.4
981.5
982.4
967.0
980.4
966.5
981.7
977.0
962.8
965.1
965.4
967.4
966.4
962.9
968.7
965.5
963.5
962.9
967.4
966.1
964.7
964.1
961.9
969.9
967.3
965.3
965.4
965.3
968.6
962.5
962.6
968.3
983.9
983.4
983.6
983.6
978.3



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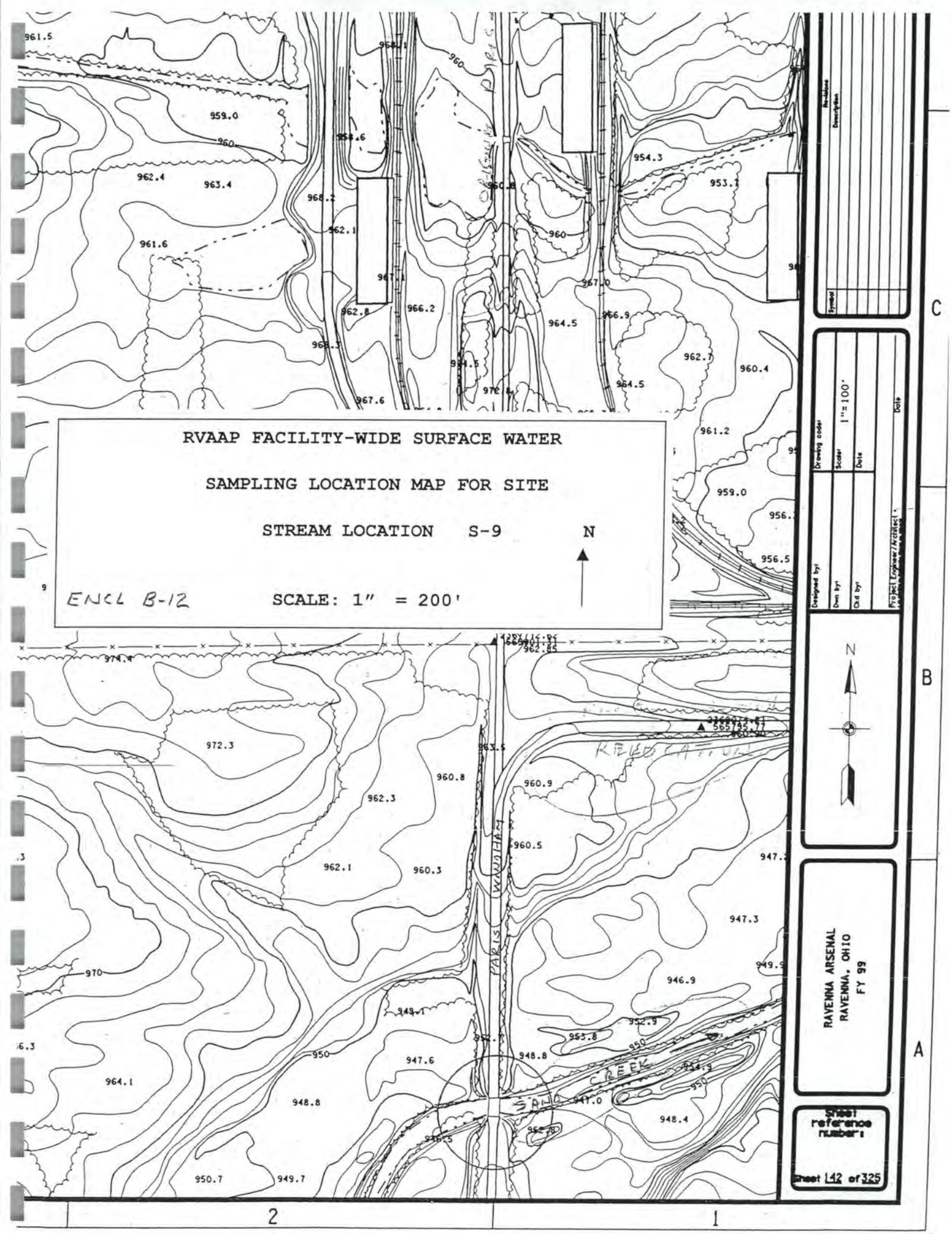
RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION S-9
N
ENCL B-12
SCALE: 1" = 200'
RAVENNA ARSENAL
RAVENNA, OHIO
FY 99
Sheet reference number:
Sheet 142 of 325
Drawing code:
Scale: 1"=100'
Date
Designed by:
Drawn by:
Chkd by:
Project Engineer/Architect:
Revisions
Description
Symbol
PARIS
WOODHALL
CREEK
SAND
RIVER STATION
961.5
959.0
962.4
963.4
961.6
962.1
962.8
966.2
964.5
962.7
960.4
964.5
961.2
959.0
956.5
972.3
960.8
962.3
960.9
960.5
962.1
960.3
947.3
970
946.9
964.1
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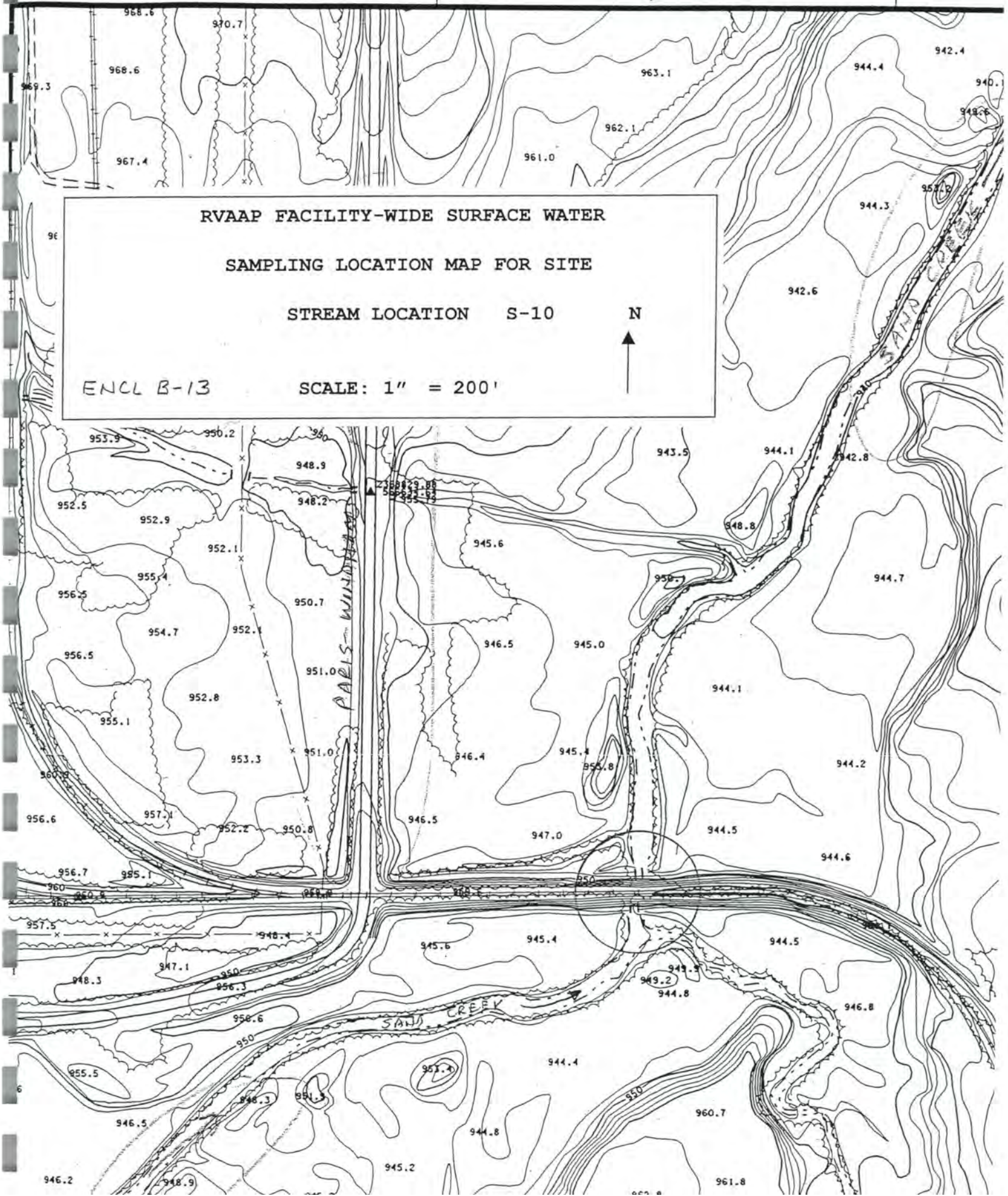
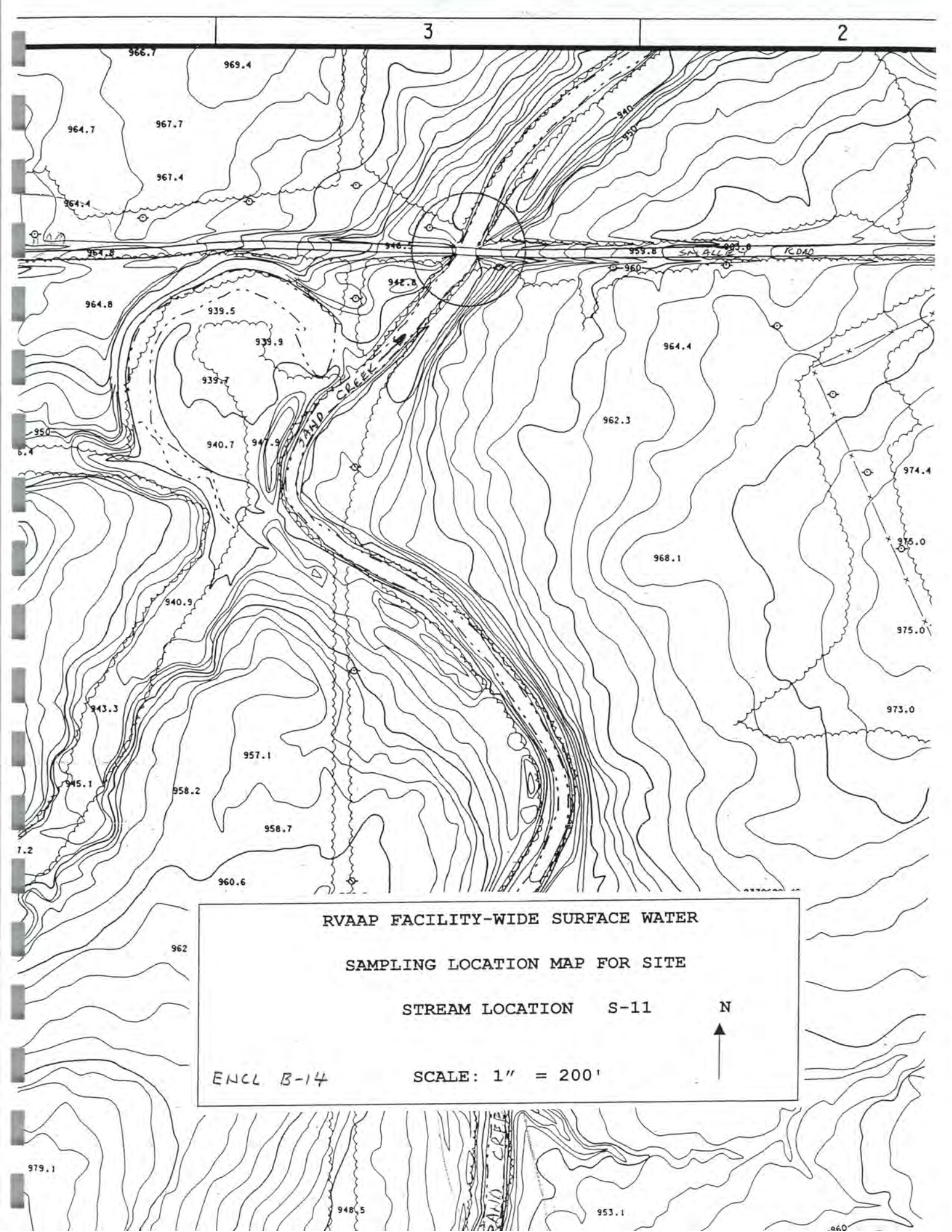
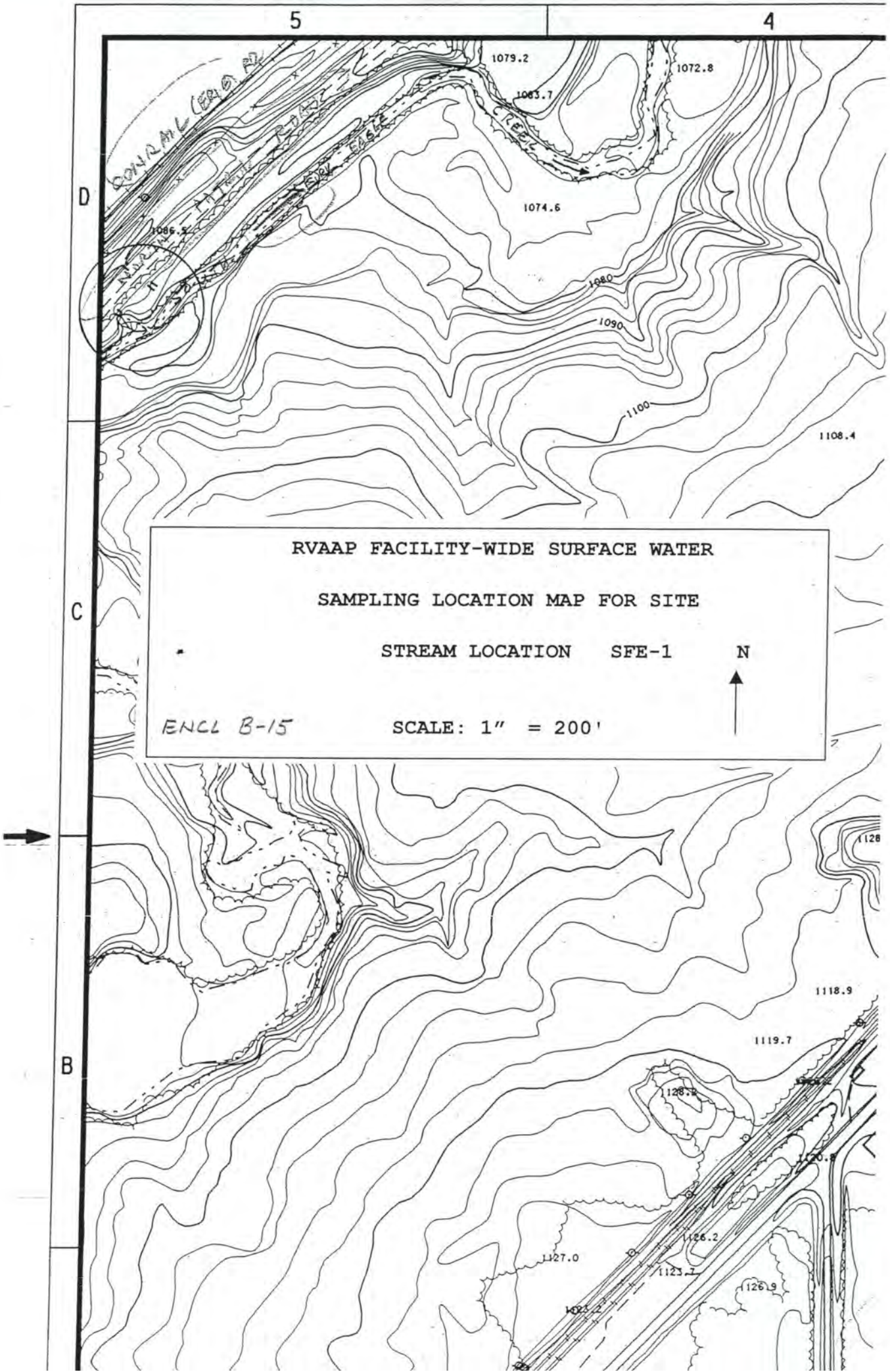
948.8
948.4
950.7
949.7
2
1
A
B
C

***

5 4


RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION S-10
N
ENCL B-13
SCALE: 1" = 200'
PAELS-WINNERMAN ROAD
SAND CREEK
SAND CREEK


3
2
966.7
969.4
964.7
967.7
967.4
964.4
964.8
946.5
959.8
960
942.8
964.8
939.5
939.9
939.7
964.4
962.3
950
940.7
947.9
SAND CREEK
974.4
968.1
940.9
975.0
973.0
943.3
957.1
945.1
958.2
958.7
960.6
962
979.1
948.5
953.1
960
RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION S-11
N
ENCL B-14
SCALE: 1" = 200'


5
4
D
C
B
1079.2
1072.8
1083.7
1074.6
1086.5
1080
1090
1100
1108.4
1118.9
1119.7
1128.2
1127.0
1123.7
1126.9
1123.2
RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION SFE-1
N
ENCL B-15
SCALE: 1" = 200'

RVAAP FACILITY-WIDE SURFACE WATER

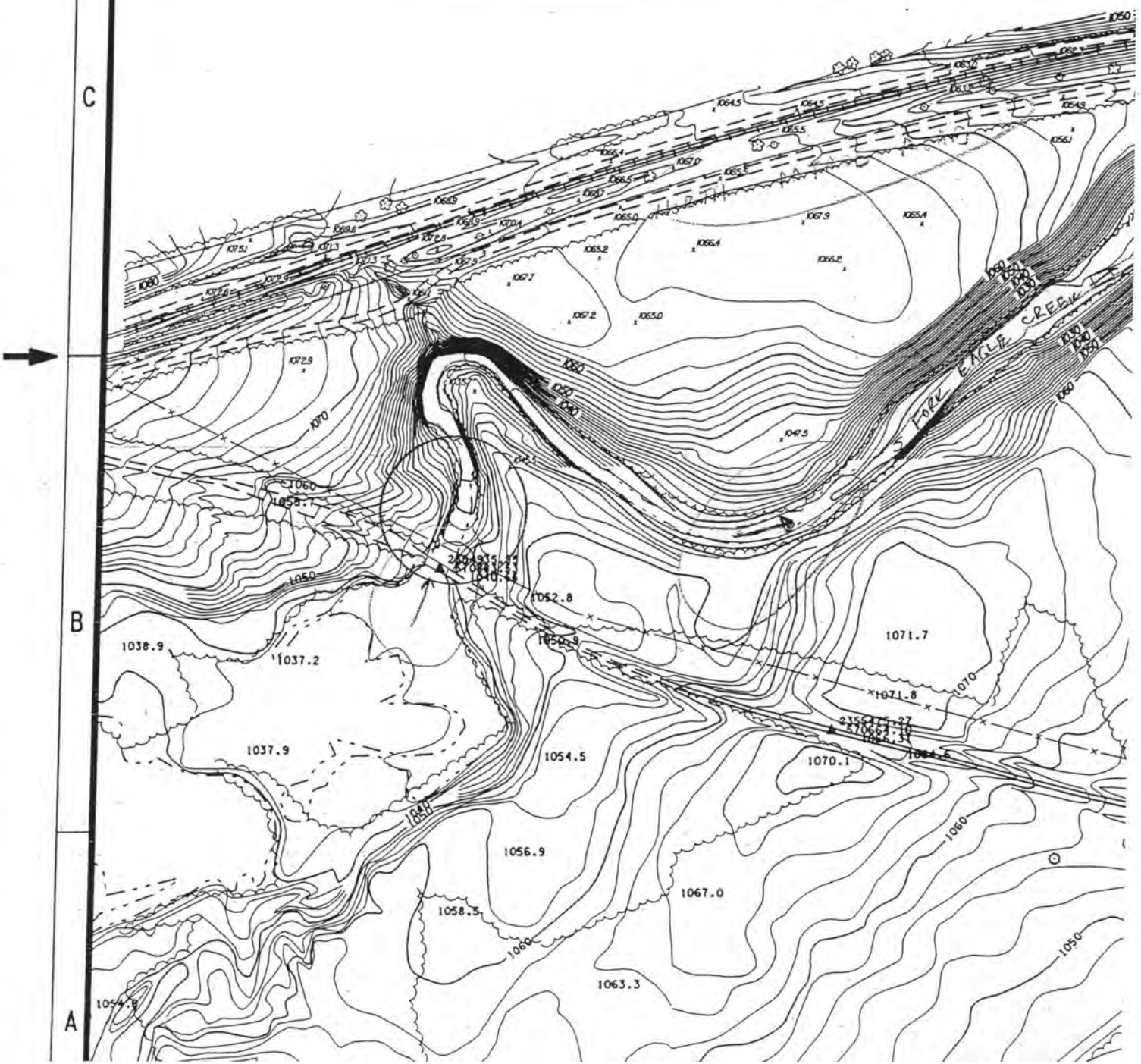
SAMPLING LOCATION MAP FOR SITE

STREAM LOCATION SFE-2

N

ENCL B-16

SCALE: 1" = 200'



RVAAP FACILITY-WIDE SURFACE WATER

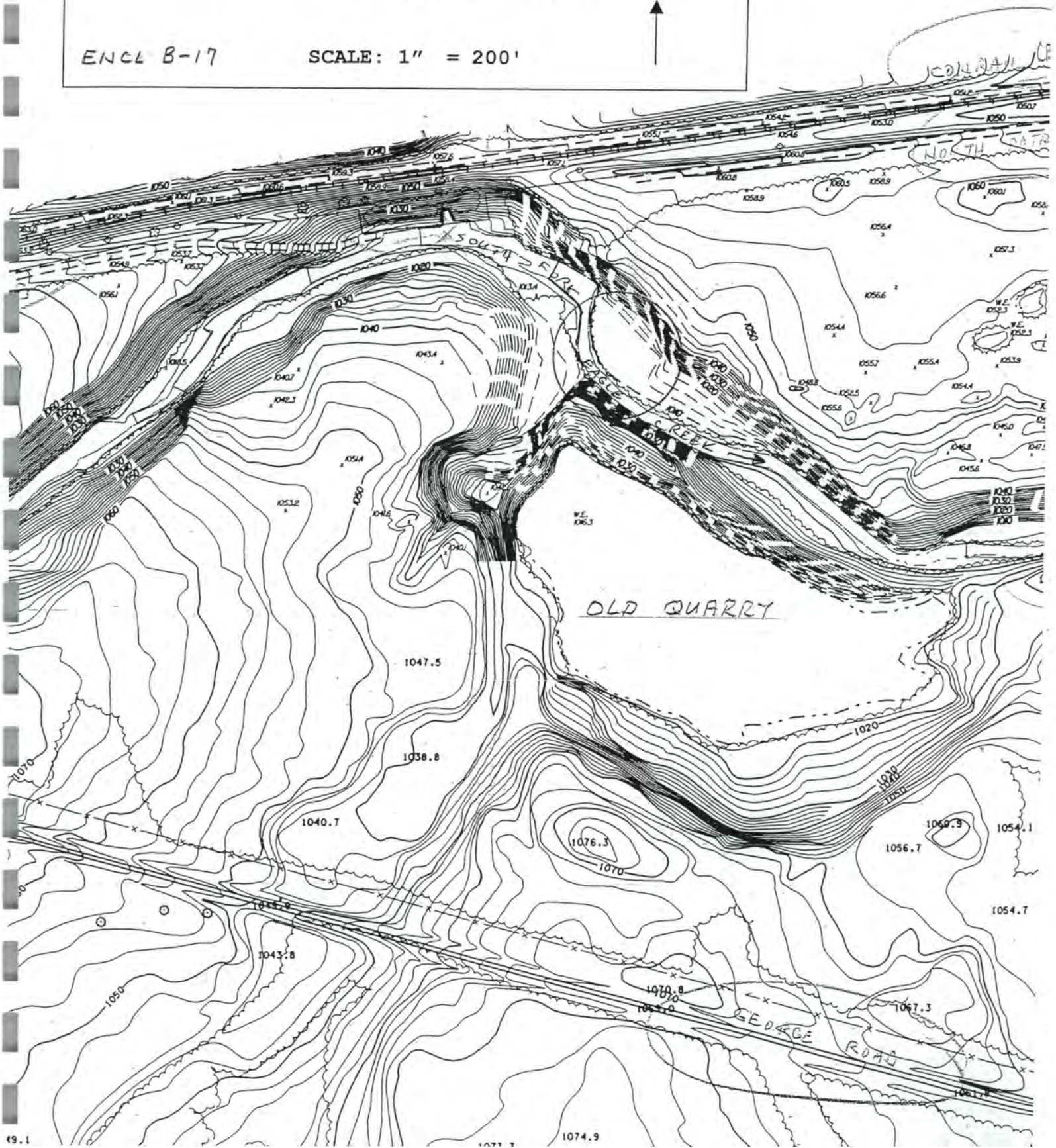
SAMPLING LOCATION MAP FOR SITE

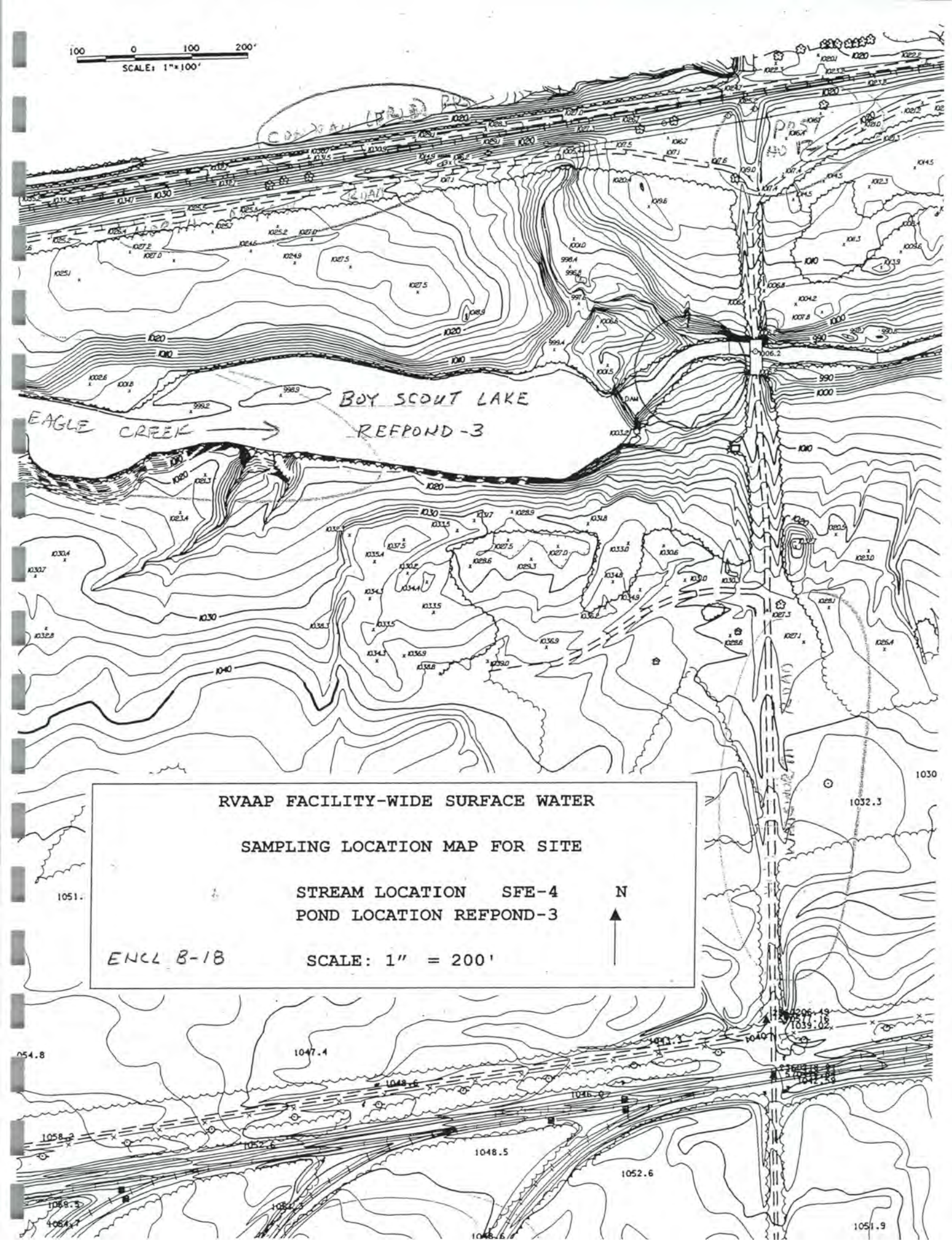
STREAM LOCATION SFE-3

N

ENCL B-17

SCALE: 1" = 200'



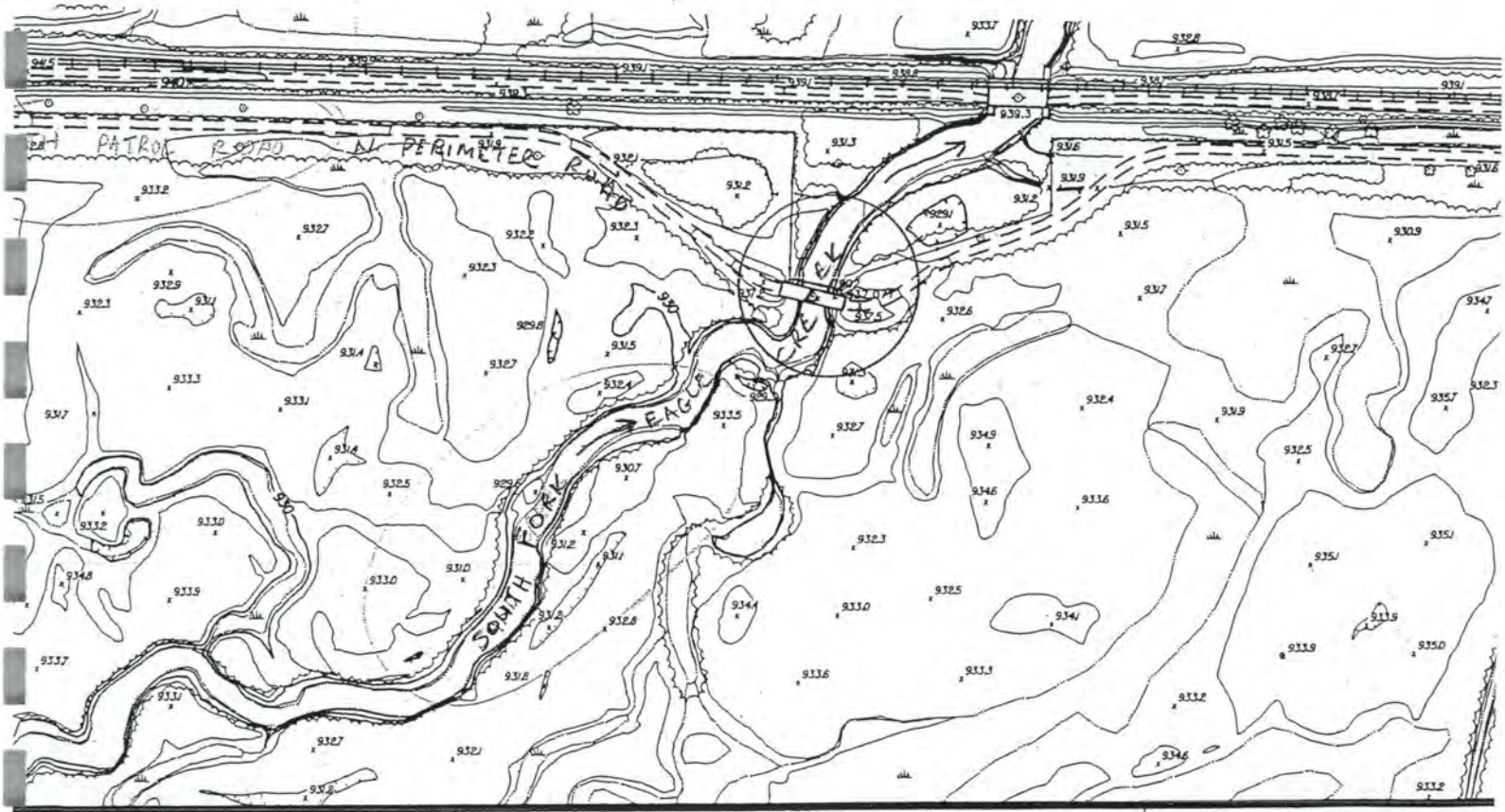

100 0 100 200'
SCALE: 1"=100'
BOY SCOUT LAKE
EAGLE CREEK
REFPOND-3
DAM
RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION SFE-4
POND LOCATION REFPOND-3
N
ENCL B-18
SCALE: 1" = 200'

RVAAP FACILITY-WIDE SURFACE WATER

SAMPLING LOCATION MAP FOR SITE

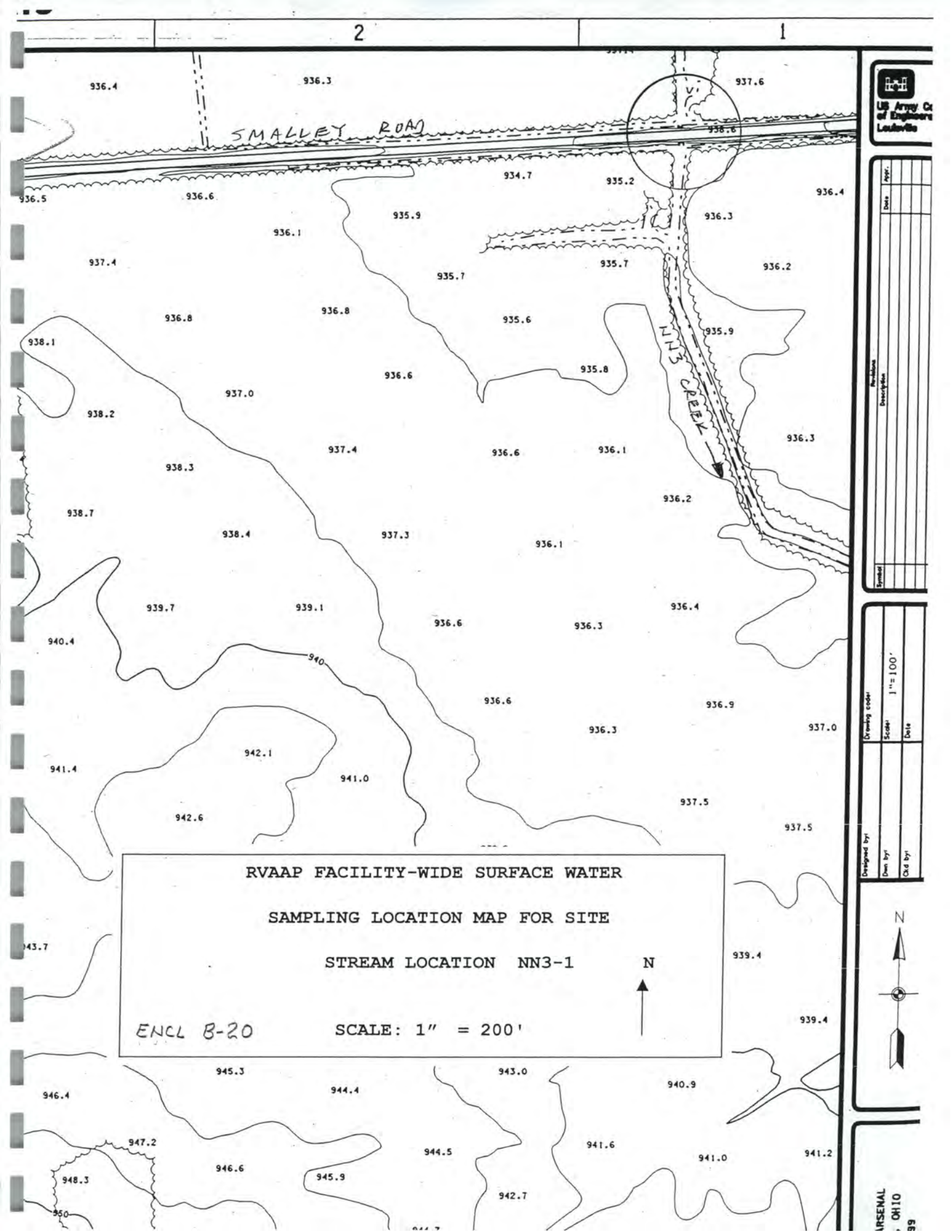
STREAM LOCATION SFE-5 N

ENCL B-19 SCALE: 1" = 200'



5 4 3

*** SUPPORT VALUE ENG


2
1
SMALLEY ROAD
NN3 CREEK
936.4
936.3
937.6
936.5
936.6
934.7
935.2
935.9
936.1
937.4
935.7
936.2
936.8
935.6
938.1
935.8
937.0
938.2
937.4
936.1
938.3
936.2
938.7
938.4
937.3
936.1
939.7
939.1
936.4
940.4
940
936.9
937.0
942.1
941.4
941.0
937.5
942.6
937.5
RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION NN3-1
N
ENCL B-20
SCALE: 1" = 200'
943.7
939.4
939.4
945.3
943.0
946.4
944.4
940.9
947.2
944.5
941.6
941.0
941.2
946.6
948.3
945.9
942.7
950
Drawing code:
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Revisions
Description
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Appr.
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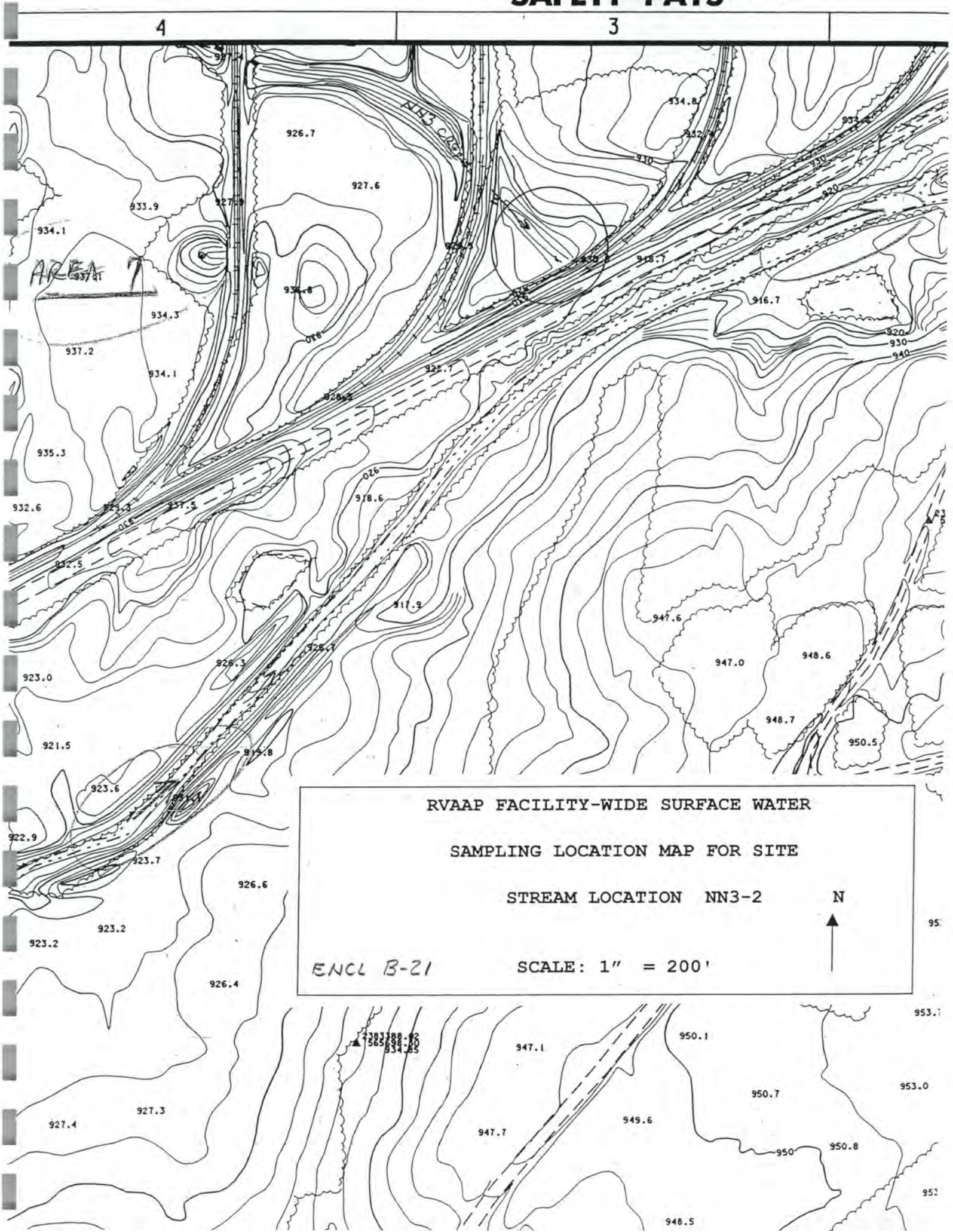
US Army Corps of Engineers Louisville
N
ARSENAL
OHIO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3
AREA 7
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927.6
933.9
934.1
934.3
937.2
934.1
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932.6
932.5
923.0
921.5
923.6
922.9
923.7
926.6
923.2
923.2
926.4
927.3
927.4
934.8
930
918.7
916.7
920
930
940
922.7
918.6
917.9
947.6
947.0
948.6
948.7
950.5
926.3
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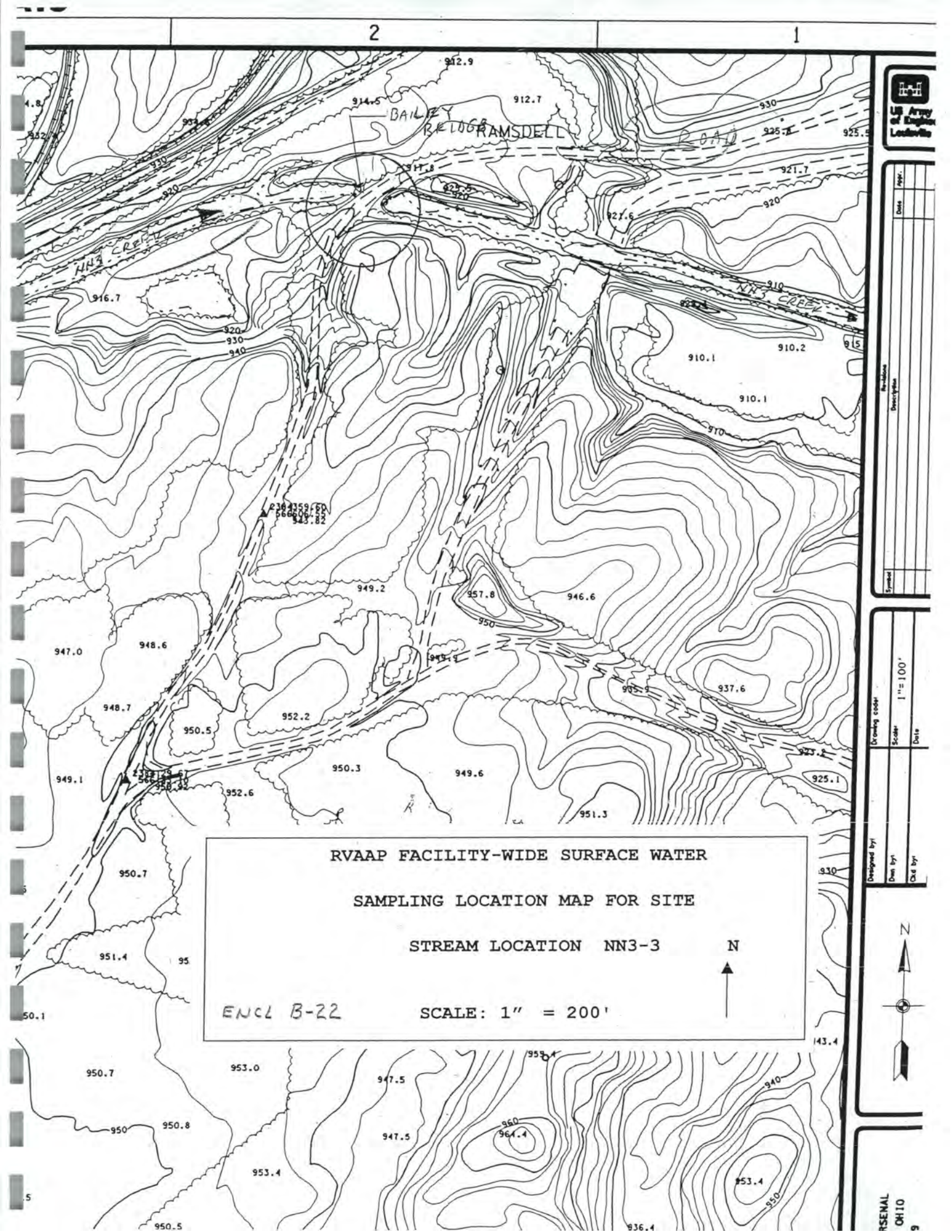
947.1
950.1
950.7
953.0
949.6
947.7
950
950.8
948.5
RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION NN3-2
N
ENCL B-21
SCALE: 1" = 200'


2
1
BAILEY
RELOGRAMSDELL
ROAD
NN3 CREEK
NN3 CREEK
912.9
912.7
914.5
917.8
921.7
927.6
925.4
925.5
916.7
910.1
910.2
910.1
949.2
957.8
946.6
947.0
948.6
948.7
952.2
950.5
950.3
949.6
949.1
952.6
951.3
937.6
925.2
925.1
950.7
951.4
950.1
953.0
947.5
950.8
964.4
953.4
950.5
936.4
RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION NN3-3
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ENCL B-22
SCALE: 1" = 200'
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Designed by
Drn by
Chd by
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Revisions
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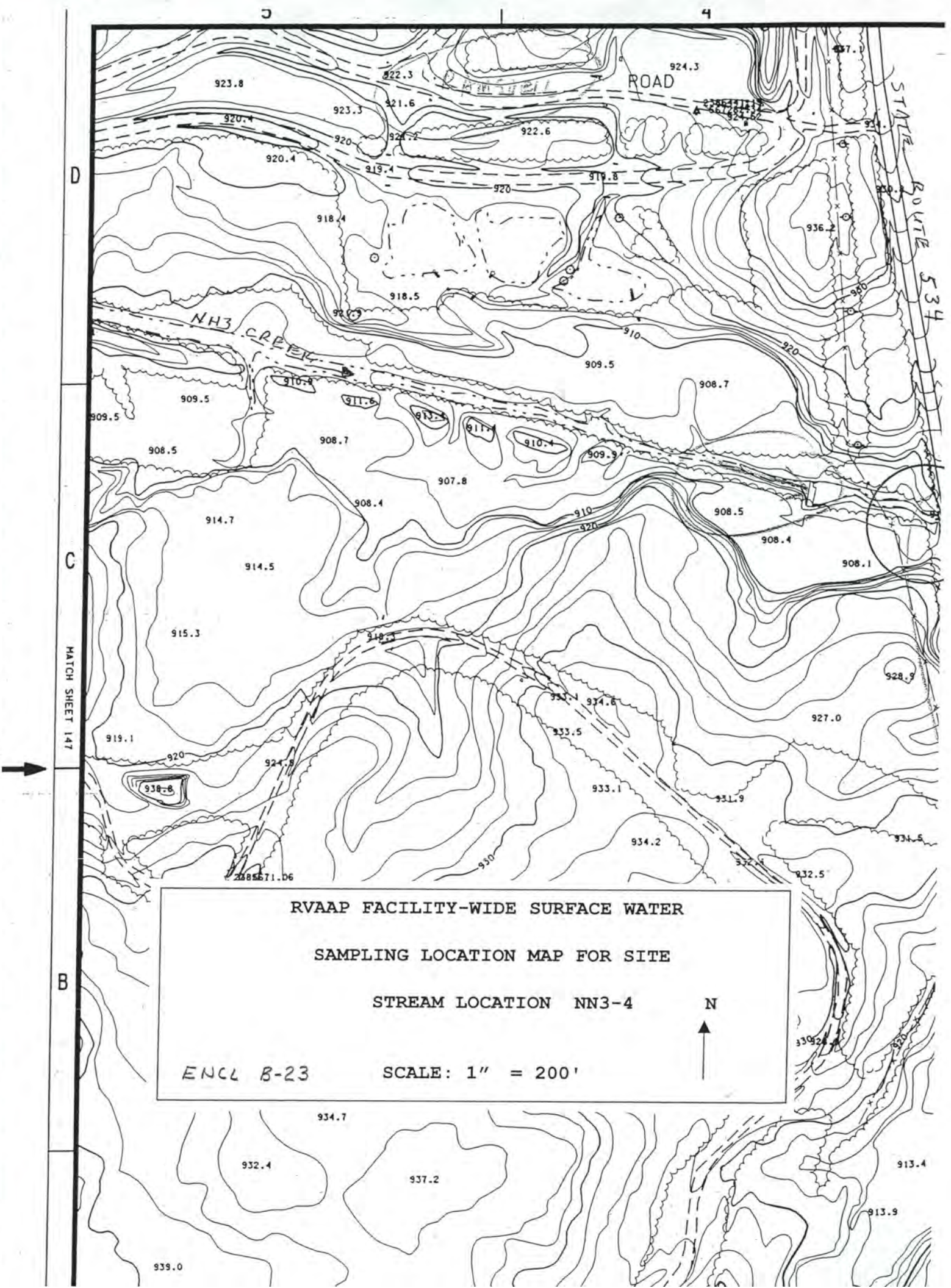
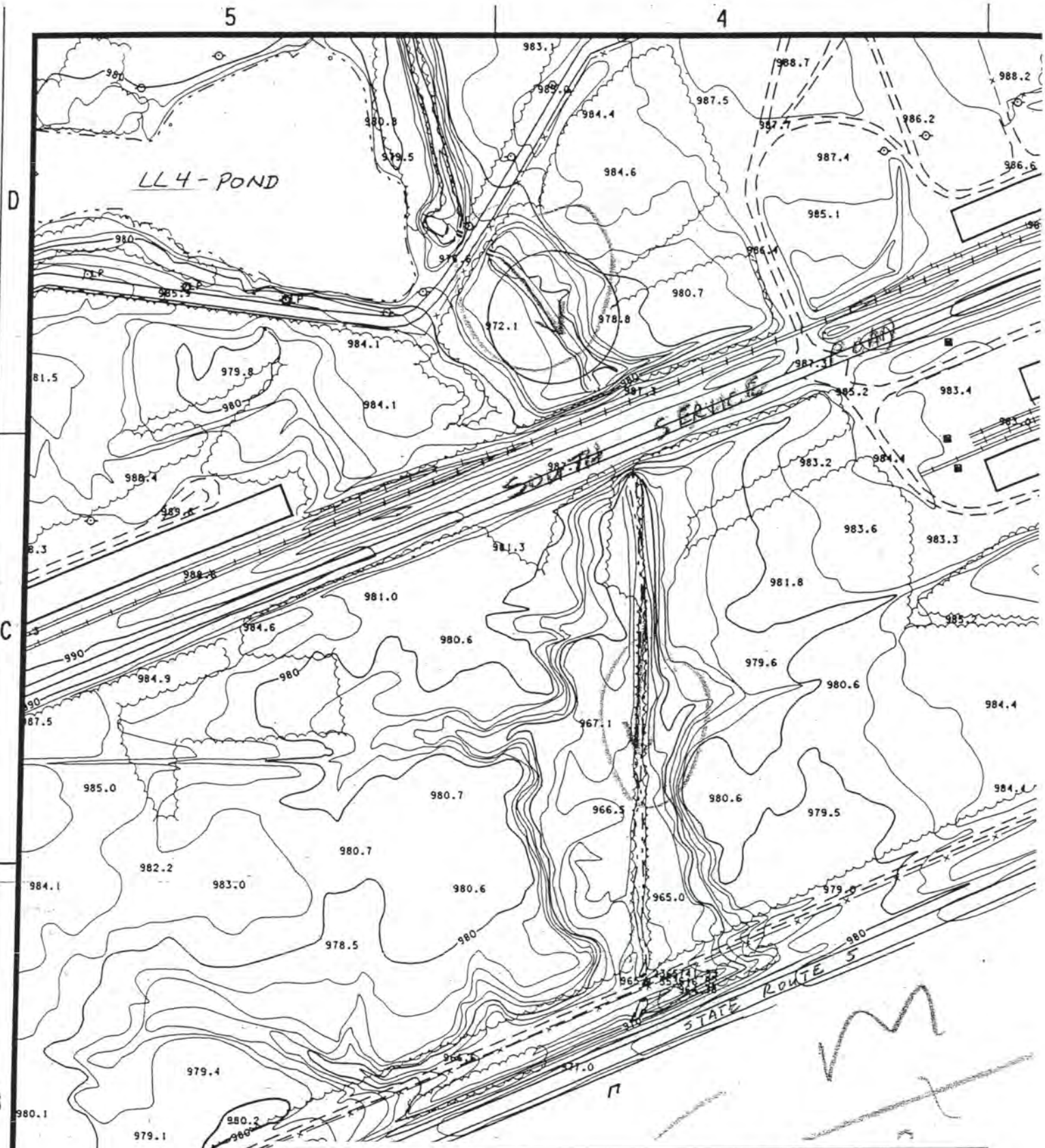
RSENAL
OH10


5
4
D
C
B
ROAD
STATE ROUTE 534
NH3 CREEK
MATCH SHEET 147
RVAAP FACILITY-WIDE SURFACE WATER
SAMPLING LOCATION MAP FOR SITE
STREAM LOCATION NN3-4
N
ENCL B-23
SCALE: 1" = 200'



RVAAP FACILITY-WIDE SURFACE WATER

SAMPLING LOCATION MAP FOR SITE

STREAM LOCATION LL4STREAM

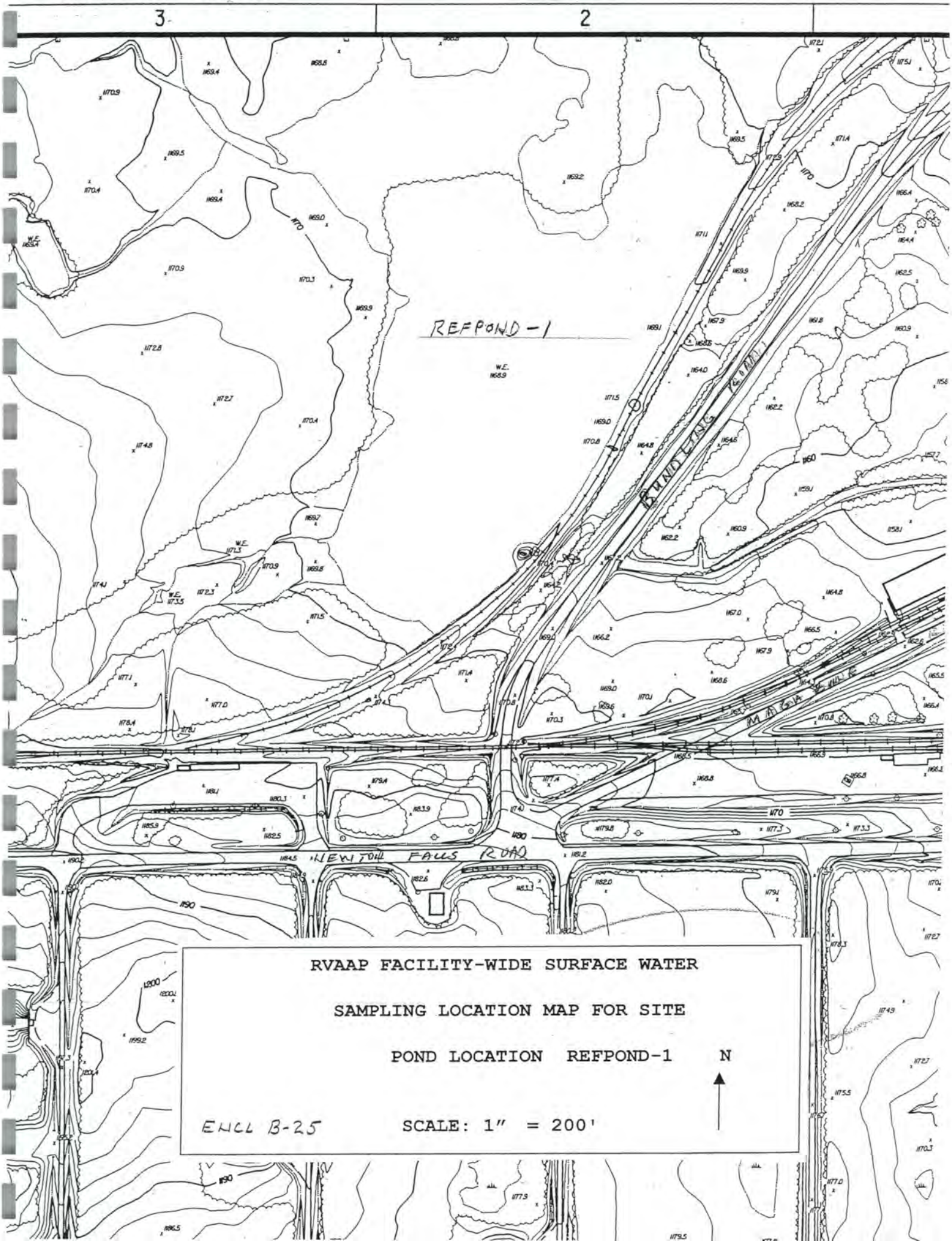
POND LOCATION LL4-POND

N

ENCL B-24

SCALE: 1" = 200'

SAFETY PAYS



RVAAP FACILITY-WIDE SURFACE WATER

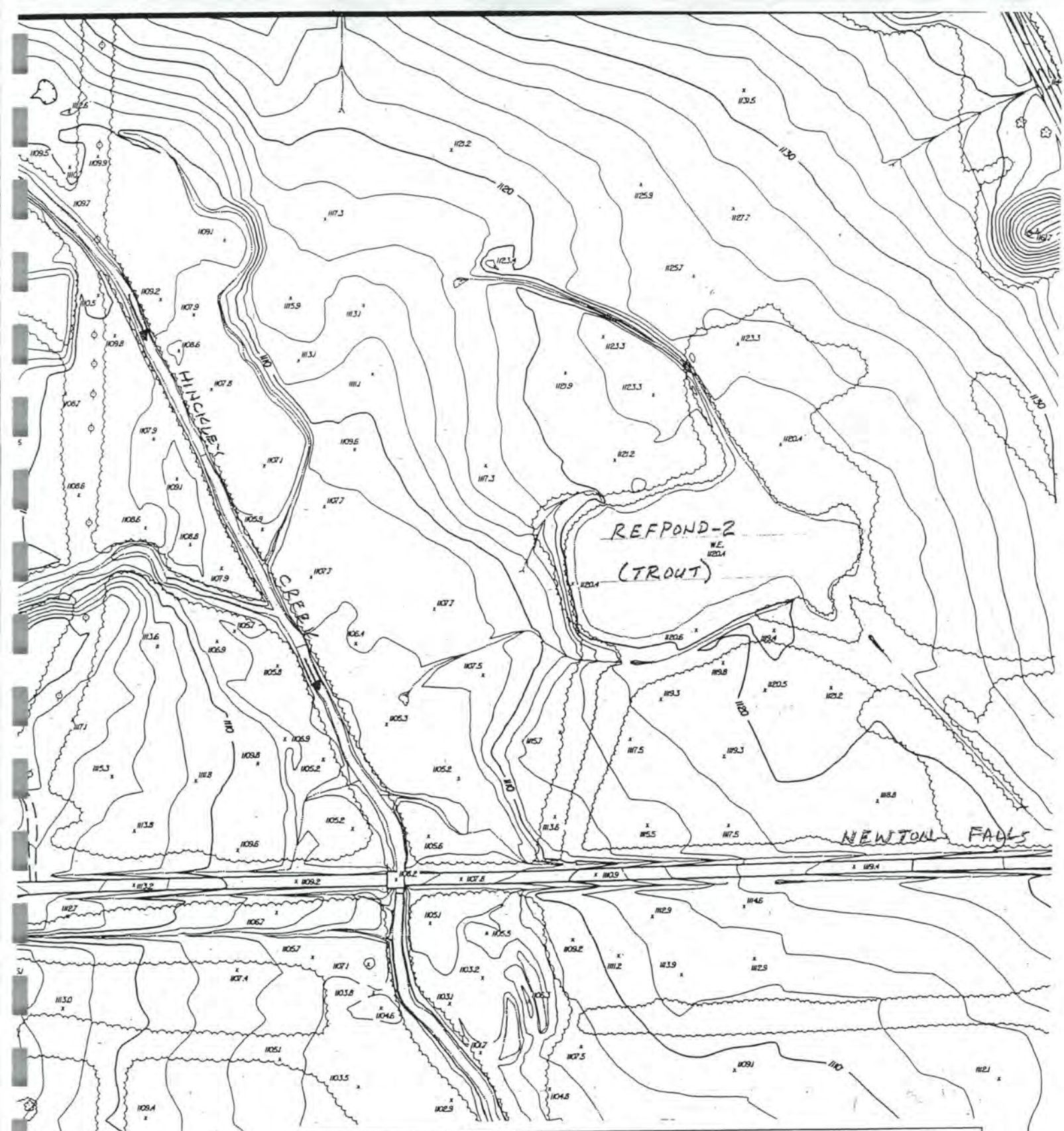
SAMPLING LOCATION MAP FOR SITE

POND LOCATION REFPOND-1

N

ENCL B-25

SCALE: 1" = 200'



RVAAP FACILITY-WIDE SURFACE WATER

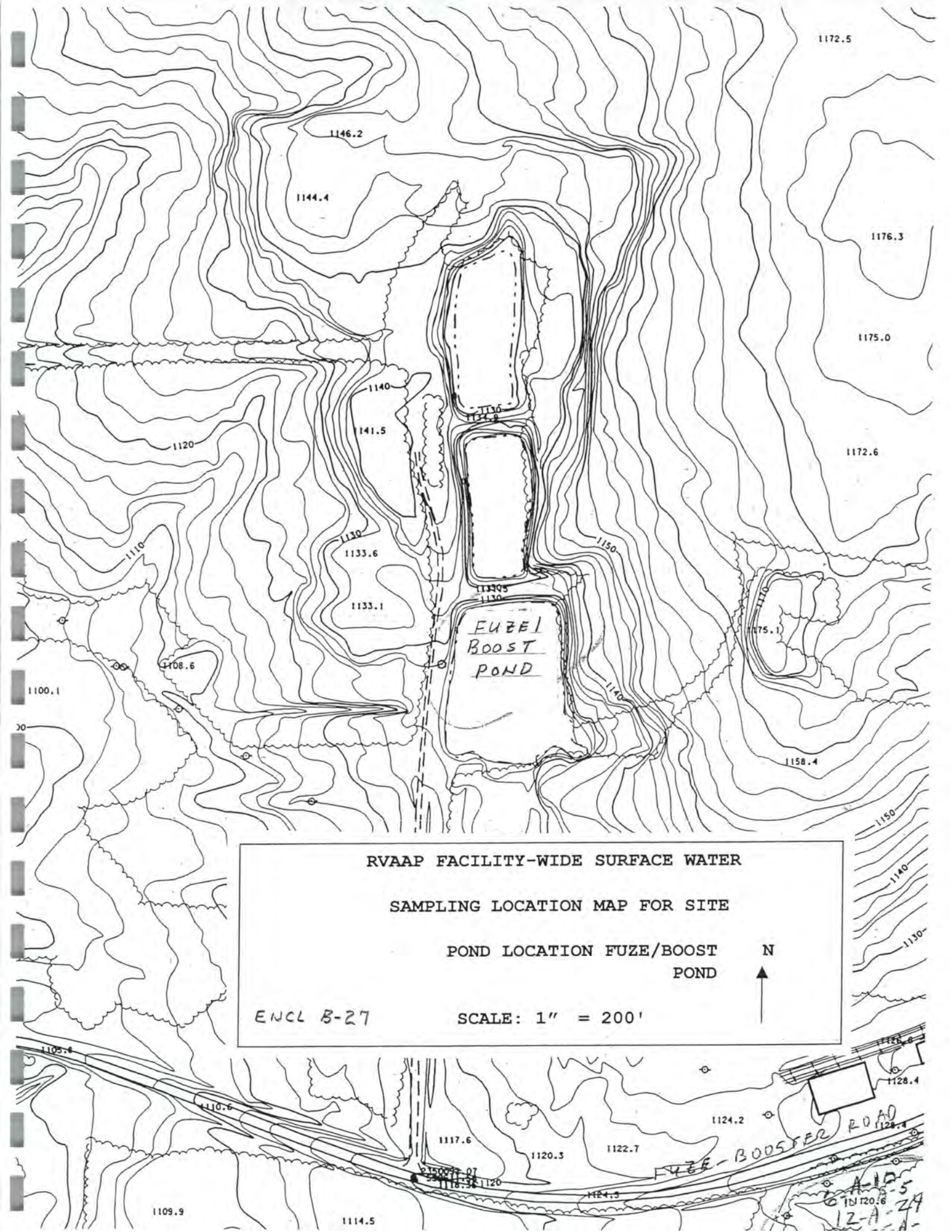
SAMPLING LOCATION MAP FOR SITE

POND LOCATION REFPOND-2

N

ENCL B-26

SCALE: 1" = 200'



RVAAP FACILITY-WIDE SURFACE WATER

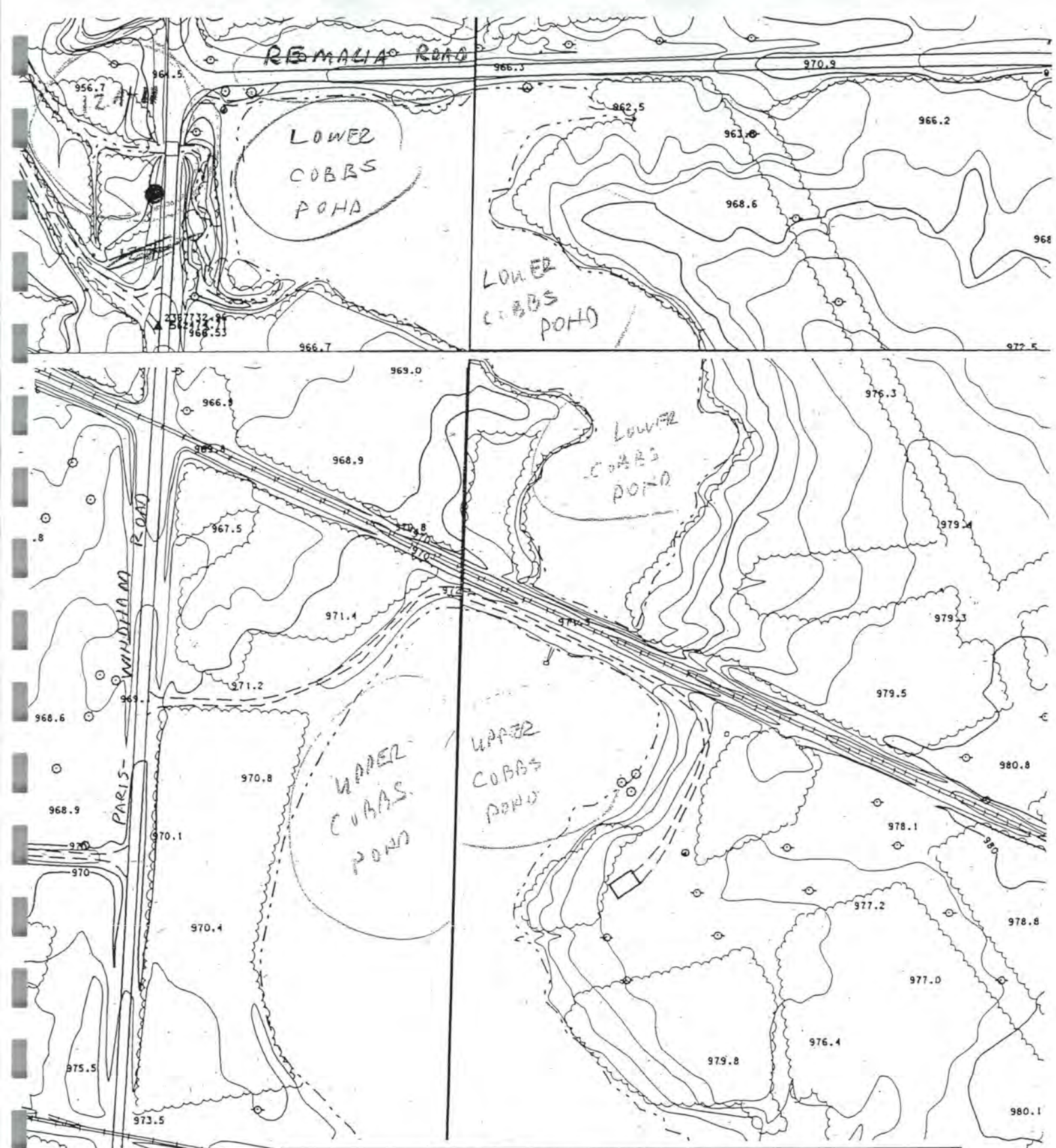
SAMPLING LOCATION MAP FOR SITE

POND LOCATION FUZE/BOOST POND

N

ENCL B-27

SCALE: 1" = 200'



RVAAP FACILITY-WIDE SURFACE WATER

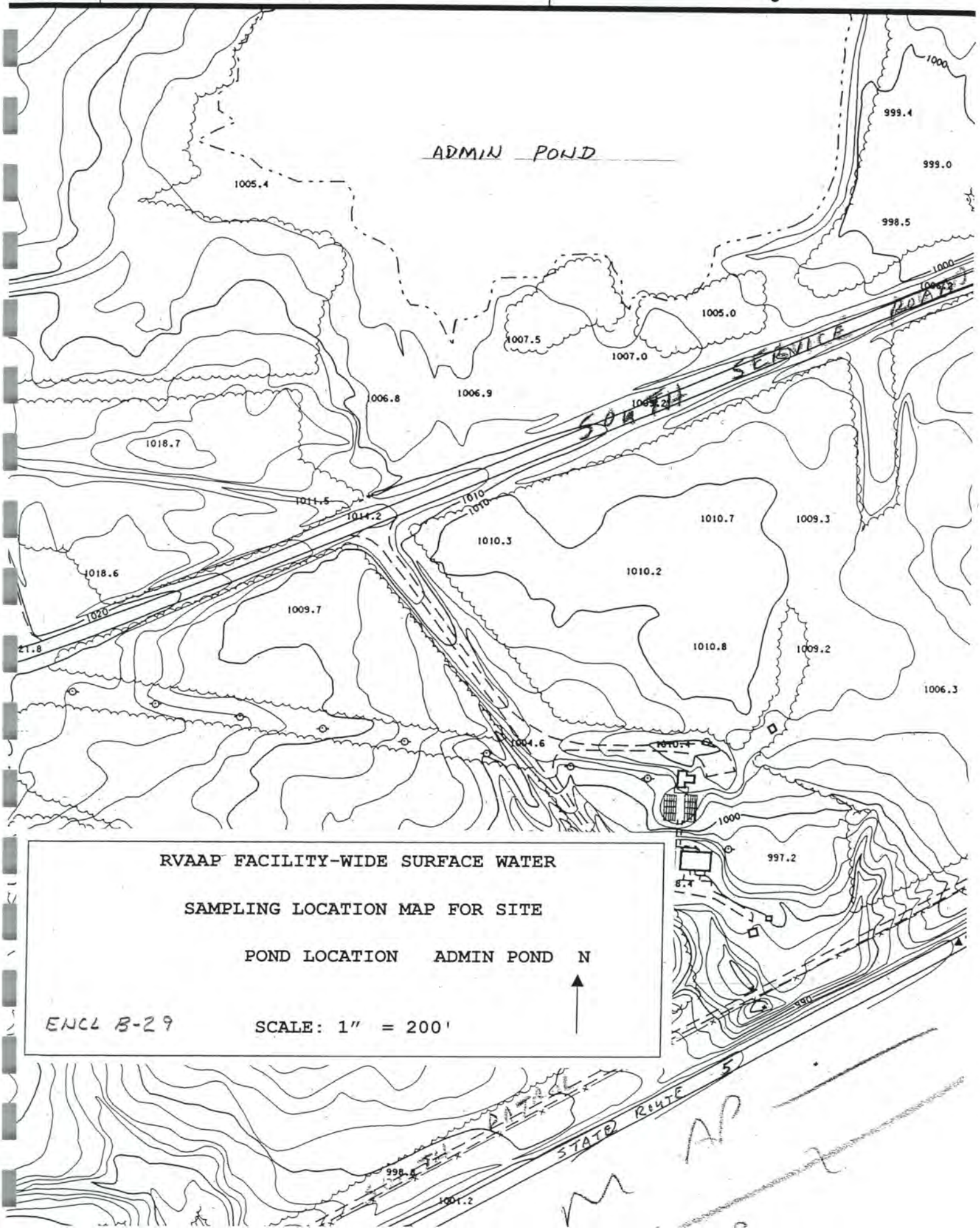
SAMPLING LOCATION MAP FOR SITE

POND LOCATION UPPERCOBB
LOWERCOBB

N

ENCL B-28

SCALE: 1" = 200'



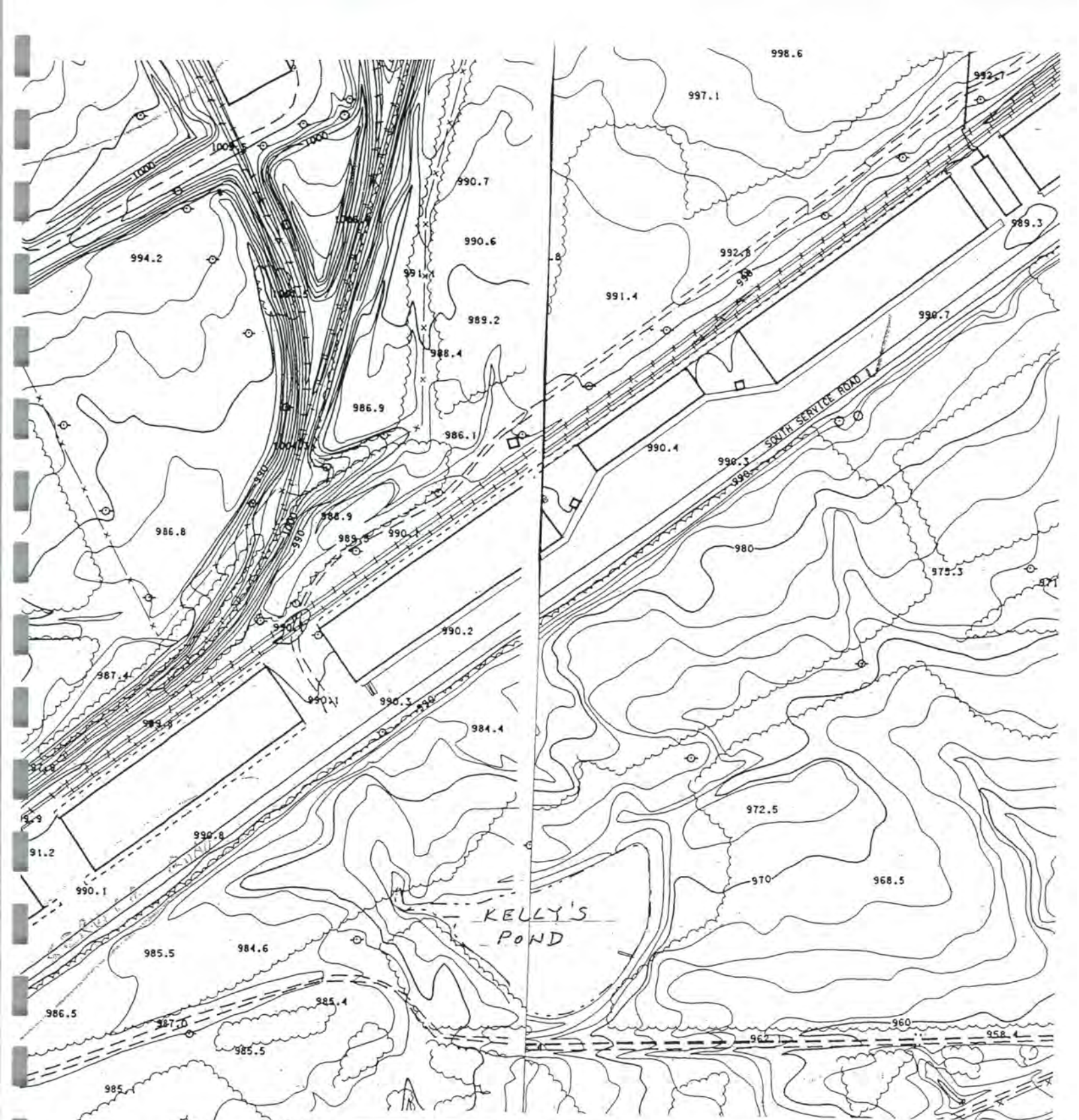
RVAAP FACILITY-WIDE SURFACE WATER

SAMPLING LOCATION MAP FOR SITE

POND LOCATION ADMIN POND N

ENCL B-29

SCALE: 1" = 200'



RVAAP FACILITY-WIDE SURFACE WATER

SAMPLING LOCATION MAP FOR SITE

POND LOCATION KELLY'S POND N

ENCL B-30

SCALE: 1" = 200'

- *Meeting Minutes*
- *General Types of Biological Comparisons*
- *Ravenna Drainage Basin*
- *ODNR Fish Survey*
- *Fish Collection Sites*
- *Site Location 1999 Survey*

Ravenna Facility-Wide Surface Water Sampling
Minutes of Meetings (Oct 22-24, 2002)

1 Previously, a series of meetings were held on August 30 and 31 by many of the RVAAP Environmental Team members to:

discuss past and current surface water sampling and analyses,
coordinate plans for the upcoming CERCLA based facility-wide surface water sampling with the main stakeholders, and
initiate efforts at consolidating or at least coordinating the planned CERCLA effort with those of the NPDES and OHARNG.

Minutes of this earlier meeting were previously provided.

2 During the period Oct 22-24, 2002, many of the stakeholders of the RVAAP Environmental Team assembled at the facility to select sampling sites for the upcoming CERCLA facility-wide surface water monitoring program. The people listed in Appendix A were involved during some or all of these discussions.

3 Following the August meetings, Tim Morgan (OHARNG) provided two sets of previous fish population studies performed in 1993 and 1999 by the Ohio Department of Natural Resourses for the Ohio Army National Guard. Location maps and descriptions of study sites from both of these studies are provided as Appendices G and H, respectively.

4 At the beginning of the October meetings,

- a general discussion of general types and uses of biological comparisons was presented, Appendix B,
- approximate areas of the drainage basins were presented, Appendix C, and
- an example of IBI measurements, calculations, and a comparison were presented, Appendix D.

5 For purposes of comparing biological measurements over time, it would be advantageous to conduct the proposed sampling at locations previously sampled in either or both the 1993 and 1999 studies. A map showing the 1993 and 1999 sampling sites, as well as those visited during the August meeting was prepared and is provided as Appendix F. From the drainage basin calculations presented, it was noted that the largest type of drainage basin of any streams within the RVAAP is "Headwater" (drainage area < 20 sq miles); and moreover, that there are many streams of the "Primary" (drainage area <1 sq mile) type. Many of the streams studied previously in the OHARNG studies were of the "Primary" type, and these would not be of value for the CERCLA-related purposes of the upcoming study.

6 Since the OH EPA has much experience in biological surface water sampling, Dave Altfater was asked to forward to the Corps a sample work plan and any other guidance he thought might be prudent. Mr. Altfater noted that his office has software to automatically compute IBI's from fish population study results. Mr. Altfater also noted that there are only a few private individuals certified by the OH EPA to conduct IBI studies and only one individual certified to perform ICIs.

7 During the course of Oct 22-24, the team visited many possible surface water sampling sites. Summary findings of these sites are noted in Appendix E. Based on these findings the team decided upon the following numbers of surface water sample locations.

Confirmed stream sample locations	25
Contingency stream sample locations	3
TOTAL Stream Sample Locations	**28**

Reference pond locations	3
Study pond locations	6
Contingency pond locations	1
TOTAL Pond Locations	**10.**

Due to field conditions, determinations of ICIs will not be possible at some of the stream sampling locations. Although the decisions to perform ICI testing will be done at the time of actual sampling, for planning purposes only about 15 stream sampling locations will be considered appropriate for ICI determinations. At the pond sampling locations, some ICI-related measurements will be taken, but the use of these measurements will be determined at the time of sampling by the RVAAP Environmental Team.

8 Based upon the results of the August and October meetings, the Corps is to prepare a Draft Work Plan for the upcoming Facility-Wide Surface Water Sampling.

Respectfully submitted,

John P. Jent, P.E.

APPENDICES

Appendix A	List of People During Some or All the October Meetings
Appendix B	General Types of Biological Comparisons
Appendix C	Ravenna Drainage Basins
Appendix D(1,2,3)	Example IBI Calculations and Comparisons
Appendix E	Table of Possible Facility-Wide Surface Water Sampling Locations
Appendix F	Map of Possible Surface Water Sampling Locations
Appendix G	Location Map and Description of 1993 Fish Population Sampling Sites
Appendix H	Location Map and Description of 1999 Fish Population Sampling Sites

APPENDIX A

LIST OF ATTENDEES AT RVAAP OCT 22-24, 2002 MEETINGS

NAME	ORGANIZATON	PHONE NUMBER
Tim Morgan	RTLS OHARNG	614 336-6568
Kim Ludt	RTLS OHARNG	614 335-6569
Mark Patterson	RVAAP	330 358-7311
Eileen Mohr	OH EPA	330 963-1221
Todd Fisher	OH EPA	330 963-1148
Brian Tucker	OH EPA	614 644-3120
Laurie Eggert	OH EPA	937 285-6457
Dave Altfater	OH EPA	614 836-8786
Dave Brancato	USACE-Louisville	502 315-6494
Elizabeth Ferguson	USACE-Louisville	502 315-6316
John Jent	USACE-Louisville	502 315-6343
Paul Zorko	USACE-Louisville	502 315-6353

APPENDIX B

General Types of Biological Comparisons

A Populations of a Range of Species at fixed locations
B Quantitative Biological Indices at fixed locations

1 Compare population numbers of a species (or quantitative indices) at discreet points at different times to quantitatively evaluate improving or degrading environmental conditions over time.

Variation over time

Fish populations at same locations from 1993, 1999, and 2003
IBI indices at same locations from 1993, 1999, and 2003
Many other populations (butterflies, snakes, etc.) from 1993 and 1999

2 Compare populations numbers of a species (or qualitative indices) along a given stream at a relatively fixed time, ordered from upstream to downstream to evaluate impact of the RVAAP on through streams.

Variation along a stream

Fish populations from upstream to downstream along the major drainageways- can do for 1993, 1999, and 2003
IBI indices from upstream to downstream along the major Drainageways- can do for 1993, 1999, and 2003

3 Compare population numbers of a species (or quantitative indices) with either state-wide similar measures or county/regional-wide similar measures.

Comparison to similar state/county/regional-wide benchmarks

Compare measured IBIs and ICIs to the appropriate Ecoregion Biocriteria, (all the surface water sites at the RVAAP are headwater sites(drainage areas < 20 sq miles), and the Ecoregion is the Eastern-Ontario Lake Plain);
IBI criterion is 40, and the
ICI criterion is 34.
See Figure 4 of Ref 1.

Complicating Factors- See Figure 1 of Reference 1

A Repeatability of measurements (compare measurements made at same location, but only separated by a short time, as a month)

B Accuracy of measurements (have two groups of people make quantitative assessment at the same location)

C Physical conditions
- Stream flow
- Stream bed condition (size, rock/soil, sunlight, etc)
- Air temperature
- Stream gradient
- Sediment (type, size, turbidity, amount)

QHEI should be used as a guide on the overall influence of physical conditions on the biological metrics

D Chemical conditions
- Acidity
- Contamination

E Influence of a very small watershed.

OEPA has presented much new guidance on "Primary" Headwater watersheds, Primary if drainage area < 1.0 sq miles.

Should prove very useful.

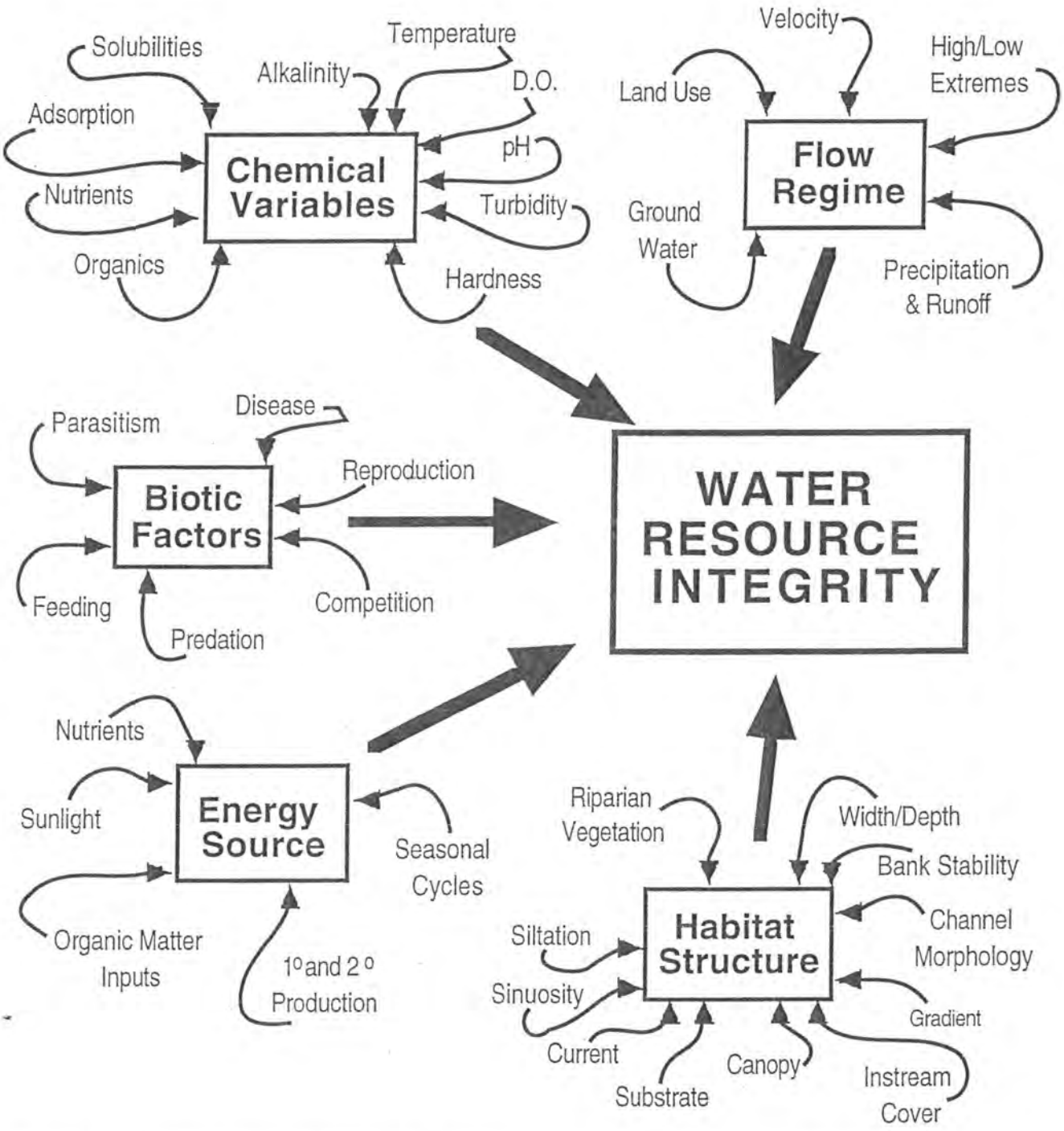


Figure 1. The five principal factors, with some of their important chemical, physical, and biological components that influence and determine the integrity of surface water resources (modified from Karr *et al.* 1986).

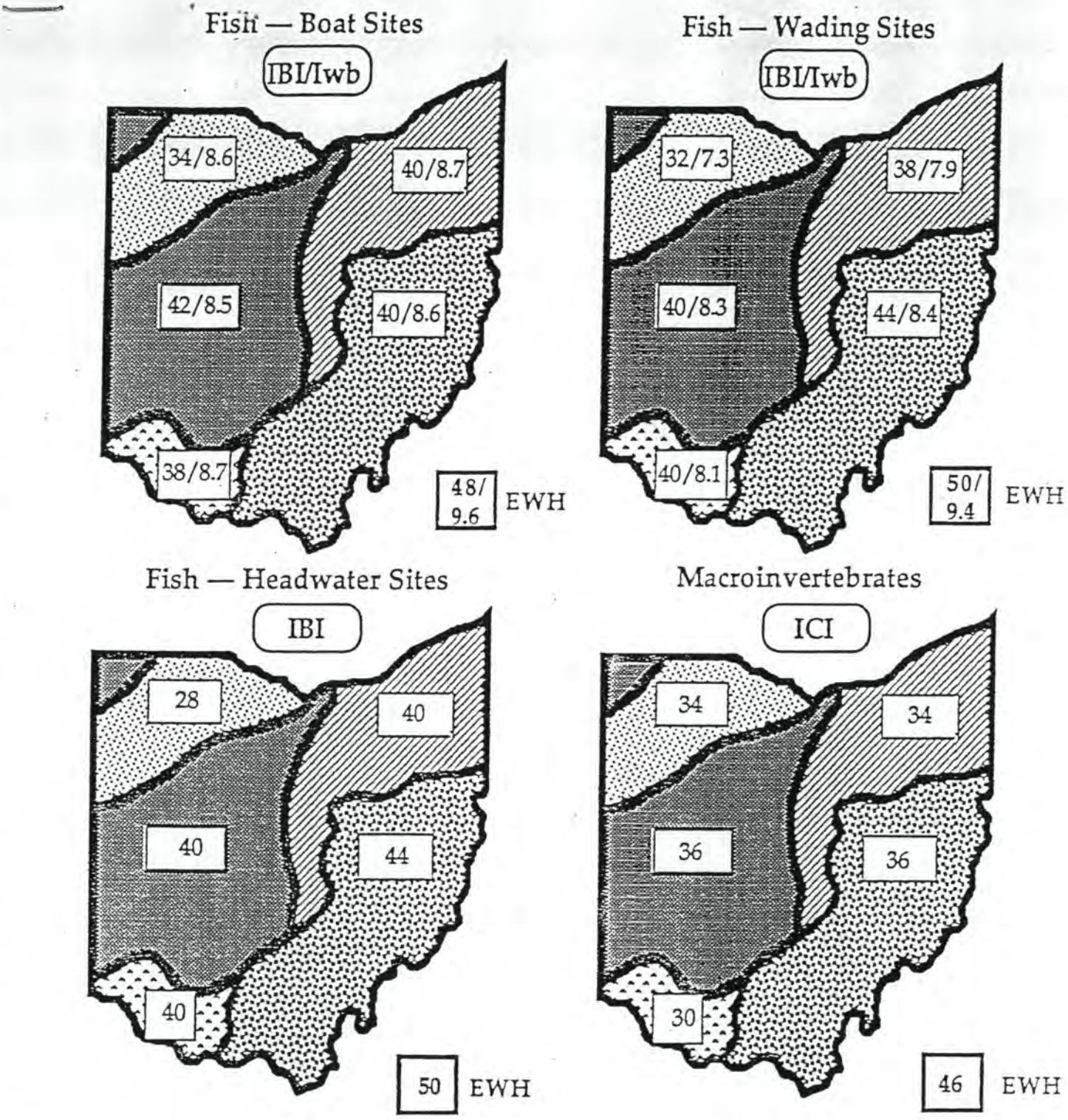


Figure 8. Biological criteria in the Ohio Water Quality Standards for Warmwater (WWH) and Exceptional Warmwater (EWH) streams. Scores on maps in rectangular boxes apply to WWH streams by ecoregion and scores in boxes adjacent to maps apply statewide to EWH streams. Rounded edge boxes above each map identify the applicable indices.

APPENDIX C

RAVENNA DRAINAGE BASINS

Headwater Drainage Area	< 20 Sq Miles
Primary Headwater Area	< 1 Sq Mile
Wading Drainage Area	20 - 554 Sq Miles
Boat Drainage Area	90 - 6471 Sq Miles

Basin	Name	Size Ft^2	Size Mi^2	Basin Type
1	Far West	5,000 x 10,000	1.8	Headwater
2	S of Hinckley	6,500 x 7,000	1.6	Headwater
3	Hinckley	7,500 x 17,000	4.6	Headwater
4	S Fork Eagle	28,000 x 8,000	8.0	Headwater
5	Sand	34,000 x 12,000	14.6	Headwater
6	S of LL-8	4,000 x 2,500	0.36	Primary
7	S of LL-6	1,500 x 5,500	0.30	Primary
8	S of Admin	4,000 x 2,000	0.29	Primary
9	Admin Area	8,000 x 3,200	0.98	Primary
10	LL-4 Area	4,000 x 7,500	1.08	Headwater
11	S of LL-12	5,000 x 2,000	0.36	Primary
12	S of LL-3	3,200 x 1,800	0.21	Primary
13	S of LL-2	4,500 x 3,000	0.48	Primary
14	Far NE	4,500 x 2,500	0.40	Primary

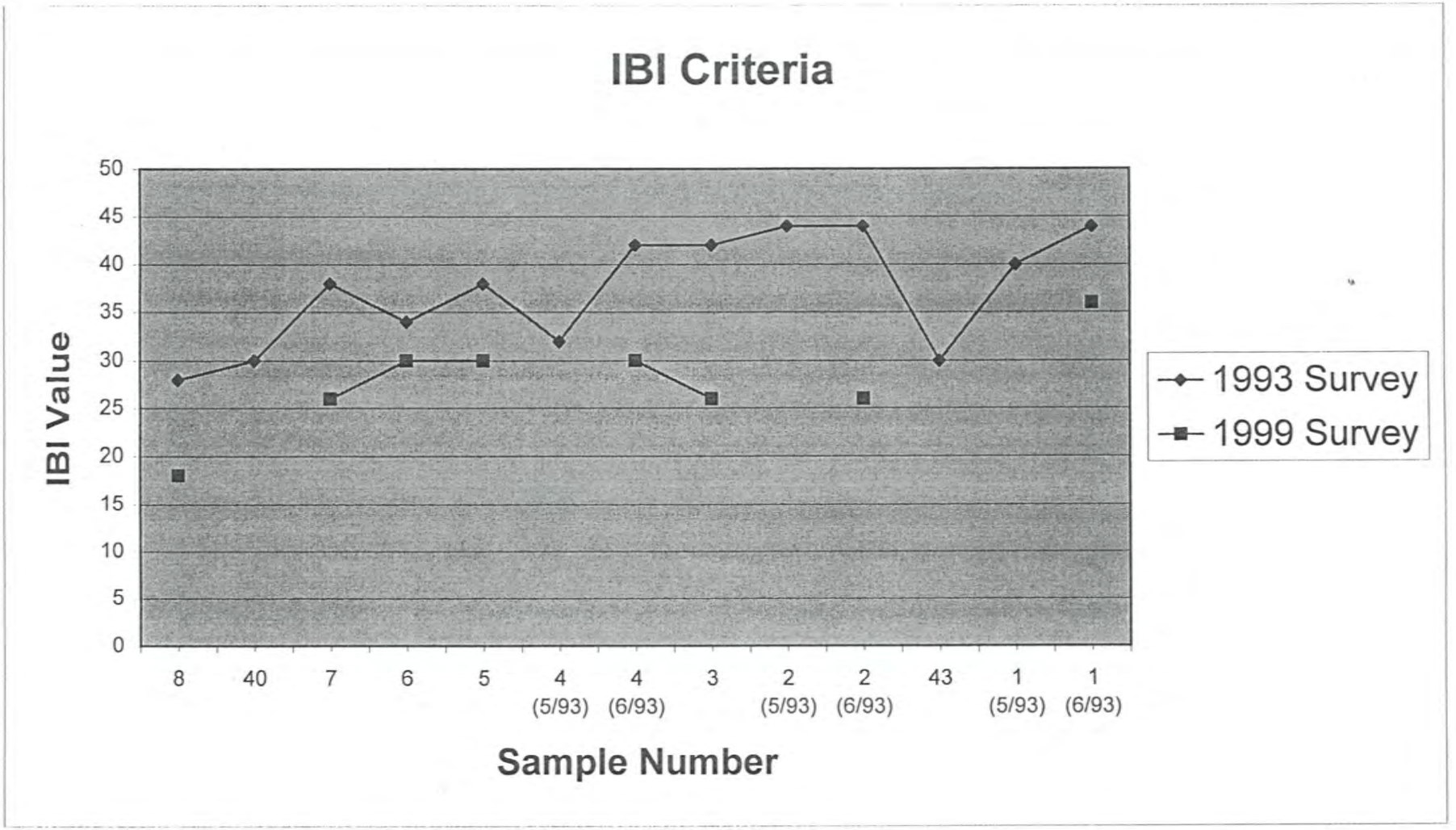
ODNR FISH SURVEY (1993)
STREAM: UPPER SAND CREEK

		21		20		19		18		26		17		16		24		25		22		23		15	
	IBI Metric	Value	IBI Score	Value	IBI Score	Value	IBI Score	Value	IBI Score	Value	IBI Score	Value	IBI Score	Value	IBI Score	Value	IBI Score	Value	IBI Score	Value	IBI Score	Value	IBI Score	Value	IBI Score
1.	Total Number of Species	5	1	10	3	12	3	13	3	9	1		1		1		1		1		1		1		1
2.	Number of Darter Species	0		1		2		2		2															
	% of Round-Bodied Suckers	10.3	1	5.5	1	13.0	1	8.1	1		1		1		1		1		1		1		1		1
3.	Number of Sunfish Species	1	1	1	1	1	1	1	1		1		1		1		1		1		1		1		1
	Number of Headwaters Species	0		1		2		3																	
4.	Number of Sucker Species	1	1	1	1	1	1	1	1		1		1		1		1		1		1		1		1
	Number of Minnow Species	2		5		5		6																	
5.	Number of Intolerant Species	0	1	0	1	0	1	0	1		1		1		1		1		1		1		1		1
	Number of Sensitive Species	0		0		0		0																	
6.	% Green Sunfish	84		1		3.9		0.3																	
	% Tolerant Species	100	1	100	1	100	1	100	1		5		5		5		5		5		5		5		5
7.	% Omnivores	10.3	5	12.7	5	29.9	1	18.4	3		5		5		5		5		5		5		5		5
8.	% Insectivorous Cyprinids	0		33.1		22.7		30.4																	
	% Insectivorous Species	40	3	30	3	50	3	38.5	3		1		1		1		1		1		1		1		1
9.	% Top Carnivores	0	1	0.9	1	1.3	1	0.3	1		1		1		1		1		1		1		1		1
	% Pioneering Species	40		40		41.7		59.9																	
10.	Number of Individuals	165	5	347	3	154	5	332	3		5		5		5		5		5		5		5		5
11.	% Hybrids	0		0		0		0																	
	% Simple Lithophils	10.3	1	14.7	1	21.4	1	25.3	3		1		1		1		1		1		1		1		1
	Number of Simple Lithophilic Species	1		1		3		4																	
12.	% Diseases Individuals	0		0		0		0																	
	% DELT Anomalies	0	5	0	5	0	5	0	5		5		5		5		5		5		5		5		5
	IBI Score for Sample		26		26		24		26		28		28		28		28		28		28		28		28

APPENDIX D-1

Category	Metric	Scoring Criteria 5	3	1
Species Composition	Total Species	>20	10-20	<10
	% Round-bodied Suckers	>38	19-38	<19
	Sunfish Species	>3	2-3	<2
	Sucker Species	>5	3-5	<3
	Intolerant Species	>3	2-3	<2
	% Tolerant (no.)	<15	15-27	>27
Trophic Composition	% Omnivores	<16	16-28	>28
	% Insectivores	>54	27-54	<27
	% Top Carnivores	>10	5-10	<5
Fish Condition	% Simple Lithophils <= 600 sq. mi. > 600 sq. mi.	>50	25-50 Varies with drainage area	<25
	% DELT Anomalies	<0.5	0.5-3.0	>3.0
	Fish Numbers	<200	200-450	>450

APPENDIX D-2



* Gaps in 1999 Survey represent samples taken in 1993 but not taken in 1999

APPENDIX D-3

APPENDIX E

RVAAP- PRELIMINARY SITING OF FACILITY-WIDE SURFACE WATER SAMPLING LOCATIONS

MAP SITE NUMBER	SITE LOCATION	GPS NAME	1993 SAMPL STA	1999 SAMPL STA	WATERSHED	APPROX POSITION IN WATERSHED	SURFACE WATER TYPE	RELEVANCE TO AOCs	DESCRIPTION	*FINAL SITE NAME
A	HINKLEY @ N PERIMETER RD				HINKLEY CR	UPPER	STREAM		STREAM PONDED BY BEAVER DAM	
B	HINKLEY @ VAIR-STEEL RD				HINKLEY CR	UPPER	STREAM		STREAM PONDED BY BEAVER DAM WAS CHEMISTRY BG SITE SD/SW-003	
C	HINKLEY @ MAGAZINE RD	W-4	30		HINKLEY CR	UPPER	STREAM		FREE- FLOWING	H-1
D	SAND CR @ N LINE RD				SAND CR	UPPER	STREAM		STREAM PONDED BY BEAVER DAM	
E	TRIB TO S. FORK EAGLE CR @ SLAGLE RD				EAGLE CR	UPPER	STREAM		MARGINAL- BUT APPEARS TOO DRY	
F	TRIB TO S. FORK EAGLE CR @ N PERIMETER RD				EAGLE CR	UPPER	STREAM		TOO DRY, UNUSABLE	
G	SAND CR @ N PERIMETER RD				SAND CR	UPPER	STREAM		TOO DRY, UNUSABLE	
H	HINKLEY CR @ S PATROL RD	W-8	28	58	HINKLEY CR	INTERMED	STREAM		FREE-FLOWING	H-2
I	HINKLEY CR @ S PERIMETER RD	W-9	27	57	HINKLEY CR	DS LIMIT IN FACILITY	STREAM		FREE-FLOWING; IS ALSO NPDES SITE BUILT AS DELUXE GAGING STA	H-4
J	MINOR STR AT E END OF RUNWAY				NO NAME #1	DS LIMIT IN FACILITY	STREAM		TOO DRY, UNUSABLE	
K	MINOR STR NEAR POST 4				NO NAME #2	DS LIMIT IN FACILITY	STREAM		TOO DRY, UNUSABLE	
L	SAND CR TRIB AT NEWTON FALLS RD	W-10	26	56	SAND CR	INTERMED	STREAM	DS OF EAST FUZE BOOSTER LL's	FREE-FLOWING	S-3
M	SAND CR TRIB AT NEWTON FALLS RD	W-11	18	48	SAND CR	INTERMED	STREAM	DS OF WEST FUZE BOOSTER LL's	FREE-FLOWING	S-2
N	SAND CR AT GEORGE RD	W-12	17	47	SAND CR	INTERMED	STREAM	DS OF DEMO AREA #2	FREE-FLOWING HAS ROCK BOTTOM	S-4
O	SAND CR AT RR W OF PARIS WINDHAM RD	W-13			SAND CR	INTERMED	STREAM	DS OF CENTRAL BURN PITS	FREE FLOWING UPSTREAM OF LARGE SUPERSPAN; ADJACENT TO US END OF SAND CR LANDFILL	S-7
P	OUTFALL FROM LOWER COBBS	W-14			SAND CR	INTERMED	STREAM	DS OF LOWER COBBS POND	FREE-FLOWING, BUT SMALL FLOW	S-8
Q	LOWER COBBS POND	W-15	45	9	SAND CR	INTERMED	POND	IS AN AOC	POND- WOULD HAVE TO BE COMPARED TO A REFERENCE POND FISH TISSUE SAMPLING DONE IN 1997	LOWCOBB POND
R	SAND CR AT PARIS-WINDHAM RD	W-16	12	42	SAND CR	INTERMED	STREAM	DS OF PARIS-WINDHAM DUMP	FREE-FLOWING	S-9
S	SAND CR AT AT SMALLEY RD	W-17	9,10	40	SAND CR	DOWN STREAM	STREAM		FREE-FLOWING	S-11
T	DRAINAGE FR ERIE AT SMALLEY RD	W-18			NO NAME #3	INTERMED	STREAM	DS OF ERIE US OF LL-1	PONDED BY BEAVER DAM FURTHER DS; MAY HAVE TO USE	NN3-1
U	DRAINAGE FR ERIE AT RR TRANS AREA				NO NAME #3	INTERMED	STREAM	DS OF ERIE US OF LL-1	PONDED BY BEAVER DAM FURTHER DS; WOULD USE SITE T INSTEAD	
V	SNOW POND		43	19	EAGLE CR	DOWN STREAM	POND		DENSE COVER OF WATER LILLIES MAKES SITE UNUSABLE	
W	OUTFALL FROM CRIGGYS POND AT BUTTS-KISTLER				NO NAME #3	INTERMED	STREAM	DS OF CRIGGYS POND (LL-1) & ORE PILE AREA	APPEARED DRY- DUE TO PROXIMITY TO LL-1 & ORE PILES, MAY BE REASSESSED FOR USE	
X	CREEK OUTFALL FROM KELLYS POND (LL-2)				NO NAME #4	DOWN STREAM	STREAM	DS OF KELLYS POND (LL-2)	TOO DRY, UNUSABLE	
Y	KELLYS POND	W-19	44	8	NO NAME #4	DOWN STREAM	POND	DS OF LL-2	SEDIMENT DAM FOR LL-2 WOULD HAVE TO COMPARE TO A REFERENCE POND	KELLY POND
Z	STREAM FROM LL-4	W-20			NO NAME #5	DOWN STREAM	STREAM	DS OF LL-4	FREE-FLOWING; LL-4 IS AREA WHERE COMPOSTING IS TO BE DONE	LL4STREAM
AA	BAILEY BRIDGE SITE		33		NO NAME #3	INTERMED	STREAM		FREE-FLOWING MUCH OHARNG ACTIVITY HERE	NN3-3
BB	N0 NAME #3 AT ST RT 534				NO NAME #3	DS LIMIT IN FACILITY	STREAM		FREE-FLOWING MUCH SAMPLING HAS BEEN DONE IN PAST; IS NPDES LOCATION	NN3-4

TOTAL STREAM YES VISITED = 43

TOTAL STREAM YES 25

ESTIMATED ADDITIONAL STREAMS 3

TOTAL STREAM W/ CONTINGENCY = 28

TOTAL PONDS YES 6

REFERENCE PONDS 3

CONTING POND =

TOTAL POND WITH CONTINGENCY = 10

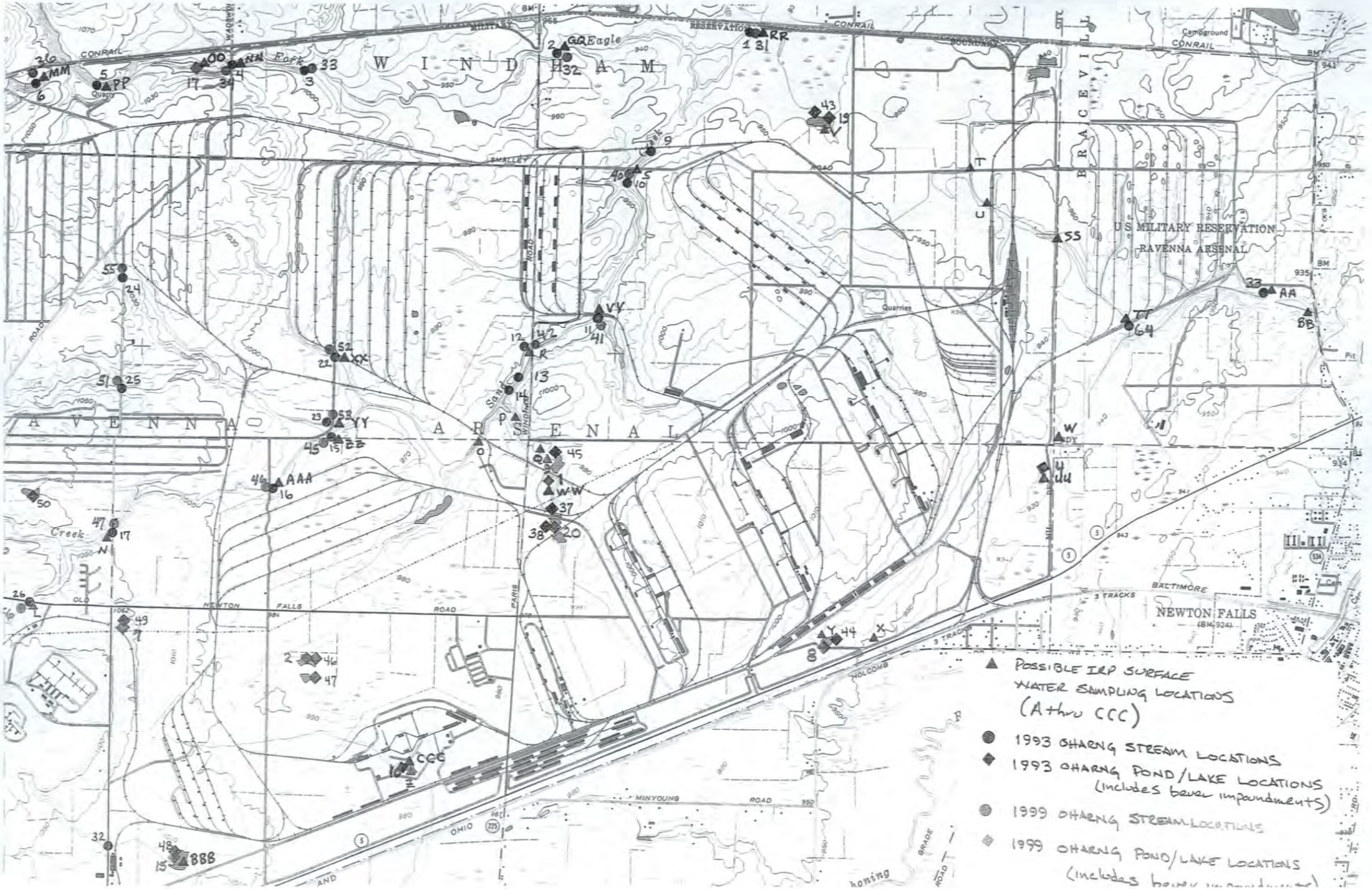
*FINAL SITE NAME ? IF COLUMN BLANK, MEANS NO

RVAAP- PRELIMINARY SITING OF FACILITY-WIDE SURFACE WATER SAMPLING LOCATIONS

MAP SITE NUMBER	SITE LOCATION	GPS NAME	1993 SAMPL STA	1999 SAMPL STA	WATERSHED	APPROX POSITION IN WATERSHED	SURFACE WATER TYPE	RELEVANCE TO AOCs	DESCRIPTION	*FINAL SITE NAME
CC	SAND CR W OF SLAGLE RD		20	50	SAND CR	UPPER	STREAM		FREE-FLOWING	S-1
DD	FRANK'S POND		57	6	TRIB 1, W BR MAHONING	UPPER	POND	POSSIBLE REF POND	200' x 800'	
EE	BEAVER IMP BUNDLING RD	W-4	42	21	HINKLEY CR	UPPER	POND	POSSIBLE REF POND	400' x 900'	REFPOND-1
FF	HATCHERY PONDS		55 56	63	HINKLEY CR	UPPER	STREAM	POSSIBLE REF POND	5 PONDS, EACH ABOUT 200' x 200'	
GG	RT 80 TROUT POND		54	13	HINCKLEY CR	UPPER	POND	POSSIBLE REF POND	200' x 300'	REFPOND-2
HH	HINCKLEY CR @ NEWTON FALLS		29	59	HINCKLEY CR	UPPER	STREAM		TOO STAGNANT	
II	FUZE/BOOSTER QUARRY PONDS		51,52 53	11,14	HINCKLEY CR	INTERMED	PONDS	FUZE/BOOSTER QUARRY PONDS		FUZE/BOOST POND
JJ	HINKLEY CR S OF NACA				HINKLEY CR	INTERMED	STREAM	NACA, DEMO #1	FREE-FLOWING	H-3
KK	TRIB TO S.FORK EAGLE CR ALONG SLAGLE		8	38	S FORK EAGLE CR	UPPER	STREAM		NO FLOW	
LL	S. FORK EAGLE CR (WHERE ENTERS)		7	37	S. FORK EAGLE CR	UPPER	STREAM		FREE-FLOWING	SFE-1
MM	S. FORK EAGLE CR		6	36	S. FORK EAGLE CR	UPPER	STREAM		FREE-FLOWING BELOW DAM / BRIDGE	SFE-2
NN	S. FORK EAGLE CR		4	34	S. FORK EAGLE CR	INTERMED	STREAM	DS OF BOY SCOUT DAM	FREE-FLOWING	SFE-4
OO	BOY SCOUT LAKE			17	S. FORK EAGLE CR	INTERMED	LAKE	BOY SCOUT LAKE	POSSIBLE REFERENCE LAKE	REFPOND-3
PP	S. FORK EAGLE CR		5		S. FORK EAGLE CR	INTERMED	STREAM	ADJ TO QUARRY	FREE-FLOWING	SFE-3
QQ	S. FORK EAGLE CR		2	32	S. FORK EAGLE CR	LOWER	STREAM		EAST OF PARIS-WINDHAM STAGNANT WATER	
RR	S. FORK EAGLE CR		1	31	S. FORK EAGLE CR	LOWER	STREAM	WHERE EXITS FACILITY	SOMEWHAT STILL, BUT ACCEPTABLE DS OF SAND CR CONFLUENCE	SFE-4
SS	DRAINAGE FR ERIE @ COUNTY LINE				NO NAME #3	INTERMED	STREAM	DS OF ERIE US OF LL-1	MINIMAL FLOW	
TT	DRAINAGE FR ERIE S OF AREA 7			64	NO NAME #3	INTERMED	STREAM	DS OF ERIE US OF LL-1	FREE-FLOWING	NN3-2
UU	CRIGGY'S POND			4	NO NAME #3	INTERMED	POND	SED BASIN DS OF LL-1	TOO SHALLOW	
VV	SAND CR SE OF AREA 2		11	41	SAND CR	LOWER	STREAM		FREE-FLOWING	S-10
WW	UPPER COBBS POND			1	SAND CR	INTERMED	POND	DS OF LL-3, 12		UPPERCOBB POND
XX	SAND CR TRIB WINKLE ROAD S OF AREA 1-A		22	52	SAND CR	INTERMED	STREAM		NOT ENOUGH FLOW	
YY	SAND CR TRIB WINKLE ROAD		23	53	SAND CR	INTERMED	STREAM	DS OF N WINKLE LAND FILL	LOW FLOW, BUT DOABLE	S-6
ZZ	SAND CR WINKLEPECK RD @ BEND IN ROAD		15	45	SAND CR	INTERMED	STREAM	DS OF WINKLE BURN GROUND	NOT AS GOOD AS AAA NEARBY	
AAA	SAND CR @ WILCOX-WAYLAND		16	46	SAND CR	INTERMED	STREAM	DS OF WINKL BURN GROUND	FREE-FLOWING	S-5
BBB	POND E OF ADMIN AREA		48	15			POND			ADMINPOND
CCC	LL-4 POND			10	NO NAME #5		POND	DS OF LL-4		LL4POND

FINAL SITE NAME ? IF COLUMN BLANK, MEANS NO


U S MILITARY RESERVATION
RAVENNA ARSENAL
CHARLESTOWN
Freedom Sta.
ERIE—LACKAWANNA
RAVENNA
Hinkley Creek
Augerburg
Charlestown
NEWTON FALLS
PIPELINE
ROAD


U.S. MILITARY RESERVATION
RAVENNA ARSENAL
NEWTON FALLS
(BM 924)
CONRAIL
Campground
Quarries
Pit
3 TRACKS
BALTIMORE
OLD NEWTON FALLS ROAD
PARIS
MINYOUNG ROAD
HOLCOMB
SMALLEY ROAD
HARDACRE
MILITARY RESERVATION BOUNDARY
BRACEVILLE
Creek
OHIO
AND
honing
ROAD
▲ POSSIBLE IRP SURFACE WATER SAMPLING LOCATIONS (A thru CCC)
1993 OHARNG STREAM LOCATIONS
1993 OHARNG POND/LAKE LOCATIONS (Includes beaver impoundments)
1999 OHARNG STREAM LOCATIONS
1999 OHARNG POND/LAKE LOCATIONS (Includes beaver impoundments)

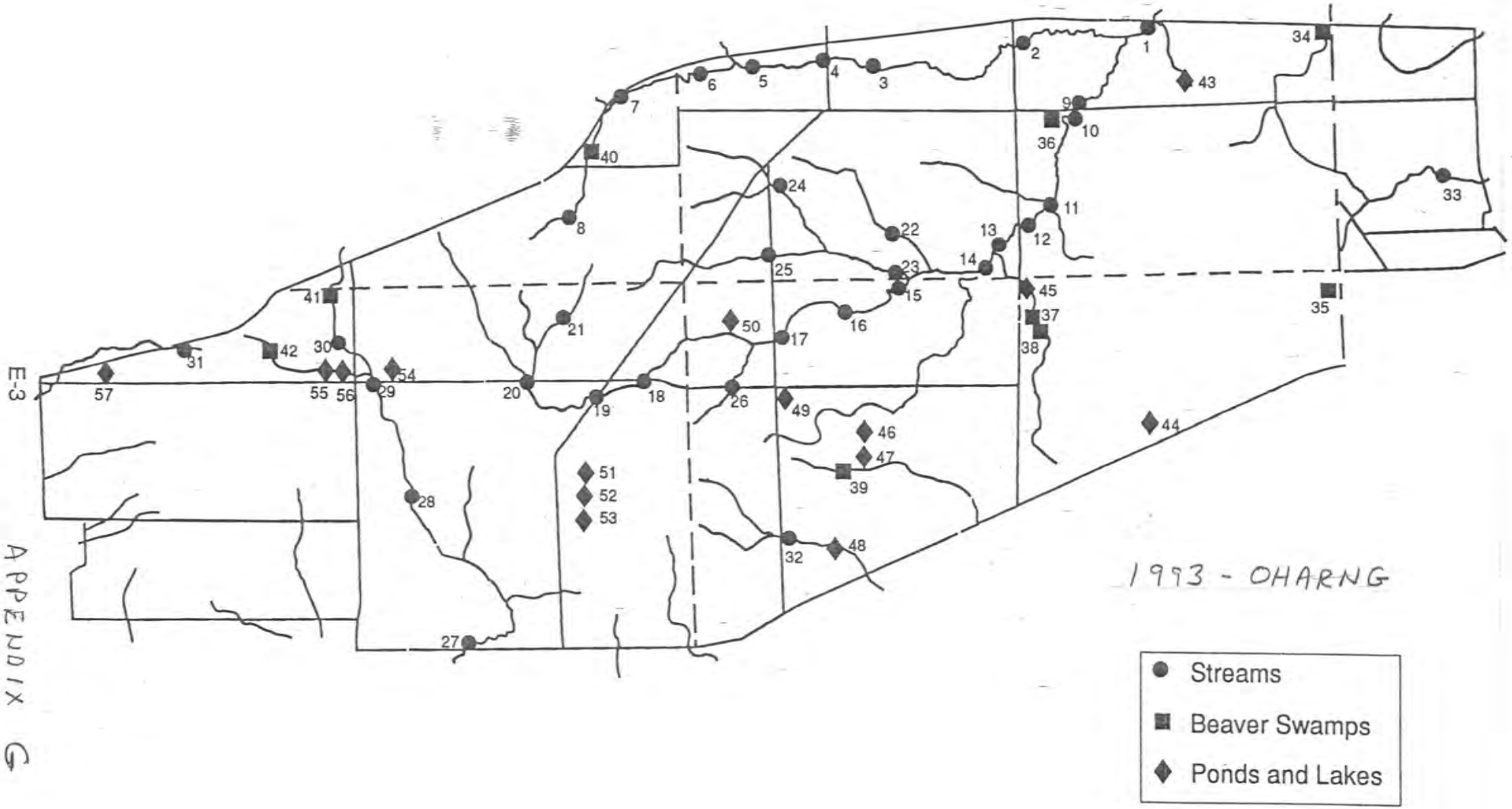


Figure 1. Map of the fish sampling stations at Ravenna Arsenal.

APPENDIX G

TABLE 1. FISH COLLECTION SITES ON THE RAVENNA ARSENAL.

STREAM HABITATS

Station	Locality
1	South Fork Eagle Creek at wooden bridge on the north perimeter road of Ravenna Arsenal, Windham Twp., Portage Co.
2	South Fork Eagle Creek at Paris Windham Road, Ravenna Arsenal, Windham Twp., Portage Co.
3	South Fork Eagle Creek adjacent to the north perimeter road, ½ mile below Scout Dam, Ravenna Arsenal, Windham Twp., Portage Co.
4	South Fork Eagle Creek below the old Scout Dam, Ravenna Arsenal, Windham Twp., Portage Co.
5	South Fork Eagle Creek at washout on the north perimeter road above dam, Ravenna Arsenal, Windham Twp., Portage Co.
6	South Fork Eagle Creek below dam at bridge crossing on the North Service Road bypass around old scout camp, at Ravenna Arsenal, Windham Twp., Portage Co.
7	South Fork Eagle Creek adjacent to the north perimeter road, east of intersection with Smalley Road, Ravenna Arsenal, Windham Twp., Portage Co.
8	South Fork Eagle Creek at bridge on Slagle Road, Ravenna Arsenal, Windham Twp., Portage Co.
9	Sand Creek downstream from bridge on Smalley Road, Ravenna Arsenal, Windham Twp., Portage Co.
10	Sand Creek upstream from bridge on Smalley Road, Ravenna Arsenal, Windham Twp., Portage Co.
11	Sand Creek upstream from culvert on RR, east of first 90 degree bend on Paris Windham Road, Ravenna Arsenal, Windham Twp., Portage Co.
12	Sand Creek at bridge on Paris Windham Road, Ravenna Arsenal, Windham Twp., Portage Co.
13	Sand Creek at treatment plant west of Cobbs Ponds, Ravenna Arsenal, Windham Twp., Portage Co.
14	Sand Creek between sewage treatment plant and RR, Ravenna Arsenal, Windham Twp., Portage Co.
15	Sand Creek adjacent to Winklepeck Road on Burning Grounds, Ravenna Arsenal, Windham Twp., Portage Co.

Table 1. continued

Station	Locality
16	Sand Creek at bridge on Wilcox - Wayland Road, Ravenna Arsenal, Paris Twp., Portage Co.
17	Sand Creek at George Road downstream from bridge, Ravenna Arsenal, Paris Twp., Portage Co.
18	Sand Creek on Newton Falls Road ¼ mile east of Greenleaf Road, Ravenna Arsenal, Charlestown Twp., Portage Co..
19	Sand Creek at bridge on Greenleaf Road, Ravenna Arsenal, Charlestown Twp., Portage Co.
20	Sand Creek at bridge on Newton Falls Road ¼ mile west of Slagle Road, Ravenna Arsenal, Charlestown Twp., Portage Co.
21	Sand Creek at bridge on Slagle Road (downstream), Ravenna Arsenal, Charlestown Twp., Portage Co.
22	Sand Creek Tributary 1, tributary to Sand Creek at culvert on Winkelpeck Road South of Smalley Road, Ravenna Arsenal, Windham Twp., Portage Co.
23	Sand Creek Tributary 2, tributary to Sand Creek upstream from bridge on Winklepeck Road in the Burning Ground area, Ravenna Arsenal, Windham Twp., Portage Co.
24	Sand Creek Tributary 2, tributary to Sand Creek downstream from Greenleaf Road at bridge on abandoned Road, Ravenna Arsenal, Windham Twp., Portage Co.
25	Sand Creek Tributary 3, tributary to Sand Creek extension of George Road through Burning Grounds, Ravenna Arsenal, Windham Twp., Portage Co.
26	Sand Creek Tributary 4, tributary to Sand Creek at culvert on Newton Falls Road west of George Road, Ravenna Arsenal, Paris Twp., Portage Co.
27	Hinkley Creek at South Service Road, Ravenna Arsenal, Charlestown Twp., Portage Co.
28	Hinkley Creek at bridge on Patrol Road, Ravenna Arsenal, Charlestown Twp., Portage Co.
29	Hinkley Creek at bridge on Newton Falls Road in Ravenna Arsenal, Charlestown Twp., Portage Co.
30	Hinkley Creek at bridge on Magazine Road, Ravenna Arsenal, Charlestown Twp., Portage Co.

Table 1. continued

Station	Locality
31	Roadside ditch on the North Perimeter Road; 1.6 miles west of Route 80, Ravenna Arsenal, Charlestown Twp., Portage Co.
32	West Branch Tributary 2, (tributary to West Branch Mahoning River) at George Road, just north of service buildings, Ravenna Arsenal, Paris Twp., Portage Co.
33	West Branch Tributary 1, (tributary to West Branch Mahoning River) on UTES property, Ravenna Arsenal, Braceville Twp., Trumbull Co.
	BEAVER SWAMPS
34	Beaver flooding at NE corner of Ravenna Arsenal, Windham Twp., Portage Co., east side of Trumbull County line.
35	Criggys Pond, wetland on east side of Ravenna Arsenal, Paris Twp., Portage Co.
36	Beaver impoundment adjacent to Sand Creek at Smalley Road, Ravenna Arsenal, Windham Twp., Portage Co.
37	Northside Loadline 3 Road on small tributary to Sand Creek at upper end of Big Cobb Pond, Ravenna Arsenal, Paris Twp., Portage Co.
38	Wetlands at the south end of Big Cobb Road, south side of Load Line 3 Road, on the tributary to Sand Creek, Ravenna Arsenal, Paris Twp., Portage Co.
39	Beaver impoundment on tributary to West Branch Mahoning River at Wilcox - Wayland Road approximately ½ mile north of South Service Road, Ravenna Arsenal, Paris Twp., Portage Co.
40	South Fork Eagle Creek downstream from Smalley Road (stream channel backed up by beaver dam for approximately ¼ mile), Ravenna Arsenal, Windham Twp., Portage Co.
41	Beaver impoundment on Hinkley Creek at Bundling Road, Ravenna Arsenal, Charlestown Twp., Portage Co.
42	Beaver impoundment on tributary to Hinkley Creek on Bundling Road about 0.2 mile north of Newton Falls Road, Ravenna Arsenal, Charlestown Twp., Portage Co.
	LAKES & PONDS
43	Snow Road Pond located approximately 0.2 mile west of Snow Road and 0.4 mile north of Smalley Road, Ravenna Arsenal, Windham Twp., Portage Co.

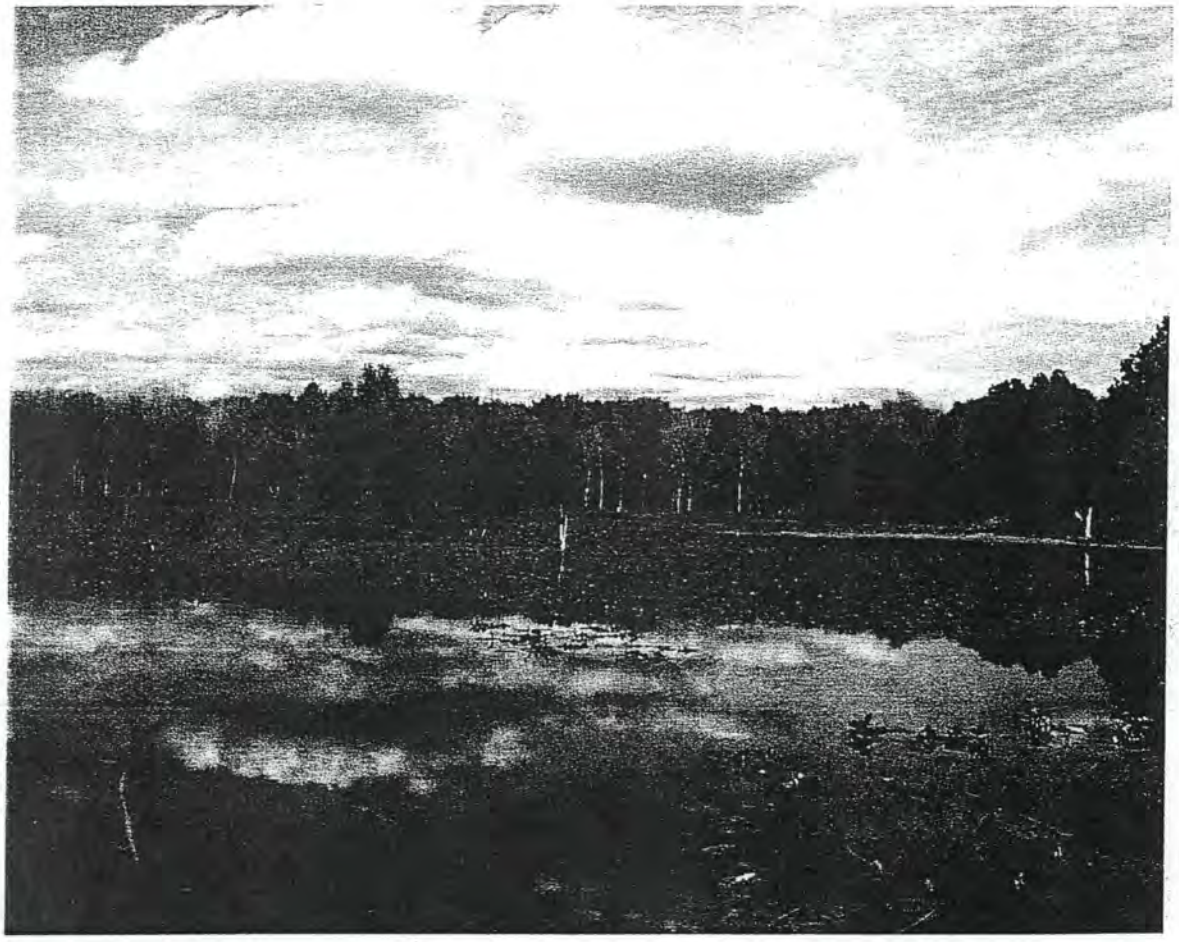
Table 1. continued

Station	Locality
44	Kelly's Pond, north side of abandoned road south of inert storage are on the South Service Road at east end of Ravenna Arsenal, Paris Twp., Portage Co.
45	Little Cobb's Pond, east side of Paris Windham Road at junction with Remalia Road, Ravenna Arsenal, Paris Twp., Portage Co.
46	Big Paul's Pond, east of Wilcox-Wayland Road, Ravenna Arsenal, Paris Twp., Portage Co.
47	Little Paul's Pond, east of Wilcox-Wayland Road, Ravenna Arsenal, Paris Twp., Portage Co..
48	S. Service Road pond, north side South Service Road approximately .4 mile east of George Road, Ravenna Arsenal, Paris Twp., Portage Co.
49	Spring fed pond, east side of George Road at railroad tracks, Ravenna Arsenal, Windham Twp., Portage Co.
50	Mack's Pond on the burning grounds at Ravenna Arsenal, 0.4 miles west of George Road, Paris Twp., Portage Co.
51	Northern most demolition pit in Demolition Area #2; See Station #52.
52	Middle one of 3 demolition pits in Demolition Area #2 north of Fuse - Booster Spur Road about 0.25 mile east of its intersection with Greenleaf Road, Ravenna Arsenal, Charlestown Twp., Portage Co..
53	Southern most demolition pit in Demolition area #2 north of Fuse - Booster Spur Road about 0.25 mile east of its intersection with Greenleaf Road in Ravenna Arsenal, Charlestown Twp., Portage Co.
54	Route 80 Trout Pond on north side of Newton Falls Road approximately 0.2 miles east of Hinkley Creek, Ravenna Arsenal, Charlestown Twp., Portage Co.
55	Western most hatchery pond, west of Route 80 and ¼ mile north of old Newton Falls Rd/. Ravenna Arsenal, Charlestown Twp., Portage Co.
56	Large hatchery pond west of Route 80 and ¼ mile north of old Newton Falls Road, Ravenna Arsenal, Charlestown Twp., Portage Co..
57	Frank's Pond, north corner of Ravenna Arsenal on north side of Newton Falls Road, Charlestown Twp., Portage Co.

Fish Survey of the Streams, Ponds, and Beaver Swamps of the Ravenna Training and Logistics Site (Ohio National Guard)

Spring – Fall 1999

Produced for the Ohio National Guard



By

Daniel Rice, Chief Zoologist
&
Megan Michael, Assistant Zoologist

Ohio Department of Natural Resources
Division of Natural Areas and Preserves
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Columbus, Ohio 43224
(614) 265-6469

APPENDIX H

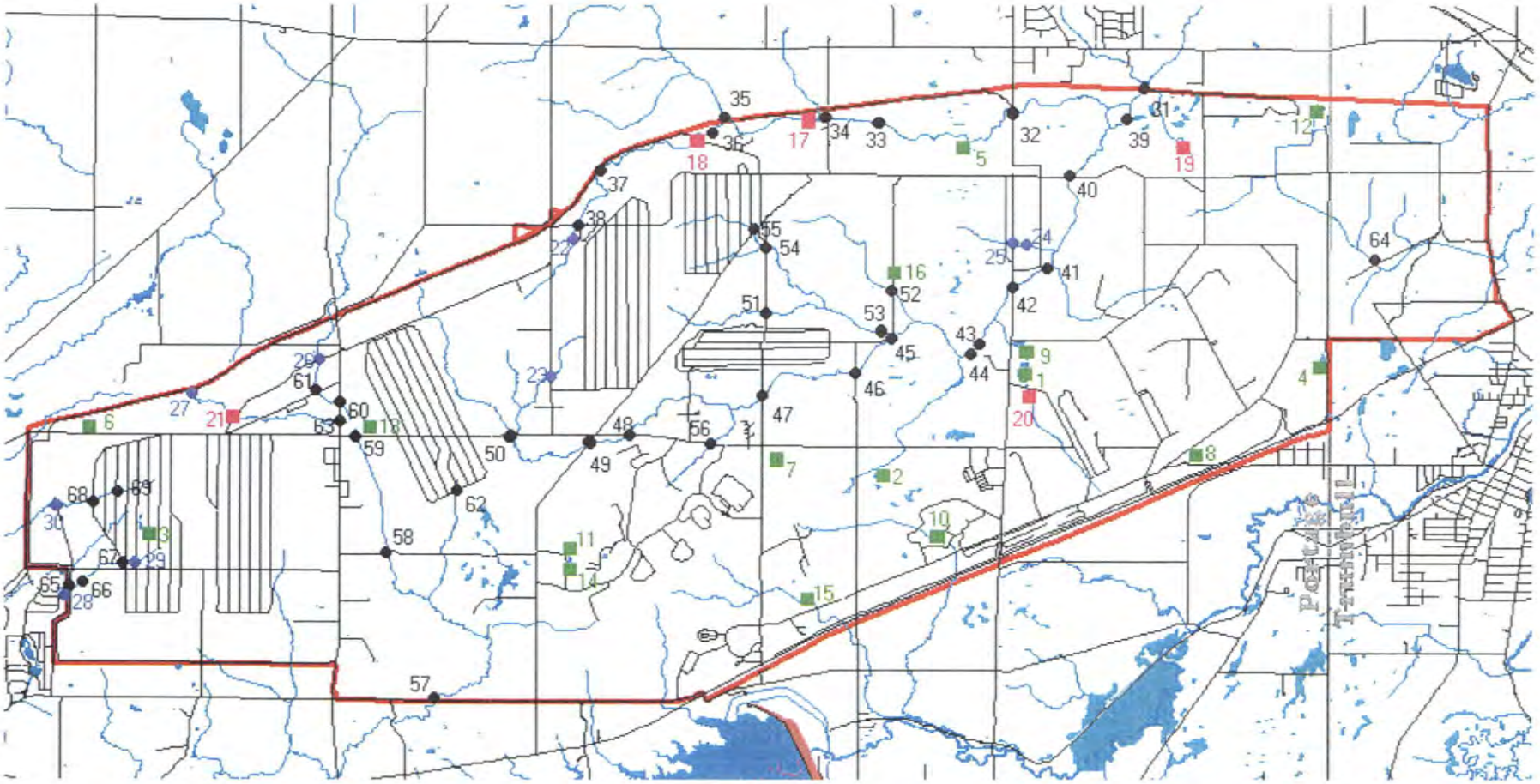

Figure 1. Locations of the fish collecting stations in the Ravenna Training and Logistics Site.

Table 1. Locations of the collecting stations within the Ravenna Training and Logistics Site for the 1999 survey.

Pond Localities

SITE #	POND NAME	LOCATION
1	Big Cobb's Pond	Located off of Paris Windham Rd., near picnic area. Ravenna Arsenal, Paris Twp., Portage Co.
2	Big Paul's Pond	Located on the east side of Wilcox-Wayland Rd. Ravenna Arsenal, Paris Twp., Portage Co.
3	Block A Quarry	Located in A Block adjacent to road 6-A, near Igloo 6-A-8. Ravenna Arsenal, Windham Twp., Portage Co.
4	Criggy's Pond	Located off of South Patrol Rd. on east side of arsenal. Ravenna Arsenal, Paris Twp., Portage Co.
5	Ed's Pond	Located off of Paris Windham Rd., north of Area 2. Ravenna Arsenal, Windham Twp. Portage Co.
6	Frank's Pond	Located on the north side of Newton Falls Rd. in the northwest corner of the Ravenna Arsenal, Charlestown Twp. Portage Co.
7	George Rd. Pond	Located on the east side of George Rd., south of Newton Falls Rd. Ravenna Arsenal, Windham Twp., Portage Co.
8	Kelly's Pond	Located on north side of abandoned road, south of inert storage area, on S. Service Rd. Ravenna Arsenal, Paris Twp., Portage Co.
9	Little Cobb's Pond	Located on east side of Paris Windham Rd. at junction with Remalia Rd. Ravenna Arsenal, Paris Twp., Portage Co.
10	Load Line 4 Pond	Located in Load Line 4 off of South Service Rd. Ravenna Arsenal, Paris Twp., Portage Co.
11	Middle Demolition Pit	Located in Demolition Area 2, north of Fuse and Booster Spur, ¼ mile east of Greenleaf Rd. Ravenna Arsenal, Charlestown Twp. Portage Co.
12	N. E. Perimeter Pond	Located at the northeast corner of arsenal off of North Perimeter Rd. Ravenna Arsenal, Windham Twp., Portage Co.
13	Rt. 80 Trout Pond	Located on the north side of Newton Falls Rd. near intersection with Rt. 80. Ravenna Arsenal, Charlestown Twp., Portage Co.
14	South Demolition Pit	Located in Demolition Area 2, north of Fuse and Booster Spur, ¼ mile east of Greenleaf Rd. Ravenna Arsenal, Charlestown Twp. Portage Co.
15	S. Service Rd. Pond	Located on the north side of South Service Rd. approximately 0.4 mile east of George Rd. Ravenna Arsenal, Paris Twp., Portage Co.
16	Winklepeck Pond	Located adjacent to Winklepeck Rd. in Area 1A. Ravenna Arsenal, Windham Twp., Portage Co.

Large Beaver Swamp/Impoundments Localities

SITE #	POND NAME	LOCATION
17	Boy Scout Pond	Impounded section of S. Fk. Eagle Cr. (RM 5.60) off of Wadsworth Rd. Ravenna Arsenal, Windham Twp., Portage Co.
18	N. Patrol Rd. Pond	Impoundment on trib. #1 to S. Fk. Eagle Cr. (RM 0.40) off of N. Patrol Rd. Ravenna Arsenal, Windham Twp., Portage Co.
19	Snow Rd. Pond	Located on trib. #2 to S. Fk. Eagle Cr. (RM 0.75) 0.2 mi. west of Snow Rd., north of Smalley. Ravenna Arsenal, Windham Twp., Portage Co.
20	Load Line 3 Wetland	Located on trib to Sand Cr. (RM 0.72) on south end of Big Cobbs Pond, south of Load line 3 Rd. Ravenna Arsenal, Paris Twp., Portage Co.
21	Bundling Rd. Pond	Beaver impoundment on a trib. to Hinkley Cr. (RM 1.00) on Bundling Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.

Small Beaver Swamp Localities

SITE #	STREAM NAME	LOCATION
22	Trib. to S. Fk. Eagle Cr. (RM 2.00)	Located downstream from Smalley Rd. Ravenna Arsenal, Windham Twp., Portage Co.
23	Sand Creek (RM 7.72)	Located just downstream of Slagle Rd., north of Newton Falls Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.
24	Trib. #1 to Sand Creek (RM 0.35)	Located off of Paris Windham Rd. in area 2 downstream of a swamp at RM 0.40. Ravenna Arsenal, Windham Twp., Portage Co.
25	Trib. #1 to Sand Creek (RM 0.40)	Located off of Paris Windham Rd. in area 2, upstream of a swamp at RM 0.35. Ravenna Arsenal, Windham Twp., Portage Co.
26	Hinkley Creek (RM 6.75)	Located on Bundling Rd. just west of Rt. 80. Ravenna Arsenal, Charlestown Twp. Portage Co.
27	Trib. to Hinkley Cr. (RM 1.60)	Located on North Perimeter Rd. 1.6 mi. west of Rt. 80. Ravenna Arsenal, Charlestown Twp., Portage Co.
28	Trib. #2 to W. Br. Mahoning (RM 0.35)	Located on the W. Perimeter Rd. south of McCormick Rd. on east side of culvert. Ravenna Arsenal, Charlestown Twp., Portage Co.
29	Trib. #2 to W. Br. Mahoning (RM 0.50)	Located in A Block on McCormick Rd. west of road 4-A. Ravenna Arsenal, Charlestown Twp. Portage Co.
30	Trib. #3 to W. Br. Mahoning (RM 0.80)	Located adjacent to Yard Rd. north of McCormick Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.

Stream Localities

SITE #	STREAM NAME	LOCATION
31 *	S. Fk. Eagle Cr. (RM 2.70)	Upstream from wooden bridge on North Patrol Rd. Ravenna Arsenal, Windham Twp., Portage Co.
32	S. Fk. Eagle Cr. (RM 3.85)	Downstream from bridge on Paris Windham Rd. Ravenna Arsenal, Windham Twp., Portage Co.
33	S. Fk. Eagle Cr. (RM 5.20)	Downstream from bridge on North Patrol Rd. Ravenna Arsenal, Windham Twp., Portage Co.
34 *	S. Fk. Eagle Cr. (RM 5.50)	Upstream from stone bridge to Scout Pond dam. Ravenna Arsenal, Windham Twp., Portage Co.
35	S. Fk. Eagle Cr. (RM 6.30)	Adjacent to washout on North Patrol Rd. upstream of the Scout Pond dam. Ravenna Arsenal, Windham Twp., Portage Co.
36	Trib. #1 to S. Fk. Eagle Cr. (RM 0.35)	Downstream of bridge over N Patrol Pond dam on N. Patrol Rd. bypass around Scout Camp. Ravenna Arsenal, Windham Twp., Portage Co.
37	Trib. #1 to S. Fk. Eagle Cr. (RM 1.10)	Adjacent to North Patrol Rd. east of Smalley Rd. near large RR culvert. Ravenna Arsenal, Windham Twp., Portage Co.
38	Trib. #1 to S. Fk. Eagle Cr. (RM 2.62)	Upstream and downstream from bridge on Slagle Rd. Ravenna Arsenal, Freedom Twp., Portage Co.
39	Sand Creek (RM 0.10)	Upstream from junction with S. Fk. Eagle Cr. Ravenna Arsenal, Windham Twp., Portage Co.
40 *	Sand Creek (RM 0.79)	Upstream and downstream from bridge on Smalley Rd. Ravenna Arsenal, Windham Twp., Portage Co.
41	Sand Creek (RM 1.56)	Upstream and downstream from RR culvert east of the first 90° bend on Paris Windham Rd. Ravenna Arsenal, Windham Twp., Portage Co.
42	Sand Creek (RM 1.90)	Upstream and downstream from bridge on Paris Windham Rd. Ravenna Arsenal, Windham Twp., Portage Co.
43	Sand Creek (RM 2.18)	Upstream to Paris Windham Rd. and downstream to RR culvert from treatment plant. Ravenna Arsenal, Windham Twp., Portage Co.
44	Sand Creek (RM 2.30)	Between treatment plant and RR trestle. Ravenna Arsenal, Windham Twp. Portage Co.
45	Sand Creek (RM 3.25)	Upstream from tributary adjacent to Winklepeck Rd. in the Burning Grounds. Ravenna Arsenal, Windham Twp., Portage Co.
46	Sand Creek (RM 3.60)	Upstream and downstream from Wilcox Wayland Rd. Ravenna Arsenal, Paris Twp., Portage Co.
47	Sand Creek (RM 4.50)	Downstream from bridge on George Rd. Ravenna Arsenal, Paris Twp., Portage Co.
48	Sand Creek (RM 5.90)	Upstream of Newton Falls Rd. ¼ mi. east of Greenleaf Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.

Stream Localities Continued

SITE #	STREAM NAME	LOCATION
49	Sand Creek (RM 5.90)	Upstream and downstream from bridge on Greenleaf Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.
50	Sand Creek (RM 7.00)	Upstream from bridge on Newton Falls Rd. ¼ mi. west of Slagle Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.
51	Trib. to Trib. to Sand Creek (RM 0.61)	Upstream and downstream from extension of George Rd. through the Burning Grounds. Ravenna Arsenal, Charlestown Twp., Portage Co.
52	Trib. #2 to Sand Creek (RM 0.30)	Upstream and downstream from culvert on Winklepeck Rd. south of Smalley Rd. Ravenna Arsenal, Windham Twp., Portage Co.
53	Trib. #3 to Sand Creek (RM 0.12)	Upstream from bridge on Winklepeck Rd. in the Burning Grounds. Ravenna Arsenal, Windham Twp., Portage Co.
54	Trib. #3 to Sand Creek (RM 1.71)	Upstream and downstream from the bridge on the extension of George Rd. in Burning Grounds. Ravenna Arsenal, Windham Twp., Portage Co.
55	Trib. #3 to Sand Creek (RM 1.74)	Upstream and downstream from the bridge on Greenleaf Rd. Ravenna Arsenal, Windham Twp., Portage Co.
56	Trib. #4 to Sand Creek (RM 0.45)	Downstream from the culvert on Newton Falls Rd. west of George Rd. Ravenna Arsenal, Paris Twp., Portage Co.
57 *	Hinkley Creek (RM 3.30)	Upstream from bridge on South Service Rd. Ravenna Arsenal. Charlestown Twp., Portage Co.
58	Hinkley Creek (RM 5.15)	Downstream from bridge on South Patrol Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.
59	Hinkley Creek (RM 6.08)	Downstream from bridge on Newton Falls Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.
60	Hinkley Creek (RM 6.30)	Upstream and downstream from bridge on Rt. 80 north of the Hatchery Ponds. Ravenna Arsenal, Charlestown Twp., Portage Co.
61	Hinkley Creek (RM 6.59)	Downstream from bridge on Magazine Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.
62	Trib. #1 to Hinkley Creek (RM 0.70)	Adjacent to road 7-B in B Block. Ravenna Arsenal, Charlestown Twp., Portage Co.
63	Trib. #2 to Hinkley Creek (RM 0.10)	Upstream and downstream from bridge on Rt. 80 adjacent to Hatchery Ponds. Ravenna Arsenal, Charlestown Twp., Portage Co.
64	Trib. #1 to W. Br. Mahoning (RM 2.55)	Upstream and downstream of wooden bridge on West side of Guard Property. Ravenna Arsenal, Braceville Twp., Trumbell Co.
65	Trib. #2 to W. Br. Mahoning (RM 0.30)	Upstream from W. Perimeter Rd. south of McCormick Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.
66	Trib. #2 to W. Br. Mahoning (0.35)	Downstream from W. Perimeter Rd. south of McCormick Rd. Ravenna Arsenal, Charlestown Twp., Portage Co.

COMMENT RESPONSES OHIO EPA

Comment No.	Comment	Response
	Reviewer Organization (*Ohio EPA*)	
1	On page 4, 1st paragraph, 2nd sentence, please change "hazardous waste investigations" to "remedial investigations." The term "hazardous waste" has exclusive meaning, and should not be used loosely in the text. (Section 1.0)	Comment noted. Text changed.
2	Please revise the sentence on page 4 to read: "...waters entering and leaving the RVAAP facility, specifically targeting...." (Section 1.0)	Comment noted. Text changed.
3	Please revise the text on page 4 as follows (in the facility-wide description, section 1.1): ".... the City of Ravenna..."	Comment noted. Text changed.
4	Please modify the spelling of "fuse" to "fuze" throughout the document.	Comment noted. Text changed.
5	Update the text on page 5 (section 1.1) to reflect the latest Memorandum of Agreement (MOA) between the Army, National Guard Bureau (NGB) and the Ohio Army National Guard (OHARNG) regarding the transfer of land. In addition, please specify the exact acreage transferred.	Comment noted. Text changed.
6	In the section that details the past military activities in the Preliminary Assessment (PA), please also include Areas of Concern (AOCs) such as the Pistol Range and the 40 mm	Comment noted. Text changed.

Comment No.	Comment	Response
	Range. In addition, please revise the last bullet to read: "Various dump areas that occur along roads and creeks." (Section 1.1, page 5)	
7	On page 5 (section 1.2), please add additional text to the revised workplan which indicates that the unconsolidated unit is used as a source of drinking water for a good percentage of residents in the vicinity of the RVAAP.	This section is accurate with the paragraph specific to RVAAP. Residential use of GW will be documented in other reports and human health risk assessments. No change made.
8	The text on page 6 (section 1.2.1.1) indicates that due to access limitations, fishing is no longer permitted at the RVAAP. Please confirm this observation, as it is Ohio EPA's understanding that OHARNG personnel are allowed to participate in catch and release fishing at the installation.	It is confirmed that no personnel are fishing.
9	Please provide additional background information/sources in the revised text on pages 6 - 7 (section 1.2.1.1) which details whether or not Hinkley Creek and the South Fork of Eagle Creek are utilized for recreational and agricultural purposes.	This is a supposition based on surrounding agricultural and recreational activities. We have to assume that it may occur, but cannot provide validation of this issue. No change recorded
10	On page 7, under section 2 (Determination of the Scope of the Assessment) add the following document - *September 30, 1989 Addendum to Biological Criteria for the Protection of Aquatic Life: Volume II: Users Manual for Biological Field Assessment of Ohio Surface Waters, October 30, 1987 (Updated January 1, 1988).* Please see Attachment One for a more complete list of documents and publications which should be referenced in the workplan.	Comment Noted. Addendum reference added.
11	On page 7 (section 2.1: bullet one) please note that the QHEI evaluates more than just physical stream **bed**	Comment noted. Text changed. However, chemical is retained at end of sentence, as the report will combine both

Comment No.	Comment	Response
	habitat. Delete the word "bed." Macro-invertebrate should read macroinvertebrate. Under bullet three, aquatic chemical seems redundant with surface water. The sentence should end with "aquatic biological results."	chemical and biological results.
12	On page 7, section 3 delete the word "quantified" from the second sentence. The last sentence on page 7 should be replaced with the following: A score between 45 and 60 suggests some habitat limitations and falls into a range between Modified Warmwater Habitat and Warmwater Habitat. The appropriate aquatic life use designation assigned, will depend on the habitat characteristics which are most limiting to aquatic life.	Comment noted. Text changed.
13	On page 8, section 3.1, this section and section 3 cover the same information. Ohio EPA recommends deleting section 3 and replacing it with section 3.1.	Comment noted. Section 3 retained as a more general introduction. Details moved to 3.1.
14	On page 8, section 3.1.1 add the following: A lake/pond QHEI evaluation form in development at Ohio EPA (Roger Thoma, NEDO DSW, personal communication) will be used to assess physical habitat features at all pond sampling locations.	Text added.
15	Ohio EPA recommends that section 3.2 (page 8) be deleted and replaced with section 3.2.1 (with some changes noted below).	Section retained. 3.2 is the general introduction, while 3.2.1 provides specific state detail.
16	On page 9, section 3.2.1, 2nd paragraph, 2nd sentence, delete the word "most" before RVAAP.	Text changed.

Comment No.	Comment	Response
17	On page 9, section 3.2.1, 3rd paragraph, 1st sentence, add the text "in streams" after uses. Change table 7-17 to table 7-15 (this number changes with the rule revisions this month).	Text changed.
18	Page 9, section 3.2.1, last paragraph. In the second to last sentence, change WWH to "applicable."	Text changed.
19	On page 9, section 3.2.1, add a paragraph as follows: Attainment/non-attainment of aquatic life uses for ponds has not been developed by Ohio EPA. However, fish communities will be sampled using boat electrofishing techniques similar to rivers. Within each pond, a 500 meter distance (if possible) along the shoreline will be sampled. Comparable to river sampling sites, an effort will be made to collect all available stunned fish. Fish will be counted, weighted, identified to species, and evaluated for external anomalies. Fish results will be used to calculate IBI and MIwb scores at each pond sampling location, along with the specific metrics that comprise the IBI. The metrics used for calculation of the IBI will include those which are used for boat electrofishing sites. Results from potentially contaminated pond locations will be compared to physically similar, on-site reference pond	Text added.
20	Ohio EPA suggests deleting section 3.3. It is redundant with section 3.3.1	Section retained. 3.3 is the general introduction, while 3.3.1 provides specific state detail.
21	Please insert the following language for section 3.3.1 in place of the existing verbiage: The macroinvertebrate	Text replaced.

Comment No.	Comment	Response
	community at the RVAAP sampling locations will be sampled qualitatively, and where flow conditions permit, quantitatively. The quantitative sample consists of a composite sample of 5 modified Hester-Dendy multiple plate samplers. The samplers are placed in flowing water and allowed to colonize for six weeks. The samplers are then collected and all the macroinvertebrates colonizing the Hester-Dendy samplers are identified to the lowest practical level and counted. When the quantitative samples are collected, a qualitative sample will also be collected. At sites where insufficient flow prevents collecting a quantitative sample, a qualitative sample will be collected. The qualitative sample consists of an inventory of all the observed macroinvertebrate taxa collected from all the available habitat types at a sampling location. The RVAAP pond sampling locations will be sampled qualitatively and quantitatively using Hester-Dendy samplers. Activity traps will also be used to sample the macroinvertebrate and amphibian community of the ponds. The activity (funnel) traps are similar to minnow traps only made of window screening. The trap consists of an aluminum screen cylinder with fiberglass screen funnels facing the inside of the trap from each open end. Macroinvertebrates, amphibians, and fish enter the trap through the funnel ends and are unable to escape. Ten traps will be used for one 24 hour sampling period in each pond. The traps will be spaced uniformly around the perimeter of the pond at a depth sufficient to almost submerge the trap. After 24 hours the traps are emptied and the contents preserved for later identification and counting. The	

Comment No.	Comment	Response
	contents of each trap are processed separately.	
22	On page 10, section 3.4.1 add the following to the 1st sentence after the word to "biocriteria (for streams only)." For your reference, attachment 2 is a pdf file of the narrative ranges of biological quality, that could be added as an appendix to the workplan.	Text added. Appendix ????
23	On page 10, section 3.4.1 revise the sentence to read: " and thus may require some remedial action." Also for the last sentence, add the following after range - "or all of the measured indices are in the fair range."	Text added.
24	Please keep in mind that although throughout the workplan, reference is made to the WWH use, some of the streams at RVAAP may be a different aquatic life use (modified warmwater, coldwater, limited resource water, exceptional warmwater).	Comment noted.
25	Please insert the following language for section 3.4.4 (page 11): The results of the IBI and MIwb fish data, as well as the qualitative, quantitative and activity trap data for macroinvertebrates from the study sites will be compared to corresponding data from the facility reference ponds.	Text added.
26 1	The following are a number of comments on table 1 (page 12): Please add grain size to the list of parameters for sediment	Text changed.

Comment No.	Comment	Response
	samples;	
26 2	The following are a number of comments on table 1 (page 12): Cyanide will be measured as total. This is fine for sediment, however, for surface water, free cyanide is the preferred analyte. The Ohio Water Quality Standards have criteria only for free cyanide. To complicate matters, until very recently, USEPA did not have a free cyanide lab method developed. So, labs (including Ohio EPA's) were only able to test for total cyanide;	Text changed.
26 3	The following are a number of comments on table 1 (page 12): Herbicides are listed for testing, however, they are not listed in the Facility-Wide Sampling and Analysis Plan for Environmental Investigations at RVAAP (March 2001). Which herbicides will be tested, and why?;	Text changed.
26 4	The following are a number of comments on table 1 (page 12): Add ammonia-N and total phosphorus under water for all samples;	Text changed.
26 5	The following are a number of comments on table 1 (page 12): Unless there is a significant concern about PCBs and pesticides on-site, we recommend testing these parameters only once in the water samples (not twice as indicated);	Text changed.

Comment No.	Comment	Response
	and,	
26 6	The following are a number of comments on table 1 (page 12): What is the reason for testing for sulfide, both in sediment and water? Sulfide should be deleted unless there is a site-specific reason for testing.	Text changed.
27	On page 12, section 4, last paragraph, change the anticipated time frame of sampling to June - August, 2003	Text changed.
28	In Table 2, the following are some corrections to site location names and information: Site S-1: delete "trib" from Sand Creek in site location Site S-10: Add "downstream RR" in site location Site SFE-1: This stream is not South Fork Eagle Creek, but an unnamed tributary to the SF Eagle Creek. Site SFE-2: This stream is not South Fork Eagle Creek, but an unnamed tributary to the SF Eagle Creek. Site SFE-3: Delete under site location "from Kelly's Pond(LL-2)"	Site S-1 does not indicate trib. Did you mean S-2? Site S-10 will be changed. SFE-1 will be changed. SFE-2 will be changed. SFE-3 will be changed.

COMMENT RESPONSES AEC

Brancato, David J LRL02

From: Brancato, David J LRL02
Sent: Wednesday, December 18, 2002 4:48 PM
To: Robert Whelove (E-mail); Mark Patterson (E-mail)
Cc: Beckham, Glen LRL02; Zorko, Paul L LRL02; Jent, John P LRL02; Ferguson, Elizabeth A LRL02; Brancato, David J LRL02
Subject: FW: Surface Water Sampling Plan
Importance: High

Bob:
Response to your comments on RVAAP surface water assessment work plan.
Drs. Dave and Elizabeth

-----Original Message-----
From: Whelove, Robert W [mailto:WheloveR@osc.army.mil]
Sent: Thursday, December 12, 2002 3:36 PM
To: 'Elizabeth.A.Ferguson@lrl02.usace.army.mil'
Cc: 'Glen.Beckham@lrl02.usace.army.mil'; Patterson, Mark
Subject: Surface Water Sampling Plan

I concur with the plan with the following exceptions; I think it should be documented as a task in the plan to get and document rainfalls month by month for three years prior to the 93 event ,the 99 event and this event.

Response: Agree. However, it is expected that three months prior to the sampling events would be adequate. Text added in 3.4.2.

There also should be some analysis of the rainfall with regards to the species outlined prior to the sampling events.

Response: Analysis is not required as the habitat evaluations will account if there is low or high flow, which later feeds into the ICI analysis. Decisions of attainment will take into account any abnormal water flow.

Also on page ten, the metrics should be numbered to avoid confusion about which are being used.

Response: All 10 metrics are used in scoring the ICI. Metric 10 was clarified in the text to be the number of EPT taxa.

More needs to be said about the "Qualitative" evaluation of the macro invertebrates on page ten

Response: Understood, however field biologist specialists have assembled this type of information in Ohio EPA guidance and associated documents that have been peer reviewed. Without setting up a regulatory forum to recreate these endpoints, we must abide by Ohio EPA guidance. This information will be clarified in the study report.

I think if there is poor or very poor water coming onto the facility -----then it will "not" automatically trigger cleanup if the stream is found to be poor or very poor ---especially if the downstream sites prove "better"

than the incoming water. Something has to be documented to this effect. Page ten does not document this very well.

Response: Agree. Text will be added to 3.4.1.

The reference stream locations are not documented in the scope-I had to call Elizabeth in order to understand which were which.

Response: Noted. However, we can not call our up-gradient stream locations as reference areas. They are noted as up-gradient and serve to provide information for stream impact from off-site.

Some sort of chart should be laid out ahead of time which governs if ICI and MIWB and IBI conflict. What will the results be --"confusion"?

Response: Confusion would not occur. The structure of Ohio guidance is where both invertebrates and fish collocate there scores are comparable. However, there are situations where invertebrates exist without fish, and vice-versa, making the path of decision specific to one or the other metrics.

I think the categories of good,fair,marginal,very poor, and poor ought to be laid out ahead of time for all indices --quantitatively and qualitatively.

Response: Agree. This is defined in Ohio EPA guidance which is referenced in our report, of which we concur and will use.

Eventually I think all the formula's the OEPA uses for this evaluation should be published in an appendices in our report.

Response: Agree. The requested formulas will be in the Study Report.

I think all samples should be taken upstream of the bridges.

Response: Possible. However, the best places for sampling will be selected by the aquatic biologist based on flow, water depths, pooling, and the like. Some times the best place is under a bridge.

A chart supplied to me shows five main variables ------Flow Regime,Chemical Variables,Biotic Factors, Energy Source and Habitat Structure---Why then will there be cleanup in the streams --which will be chemically related, when there are four other factors?

.Response: Possible. There will be no clean-up if chemicals cannot be correlated to impact .

Yours Bob W. Jar.

FINAL COMMENT – RESPONSE PACKAGE

Comment Number	Comment	Comment Resolution
	(Reviewer: Ohio EPA)	
1	On new page 5, please add in the meaning of the acronym "BRACO", and add this new entry to the workplan's acronym list.	Base Realignment and Closure Office will be added as the meaning of the new acronym. Acronym list will be checked to ensure inclusion as well.
2	Under "Objectives" (new page 9): add MIwb with the IBI in parentheses.	Text changed as requested
3	As section 3.2 (Fish Lotic and Lentic) was not deleted as previously requested by the Agency, please revise as follows: 1. 2nd paragraph, last sentence: Replace last sentence with the following - "The overall IBI score is compared to biocriteria values listed in the Ohio water quality standards, in addition to narrative ranges developed by the Ohio EPA for the appropriate ecoregion." 2. The list of IBI metrics in the workplan is for wading sites, not headwater sites. Change the following metrics: number of sunfish species to number of headwater species, number of sucker species to number of minnow species, number of intolerant species to number of sensitive species, percent top carnivores to percent pioneering species, and proportion of individuals as simple lithophilic spawners to number of simple lithophilic species. 3. Last paragraph, replace 3rd sentence with the following:	Text changed as requested.

	"Relative numbers and relative weights are adjusted to represent a 0.3 km sampling reach for headwater and wading sites and 1.0 km for boat sampling sites." Last paragraph, replace last sentence with the following: "The MIwb is based on a scoring range of 0 to12, with 0-5 being "very poor" and greater than 9.5 being "exceptional" quality."	
4	On new page 13 (section 3.4.1), change the text to read as follows: "...'fair category', which may...."	Text changed as requested
5	On new page 13 (section 3.4.1), please revise the text to read as follows: "Impacts due to upgradient, off-installation activities that may...."	Text changed as requested
6	On Table 2: As your response to Ohio EPA comments indicates, S-1 should be S-2.	Agreed. Change made to S-2 based on earlier comments.