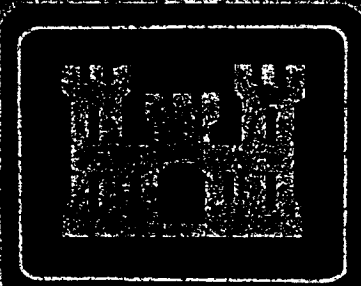


1974

# ENVIRONMENTAL MONITORING IMPLEMENTATION FOR THE ST. LOUIS STIDS PORTYARD

ST. LOUIS, MISSOURI

1974



U.S. Army Corps of Engineers  
St. Louis District Office  
Formerly St. Louis District Office Remedial Action Program

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**FINAL**

# **ENVIRONMENTAL MONITORING IMPLEMENTATION FOR THE ST. LOUIS SITES FOR FY01**

**ST. LOUIS, MISSOURI**

**MARCH 2001**

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*prepared by*

U.S. Army Corps of Engineers, St. Louis District Office, Formerly Utilized Sites Remedial Action Program

*with assistance from*

Science Applications International Corporation  
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## ACRONYMS AND ABBREVIATIONS

Ac	actinium
ADAR	Annual Data and Analysis Report
AEC	Atomic Energy Commission
AOC	area of contamination
ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Aquatic Water Quality Criteria
BMP	Best Management Practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
CFR	Code of Federal Regulations
COPC	constituent of potential concern
DOE	U.S. Department of Energy
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EMG	Environmental Monitoring Guide
EMP	Environmental Monitoring Program
EMIFY	Environmental Monitoring Implementation Fiscal Year
FFA	Federal Facilities Agreement
FS	Feasibility Study
FUSRAP	Formerly Utilized Sites Remedial Action Program
FY	Fiscal year
HISS	Hazelwood Interim Storage Site
HU	hydrostratigraphic unit
HZ	hydrostratigraphic zones
Inc.	Incorporated
IDW	investigation derived wastes
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MDA	minimum detectable activity
MDNR	Missouri Department of Natural Resources
mg/L	milligrams per liter
mg/kg	milligram per kilogram
mrem/yr	millirem per year
MSD	Metropolitan Sewer District
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
Pa	protactinium
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/m <sup>2</sup> /s	picocuries per square meter per second
pCi/m <sup>3</sup>	picocuries per cubic meter
PCOC	potential contaminant of concern

## ACRONYMS AND ABBREVIATIONS (CONT'D)

POTW	publicly owned treatment works
QA/QC	quality assurance/quality control
Ra	radium
RA	Remedial/ Removal Action
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
Rn	radon
ROD	Record of Decision
s	second
SAG	Sampling and Analysis Guide
SDWA	Safe Drinking Water Act
SLAPS	St. Louis Airport Site
SLDS	St. Louis Downtown Site
SLS	St. Louis Sites
SQB	Sediment Quality Benchmarks
SQRT	Sediment Quick Reference Table
SVOC	Semi-volatile organic compound
TEDE	total effective dose equivalent
Th	thorium
TLD	thermoluminescent dosimeters
TOC	toxic organic compound
U	uranium
UMTRCA	Uranium Mill Tailings Radiation Control Act
USACE	U.S. Army Corps of Engineers
USACE-SLD	U.S. Army Corps of Engineers- St. Louis District
USEPA	U.S. Environmental Protection Agency
UTL	upper tolerance level
VOC	volatile organic compound
VP	Vicinity Property
WD	work description

## 1.0 INTRODUCTION

### 1.1 PROGRAM OVERVIEW

This Environmental Monitoring Implementation of Fiscal Year 2001 (EMIFY01) applies to the St. Louis Sites (SLS) within the Formerly Utilized Sites Remedial Action Program (FUSRAP) [See Figure 1-1]. These sites are the St. Louis Downtown Site (SLDS), St. Louis Airport Site (SLAPS), and the Hazelwood Interim Storage Site (HISS) [See Figures 1-2, 1-3, and 1-4]. The FUSRAP program was initiated in 1974 by the Atomic Energy Commission (AEC), the predecessor to the U.S. Department of Energy (DOE). FUSRAP, transferred to the U.S. Army Corps of Engineers (USACE) on October 13, 1997, is responsible for the characterization and remediation of contamination associated with the historical AEC facilities that supported the nation's early nuclear defense-related activities. One primary element of the FUSRAP mission is the environmental monitoring of sites where remedial measures are being implemented or actions have been completed with contaminants left in place. Continued environmental monitoring of sites where contaminants remain is a statutory requirement under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Environmental monitoring serves as a critical tool to evaluate potential future migration of residual contaminants, whether as a component of remedial actions or as a best management practice (BMP).

This EMIFY01 document serves as a component of an integrated approach to collecting environmental data at the SLS. It is recognized that monitoring requirements and data objectives for the SLS will change as a result of promulgation of new regulations, issuance of permits, meeting substantive requirements, and implementation of remedial actions. Accordingly, program-level requirements with respect to field sampling procedures, sample management requirements, analytical protocols, and quality assurance/quality control (QA/QC) activities that are unlikely to change are specified in an upper tier document titled *Sampling and Analysis Guide for the St. Louis Sites* (SAG) (USACE, 2000a). The *Environmental Monitoring Guide* (EMG) (USACE, 1999) describes the overall objective, program structure, media to be monitored and program requirements of the environmental monitoring program. In order to address changing monitoring objectives, annual EMIFYs are issued under the EMG and specifically identify sampling locations, frequencies, monitoring parameters, and criteria for evaluation of the resultant data that are specific for the subject year. Non-periodic environmental sampling activities such as soil sampling to define unit boundaries for design purposes or verify compliance with clean-up objectives or other special studies are specified in activity-specific Work Descriptions (WD) and Final Status Survey Plans. In accordance with requirements of the Federal Facilities Agreement (FFA), data obtained from EMIFY or WD activities are reported to the U.S. Environmental Protection Agency (USEPA) Region VII in quarterly FFA reports. An evaluation of the data obtained from monitoring under each EMIFY during each fiscal year is provided in an Annual Environmental Monitoring Data and Analysis Report (ADAR) for each calendar year.

The remainder of Section 1 contains a summary description of the contents of this document.

Section 2 presents evaluation criteria and guidelines derived from various environmental regulations that will be used for assessment of the data obtained under this EMIFY during FY2001.

Section 3 presents the various types of monitoring to be conducted at the SLS.

Section 4 references the SAG, which is necessary to fulfill the requirements of this EMIFY, including field sampling procedures, sample management requirements, sample packaging and shipping requirements, management of investigative derived wastes (IDW), analytical protocols and QA/QC requirements.

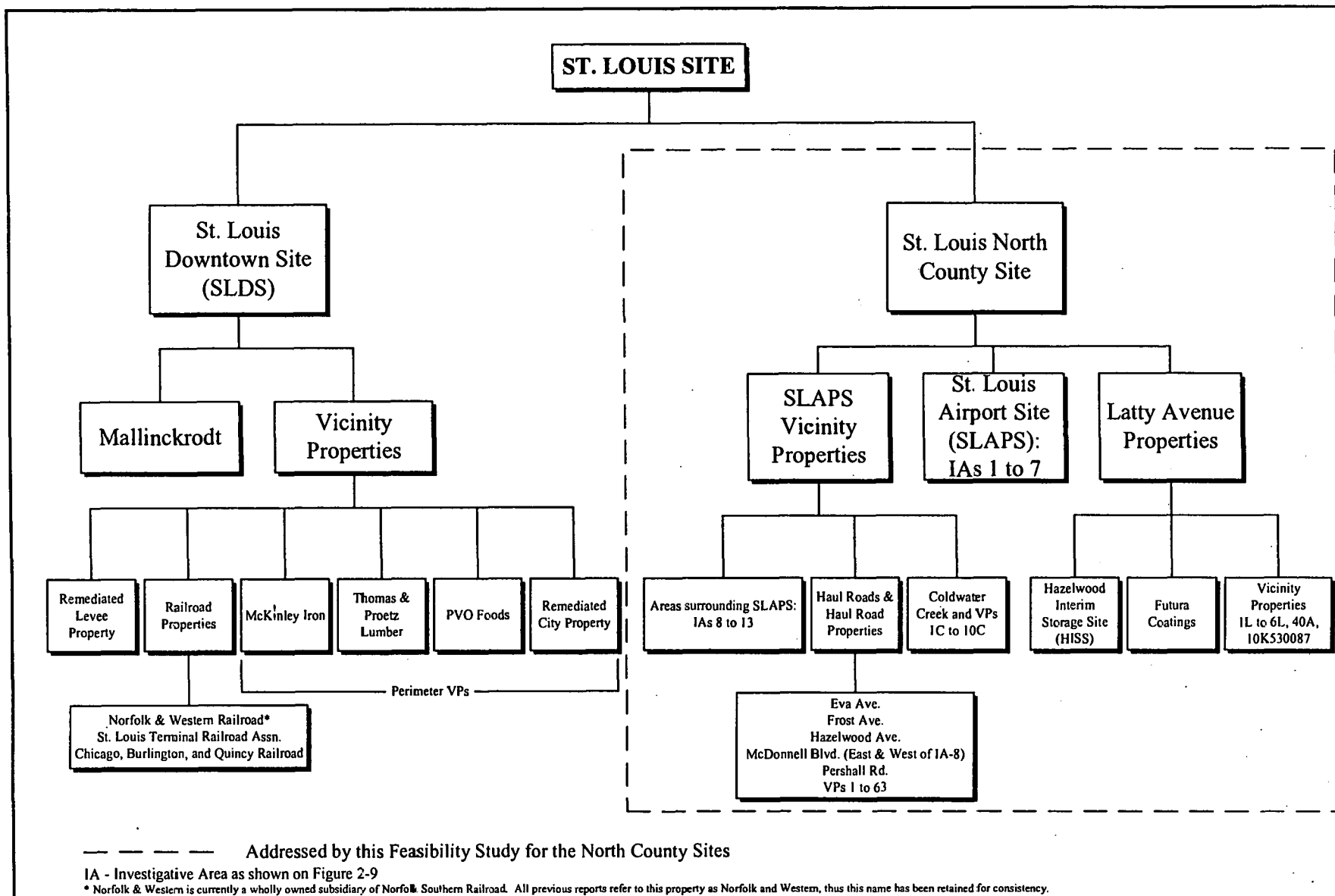


Figure 1-1. Schematic Representation of the FUSRAP St. Louis Site

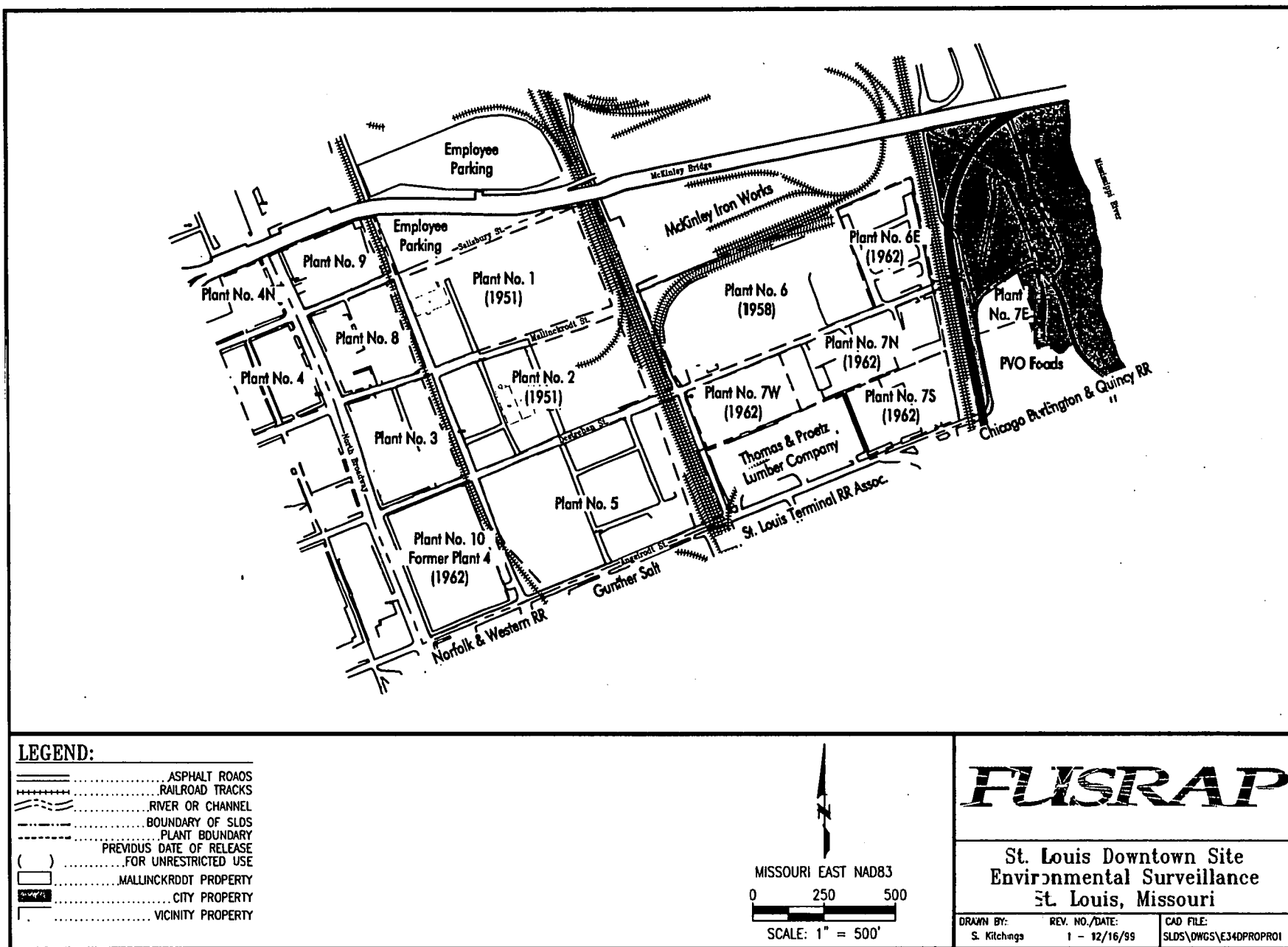


Figure 1-2. Location Map of SLDS

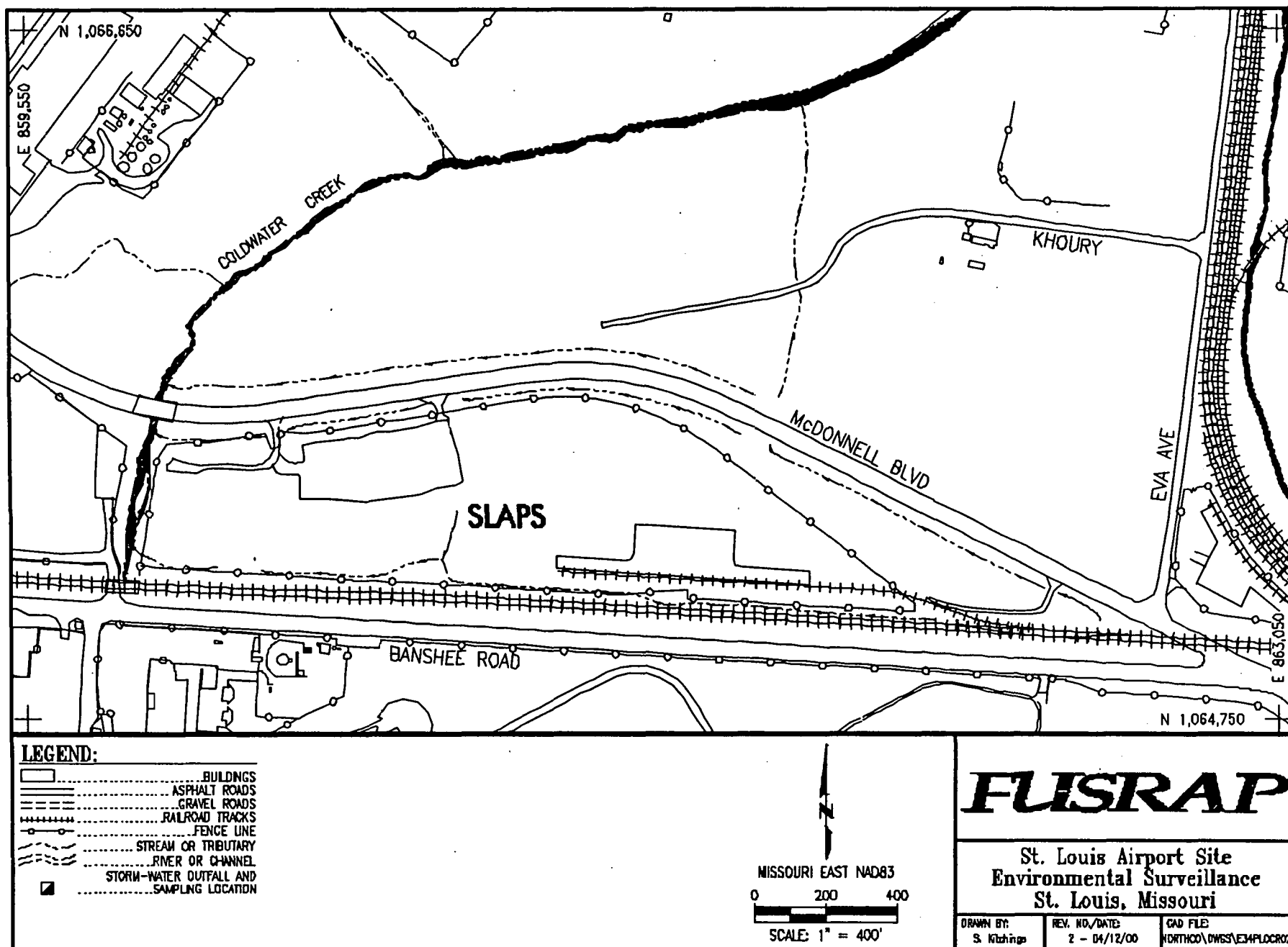


Figure 1-3. Location Map of the SLAPS

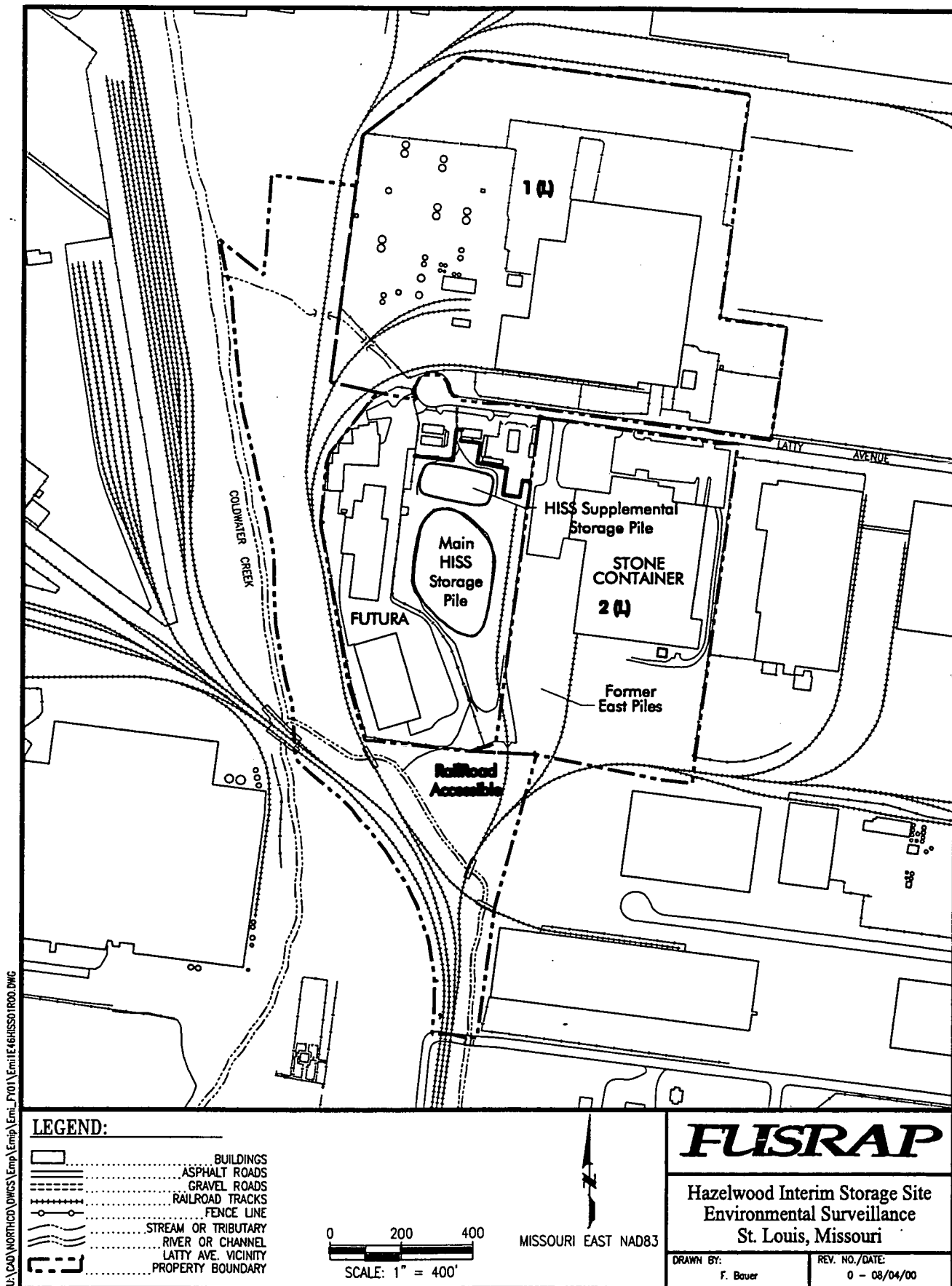


Figure 1-4. Location Map of HISS and Latty Avenue Vicinity Properties

## **2.0 OBJECTIVES AND EVALUATION GUIDELINES FOR THE ENVIRONMENTAL MONITORING PROGRAM FOR 2001**

### **2.1 PROGRAM OBJECTIVES FOR FY01**

The objectives for environmental monitoring program (EMP) during FY01 are identified below.

- Conduct periodic monitoring as required to meet substantive requirements or permit conditions of each of the SLS;
- Collect environmental data for site re-evaluation as required by CERCLA or agreed to by the USACE at the sites; and
- Conduct BMP monitoring to obtain data for impact evaluation relative to guidelines derived from other environmental regulations.

In order to fulfill these objectives, Section 3.0 identifies sampling locations and frequencies for various environmental media based on: applicable or relevant and appropriate requirements (ARARs); permit conditions; site characteristics; risk assessment considerations and other site factors. Such sampling locations may include the area of contamination (AOC), points of compliance at the AOC boundary, receptor areas, off-site unaffected areas, critical receptors, and migration pathways. Similarly, the monitoring parameters that are identified in Section 3.0 were selected from permit conditions or best professional judgment based on historical site studies, the *Feasibility Study for the St. Louis North County Site* (USACE, 2000b) and other CERCLA decision documents.

### **2.2 EVALUATION GUIDELINES FOR ENVIRONMENTAL MONITORING DATA**

Data acquired during FY01 will be evaluated with respect to ARARs or permit conditions and guidelines derived from other environmental regulations. The remainder of this section identifies these various criteria.

#### **2.2.1 Evaluation Guidelines for 2001 Ground-water Data**

Criteria and guidelines for evaluating ground-water data obtained under this EMIFY01 are derived from environmental regulatory programs and from preliminary North County background conditions for shallow and deep ground-water (USACE, 2000b). The regulatory based guidelines considered for evaluation of ground-water data are the Maximum Contaminant Levels (MCLs) of the Safe Drinking Water Act (SDWA), ground-water quality criteria promulgated by the Missouri Department of Natural Resources (MDNR) under 10 CSR 20-7, and the health based advisories for ground-water quality included under 10 CSR 20-7 Table A Class I and VII. Criteria derived from regulatory guidelines will be used as benchmarks to evaluate ground-water monitoring data. The evaluation criteria are provided in Table 2-1.

**Table 2-1. Evaluation Criteria for Ground-Water Data<sup>a</sup>**

Constituent	Background Criteria <sup>b</sup> Shallow	Background Criteria <sup>b</sup> Deep	MCL, Secondary MCL or MCLG <sup>c</sup>	Ground-Water Quality Criteria <sup>c</sup>
<b>Radiochemical Parameters</b>				
Ra-226 + Ra-228 (pCi/L)	0.91	1.03	5	NA-NG
U-238 (pCi/L)	2.28	0.11	NA-NG	NA-NG
U-234 (pCi/L)	6.07	0.00	NA-NG	NA-NG
U-235 (pCi/L)	0.47	0.49	NA-NG	NA-NG
Ra-226 (pCi/L)	0.91	1.03	NA-NG	NA-NG
Ra-228 (pCi/L)	<sup>d</sup>	0.00	NA-NG	NA-NG
Th-230 (pCi/L)	1.18	0.63	NA-NG	NA-NG
Th-232 (pCi/L)	0.25	0.00	NA-NG	NA-NG
Th-228 (pCi/L)	0.66	0.62	NA-NG	NA-NG
<b>Metals-TAL</b>				
Aluminum (mg/L)	<sup>d</sup>	0.05	0.05-0.2 <sup>b</sup>	NA-NG
Antimony (mg/L)	<sup>d</sup>	0.00	0.006	0.006
Arsenic (mg/L)	<sup>d</sup>	0.08	0.05	0.05
Barium (mg/L)	0.20	0.42	2	2
Beryllium (mg/L)	<sup>d</sup>	0.00	0.004 <sup>e</sup>	0.004
Boron (mg/L)	0.06	0.21	NA-NG	NA-NG
Cadmium (mg/L)	<sup>d</sup>	0.00	0.005	0.005
Chromium (mg/L)	0.01	0.01	0.1	0.1
Cobalt (mg/L)	<sup>d</sup>	0.00	NA-NG	1
Copper (mg/L)	0.01	0.00	1.0 <sup>b</sup> (1.3 <sup>e</sup> )	1.3
Iron (mg/L)	<sup>d</sup>	15.2	0.3 <sup>b</sup>	0.3
Lead (mg/L)	<sup>d</sup>	0.00	0.015 (0 <sup>e</sup> )	0.015
Lithium (mg/L)	0.01	0.00	NA-NG	NA-NG
Manganese (mg/L)	1.58	0.23	0.05 <sup>h</sup>	0.05
Mercury (mg/L)	<sup>d</sup>	0.00	0.002	0.002
Molybdenum (mg/L)	<sup>d</sup>	0.00	NA-NG	NA-NG
Nickel (mg/L)	<sup>d</sup>	0.00	NA-NG	0.1
Silicon (mg/L)	7.95	8.36	NA-NG	NA-NG
Strontium (mg/L)	0.32	0.74	NA-NG	NA-NG
Selenium (mg/L)	<sup>d</sup>	0.00	0.05	0.05
Silver (mg/L)	<sup>d</sup>	0.00	0.15 <sup>b</sup>	0.05
Titanium (mg/L)	<sup>d</sup>	0.01	NA-NG	NA-NG
Thallium (mg/L)	<sup>d</sup>	0.00	0.002 (0.0005 <sup>e</sup> )	0.002
Uranium (mg/L)	<sup>d</sup>	0.00	0.020	NA-NG
Vanadium (mg/L)	<sup>d</sup>	0.00	NA-NG	NA-NG
Zinc (mg/L)	0.01	0.05	5 <sup>b</sup>	5
<b>Field Parameters</b>				
pH	NA-NG	NA-NG	6.5-8.5 <sup>b</sup>	NA-NG
Color (color units)	NA-NG	NA-NG	15 <sup>b</sup>	NA-NG
Total Dissolved Solids (mg/L)	MISC	NA-NG	500 <sup>b</sup>	NA-NG
<b>VOCs</b>				
Benzene (mg/L)	<sup>d</sup>	<sup>d</sup>	0.005 (0 <sup>e</sup> )	0.005
Carbon Tetrachloride (mg/L)	<sup>d</sup>	<sup>d</sup>	0.005 (0 <sup>e</sup> )	0.005
Chlorobenzene (mg/L)	<sup>d</sup>	<sup>d</sup>	0.1	0.1
Chloroform (mg/L)	<sup>d</sup>	<sup>d</sup>	NA-NG	NA-NG
Ethylbenzene (mg/L)	<sup>d</sup>	<sup>d</sup>	0.7	0.7
Methylene Chloride (mg/L)	<sup>d</sup>	<sup>d</sup>	0.005 (0 <sup>e</sup> )	0.005
Styrene (mg/L)	<sup>d</sup>	<sup>d</sup>	0.1	0.1
Tetrachloroethene (mg/L)	<sup>d</sup>	<sup>d</sup>	0.005	0.005
Toluene (mg/L)	<sup>d</sup>	<sup>d</sup>	1	1
Trichloroethylene (mg/L)	<sup>d</sup>	<sup>d</sup>	0.005	0.005
Vinyl Chloride (mg/L)	<sup>d</sup>	<sup>d</sup>	0.002 (0 <sup>e</sup> )	0.002
Chloromethane (mg/L)	<sup>d</sup>	<sup>d</sup>	NA-NG	NA-NG

**Table 2-1. Evaluation Criteria for Ground-Water Data<sup>a</sup> (Cont'd)**

Constituent	Background Criteria <sup>b</sup> Shallow	Background Criteria <sup>b</sup> Deep	MCL, Secondary MCL or MCLG <sup>c</sup>	Ground-Water Quality Criteria <sup>c</sup>
Xylenes, Total (mg/L)	d	d	10	10
1,1,1-Trichloroethane (mg/L)	d	d	0.2 <sup>c</sup>	0.2
1,1,2,2-Tetrachloroethane (mg/L)	d	d	0.00017 (0 <sup>c</sup> )	0.00017
1,1,2-Trichloroethane (mg/L)	d	d	0.005	0.005
1,2-Dichloroethene (mg/L)	d	d	0.007	0.007
1,2-Dichloroethane (mg/L)	d	d	0.005 (0 <sup>c</sup> )	0.005
1,2-Dichloropropane (mg/L)	d	d	100	100
Cis-1,2,-Dichloroethlyene (mg/L)	d	d	0.07	NA-NG
Trans-1,2-Dichloroethlyene (mg/L)	d	d	0.1	NA-NG
Dibromochloropropane (mg/L)	d	d	0 <sup>c</sup>	NA-NG
1,2-Dichloropropane (mg/L)	d	d	0 <sup>c</sup>	NA-NG
<b>SVOCs</b>				
1,2,4-Trichlorobenzene (mg/L)	d	d	0.07 <sup>c</sup>	0.07
2,4,5-Trichlorophenol(mg/L)	d	d	2.6	2.6
2,4,6-Trichlorophenol(mg/L)	d	d	0.002	0.002
2,4-Dichlorophenol (mg/L)	d	d	0.093	0.093
2,4-Dimethylphenol(mg/L)	d	d	0.54	0.54
2,4-Dinitrophenol(mg/L)	d	d	0.07	0.07
2-Chlorophenol (mg/L)	d	d	0.1	0.001
Anthracene (mg/L)	d	d	NA-NG	9.6
Benzo(a)anthracene (mg/L)	d	d	NA-NG	4.40E-06
Benzo(a)pyrene (mg/L)	d	d	0.0002	0.0002
Benzo(b)fluoranthene (mg/L)	d	d	NA-NG	4.40E-06
Benzo(k)fluoranthene (mg/L)	d	d	NA-NG	4.40E-06
Bis(2-chloroethyl)ether (mg/L)	d	d	NA-NG	3.00E-05
Bis(2-ethylhexyl)phthalate (mg/L)	d	d	0.006	0.006
Butyl Benzyl Phthalate(mg/L)	d	d	NA-NG	3
Di-n-butyl Phthalate (mg/L)	d	d	NA-NG	2.7
Diethyl Phthalate(mg/L)	d	d	NA-NG	23
Dimethyl Phthalate (mg/L)	d	d	NA-NG	313
Fluoranthene (mg/L)	d	d	NA-NG	0.3
Fluorene (mg/L)	d	d	NA-NG	1.3
Hexachlorobenzene (mg/L)	d	d	0.001	0.001
Hexachlorobutadiene (mg/L)	d	d	NA-NG	4.50E-04
Hexachlorocyclopentadiene (mg/L)	d	d	0.05	0.05
Isophorone (mg/L)	d	d	NA-NG	0.036
N-Nitrosodiphenylamine (mg/L)	d	d	NA-NG	7.00E-07
Naphthalene (mg/L)	d	d	NA-NG	0.02 <sup>b</sup>
Nitrobenzene(mg/L)	d	d	NA-NG	0.017
Pentachlorophenol (mg/L)	d	d	0 <sup>c</sup>	0.001
Phenol (mg/L)	d	d	NA-NG	0.3
Pyrene (mg/L)	d	d	NA-NG	0.96
<b>Geochemical Parameters</b>				
Ammonia	0.29	6.7	NA-NG	NA-NG
Alkalinity	d	d	NA-NG	NA-NG
Chloride (mg/L)	13.4	1.21	250 <sup>b</sup>	250
Fluoride (mg/L)	0.25	0.24	4 (2 <sup>b</sup> )	4
Nitrate (as Nitrogen) (mg/L)	0.72	0.10	10	10
Nitrite (as Nitrogen) (mg/L)	d	0.00	1	1
Total nitrate and Nitrite (as Nitrogen) (mg/L)	0.72	0.10	10	10
Sulfate (mg/L)	376	6.93	250 <sup>b</sup>	250
<b>Pesticide/PCBs</b>				
Heptachlor	d	d	0.0004	NA-NG

**Table 2-1. Evaluation Criteria for Ground-Water Data<sup>a</sup> (Cont'd)**

Constituent	Background Criteria <sup>b</sup> Shallow	Background Criteria <sup>b</sup> Deep	MCL, Secondary MCL or MCLG <sup>c</sup>	Ground-Water Quality Criteria <sup>c</sup>
Heptachlor Epoxide	d	d	0.0002	NA-NG
Toxaphene	d	d	0.003	NA-NG
Endosulfan I	d	d	NA-NG	NA-NG
Aroclor-1016(mg/L)	d	d	0.005 (0 <sup>c</sup> )	0.002
Aroclor-1221(mg/L)	d	d	0.005 (0 <sup>c</sup> )	0.002
Aroclor-1232(mg/L)	d	d	0.005 (0 <sup>c</sup> )	0.002
Aroclor-1242(mg/L)	d	d	0.005 (0 <sup>c</sup> )	0.002
Aroclor-1248(mg/L)	d	d	0.005 (0 <sup>c</sup> )	0.002
Aroclor-1254 (mg/L)	d	d	0.005 (0 <sup>c</sup> )	0.002
Aroclor-1260 (mg/L)	d	d	0.005 (0 <sup>c</sup> )	0.002
Chlordane	d	d	0.002	NA-NG
Lindane	d	d	0.0002	NA-NG
Endrin	d	d	0.002	NA-NG
<b>Herbicides</b>				
2,4 D	d	d	0.07	NA-NG
Dalapon	d	d	0.2	NA-NG
Dinoseb	d	d	0.007	NA-NG
MCPP (mg/L)	d	d	NA-NG	NA-NG

<sup>a</sup> Source: MCL or MCLG and Secondary MCL = 40 CFR 141 and 40 CFR 143, respectively.

<sup>b</sup> Background Criteria = Feasibility Study for the St. Louis North County Site

<sup>c</sup> Criteria are secondary MCLs. MCLG - as noted otherwise if MCL exists

<sup>d</sup> Assigned as 0.00 for analytes never detected in background.

Source: 10 CSR 20-7 Table A Class I, VII.

NA-NG = not applicable, no guidance is available.

## 2.2.2 Evaluation Guidelines for Storm-water Data and Coldwater Creek Surface-water Data

The MDNR has issued a National Pollutant Discharge Elimination System (NPDES) permit for HISS that requires monitoring of the discharge from three outfalls. Discharge limits for HISS are included in Table 2-2. The MDNR has also issued an ARAR document outlining limits for the four storm-water outfalls (includes outfall at emergency spillway) at SLAPS. The pollutants addressed by these limits are also identified in Table 2-2. These discharge limits will be used as evaluation criteria for storm-water monitoring data obtained under this EMIFY01. Additionally, North County preliminary background data and Aquatic Water Quality Criteria (AWQC) for Class I and III streams under 10 CSR 20-7 may be guidelines for evaluation of the surface water data and are also presented in Table 2-2.

Environmental monitoring data concerning surface-water quality in Coldwater Creek obtained under this EMIFY will be evaluated relative to guidelines derived from environmental regulatory programs. Regulatory guidelines selected for evaluation of the surface-water monitoring data are the 10 CSR 20-7 Table A Class I, II, and V. These various criteria are presented in Table 2-2.

**Table 2-2. Evaluation Criteria for Surface-water, Waste-water, and Storm-water Data**

Constituent	Background Criteria <sup>b</sup>	Ambient Water Quality Criteria	SLAPS Discharge Limit-Based Criteria	SLDS Discharge Limit-Based Criteria	HISS Discharge Limit-Based Criteria
<b>Radiochemical Parameters</b>					
Ra-226 (pCi/L) <sup>c</sup>	0.88	5.0	NL <sup>a</sup>	NP	NL <sup>a</sup>
Ra-228 (pCi/L) <sup>c</sup>	0.34	5.0	NL <sup>a</sup>	NP	NL <sup>a</sup>
Th-230 (pCi/L) <sup>c</sup>	4.65	NA-NG	NL <sup>a</sup>	NP	NL <sup>a</sup>
Th-232 (pCi/L) <sup>c</sup>	<sup>d</sup>	NA-NG	NL <sup>a</sup>	NP	NL <sup>a</sup>
U-234 (pCi/L)	3.9	NA-NG	NP	NP	NP
U-235 (pCi/L)	<sup>d</sup>	NA-NG	NP	NP	NP
U-238 (pCi/L)	5.05	NA-NG	NP	NP	NP
Gross Alpha (pCi/L)	7.86	15	NL <sup>a</sup>	15 <sup>b</sup>	NL <sup>a</sup>
Gross Beta (pCi/L)	41.8	4 mrem/yr	NL <sup>a</sup>	50	NL <sup>a</sup>
Lead 210 (pCi/L)	NA-NG	NA-NG	NP	NP	NL <sup>a</sup>
<b>Metals- TAL</b>					
Aluminum (mg/L)	1.13	0.75	NP	NP	NP
Antimony (mg/L)	0.04	4.3	NP	NP	NP
Arsenic (mg/L)	0.01	0.02	0.1	NP	NP
Beryllium (mg/L)	<sup>d</sup>	0.005	NP	NP	NP
Cadmium (mg/L)	<sup>d</sup>	0.094	0.94	NP	NP
Chromium (mg/L)	0.05	0.28	0.28	NP	NP
Copper (mg/L)	0.02	0.084	0.084	NP	NP
Iron (mg/L)	2.15	1	NP	NP	NP
Lead (mg/L)	0.01	0.15	0.19	NP	NP
Manganese (mg/L)	0.63	NA-NG	NP	NP	NP
Mercury (mg/L)	<sup>d</sup>	0.0024	NP	NP	NP
Molybdenum (mg/L)	0.01	NA-NG	NP	NP	NP
Nickel (mg/L)	0.01	6.9	NP	NP	NP
Orthophosphate (mg/L)	0.46	NA-NG	NP	NP	NP
Selenium (mg/L)	<sup>d</sup>	0.005	NP	NP	NP
Silver (mg/L)	<sup>d</sup>	0.1 <sup>b</sup>	NP	NP	NP
Thallium (mg/L)	<sup>d</sup>	NA-NG	NP	NP	NP
Titanium (mg/L)	0.03	NA-NG	NP	NP	NP
Zinc (mg/L)	0.06	2.073	NP	NP	NP
<b>Field Parameters</b>					
Total Organic Carbon (mg/L)	NL	NA-NG	NP	NP	NL <sup>a</sup>
Total Organic Halogens (mg/L)	NL	NA-NG	NP	NP	NL <sup>a</sup>
Specific Conductance (mmhos/cm <sup>3</sup> )	NL	NA-NG	NP	NP	NL <sup>a</sup>
Chemical Oxygen Demand (mg/L)	NL	NA-NG	120	NP	NP
Oil and Grease (mg/L)	NL	10	15	NP	NP
Total Petroleum Hydrocarbon (mg/L)	NL	NA-NG	10	NP	NP
<b>VOCs</b>					
Dimethylbenzene (mg/l.)	<sup>d</sup>	10	NP	NP	NP
Methylene Chloride (mg/L)	<sup>d</sup>	1.6	NP	NP	NP
Acetone (mg/L)	0.02	NA-NG	NP	NP	NP
Trichloroethene (mg/l)	<sup>d</sup>	NA-NG	NP	NP	NP
Tetrachloroethene (mg/l)	<sup>d</sup>	NA-NG	NP	NP	NP
Benzene (mg/L)	<sup>d</sup>	0.32	NP	NP	NP

**Table 2-2. Evaluation Criteria for Surface-water, Waste-water, and Storm-water Data (Cont'd)**

Constituent	Background Criteria <sup>b</sup>	Ambient Water Quality Criteria	SLAPS Discharge Limit-Based Criteria	SLDS Discharge Limit-Based Criteria	HISS Discharge Limit-Based Criteria
<b>SVOCs</b>					
Bis(2-ethylhexyl)phthalate (mg/L)	0.01	NA-NG	NP	NP	NP
2,4-Dichlorophenol (mg/L)	<sup>d</sup>	0.007	NP	NP	NP
2-Chloronaphthalene (mg/L)	<sup>d</sup>	4.3	NP	NP	NP
Phenanthrene (mg/L)	<sup>d</sup>	0.049	NP	NP	NP
Benzo(a)anthracene (mg/L)	<sup>d</sup>	0.049	NP	NP	NP
Benzo(b)fluoranthene (mg/L)	<sup>d</sup>	0.049	NP	NP	NP
Benzo(k)fluoranthene (mg/L)	<sup>d</sup>	0.049	NP	NP	NP
Benzo(a)pyrene (mg/L)	<sup>d</sup>	0.049	NP	NP	NP
Indeno(1,2,3-cd)pyrene (mg/L)	<sup>d</sup>	0.049	NP	NP	NP
Dibenzo(a,b)anthracene (mg/L)	<sup>d</sup>	0.049	NP	NP	NP
Benzo(g,h,i)perylene (mg/L)	<sup>d</sup>	0.049	NP	NP	NP
Fluoranthene (mg/L)	<sup>d</sup>	0.3	NP	NP	NP
Hexachlorocyclopentadiene (mg/L)	<sup>d</sup>	0.0005	NP	NP	NP
<b>Geochemical Parameters</b>					
Sulfate (mg/L)	210	250	NP	NP	NP
Nitrite (mg/L)	0.19	1	NP	NP	NP
Nitrate (mg/L)	2.51	10	NP	NP	NP
Chloride (mg/L)	240	860	NP	NP	NP
Fluoride (mg/L)	1.10	4	4	NP	NP

NL = No limit

<sup>a</sup> Monitoring only requirement

<sup>b</sup> Includes contributions from Thorium and Uranium

<sup>c</sup> 10 CFR 20 limits apply and are more restrictive:

<sup>d</sup> Assigned as 0.00 for analytes never detected in background.

Sources: AWQC - 10 CRS 20-7, Table A Class I, II, and V.

HISS - MDNR, NPDES permit number MO - 0111252.

SLAPS - MDNR, ARAR document letter from MDNR to USACE dated 10/2/98.

SLDS - MSD discharge authorization letter dated 10/30/98 from MSD to IT.

NA-NG = not applicable, no guidance is available.

NP = not required monitoring parameter.

### 2.2.3 Evaluation Guidelines for Coldwater Creek Sediment Data

Environmental monitoring data for Coldwater Creek sediments obtained under this EMIFY in 2001 will be evaluated with respect to preliminary North County background concentrations. The background concentrations considered for evaluation of sediment data were developed for the *Feasibility Study for the St. Louis North County Site* (USACE, 2000b). These criteria are equal to the 95% upper tolerance level (UTL) of background soils criteria for the North County Sites. In general, these criteria are the National Oceanic and Atmospheric Administration (NOAA) Sediment Quick Reference Table (SQRT) values and USEPA Sediment Quality Benchmarks (SQB). These various criteria are presented in Table 2-3.

Table 2-3. Evaluation Criteria for Sediment Data

Constituent	Background Criteria <sup>a</sup>	EPA			NOAA	
		SQC	SQB <sup>b</sup>	EQP SQB	TEL	PEL
Radiochemical Parameters						
Ra-226 (pCi/g)	4.7	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Ra-228 (pCi/g)	1.3	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Th-228 (pCi/g)	1.3	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Th-230 (pCi/g)	2.2	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Th-232 (pCi/g)	1.2	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
U-234 (pCi/g)	4.3	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
U-235 (pCi/g)	<sup>c</sup>	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
U-238 (pCi/g)	4.3	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Metals –TAL						
Aluminum (mg/kg)	51000	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Antimony (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Arsenic (mg/kg)	13	NA-NG	NA-NG	NA-NG	5.9	17
Barium (mg/kg)	890	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Beryllium (mg/kg)	2	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Boron (mg/kg)	75.9	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Cadmium (mg/kg)	4	NA-NG	NA-NG	NA-NG	0.596	3.53
Calcium (mg/kg)	116000	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Chromium (mg/kg)	140	NA-NG	NA-NG	NA-NG	37.3	90
Cobalt (mg/kg)	31	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Copper (mg/kg)	330	NA-NG	NA-NG	NA-NG	35.7	197
Iron (mg/kg)	42000	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Lead (mg/kg)	380	NA-NG	NA-NG	NA-NG	35	91.3
Magnesium (mg/kg)	2100	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Manganese (mg/kg)	3200	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Mercury (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	NA-NG	0.174	0.486
Molybdenum (mg/kg)	6.0	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Nickel (mg/kg)	72.0	NA-NG	NA-NG	NA-NG	18	35.9
Potassium (mg/kg)	15000	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Selenium (mg/kg)	54.4	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Silver (mg/kg)	4	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Sodium (mg/kg)	10000	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Thallium (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Uranium (mg/kg)	8.69	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Vanadium (mg/kg)	99	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Zinc (mg/kg)	1370	NA-NG	NA-NG	NA-NG	123	315
VOCs						
1,1,1-Trichloroethane (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.030 <sup>b</sup>	NA-NG	NA-NG
1,1,2,2-Tetrachloroethane (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	1.4 <sup>b</sup>	NA-NG	NA-NG
1,1,2-Trichloroethane (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	1.2 <sup>b</sup>	NA-NG	NA-NG
1,1-Dichloroethane (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.027 <sup>b</sup>	NA-NG	NA-NG
1,1-Dichloroethene (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.031 <sup>b</sup>	NA-NG	NA-NG
1,2-Dichloroethane (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.250 <sup>b</sup>	NA-NG	NA-NG
1,2-Dichloropropane (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
1,3-cis-Dichloropropene (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	5.10E-04	NA-NG	NA-NG
2-Butanone (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.27 <sup>b</sup>	NA-NG	NA-NG
2-Hexanone (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.022 <sup>b</sup>	NA-NG	NA-NG
Acetone (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.0087 <sup>b</sup>	NA-NG	NA-NG
Benzene (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.160 <sup>b</sup>	NA-NG	NA-NG
Carbon Disulfide (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.00085 <sup>b</sup>	NA-NG	NA-NG
Carbon Tetrachloride (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.047 <sup>b</sup>	NA-NG	NA-NG
Chlorobenzene (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.410 <sup>b</sup>	NA-NG	NA-NG
Chloroform (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.077 <sup>b</sup>	NA-NG	NA-NG
Ethylbenzene (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.089 <sup>b</sup>	NA-NG	NA-NG
Methylene Chloride (mg/kg)	0.03	NA-NG	NA-NG	0.37	NA-NG	NA-NG
Tetrachloroethene (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.410 <sup>b</sup>	NA-NG	NA-NG
Toluene (mg/kg)	0.002	NA-NG	NA-NG	0.050 <sup>b</sup>	NA-NG	NA-NG
Trichloroethene (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.220 <sup>b</sup>	NA-NG	NA-NG
Xylenes, Total (mg/kg)	<sup>c</sup>	NA-NG	NA-NG	0.16	NA-NG	NA-NG

**Table 2-3. Evaluation Criteria for Sediment Data (Cont'd)**

		EPA			NOAA	
Constituent	Background Criteria <sup>a</sup>	SQC	SQB <sup>b</sup>	EqP SQB	TEL	PEL
SVOCs						
1,2,4-Trichlorobenzene (mg/kg)	c	NA-NG	NA-NG	9.6 <sup>b</sup>	NA-NG	NA-NG
1,2-Dichlorobenzene (mg/kg)	c	NA-NG	NA-NG	0.33 <sup>b</sup>	NA-NG	NA-NG
1,3-Dichlorobenzene (mg/kg)	c	NA-NG	NA-NG	1.7 <sup>b</sup>	NA-NG	NA-NG
1,4-Dichlorobenzene (mg/kg)	c	NA-NG	NA-NG	0.340 <sup>b</sup>	NA-NG	NA-NG
2,4-Dimethylphenol (mg/kg)	c	NA-NG	NA-NG	0.029 <sup>c</sup>	NA-NG	NA-NG
2-Methylnaphthalene (mg/kg)	c	NA-NG	NA-NG	0.130 <sup>b</sup>	NA-NG	NA-NG
2-Methylphenol (mg/kg)	c	NA-NG	NA-NG	0.012 <sup>b</sup>	NA-NG	NA-NG
4-Methylphenol (mg/kg)	c	NA-NG	NA-NG	0.67 <sup>c</sup>	NA-NG	NA-NG
Acenaphthene (mg/kg)	0.25	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Anthracene (mg/kg)	0.20	NA-NG	NA-NG	0.220 <sup>b</sup>	NA-NG	NA-NG
Benzo(a)anthracene (mg/kg)	2.3	NA-NG	NA-NG	0.110 <sup>b</sup>	0.031	0.385
Benzo(a)pyrene (mg/kg)	1.7	NA-NG	NA-NG	0.140 <sup>b</sup>	0.031	0.782
Benzo(b)fluoranthene (mg/kg)	1.5	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Benzo(g,h,i)perylene (mg/kg)	1.8	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Benzo(k)fluoranthene (mg/kg)	1.4	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Bis(2-ethylhexyl)phthalate (mg/kg)	0.56	NA-NG	NA-NG	890.0 <sup>b</sup>	NA-NG	NA-NG
Butyl Benzyl Phthalate (mg/kg)	c	NA-NG	NA-NG	11.0 <sup>b</sup>	NA-NG	NA-NG
Chrysene (mg/kg)	2.4	NA-NG	NA-NG	NA-NG	0.057	0.862
Di-n-butyl Phthalate (mg/kg)	0.047	NA-NG	11	11.0 <sup>b</sup>	NA-NG	NA-NG
Di-n-octyl Phthalate (mg/kg)	c	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Dibenz(a,h)anthracene (mg/kg)	c	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Dibenzofuran (mg/kg)	0.086	NA-NG	2	0.420 <sup>b</sup>	NA-NG	NA-NG
Diethyl Phthalate (mg/kg)	c	NA-NG	NA-NG	0.60 <sup>b</sup>	NA-NG	NA-NG
Dimethyl Phthalate (mg/kg)	c	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Fluoranthene (mg/kg)	7.1	2.9	NA-NG	6.2 <sup>d</sup>	0.111	2.36
Fluorene (mg/kg)	0.2	NA-NG	0.54	0.540 <sup>b</sup>	NA-NG	NA-NG
Hexachloroethane (mg/kg)	c	NA-NG	NA-NG	1.0 <sup>b</sup>	NA-NG	NA-NG
Indeno(1,2,3-cd)pyrene (mg/kg)	1.5	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Naphthalene (mg/kg)	0.04	NA-NG	0.48	0.240 <sup>b</sup>	NA-NG	NA-NG
Phenanthrene (mg/kg)	5.7	0.85	NA-NG	1.8 <sup>d</sup>	0.41	0.515
Phenol (mg/kg)	0.97	NA-NG	NA-NG	0.42 <sup>c</sup>	NA-NG	NA-NG
Pyrene (mg/kg)	4	NA-NG	NA-NG	NA-NG	0.053	0.875
Pesticides/PCBs						
Endosulfan Sulfate (mg/kg)	c	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
Endrin ketone (mg/kg)	c	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG
PCB Total (mg/kg)	c	NA-NG	NA-NG	NA-NG	0.0341	0.277
Aroclor 1221 (mg/kg)	c	NA-NG	NA-NG	0.12	NA-NG	NA-NG
Aroclor 1232 (mg/kg)	c	NA-NG	NA-NG	0.2	NA-NG	NA-NG
Aroclor 1242 (mg/kg)	c	NA-NG	NA-NG	0.17	NA-NG	NA-NG
Aroclor 1248 (mg/kg)	c	NA-NG	NA-NG	1	NA-NG	NA-NG
Aroclor 1254 (mg/kg)	c	NA-NG	NA-NG	0.81	NA-NG	NA-NG
Aroclor 1220 (mg/kg)	c	NA-NG	NA-NG	NA-NG	NA-NG	NA-NG

<sup>a</sup> All units are mg/kg except for radiochemical criteria that are expressed in pCi/g.

<sup>b</sup> Secondary chronic derived SQB value

<sup>c</sup> Washington State sediment quality standards

<sup>d</sup> USEPA proposed sediment quality criteria

<sup>e</sup> Assigned as 0.00 for analytes never detected in background.

EqP = Equilibrium Partitioning SQB based on 1% toxic organic compound (TOC) in sediment

TEL = Threshold Effects Levels

PEL = Probable Effects Levels

NA-NG = not applicable, no guidance is available.

## 2.2.4 Evaluation Criteria and Guidelines for Air Monitoring Data

Outdoor air monitoring will be conducted as BMP activities under this EMIFY during 2001. Air monitoring is appropriate at the site boundaries. Other locations for airborne particulates will be evaluated with respect to regulatory guidelines from 40 CFR 61 and 10 CFR 20. Regulation 40 CFR 61 limits dose to the maximum exposed member of the public to less

than 10 mrem/yr from radioactive airborne particulates (excluding radon). This value applies to the critical receptor receiving the highest dose as determined by modeling and/or monitoring which considers inputs such as wind direction and duration of human occupancy. Title 10 Code of Federal Regulation Part 20 (10 CFR 20) limits exposure to the public from operating activities to 100 mrem/yr from all pathways. In Appendix B of 10 CFR 20, the Nuclear Regulatory Commission (NRC) provides values that apply at the facility fenceline for air effluent discharges which equate to 50 mrem/yr if continuously exposed. Guidance is given in 10 CFR 20 on how to use these values to prove compliance with the 100 mrem/yr standard when considering all pathways.

Annual radon monitoring results will be evaluated with respect to regulatory guidelines from 40 CFR 192 that limit radon flux to 20 pCi/m<sup>2</sup>/s or less and radon concentrations to 2.0 pCi/L above background (assuming 5% equilibrium between Rn-222 and progeny) at the site perimeter.

All evaluation criteria for air monitoring data are provided in Table 2-4. Tables 2-5 through 2-7 list regulatory commitments and a general description of how the commitments will be implemented.

**Table 2-4. Evaluation Criteria for the Air Monitoring Data**

Media	Parameter	Regulatory Based Guideline	Type of Monitoring
Outdoor Air	Radon Flux	Radon flux ≤ 20 pCi/m <sup>2</sup> /s	Carbon canisters (specific to HISS)
	Radon	Radon concentration 2.0 pCi/L above background	Fenceline and other Radon detectors and E-Perm
	Radiation Dose to Public	Total dose to member of public from all pathways <100 mrem/yr.  Airborne particulate dose to member of public <10mrem/yr (exclusive of Rn).	Air Particulates and TLDs at fenceline and other locations

**Table 2-5. Summary of NESHAP Air Emissions Regulation**

Regulation: NESHAP* Air Emissions		
Regulation	Description/Standard	Implementation
40 CFR 61 Subpart I  { ARAR in SLDS ROD (USACE, 1998b) and EE/CAs for SLAPS and HISS (USACE, 1998c; 1998e)	Radionuclide emissions to ambient air particulates from federal facilities other than NRC licensees shall not exceed those amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem/yr	Compliance with this standard will be demonstrated through the use of the EPA computer code. CAP88PC and/or measurement of radionuclide air concentrations at critical receptor locations in accordance with 40 CFR 61, 107(b)(5). EPA approval is required to use environmental measurements to show compliance.  <u>Reporting</u> Data will documented in annual environmental monitoring data and analyses report for each calendar year.

\*NESHAP, National Emission Standards for Hazardous Air Pollutants

**Table 2-6. Summary of UMTRCA Radon Emissions Regulation**

Regulation: UMTRCA Radon Emissions		
Regulation	Description/Standard	Implementation
<p>40 CFR 192, Subpart A § 192.02</p> <p>and</p> <p>40 CFR 192, Subpart D</p> <p>{ ARAR in SLDS ROD. The equivalent of this standard, 40 CFR 61 Subpart Q, was listed in the EE/CAs for SLAPS and HISS (USACE, 1998c; 1998e)</p>	<p>Standards for Control of Residual Radioactive Materials from Inactive Uranium Processing Sites</p> <ol style="list-style-type: none"> <li>1. Radon Flux Monitoring at source to ensure releases of Rn-222 &lt;20 pCi/m<sup>2</sup>/s</li> <li>2. Radon measurements to ensure the average annual concentration is &lt;0.5 pCi/L at or above the site</li> </ol>	<ol style="list-style-type: none"> <li>1. Radon Flux measurements will be made using charcoal canisters with the EPA method contained in 40 CFR 61 Appendix B, Method 115, 2.0, <i>Emissions from Uranium Mill Tailings Piles</i>. Guidance for the measurement procedure and the required data evaluation are contained in EPA 520/5-85-029, <i>Radon Flux Measurements on ....phosphogypsum Piles...</i>(USEPA, 1986).</li> <li>2. Radon measurements will be performed at the site perimeter (the fence line) using radon alpha track detectors as described in 40 CFR 61 Appendix B, Method 114, Method A-7.</li> </ol> <p><u>Reporting</u></p> <p>The results of each flux measurement and the mean radon flux are reported in the emission test report in accordance with 40 CFR 61 Appendix B Method 115.</p> <p>Note: 10 CFR 20 air effluent is 0.1 pCi/L when Rn-222 is in 100% equilibrium with progeny, 2.0 pCi/L at St. Louis FUSRAP assumes 5% equilibrium.</p>

**Table 2-7. Summary of Dose Limits to Individual Members of the Public Regulation**

Regulation: 10 CFR 20.1301 Dose Limits to Individual Members of the Public		
Regulation	Description/Standard	Implementation
10 CFR 20 § 20.1301	Dose limits for individual members of the public shall not exceed 100 mrem/yr, exclusive from dose from background	Compliance with this standard will be demonstrated using a combination of TLDs, passive radon detectors, and air samples for particulate radionuclides. Monitoring locations will be at the fence line and/or in areas occupied by members of the public. The summation of the dose measured with the TLD, and the calculated dose from radon detectors and particulate air sample results will be used to demonstrate compliance with the 100 mrem/yr criterion. These calculations assume that the dose contribution from water pathways is negligible. Dose from fence line to critical receptor's will be modeled to maximally exposed receptor location.
10 CFR 20, Appendix B Air Effluent Limit		<p><u>Reporting</u></p> <p>10 CFR 20 is specific to NRC licensees. The St. Louis Sites are not licensed by the NRC. The USACE has chosen to comply with 10 CFR 20 as a best engineering practice. Therefore, annual reports will be submitted to the USACE.</p>

### **3.0 ENVIRONMENTAL MONITORING ACTIVITIES FOR FY01**

This section describes the periodic sampling and analysis selected for FY 2001 to achieve the objectives of the EMP. These EMIFY01 activities will be implemented in conjunction with the program objectives defined as the EMG and program protocols described in the SAG. This section of the EMIFY summarizes the sampling locations, frequencies, and analytes of concern. The SAG details the specific sampling and analytical protocols necessary for field implementation. Characterization efforts, monitoring to support treatability studies, and remedial action confirmation sampling are considered non-periodic monitoring activities outside of the scope of the EMIFY, and are implemented through issuance of WD.

#### **3.1 AIR MONITORING AND DIRECT RADIATION MONITORING**

##### **3.1.1 Rationales and Objectives for Air and Direct Gamma Radiation Monitoring**

Objectives for air and direct gamma radiation monitoring follow:

- Provide surveillance of public exposure routes through sampling and analysis;
- Verify compliance with regulations;
- Provide indication and methods to quantify release of materials from the site; and
- Characterize trends in environmental measurements, especially as they are impacted by site remedial actions.

Measurement objectives to meet regulatory requirements follow:

- Determine the total effective dose equivalent to the maximally exposed members of the public from all pathways.
- Determine the effective dose equivalent from airborne emissions to the maximally exposed members of the public.
- Calculate radon concentrations at the fence line.
- Determine the radon flux off the engineered piles at the HISS.
- Determine the direct external gamma exposure in areas accessible to members of the public at the site fenceline.
- Determine background values for the parameters of concern from off-site locations.

Thermoluminescent dosimeters (TLDs), radon alpha track detectors, charcoal canisters, and particulate air filters will be used in various combinations at the SLS to monitor gamma exposure levels and airborne radionuclide emissions. Data from these measurements will be reduced, evaluated, and in some cases converted into effective dose equivalent. Reports to the USACE and the U.S. Environmental Protection Agency (EPA) will be made to meet regulatory and contract requirements.

### 3.1.2 Sample Locations

Locations for TLD, radon alpha track detectors, and particulate air samples are shown for the three SLS in Figures 3-1, 3-2 and 3-3. Figure 3-2 also provides the location of the North County background gamma radiation, radon alpha track and particulate air sampling station. Figure 3-4 shows the approximate radon flux charcoal canister locations on the HISS piles. See Table 3-1 for type, frequency, and location of air particulate, radon, and gamma radiation monitoring.

#### *External Gamma Monitoring (TLD)*

TLDs will measure direct gamma exposure from residual radioactivity at the SLS. The TLDs will be located at site perimeters (property fence lines) and at an off-site location assumed to be representative of background exposure levels. QC TLDs will include shipment blanks (to evaluate the exposure received in transit) and duplicate TLDs to evaluate measurement precision.

TLD locations at SLAPS and HISS will be relatively evenly spaced around the perimeter. There are no industries or residences near the SLAPS and, therefore, the fence line monitoring locations are assumed to be very conservative for estimating exposure to members of the public. At HISS, there are two industries on the contiguous properties, Futura Coatings and Stone Container Corporation. TLDs will be located at fence locations that are assumed to be closest to each of the private industries.

TLD locations at the SLDS will be outside locations assumed to be representative of areas accessible to the public (or Mallinckrodt's employees, who are not occupationally monitored for radiation exposure). Areas immediately surrounding Plant No. 5 controlled by Mallinckrodt's radioactive materials license will be avoided.

A background monitoring location is selected for measuring of background exposure rate. This location will be located south of SLAPS, along the fence of the Boeing Wastewater Treatment Facility (see Figure 3-2).

#### *Radon Monitoring (Radon Alpha Track Detectors)*

Radon alpha track detectors will be used to measure alpha particles emitted from Radon (primarily Rn-222) and its associated decay products. The radon emissions will increase during remedial actions such as excavation of soils. Measurements of the alpha tracks are correlated to radon concentration in air by the processors calibration. The processors reported air concentrations will then be converted to dose equivalent. Radon alpha track detectors will generally be located with the TLDs at site perimeters. Additional QC duplicates will be used to evaluate measurement precision.

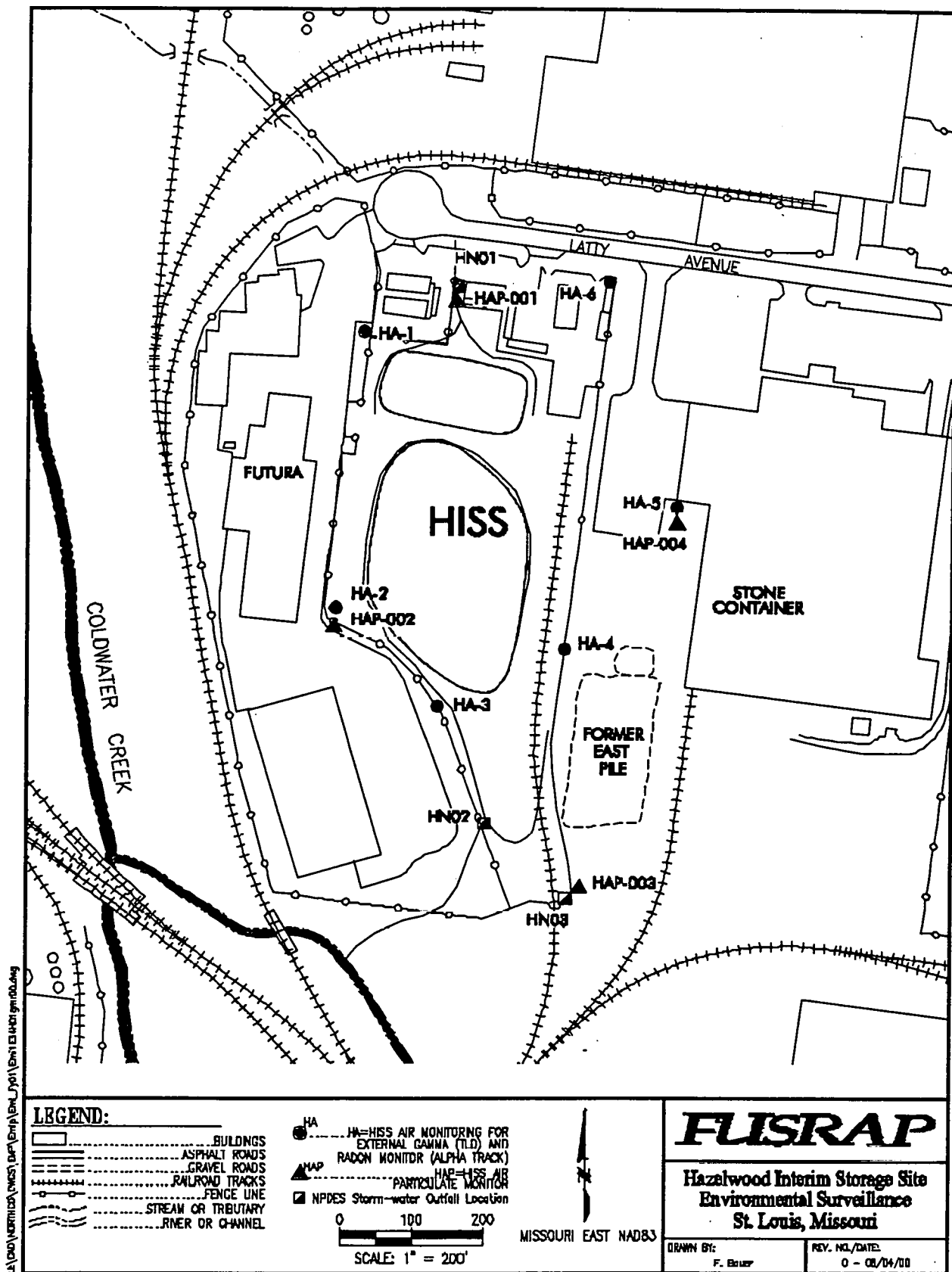


Figure 3-1. External Gamma, Radon-222, Particulate Air Monitoring and NPDES Outfall Stations at the HISS for FY 2001

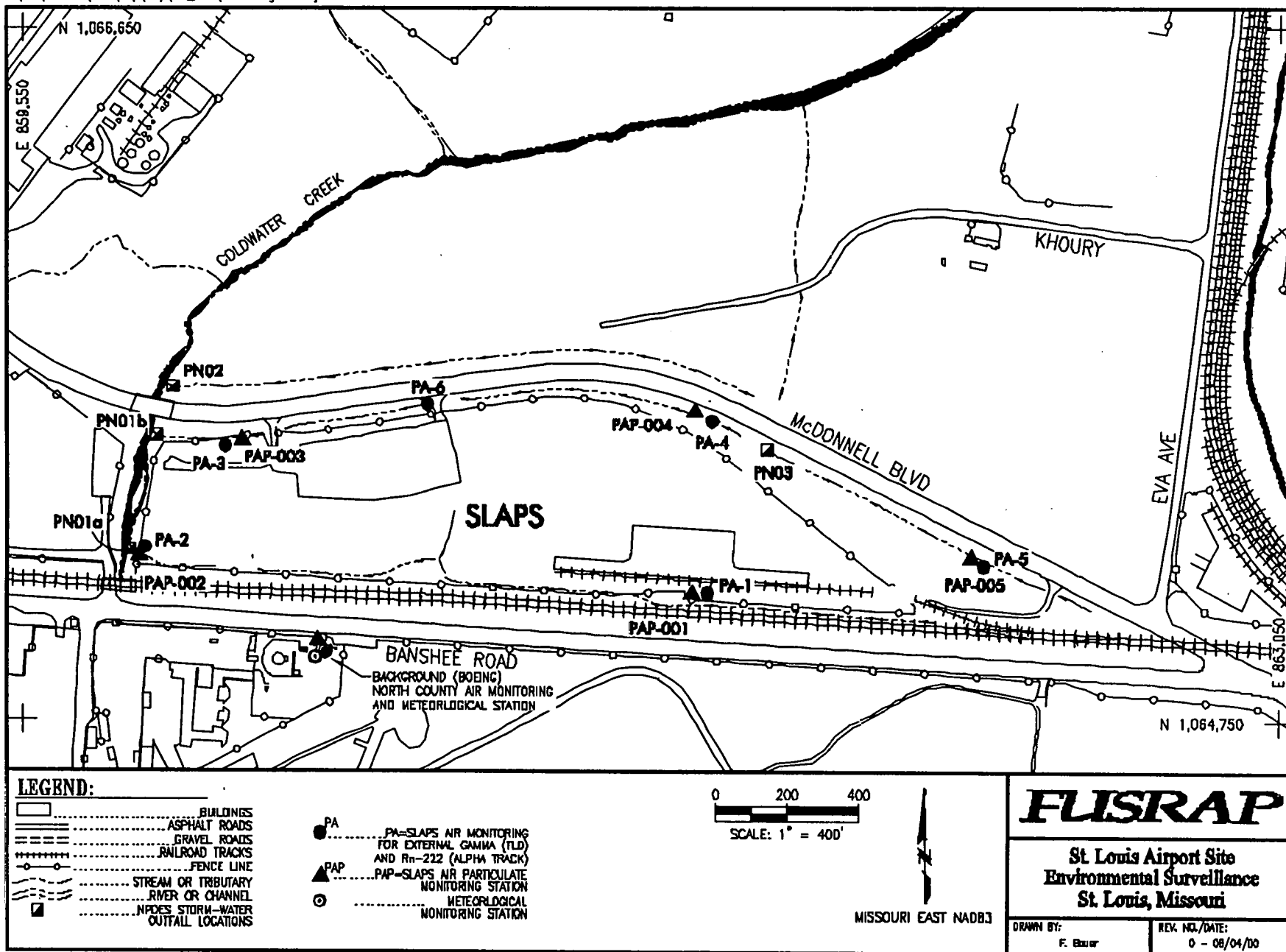


Figure 3-2. External Gamma, Radon-222, Particulate Air Monitoring and NPDES Outfall Stations at the SLAPS for FY 2001

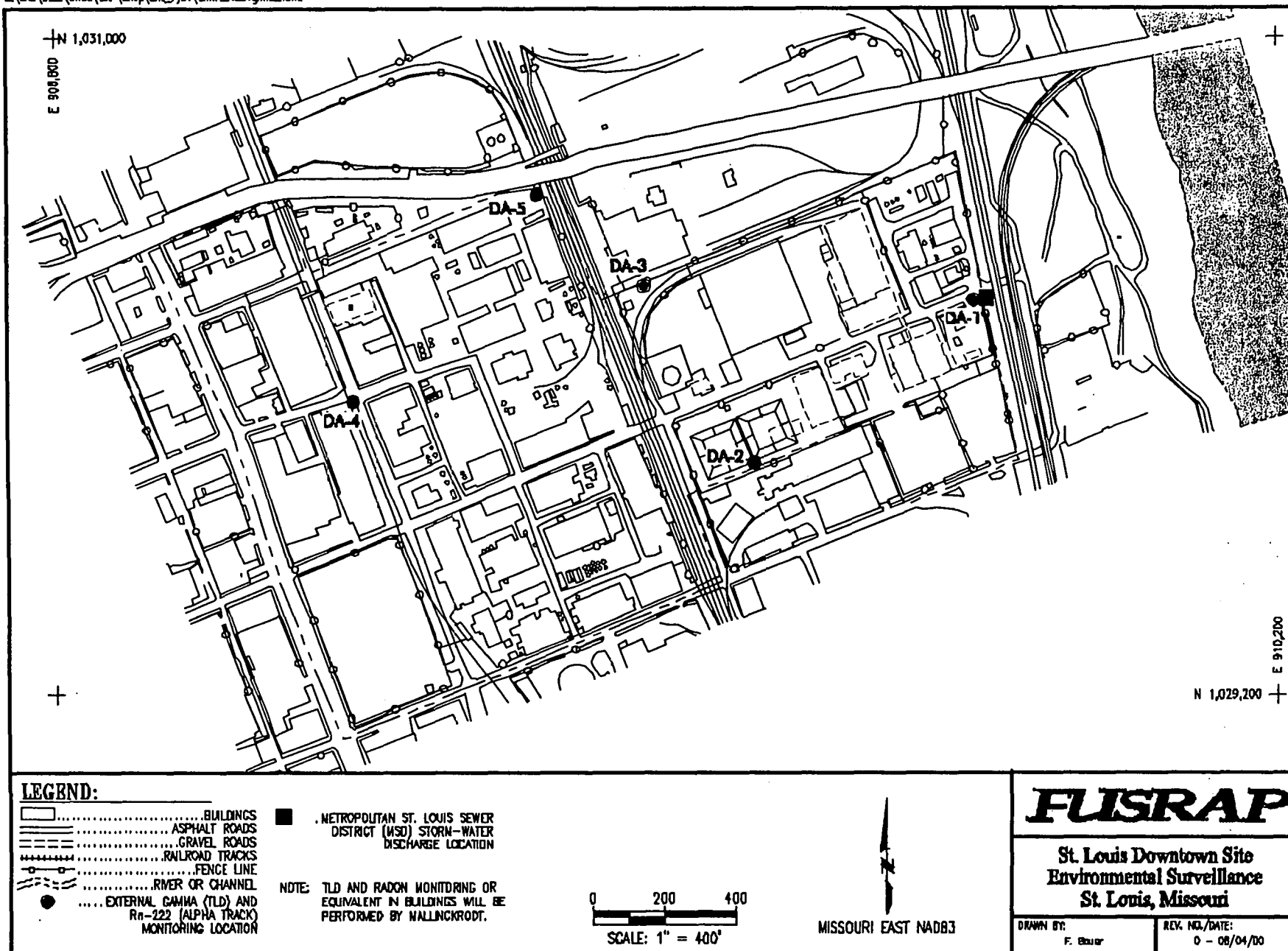


Figure 3-3. External Gamma, Radon-222 and Storm-water Discharge Station at the SLDS for FY 2001

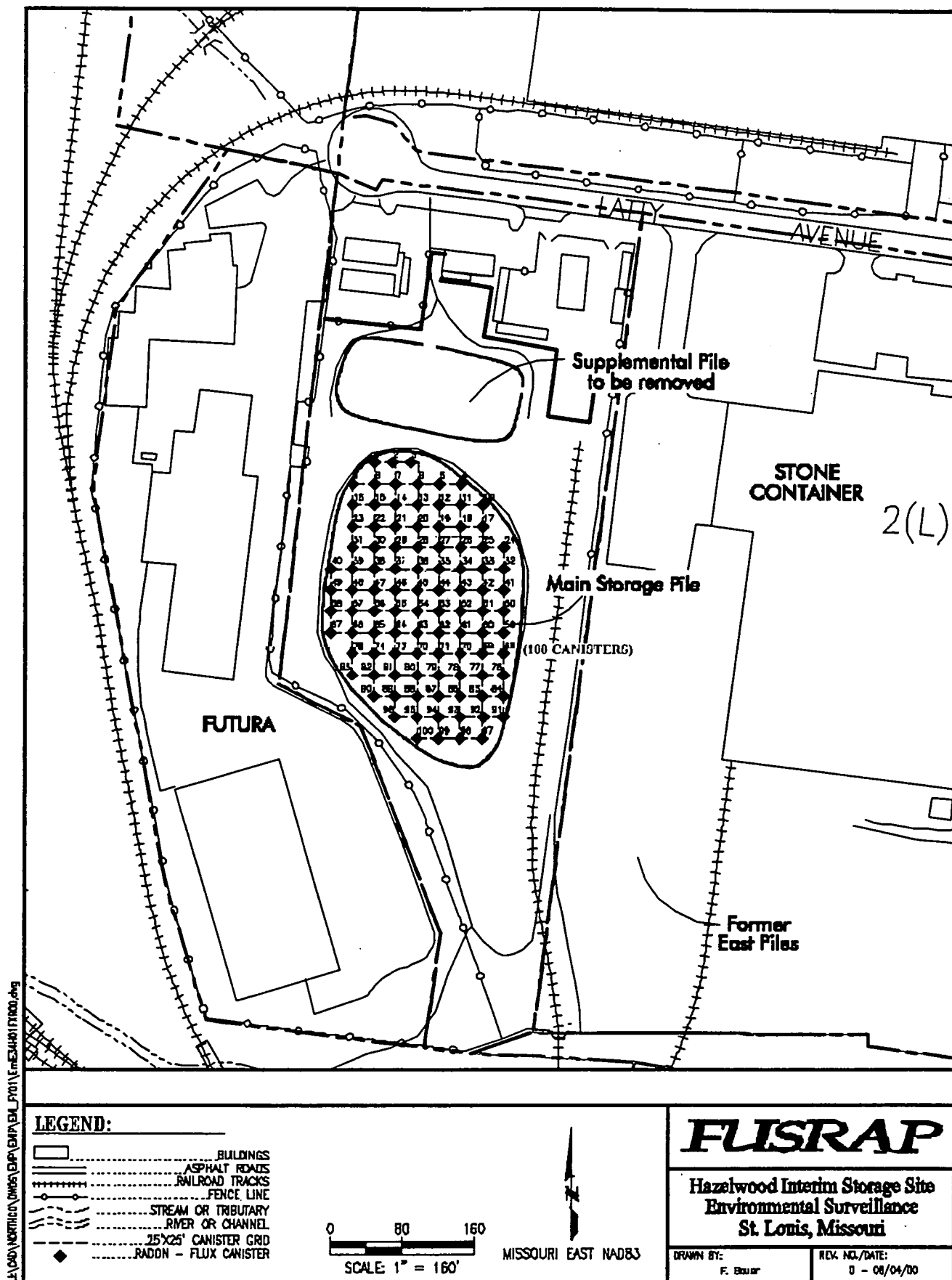


Figure 3-4. Proposed Radon Flux Monitoring Stations at the HISS for FY 2001

**Table 3-1. Air Particulate, Radon, and Gamma Radiation Monitoring**

Site	Number of Monitoring Locations	Media/Sample Type	Frequency	Parameters	Driver/Purpose
HISS	6	TLD	Quarterly	External gamma radiation	EMP - public exposure
	6	Alpha track	Semi-annual	Rn-222 and progeny	EMP - public exposure
	4	Filter	Weekly + operation specific	Particulate radionuclides	EMP - NESHAP
	100 cans (min)	Charcoal canisters	1/yr (24 hour exposure)	Radon Flux	40 CFR 192
SLAPS	6	TLD	Quarterly	External gamma radiation	EMP - public exposure
	6	Alpha track	Semi-annual	Ra-222 and progeny	EMP - public exposure
	5	Filter	Weekly + operation specific	Particulate radionuclides	EMP - NESHAP
SLDS	5	TLD	Quarterly	External gamma	EMP - public exposure
	5	Alpha track	Semi-annual	Rn-222 and progeny	EMP - public exposure
Background	1	TLD	Quarterly	External gamma radiation	EMP - public exposure
	1	Alpha Track	Semi-annual	Rn-222 and progeny	EMP - public exposure
	1	Filter	Weekly + operation specific	Particulate radionuclides	EMP - NESHAP

\* Sample identifications to be determined

Public exposure to air - monitoring requirements: 40 CFR 61 Subpart I; 10 CFR 20.1301; 40 CFR 192.32

The proposed radon monitoring locations are identical to those described for the TLDs. Locations were chosen with consideration given to predominant wind direction and areas of contamination. Southerly winds predominate from May through November, and northwesterly winds predominate from December through April. The outside locations were selected on north and southeast points of the property fence line to monitor airborne emissions at points that are likely to be highest at the fence line. Additional monitoring locations were relatively evenly spaced around the perimeter. The background location will be co-located with the background TLD station, south of SLAPS (see Figure 3-2).

#### *Radon Flux Monitors (Charcoal Canisters)*

Charcoal canisters will be used at HISS to evaluate the radon flux off the remaining piles of uranium byproduct. The former East Piles, previously located on the Stone Container property, were removed during FY 2000, and the Supplemental Pile is actively being removed. One hundred canisters will be placed in a grid pattern on the remaining Main Storage Pile at HISS (see Figure 3-4), and the results evaluated to ensure the radon emissions from this pile are within the required limits. Measurements less than the EPA criterion of 20 pCi/m<sup>2</sup>/s verify the liner and/or soil barrier over the pile or surface is effectively intact. The monitoring will be conducted once a year over a 24 hour period when the conditions are optimal for measurement (unaffected by rain or standing water, excessive humidity or wind, etc.). It is recognized that during remediation the radon flux standard may be exceeded as the pile is uncovered and the material is packaged for transport and disposal.

#### *Particulate Air Monitors*

Particulate air samplers will be located at site perimeter locations in predominant wind directions and in areas accessible to members of the public. Additional air samplers may be placed during work activities that are disturbing the soils and have a potential to generate airborne particulates. The locations of these air samples will be downwind of the work activities. Airborne particulate radionuclides will be collected and subsequently analyzed for relevant radionuclides.

As stated in the previous section, southerly winds predominate from May through November, and northwesterly winds predominate from December through April. Particulate air monitoring locations were, therefore, selected on north and southeast points of the property line to monitor airborne emissions at points that are likely to be highest at the fence line. The particulate air monitoring stations are expected to be affected mainly during periods of remediation when there is the greatest potential for generation of airborne particulate radionuclides. Additional particulate air samplers may be placed around the parameters of the work zone during remedial activities. The background air particulate station will be co-located with the background TLD station, south of SLAPS (see Figure 3-2).

### **3.1.3 Sample Frequency**

Perimeter monitoring shall be conducted until all remedial activities are complete. With the exception of radon flux monitors, monitors will be left in place to continuously monitor the survey locations. TLDs will be replaced and analyzed every quarter. Radon alpha track detectors will be replaced and analyzed every six months. Particulate air samplers will operate

continuously with samples being collected at least weekly, but possibly more frequently due to operational considerations such as dust loading on the filters, which can reduce the sample flow. The number of samples/measurements and the frequency is tabulated in Table 3-1.

### 3.1.4 Field and Laboratory Analysis

The selection of parameters to monitor, and samples to collect was based on the regulatory requirements with consideration for the radionuclides and their concentrations at each of the SLS.

#### *Rationale for Analytes*

The radionuclides found at the SLS are mainly uranium series nuclides. Each site has radionuclides in the uranium series that may be predominant (such as Ra-226 or U-238 or Th-230), thus each radionuclide must be assessed separately. The analytes selected for the air sampling and analysis program are radionuclides and/or the decay products known to be present in the soil or waste material.

HISS: HISS contains the most homogenous radionuclide distribution of the three sites. Th-230 is significantly enhanced in the HISS piles. Other uranium series radionuclides (U-238, U-234, and Ra-226) are also elevated although not as significantly as Th-230. The actinium series long-lived nuclides (U-235, Pa-231, and Ac-227) are also elevated in the HISS piles with the U-235 daughters showing higher concentrations than the U-235. Thorium series nuclides (Th-232 and Ra-228) in the piles are, however, observed to be at the U.S. average background levels for soil. The relative concentrations of the various radionuclides can be found in Table 2-1 of the *Engineering Evaluation/Cost Analysis for the Hazelwood Interim Storage Site (HISS EE/CA)* (USACE, 1998e).

SLAPS: SLAPS is known to contain elevated areas of contamination due to the burial of various uranium by-products over the history of the site. Radionuclides from all three natural decay series may be present in elevated concentrations. The relative concentrations of individual radionuclides can be found in Table C-2 of the *St. Louis Airport Site (SLAPS) Interim Action Engineering Evaluation/Cost Analysis (SLAPS EE/CA)* (DOE, 1997).

SLDS: SLDS areas are also variable with regard to the predominant radionuclide with some areas showing higher concentrations of U-238, Th-230, and Ra-226. The relative concentration levels for individual radionuclides can be found in the *Feasibility Study for the St. Louis Downtown Site (SLDS FS)* (USACE, 1998a).

#### *Analysis Methods*

Details regarding the analytical testing methods to be used for analysis of TLDs, radon detectors, and air samples are presented in the SAG for the SLS. Analysis of the various media will be accomplished through purchase orders with qualified laboratories or through analysis at the HISS laboratory using their approved Laboratory Quality Assurance Plan and standard operating and analysis procedures.

A summary of the type of radiological samples, analysis methods, and the target detection levels for the proposed radiological sampling in FY 2001 are provided in Table 3-2. Justification for the detection levels is based in part on the capabilities of the instrumentation and in part to meet a fraction of the desired regulatory standard. All detection levels are assumed to meet the definition for minimum detectable activity (MDA) at the 95% confidence level, with appropriate conversion factors, factors for efficiency, chemical yield, and volumes to convert the measurement to the desired units.

**Table 3-2. Summary of Laboratory Analysis Methods and Target Detection Levels**

Detector/Sample Media	Analytes Measured	Analysis Method	Target Detection Levels
TLD	Direct external gamma exposure from residual contamination	Processed by a qualified vendor.	1 mrem/3 months
Alpha Track	Airborne Rn-222 and alpha emitting progeny which originates from Ra-226	40 CFR 61, Appendix B, Method 114, Method A-7, Radon-222 Alpha Track Detectors.	0.3 pCi/L
Particulate Air Filter	Airborne particulate radionuclides: U-234, U-235, U-238 Th-228, Th-230, Th-232, Ra-226, Ra-228	40 CFR 61, Appendix B Method 114, Method A-2, Radiochemistry Alpha counting to establish isotopic ratios of alpha emitting isotopes only.  Gamma Spectroscopy - TBD  40 CFR 61 Appendix B, Method 114, Method A-4, Direct Alpha Counting.	0.006 pCi/ m <sup>3</sup> (6E-15 $\mu$ Ci/ml)
Radon Canister	Rn-222	40 CFR 61, Appendix B Method 115, Monitoring for Radon Emissions.	0.1 pCi/m <sup>3</sup> /s

The TLD detection level of 1.0 mrem/3 months is approximately 3% of the annual background dose equivalent rate from external exposure and well below the regulatory limit for members of the public of 100 mrem/yr. Even when the 100 mrem/yr limit is reduced by a factor of 2 to account for exposure from pathways other than direct exposure, the detection level is still a factor of 50 lower than the limit.

The alpha track detection level of 0.3 pCi/L is the level achievable at the lab. This level is below the 0.5 pCi/L standard contained in 40 CFR 192 Subpart A for locations outside a disposal site. However, the St. Louis Sites are not disposal sites. The 10 CFR 20 approximate limit is 2.0 pCi/L assuming a 5% equilibrium between radon and its progeny.

The detection level concentrations for uranium and thorium isotopes in particulate air sampling is based on two analytical methods found in 40 CFR 61, Appendix B, Method 114. Method A-2, radiochemistry alpha counting, chemically extracts and separates isotopes which are then evaluated using an alpha counter to determine activity. Method A-2 will only be used to establish isotopic ratios at a given sampling location. Once isotopic ratios have been identified and established, method A-4, Direct Alpha Counting (gross alpha determination) will be used to

routinely evaluate activity levels of samples. This method will determine alpha activity of the sample without extraction and separation of isotopes. Both methods have a detection level of  $0.006 \text{ pCi/m}^3$  ( $6\text{E-}15 \text{ } \mu\text{Ci/ml}$ ) which will provide adequate minimum detection levels for dose assessment estimates.

The radon canister detection level of  $0.1 \text{ pCi/m}^2/\text{s}$  is based on the lab analysis capabilities, and is significantly below the  $20 \text{ pCi/m}^2/\text{s}$  limit.

### **3.1.5 Field Quality Control Samples**

Three types of QC samples will be collected or used during environmental air monitoring and radiation exposure monitoring. The QC samples include duplicates, trip blanks, and blanks.

#### *QC Duplicates*

Duplicate samples will be collected using the same protocol and procedures that are used for obtaining the initial samples and measurements. Duplicate sample/measurements are used to evaluate the precision of the sampling and measurement process. Duplicate analysis may be performed at the laboratory to evaluate the reproducibility of the counting technique.

At least one duplicate TLD station shall be designated at each site for quality control purposes. Two duplicate TLDs (to be removed every 3 months after placement) shall be installed, collected, and analyzed at the same time as the sample TLDs.

At least one duplicate radon monitoring station shall be designated at each site for quality control purposes. A duplicate detector shall be placed, collected, and analyzed at the same time as the sample at the location.

#### *Trip Blanks*

TLD trip blanks will be used to evaluate the integrated dose to the dosimeter when the dosimeters are not in the monitoring locations. These trip blanks will measure the dose while the dosimeters are in storage and in transit to the processing laboratory.

#### *Blanks*

The procedure for sampling and analysis of radon flux charcoal canisters requires that five percent of the samples analyzed be blanks, i.e., undeployed carbon canisters. These blanks establish a background for the batch of charcoal canisters used. If time is available, the blanks should be counted over a longer time period than the normal radon flux samples. This will improve the counting statistics for this low-level sample.

Additional information regarding field QA/QC sampling requirements, and the analytical testing methods to be used for analysis and processing of QA/QC samples, is presented in the SAG for the SLS.

### 3.1.6 Equipment and Sampling Methods

#### 3.1.6.1 Equipment

The following sections describe the types of detectors that will be used to quantify radioactive emissions from the SLS.

##### *External Gamma Radiation*

External gamma exposure rates are measured using environmental TLDs housed in the PVC holders/shelters positioned at the perimeter boundaries. Each TLD measures a cumulative dose over the period of exposure and is expressed in mrem/yr. The measurements must be corrected for shelter absorption and background.

When exposed to gamma radiation, the TLD stores a portion of the energy. When the TLD is heated, the stored energy is emitted as light that can be amplified, measured, and used to calculate dose equivalent. The TLD shelters are located approximately 6 ft above the ground surface at both fence line and off-site locations.

##### *Radon Alpha Track Detectors*

Radon (Rn) gas concentrations are measured using alpha track detectors that are designed to record alpha emissions within the sensitive element of the detector. These detectors contain film that, when exposed to alpha particles from the radioactive decay of radon, create submicron damage tracks on the film. After exposure, the detectors are returned to the manufacturer for processing. The film is placed in a caustic etching solution that amplifies the damage tracks, which are counted using a microscope or automated counting system. The number of tracks per unit area is correlated to the radon concentration in air. The alpha track detectors can be purchased from various EPA-approved manufacturers. The alpha track detectors will be placed in the perimeter stations at each site along with the external gamma detectors (TLDs) described in the previous section.

##### *Radon Flux Carbon Canisters*

Radon (Rn) flux measurements involve the absorption of Rn-222 on activated charcoal. Activated carbon canisters are placed at specified grid locations over the surface to be monitored and are allowed to collect radon for a period of 24 hours. The collectors should be carefully positioned on the surface of the pile and sealed around the rim of the canister. The radon collected on the charcoal is then measured by gamma spectroscopy. Radon flux measurements are not taken if severe storms or high winds are predicted. Additionally, moisture has a tendency to reduce radon flux; therefore, the following restrictions are placed on conducting radon flux measurements:

- Measurements shall not be initiated within 24 hours of a rainfall.
- If a rainfall occurs during the 24-hour measurement period, the measurement is invalid if the seal around the lip of the collector has washed away or if the collector is surrounded by water.

- Measurements shall not be performed if the ambient temperature is below 35° F or if the ground is frozen.

### *Airborne Particulate Monitors*

Airborne particulate monitors provide a means to collect particulate radionuclides from the ambient air. Low volume air pumps, with typical flow rates of 30-50 L/min (8-13 gpm), draw ambient air through a 47  $\mu$ m particulate filter. The filter must have a high efficiency for removal of sub-micron particles. The air pumps are equipped with calibrated measurement devices (i.e., rotameters) to monitor air flow rates. Air flow rates may also be measured externally with portable rotameters. Average flow rates are calculated using before/after sample loading data. At the end of the sample period, the filters are removed from the housing and sent to a lab for analyses.

Siting of the particulate monitoring stations must be done carefully so that appropriate measurement of particulate concentrations in an area are collected. As discussed in Section 3.1, the stationary air monitoring locations were selected based on the predominant wind directions during the summer and winter months.

During remedial activities additional particulate monitoring may be required and must be evaluated on a task by task basis.

### **3.1.6.2 Sampling Methods**

The following section describes the field sampling for direct radiation and air monitoring at the three SLS. It is not intended to replace the detailed guidance contained in project instruction guides. The chain-of-custody protocols, sample labeling, identification and shipment procedures, and field logbooks/documentation described in the SAG for the SLS are applicable to each of the following procedures.

#### *External Gamma Monitoring*

TLDs shall be placed in each ambient air monitoring station at the beginning of each monitoring period. These TLDs will be replaced and analyzed after three months. The location, date of installation, date of removal for each detector shall be logged. An unexposed TLD shall accompany the exposed dosimeter during shipment to detect any exposure incurred by the dosimeter during shipment.

#### *Radon Alpha Track Detection*

Unexposed, preassembled detectors, packaged in sealed foil are available from various manufactures and should remain sealed until they are placed in the detector housings. At the time of deployment, the location, date and type of detector shall be recorded. The new unexposed detector shall be placed in the detector housing with the air inlet holes unobstructed. At the end of the six-month exposure period, a self-adhering circular seal (available from the manufacturer) is placed on the exposed detector, covering the air inlet holes. The seals are used to prevent further exposure of the detector to radon or thoron during transport to the lab. The date of removal shall be logged. The exposed detectors shall then be packaged in zip-lock type bags and sent to the lab.

### *Radon Flux Monitoring*

Radon flux is calculated from the net counts, collector area, exposure time, counting system efficiency, and radon decay corrections. Therefore, the site, pile identification (large pile vs. small pile), canister location, number, date and time of deployment will be recorded. Observation of meteorological conditions will also be noted. The canisters should be allowed to collect radon for approximately 24 hours. As each canister is collected, it will be placed in a plastic bag and the date and time of removal shall be recorded. The radon collected on the carbon should be allowed to equilibrate for four hours before counting to allow the ingrowth of radon progeny.

To ensure high-quality radon flux data, the following QA procedures, as stated in 40 *CFR* 61, Appendix B, Method 115, Section 4.0, will be used.

A lab standard in the same geometry as the carbon canister samples will be counted on a daily basis (during the radon flux sampling period) to detect changes in counting system performance.

Five percent of the samples analyzed will be blanks, i.e., undeployed carbon canisters. If time is available, the blanks should be counted over a longer time period than the normal radon flux samples. This will improve the counting statistics for this low-level sample.

Data reproducibility will be met by selecting a random group of samples of 10% of the total shall be recounted to check the reproducibility of the counting technique. This will also verify that the radon is sealed within and not leaking from the canister.

### *Air Particulate Monitoring*

Data collection will consist of logging the sample location, date, and time that the sample collection is started, and the initial flow rate of the air pump. At the end of the sampling period, the date and time the filter is removed from the filter housing and final flow rate of the air pump will again be logged. If the initial air flow rate is different than the final flow rate, the average of the two values will be used to determine total flow volume over the sampling period. Calibrated rotameters will be used to establish initial and final flow rates. Rotameters should be calibrated semi-annually.

As the filter is removed from the filter housing, care should be taken not to disturb the collected particulate. The filter should be placed in a suitable container such that sample integrity is not lost during transport to the lab.

The length of time between filter change out may vary depending on the activities at the site. For example, if no remedial activities are being conducted, it is recommended that filter change out occur after a two-week sampling period. However, during remedial activities, more dust may be generated requiring more frequent filter change out.

### 3.1.6.3 Field Quality Control Sampling Procedures

Duplicate samples will be collected in association with the TLD measurements and alpha track detector measurements. Duplicates will be collected using the same procedures defined in Section 3.1.2.2.

### 3.1.6.4 Field Decontamination

Field decontamination is not required for the measurement and samples obtained for direct radiation exposure and air monitoring.

## 3.2 GROUND WATER

### 3.2.1 Objectives for Ground-water Sampling

Long-term ground-water monitoring at the three subject SLS will be completed to meet various federal and state requirements.

*Purpose of the ground-water monitoring effort at the SLS is to:*

- Identify potential impacts to ground-water quality resulting from remedial action activities.
- Ensure compliance with ARARs.
- Obtain requisite data for CERCLA remedial performance evaluations.
- Determine background water quality at each of the sites.

The primary objectives and a summary of the hydrogeology of each site are briefly discussed below. A detailed site description of the geology and the hydrogeology of each site can be found in prior decision documents, and the EMG (USACE, 1999).

*Objectives for SLDS:*

- Evaluate ground-water contaminant occurrence and migration within the lower hydrostratigraphic unit (HU-B) with emphasis on the uppermost HU-B surface beneath SLDS and its downgradient perimeter.
- Assess background conditions and ground-water quality in several known contamination source areas that will undergo remediation.
- Evaluate potential impacts to ground-water quality resulting from remedial actions.
- Provide data necessary for the CERCLA evaluation process.
- Resolve the ground-water head relative to that of the Mississippi River.

Ground water at SLDS is found within three hydrostratigraphic units (HUs): the upper soil unit, referred to as the HU-A; the lower soil unit, referred to as either the Mississippi River Alluvial Aquifer or the HU-B and the limestone bedrock, referred to as the HU-C (Figure 3-5) (USACE, 1998b). The HU-A is not an aquifer and is not considered a potential source of drinking water because it has insufficient yield, poor natural water quality, and susceptibility to surface water contaminants of the industrial setting (USACE, 1998b). The use of the HU-B for a drinking water resource is highly unlikely for several reasons: the industrial setting of the SLDS,

the site's proximity to both the Mississippi and the city's drinking water supply, and the poor natural water quality of the HU-B (USACE, 1998b). However, the HU-B does qualify as a potential source of drinking water under the *Guidelines for Ground-water Classification under the EPA Ground-water Protection Strategy* (USEPA, 1986). The HU-C would be an unlikely water supply source, as it is deeper and a less productive hydrostratigraphic unit (USACE, 1998b).

The ground-water monitoring well network for SLDS is identified in Figure 3-7. Charts 3-1 and 3-2 describe the methodologies used to determine the parameter analyzed for each monitoring well and at what sample interval, respectively. Ground-water sampling parameters are listed in Table 3-3. The parameter and interval may be modified based on a review of data as specified in Charts 3-1 and 3-2.

**Table 3-3. Ground-Water Monitoring by Site**

Site	Parameter <sup>a</sup>	Driver/Purpose
SLDS	1,2,3	ROD (USACE, 1998b)
SLAPS and VPs	1,2,3,4,5,6,7,8	EMP <sup>b</sup>
HISS	1,2,3,4,5,6,7,8	EMP

<sup>a</sup> Parameter and Interval charts are used to determine the parameter analyzed and at what specific sample interval for each monitoring well.

<sup>b</sup> Subject to modifications on finalization of Feasibility Study for the St. Louis North County Site.

#### Definition for Parameters

- Radiochemical Parameters** include Uranium-234, Uranium-235, Uranium-238, Thorium-228, Thorium-230, Thorium-232, Radium-226, Radium-228, Actinium-227, Protactinium-231.
- Metals – TAL** include Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Titanium, Uranium, Vanadium, Zinc. (NOTE: At SLDS Arsenic and Cadmium only metals analyzed).
- Field parameters** include Hardness, pH, Conductance, Eh, Temperature, Dissolved Oxygen, Turbidity, static water levels.
- VOCs** include Chloromethane, Bromomethane, Vinyl Chloride, Chloroethane, Methylene Chloride, Acetone, Carbon disulfide, 1,1-Dichloroethene, 1,1-Dichloroethane, 1,2-Dichloroethene (total), Chloroform, 1,2-Dichloroethane, 2-Butanone, 1,1,1-Trichloroethane, Carbon tetrachloride, Bromodichloromethane, 1,2-Dichloropropane, Cis-1,3-Dichloropropene, Trichloroethene, Dibromochloromethane, 1,1,2-Trichloroethane, Benzene, trans-1,3-Dichloropropene, 4-Methyl-2-pentanone, 2-Hexanone, Tetrachloroethene, Toluene, 1,1,2,2-Tetrachloroethane, Chlorobenzene, Ethylbenzene, Styrene, Xylenes [dimethylbenzene] (total), 1,1,2-Trichloroethane, 1,2,2-Trifluoroethane.
- SVOCs** includes Phenol, bis(2-Chloroethyl) ether, 2-Chlorophenol, 4-chlorobenzenamine, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, 1,2-Dichlorobenzene, 2-Methylphenol, bis(2-chloroisopropyl) ether, 4-Methylphenol, 2-Nitrobenzenamine, 3-Nitrobenzenamine, 4-Nitrobenzenamine, N-nitroso-di-n-dipropylamine, Hexachloroethane, Nitrobenzene, Isophorone, 2-Nitrophenol, 2,4-Dimethylphenol, Bis(2-chloroethoxy) methane, 2,4-Dichlorophenol, 1,2,4-Trichlorobenzene, Naphthalene, Hexachlorobutadiene, 4-Chloro-3-methylphenol, 2-Methylnaphthalene, Hexachlorocyclopentadiene, 2,4,6-Trichlorophenol, 2,4,5-Trichlorophenol, 2-Chloronaphthalene, Dimethylphthalate, Acenaphthylene, 2,6-Dinitrotoluene, Acenaphthene, 2,4-Dinitrophenol, 4-Nitrophenol, Dibenzofuran, 2,4-Dinitrotoluene, Diethylphthalate, 4-Chlorophenyl-phenyl ether, Fluorene, 4,6-Dinitro-2-methylphenol, N-nitrosodiphenylamine, 4-bromophenyl-phenylether, Hexachlorobenzene, Pentachlorophenol, Phenanthrene, Anthracene, Carbazole, Di-n-butylphthalate, Fluoranthene, Pyrene, Butylbenzylphthalate, 3,3'-Dichlorobenzidine, Benzo(a)anthracene, Chrysene, Bis(2-Ethylhexyl)phthalate, Di-n-octylphthalate, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene.
- Geochemical Parameters** include Ammonron, Alkalinity, Hardness, Nitrate, Sulfate, Chloride, Fluorene, Phosphorus, Total Organic Carbon, Total Suspended Solids, Total Dissolved Solids.
- Herbicides** include 2,4-D, 2,4-DB, 2,4,5-TP (Silvex), 2,4,5-T, Dalapon, Dicamba, Dichloroprop, Dinoseb, MCPA, MCPP.
- Pesticides** include Alpha-BHC, Beta-BHC, Delta-BHC, gamma-BHC, Heptachlor, Aldrin, Heptachlor epoxide, Endosulfan I, Dieldrin, 4,4'-DDE, Endrin, Endosulfan II, 4,4'-DDD, Endosulfan sulfate, 4,4'-DDT, Methoxychlor, Endrin ketone, Endrin aldehyde, Alpha-Chlordane, Lindane, Gamma-Chlordane, Toxaphene, Arochlor-1016, Arochlor-1221, Arochlor-1232, Arochlor-1242, Arochlor-1248, Arochlor-1254, Arochlor-1260.

*Objectives for St. Louis Airport Site and VP's:*

- Evaluate potential ground-water contaminant migration and flow primarily in the upper hydrostratigraphic zone.
- Monitor contaminant discharge to Coldwater Creek.
- Evaluate potential impacts to ground-water quality resulting from remedial actions and provide data necessary for CERCLA evaluation.

There are five hydrostratigraphic zones (HZs) recognized beneath SLAPS (see Figure 3-6). The surficial deposits include topsoil and anthropogenic fill (Unit 1) and the Pleistocene glacially-related sediments of stratigraphic Unit 2 and subunit 3T comprise the HZ-A. A clay with low vertical permeability comprising subunit 3M of stratigraphic Unit 3 is HZ-B. HZ-C is comprised of the stratigraphic subunit 3B and Unit 4. The shale and limestone are recognized as HZ-D and HZ-E, respectively.

The ground-water monitoring well network for SLAPS and VPs is identified in Figure 3-8. Two previously proposed new wells along Coldwater Creek are being installed. Charts 3-1 and 3-2 describe the methodologies used to determine the parameter analyzed for each monitoring well and at what sample interval, respectively. Ground-water sampling parameters are listed in Table 3-3. The parameter and interval may be modified based on a review of data as specified in Charts 3-1 and 3-2.

*Objectives for HISS:*

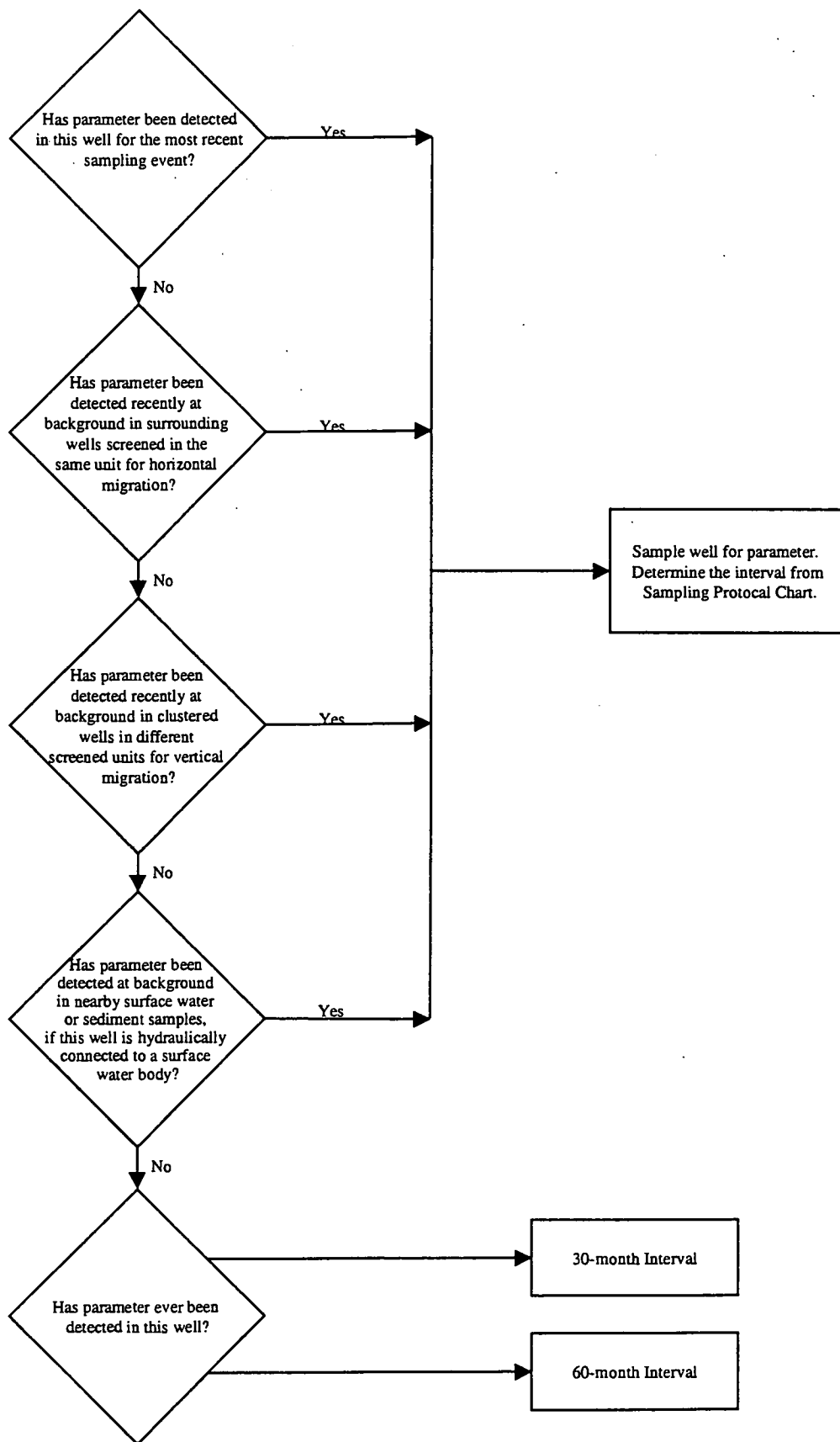
- Evaluate the ground-water contaminant occurrence and migration primarily in the upper hydrostratigraphic zone.
- Monitor contaminant discharge to Coldwater Creek.
- Evaluate potential impacts to ground-water quality resulting from remedial actions and provide data necessary for CERCLA evaluation.

The hydrogeologic and geologic setting at HISS is similar to that at SLAPS (see Figure 3-6), with an exception. The Pennsylvanian shale bedrock unit (HZ-D) present at SLAPS, which is absent at HISS.

The current ground-water monitoring well network for HISS is identified in Figure 3-9. Three previously proposed new wells are being installed. Charts 3-1 and 3-2 describe the methodologies used to determine the parameter analyzed for each monitoring well and at what sample interval, respectively. Ground-water sampling parameters are listed in Table 3-3. The parameter and interval may be modified based on a review of data as specified in Charts 3-1 and 3-2.

### **3.2.2 Proposed New Ground-water Monitoring Wells**

As identified in Section 3.2.1, long-term, ground-water, monitoring at the three SLS will be completed to meet various federal and state requirements. To accomplish these and other ground-water related objectives, several additional wells may need to be installed during FY 2001. Specific objectives and a projection of the number of new wells which may be considered



**Chart 3-1. Sampling Parameter Chart**

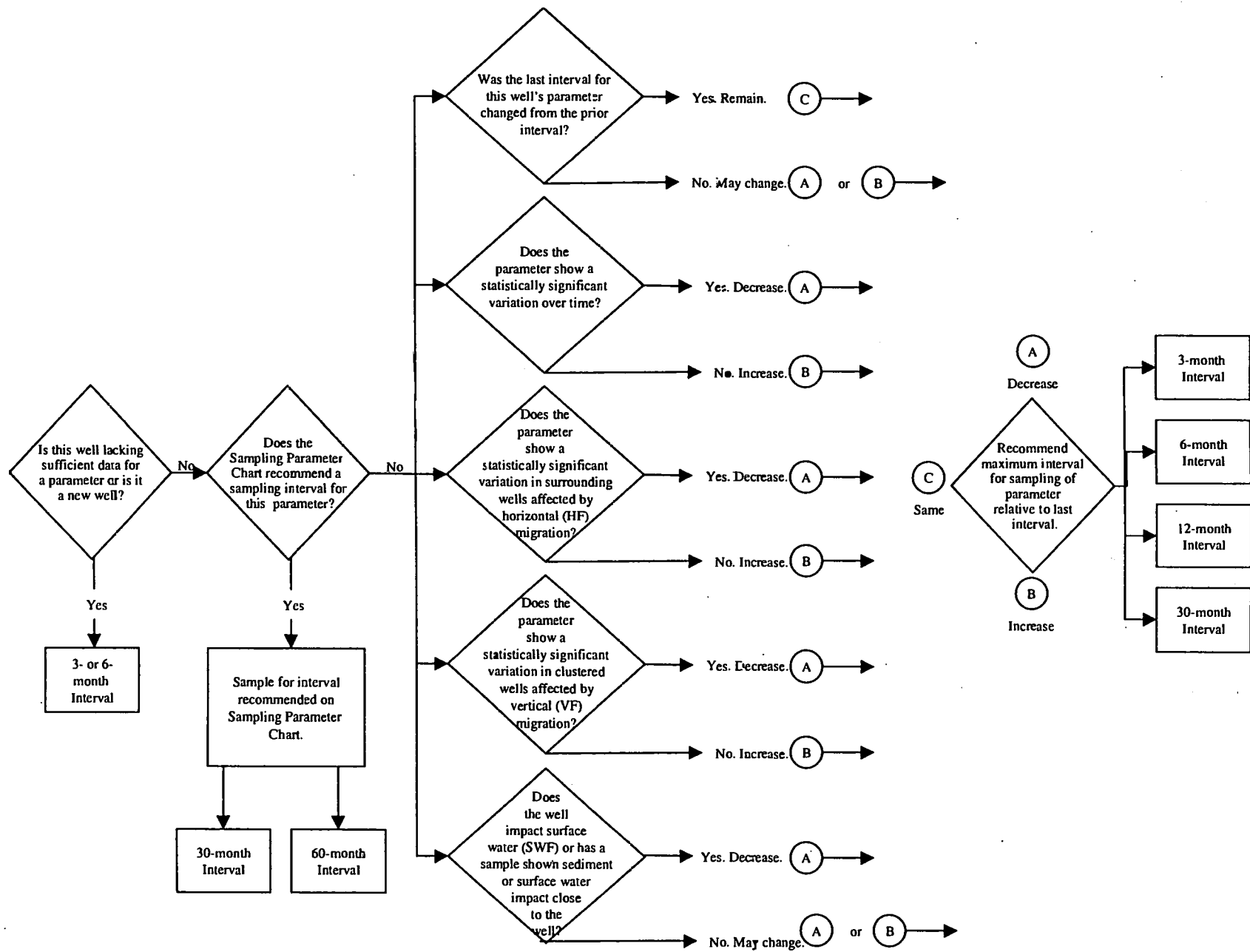
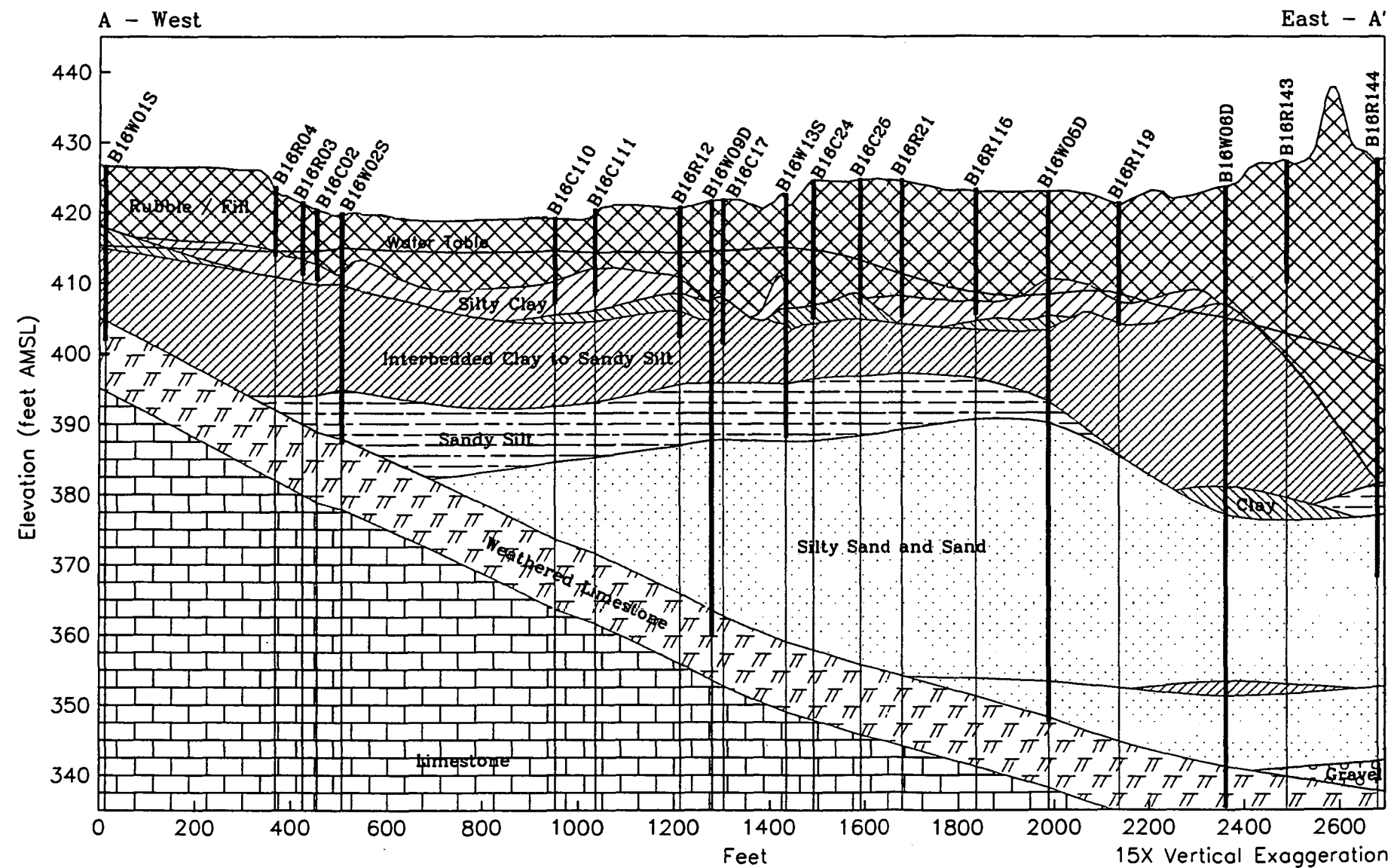


Chart 3-2. Sampling Interval Chart



Geologic Cross  
Section A - A' at  
SLDS

Geologic data used in the cross section  
collected prior to 1998.

Cross Section Location Map



**FUSRAP**

St. Louis Downtown Site  
St. Louis, Missouri

Drawn By: R. Smith

Rev. No. / Date: 0 / 24 Mar 99

File: SLDSGlg01XSectA.sho

Figure 3-5. Hydrostratigraphic Cross-Section of the SLDS Area

Zone	Period	Epoch	Stratigraphy	Thickness (ft.)	Description
Hydrostratigraphic zone (HZ)-A	Quaternary	Holocene	FILL/TOPSOIL	0-14	Unit 1 Fill - Sand, silt, clay, concrete, rubble. Topsoil - Organic silts, clayey silts, wood, fine sand.
Hydrostratigraphic zone (HZ)-B		Pleistocene	LOESS (CLAYEY SILT)	11-32	Unit 2 Clayey silts, fine sands, commonly mottled with iron oxide staining. Scattered roots and organic material, and a few fossils.
			GLACIO-LACUSTRINE SERIES: SILTY CLAY	19-75 (3) 9-27 (3T)	UNIT 3 Silty clay with scattered organic blebs and peat stringers. Moderate plasticity. Moist to saturated. (3T)
			VARVED CLAY	0-8	Alternating layers of dark and light clay as much as 1/16 inch thick (3M)
			CLAY	0-26	Dense, stiff, moist, highly plastic clay. (3M)
			SILTY CLAY	10-29	Similar to upper silty clay. Probable unconformable contact with highly plastic clay. (3B)
Hydrostratigraphic zone (HZ)-C			BASAL CLAYEY & SANDY GRAVEL	0-6	UNIT 4 Glacial clayey gravels, sands, and sandy gravels. Mostly Chert.
Hydrostratigraphic zone (HZ)-D	Pennsylvanian		Cherokee (?) group (undifferentiated)	0-35	UNIT 5 BEDROCK: Interbedded silty clay/shale, lignite/coal, sandstone, and siltstone. Erosionally truncated by glaciolacustrine sequences. (Absent at HISS).
Hydrostratigraphic zone (HZ)-E	Mississippian		STE. GENEVIEVE ST. LOUIS LIMESTONES	10+	UNIT 6 BEDROCK: Hard, white to olive, well cemented, sandy limestone with interbedded shale laminations.

***FUSRAP***

**Environmental Monitoring  
Implementation for the  
St. Louis Sites for FY01  
St. Louis, Missouri**

NOT TO SCALE

DRAWN BY:  
C. Kaple

REV. NO./DATE:  
0 - 06/01/00

FILE:

Figure 3-6. Generalized Stratigraphic Column for SLAPS and HISS

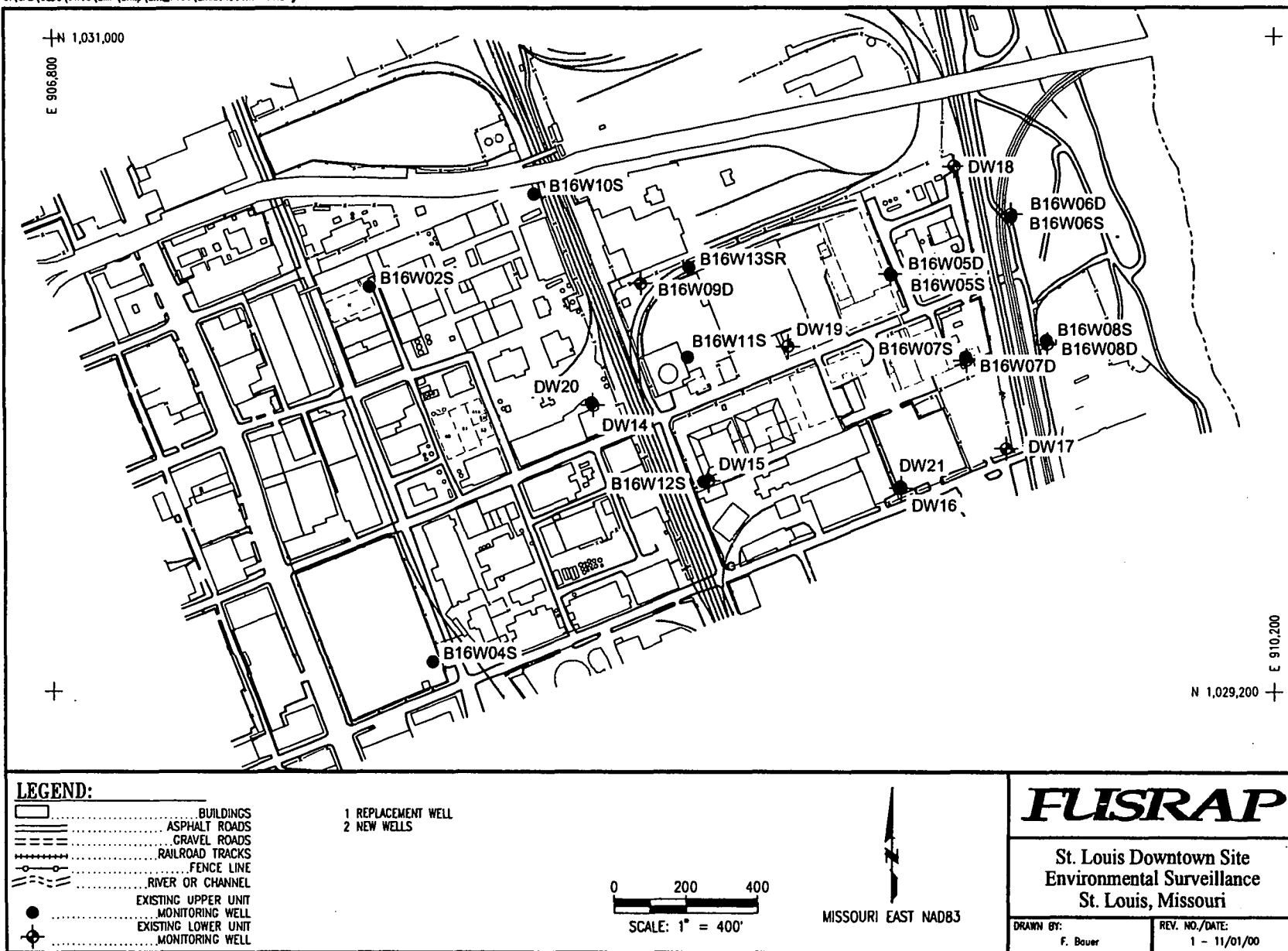


Figure 3-7. Monitoring Well Locations for Ground-water Monitoring at the SLDS

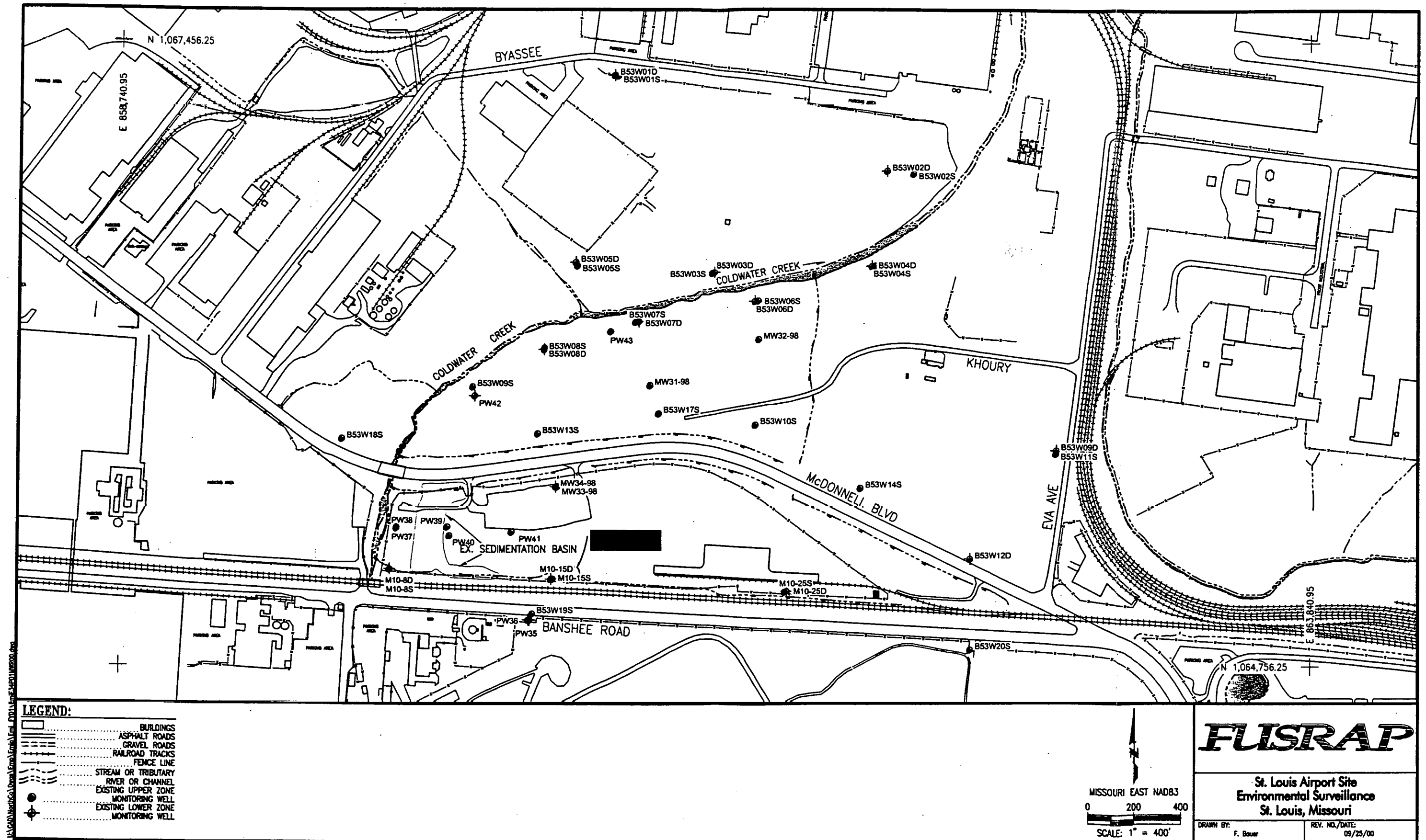


Figure 3-8. Existing Monitoring Well Locations at SLAPS and Vicinity Properties for FY 2001



at each site are identified below. Detailed scopes, including specific locations and construction criteria will be reviewed with the Technical Working Group prior to implementation.

*General rationale for new ground-water monitoring wells at the SLS for FY 2001:*

- Identify potential impacts to ground-water quality resulting from remedial action activities.
- Ensure compliance with ARARs.
- Obtain requisite data for CERCLA remedial performance evaluations.
- Determine/confirm background water quality at each of the sites.

Ensure adequate monitoring network is established for potentiometric and ground-water, quality monitoring at each key hydrostratigraphic zone.

*Objectives for SLDS:*

- Evaluate ground-water contaminant occurrence and migration within the lower hydrostratigraphic unit (HU-B).
- Determine background conditions for HU-B. The recently installed well (DW-22) is considered to be the upgradient (or background) lower hydrostratigraphic unit (HU-B) well.
- Resolve a shallow ground-water potentiometric anomaly in the area of B16W11S.
- Evaluate existing monitoring network and provide recommendations for additional wells, well to be abandoned or replaced.

To meet these objectives for SLDS, a total of 2 new wells may be considered for FY 2001.

*Objectives for St. Louis Airport Site and VP's:*

- Evaluate potential ground-water contaminant migration and flow in HZ-A.
- Determine background conditions for HZ-A, HZ-C, and HZ-E.
- Monitor contaminant migration to Coldwater Creek.
- Evaluate potential impacts to ground-water quality resulting from recent remedial actions at SLAPS.
- Evaluate existing monitoring network and provide recommendations for additional wells, well to be abandoned or replaced.

To meet these objectives for SLAPS and SLAPS VPs, a total of 2 new wells in HZ-C; 2 new (HZ-A) wells in upgradient, and 1-2 new shallow wells near SLAPS may be considered for FY 2001.

*Objectives for HISS:*

- Evaluate the ground-water contaminant occurrence and migration primarily in the upper hydrostratigraphic zone.
- Determine background conditions. The recently installed wells (HW-22 and HW-23) are considered to be the upgradient (or background) (HZ-A and HZ-C) wells at HISS.
- Evaluate potential impacts to ground-water quality resulting from remedial actions.

- Evaluate existing monitoring network and provide recommendations for additional wells, well to be abandoned or replaced.

No new wells are presently projected at HISS during FY 2001. These objectives will be evaluated as monitoring data is received for existing and the newly constructed wells at HISS.

### **3.2.3 Rational for Ground-water Sampling**

The rational for the sampling programs established for each site is based on site-specific requirements and conditions. Rationale for the ground-water monitoring plan correlates with the evaluation criteria identified in Section 2 with the exception of SLDS. The Record of Decision (ROD) requirements determined ground-water monitoring rationale at SLDS (USACE, 1998b). The programs identified in this EMIFY will be implemented after ground-water characterization activities have been completed at each site.

Analytes targeted for monitoring will include constituent of potential concern (COPCs) or contaminant of concerns (COCs) in regards to SLDS as identified in the ROD (USACE, 1998b) and other CERCLA documents and selected indicator constituents with high mobility that may serve as early indicators of contaminant migration.

These results, along with project objectives identified in the ROD for the site, are used to develop the site-specific long-term, ground-water monitoring program for SLDS (USACE, 1998b).

### **3.2.4 Field and Laboratory Analysis**

Based on previous soil and ground-water sampling conducted at the three St. Louis FUSRAP Sites categories of known or potential ground-water contaminants have been identified for each site. Based on the identified categories, ground-water samples collected from the ground-water monitoring well network at each site will undergo laboratory analytical analysis for the parameters were previously identified in Table 3-3.

Details regarding the analytical testing methods to be used for chemical analysis of these ground-water samples are presented in the SAG.

Purging and sampling of ground-water monitoring wells will be accomplished using dedicated bladder-type pumps, non-dedicated electrical submersible or peristaltic pumps, or similar equipment. Field measurements of static water level, pH, specific conductance, temperature, dissolved oxygen, and turbidity will be recorded during purging and sampling activities.

In cases where ground-water recharge into a monitoring well is rapid, ground-water samples will be collected immediately after completion of purging. However, in cases where recharge is slow, ground-water samples will be collected as soon as sufficient ground water is present in the well. If the volume of ground-water sample collected from a slow recharge well is not sufficient to perform both field parameter and chemical analyses, the entire volume of the sample will be used for chemical analysis and field parameter measurements will not be

conducted. Except for the initial sampling of new wells, all ground-water samples collected for analysis of metal and radiological parameters will be collected as filtered samples.

#### *QA Split Samples*

In addition to the field QC samples described above, QA split samples will be collected for the USACE during performance of ground-water sampling activities. During the sampling of ground water from monitoring wells, QA split samples will be collected along with ground-water samples. The monitoring well locations selected for split sampling will be random. The exact number of split samples collected will depend on the total number of ground-water samples collected during each quarterly sampling event. Approximately one split sample will be collected for every 20 ground-water samples collected, and will be proportionally distributed between the three subject sites. The QA split samples will be analyzed for the same ground-water parameters listed in the SAG.

Additional information regarding field QA/QC sampling requirements, and the analytical testing methods to be used for chemical analysis of QA/QC samples, is presented in the SAG.

### **3.3 STORM-WATER AND WASTE-WATER DISCHARGE SAMPLING**

Storm-water sampling is considered a principal component of the EMIFY at SLAPS, HISS, and SLDS. It is planned that remedial actions at all three sites will result in waste-water discharges that are covered under separate discharge requirements. Monitoring will be conducted to meet ARAR permit conditions at each site.

#### *Purpose of storm-water and waste-water discharge sampling at the SLS:*

Compliance with:

- Storm-water discharge requirements per MDNR - National Pollutant Discharge Elimination System (NPDES) permit number MO-0111252 for the HISS.
- MDNR - NPDES ARAR document dated October 2, 1998 for the SLAPS.
- Metropolitan Sewer District (MSD) discharge authorization letter dated October 30, 1999 for SLDS.

#### *Objective for SLAPS and VPs:*

- Monitoring to meet the NPDES ARAR discharge limits.

The NPDES permit for storm water discharges from SLAPS require that outfalls be sampled in accordance with the State. These locations were previously shown on Figure 3-2.

#### *Objective for HISS:*

- Monitoring storm-water discharge in accordance with MDNR to meet the Missouri State Operating Permit (MO-0111252).

The NPDES permit for storm-water discharge from HISS requires that outfalls be sampled in accordance with the State operating permit. These locations were previously shown on Figure 3-1.

*Objectives for SLDS:*

It is anticipated that remedial activities at SLDS will result in the discharge of waste-water from dewatering of excavation zones, soil dewatering, and equipment decontamination. If this waste-water is discharged under a separate local use permit, sediment sampling in the combined sewers may be implemented to assess potential transport of contamination via this pathway.

Site-specific remedial activities may also require a separate sampling location and frequency for those wastewater discharges associated with de-watering activities of open excavations, soil de-watering and decontamination. These monitoring requirements will be addressed by a WD. Parameters for each of the SLS can be found along with sampling locations, parameters, and sampling frequencies in Table 3-4.

### **3.4 SEDIMENT AND SURFACE-WATER SAMPLING**

Sediment samples will be collected, as a BMP, along Coldwater Creek to assess the potential transport of contaminants that may not be detected in their soluble form. The constituents are typically found attached to transportable sediments and could impact water quality in Coldwater Creek. The sediment sample locations and analysis will coincide with those for the surface-water samples.

*Purpose of sediment sampling:*

- Collect data for the CERCLA reevaluation process for the fate and transport contaminants.
- Compare sediment data and surface water data to differentiate impacts from upstream sources of each of the sites.

*Objectives for Coldwater Creek:*

- Assess impacts of remedial activities along Coldwater Creek.
- Assess the water quality of the creek to ensure the state Aquatic Water Quality Criteria (AWQC) for Class I waters are not exceeded at the Mississippi River.
- Assess the potential transport of contaminants.
- Compare contaminant concentrations in both their soluble and insoluble forms.
- Data collection to comply with the operating permit and will also provide data needed to support total pathways radiological and chemical exposure assessment.
- Obtaining data for the fate and transport of contaminants for the CERCLA reevaluation process.
- Determine upgradient water quality and sediment levels.

Figure 3-10 shows the sediment sample locations which will all be co-located with the surface-water locations. Sampling frequency, along with sampling parameters and locations are listed along with surface water data in Table 3-4.

**Table 3-4. Storm-Water, Waste-Water, Surface-Water and Sediment Monitoring Location, Frequencies, and Parameters**

Site	Monitoring Location	Sample ID	Media/Sample Type	Frequency <sup>a</sup>	Parameters <sup>b</sup>	Driver / Purpose	Status	Comments
HISS	#001	HN01	Storm water/composite*	Quarterly – List 1	List 1	NPDES	Active	Permit: MO-0111252
	#002	HN02	Storm water/composite*	Quarterly – List 1	List 1	NPDES	Active	Composite* = minimum of 4 grab samples collected within 24 hours.
	#003	HN03	Storm water/composite*	Quarterly – List 1	List 1	NPDES	Active	Composite* = minimum of 4 grab samples collected within 24 hours.
SLAPS	#001	PN01 a and b	Storm water/grab	Monthly – List 2	List 2	NPDES	Active	ARAR document letter from MDNR to USACE dated 10/02/98
	#002	PN02	Storm water/grab	Monthly – List 2	List 2	NPDES	Bermed excavation	Grab sample = collected during rainfall that results in discharge
	#003	PN03	Storm water/grab	Monthly – List 2	List 2	NPDES	Active-bales block culvert	For total U, Ra and Th: $\mu\text{g/L}$ – once/month
CWC	Location 1	CWC002	Surface water-sediment	Semi-annual – List 3	List 3	EMP	Active	
	Location 2	CWC003	Surface water-sediment	Semi-annual – List 3	List 3	EMP	Active	
	Location 3	CWC004	Surface water – sediment	Semi-annual – List 3	List 3	EMP	Active	
	Location 4	CWC005	Surface water – sediment	Semi-annual – List 3	List 3	EMP	Active	
	Location 5	CWC006	Surface water – sediment	Semi-annual – List 3	List 3	EMP	Active	
	Location 6	CWC007	Surface water – sediment	Semi-annual – List 3	List 3	EMP	Active	
SLDS						MSD		Sampling is batch dependent and therefore conducted on a non-routine basis. MSD discharge authorization letter dated 10/30/98 from MSD to IT.

\*Parameters are referenced from the Quality Assurance Project Plan for the St. Louis Sites

**Definition of Frequency Lists**

List 1 includes Settleable solids-monthly; Total rainfall – daily (24-hr); Flow rate – daily (24 hr); 1<sup>st</sup> quarter – Mar; 2<sup>nd</sup> quarter – Jun; 3<sup>rd</sup> quarter – Sept; 4<sup>th</sup> quarter – Dec; Weekly (SLAPS sedimentation basin RA).

List 2 includes all parameters once/month, except as noted in comments; Radon – twice year.

List 3 includes COCs – semi-annual; Pesticides.

**Definition of Parameter Lists**

List 1 includes Rainfall (in), Flow (MGD), Settleable solids (mL/L/hr), Specific conductance ( $\mu\text{mhos/cm}$ ), TOC (mg/L), TOX (mg/L), Gross alpha (pCi/L), Gross beta (pCi/L) Radium-226 (pCi/L), Radium-228 (pCi/L), Thorium-232 (pCi/L), Thorium-230 (pCi/L), Uranium (total) (pCi/L), pH.

List 2 includes Flow (MGD), Oil and grease (mg/L), Total petroleum hydrocarbons (mg/L), COD (mg/L, Settleable solids (mL/L/hr), Arsenic (total recoverable) (mg/L), Cadmium (total recoverable) (mg/L), Chromium (total recoverable) (mg/L), Copper (total recoverable) (mg/L), Lead (total recoverable) (mg/L), Gross alpha (pCi/L), Gross beta (pCi/L), PCBs ( $\mu\text{g/L}$ ), Radium (total) (pCi/L and  $\mu\text{g/L}$ ), Thorium (total) (pCi/L and  $\mu\text{g/L}$ ), Uranium (total) (pCi/L and  $\mu\text{g/L}$ ), Protactinium 231 (pCi/L), Actinium 227 (pCi/L), Radon (pCi/L), pH.

List 3 includes Radiochemical Parameters, TAL metals, SVOCs, VOCs, Pesticides, Geochemical Parameters (surface water only), Chloride, Nitrate, Sulfate, Oil and grease (surface water only), Field Parameters.

#### **Definitions for Parameters**

**Radiochemical Parameters** include Gross Alpha, Gross Beta, Uranium-234, Uranium-235, Uranium-238, Thorium-228, Thorium-230, Thorium-232, Radium-226, Radium-228, Actinium-227, Protactinium-231.

**TAL metals** include Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Titanium, Uranium, Vanadium, Zinc.

**Field Parameters** include Temperature, pH, Conductivity, and Eh (for sediment only) and Dissolved Oxygen (for water only)

**VOCs (surface water only)** include Chloromethane, Bromomethane, Vinyl Chloride, Chloroethane, Methylene Chloride, Acetone, Carbon disulfide, 1,1-Dichloroethene, 1,1-Dichloroethane, 1,2-Dichloroethene, Chloroform, 1,2-Dichloroethane, 2-Butane, 1,1,1-Trichloroethane, Carbon tetrachloride, Bromodichloromethane, 1,2-Dichloropropane, cis-1,3-Dichloropropene, Trichloroethene, Dibromochloromethane, 1,1,2-Trichloroethane, Benzene, trans-1,3-Dichloropropene, Tribromomethane, 4-Methyl-2-pentanone, 2-Hexanone, Tetrachloroethene, Toluene, 1,1,2,2-Tetrachloroethane, Chlorobenzene, Ethylbenzene, Styrene, Xylenes [dimethylbenzene], Freon.

**SVOCs** includes Phenol, bis(2-Chlorethyl) ether, 2-Chlorophenol, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, 1,2-Dichlorobenzene, 2-Methylphenol, 2-Nitrobenzenamine, 4-Methylphenol, N-nitroso-di-n-dipropylamine, Hexachloroethane, Nitrobenzene, Isophorone, 2-Nitrophenol, 2,4-Dimethylphenol, Bis(2-chlorethoxy) methane, 2,4-Dichlorophenol, 1,2,4-Trichlorobenzene, Naphthalene, Hexachlorobutadiene, 4-Chloro-3-methylphenol, 2-Methylnaphthalene, Hexachlorocyclopentadiene, 2,4,6-Trichlorophenol, 2,4,5-Trichlorophenol, 2-Chloronaphthalene, 3-Nitrobenzenamine, Dimethylphthalate, Acenaphthylene, 2,6-Dinitrotoluene, Acenaphthene, 2,4-Dinitrophenol, 4-Nitrophenol, Dibenzofuran, 2,4-Dinitrotoluene, Diethylphthalate, 4-Chlorophenyl-phenyl ether, Fluorene, 4,6-Dinitro-2-methylphenol, N-nitrosodiphenylamine, 4-Nitrobenzenamine, 4-bromophenyl-phenylether, Hexachlorobenzene, Pentachlorophenol, Phenanthrene, Anthracene, Carbazole, Di-n-butylphthalate, Fluoranthene, Pyrene, Butylbenzylphthalate, 3,3'-Dichlorobenzidine, Benzo(a)anthracene, Chrysene, Bis(2-Ethylhexyl)phthalate, Di-n-octylphthalate, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene, bis(2-chloroisopropyl)ether.

**Geochemical Parameters (surface water only)** include Ammonia, Alkalinity, Nitrate, Nitrite, Sulfate, Chloride, Fluoride, Phosphorus, Orthophosphorus, Hardness, Total Suspended Solids (for sediments only).

**Herbicides** include 2,4-D, 2,4-DB, 2,4,5-TP (Silvex), 2,4,5-T, Dalapon, Dicamba, Dichloroprop, Dinoseb, MCPA, MCPP.

**Pesticides (sediment only)** include Alpha-BHC, Beta-BHC, Delta-BHC, gamma-BHC, Heptachlor, Aldrin, Heptachlor epoxide, Endosulfan I, Dieldrin, 4,4'-DDE, Endrin, Endosulfan II, 4,4'-DDD, Endosulfan sulfate, 4,4'-DDT, Methoxychlor, Endrin ketone, Endrin aldehyde, Alpha-Chlordane, Lindane, Gamma-Chlordane, Toxaphene, Arochlor-1016, Arochlor-1221, Arochlor-1232, Arochlor-1242, Arochlor-1248, Arochlor-1254, Arochlor-1260

\* Subject to modification on finalization of Feasibility Study for the St. Louis North County Site.

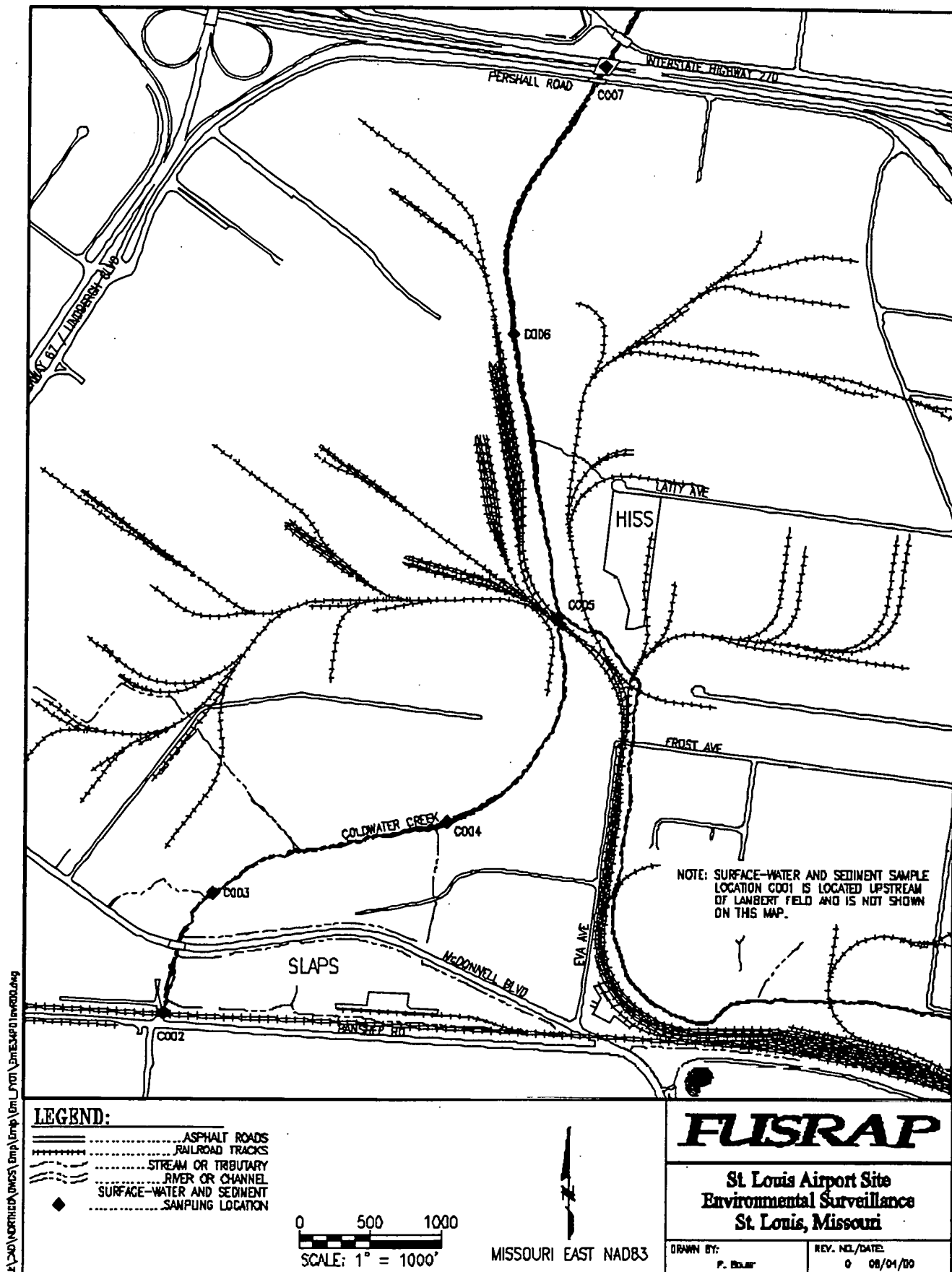


Figure 3-10. Surface-water and Sediment Sampling Locations at Coldwater Creek

## **4.0 PROGRAM PROTOCOLS**

### **4.1 ORGANIZATION**

The U.S. Army Corp of Engineers-St. Louis District (USACE-SLD) shall issue an annual EMIFY for each fiscal year that defines the program monitoring requirements for the upcoming year with respect to sampling locations, frequencies, monitoring parameters and the rationale for their selection. Organizational responsibilities for implementation of the EMIFY shall correspond to those delineated in the *Sampling and Analysis Guide for the St. Louis Sites* (SAG) (USACE, 2000a). Where non-periodic environmental sampling activities are required to meet CERCLA objectives at the SLS, a WD shall be issued that describes the activity-specific requirements. Each WD shall describe responsibilities for its implementation to the extent those roles differ from those specified by the SAG.

### **4.2 SAMPLING PROCEDURES**

Field sampling procedures for the various media monitored by the EMIFY shall conform to the requirements specified in the SAG. No unique sampling procedures are required to meet the objectives defined in this annual EMIFY.

### **4.3 SAMPLE MANAGEMENT**

Samples collected under this EMIFY will be managed in the field as specified in the SAG. Sample container, preservation, and holding time requirements for samples collected under the EMIFY are also specified in the SAG. The SAG specifies sample documentation requirements, which includes the sample numbering system, logbook requirements, and sample labels that pertain to samples collected under the EMG. Chain of custody requirements for EMIFY samples are specified in the SAG.

### **4.4 ANALYTICAL PROTOCOLS**

Samples collected under this EMIFY shall be quantified by the methods specified in the SAG. No unique analytical protocols are necessary to meet the objectives identified in the EMIFY.

### **4.5 MANAGEMENT OF INVESTIGATION DERIVED WASTE**

Investigation derived waste (IDW) resulting from implementation of the EMIFY01 will be managed in accordance with the requirements of the *EPA Guide to Management of Investigation-Derived Wastes* (Publication: 9345.3-03FS).

Table 4-1 outlines the management of IDW that is generated from various activities at the FUSRAP.

**Table 4-1. Investigation Derived Wastes Management Options**

Waste Type	IDW <sup>a</sup>	Generation Process	Management Option <sup>b</sup>	Comment
Water	Ground water	Well development Well sampling and/or purging Other characterization activities	<u>Regulated or Suspect (i.e. RCRA):</u> containerize and place in storage until receipt of analytical results. <u>Non regulated or non-suspect:</u> containerize and store in designated storage area (i.e., generated at SLDS stored at SLDS or generated in NC stored at HISS). IT disposition waste water at SLDS and SAIC to manage purge water from NC wells at HISS.	
	Surface water	Characterization activities		
	Decontamination water	Decontamination of equipment	Disposition in controlled area such that it will not pond, runoff site or through an outfall.	
Soil	Soils and/or sediment	Drill cuttings Soil sampling	<u>Known or suspect contaminated area:</u> Place soils in a contaminated soils pile or other designated location. <u>Known or suspect uncontaminated area:</u> backfill location or spread cuttings around sample location.	
Waste	Containerized Wastes	Sampling	Return unused portion to original source container.	
Sample Equipment	PPE	Sample activities Other misc. activities	<u>Reusable:</u> decontaminate. <u>Disposable:</u> dispose with other radiological trash. If used to sample suspect hazardous wastes, segregate and dispose as directed by task manger.	
	Equipment	Sampling equipment Monitoring equipment (swipes, filters, etc)	Dispose as radiological trash. If used to sample suspect hazardous wastes segregate, and dispose as directed by task manger.	
Laboratory Wastes	Soil, filter papers, test tubes, other radiological trash, etc	Analysis	Dispose as radiological trash. If used to sample suspect hazardous wastes segregate, and dispose as directed by task manger.	
	Acid Wastes	Analysis	Neutralize with caustic soda at point of generation and store in 55 gallon container.	
	Other Liquid wastes	Analysis Equipment decontamination	<u>Regulated or Suspect regulated (i.e. RCRA):</u> containerize and place in storage until receipt of analytical results <u>Non regulated or non-suspect:</u> containerize and store in designated storage area.	

<sup>a</sup> Management and disposition of wastes not listed here will be evaluated on case-by-case and follow the EPA guidance

<sup>b</sup> Options may be modified on case-by-case basis, but will follow the EPA guidance

## 5.0 REFERENCES

- DOE, 1997. *St. Louis Airport Site (SLAPS) Interim Action Engineering Evaluation/Cost Analysis (EE/CA)*, St. Louis, Missouri, DOE/OR/21950-1026. September.
- USACE, 1994. *Requirements for the Preparation of Sampling and Analysis Plans*, Manual No. EM-200-1-3.
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- USACE, 1998c. *Engineering Evaluation/Cost Analysis (EE/CA) and Responsiveness Summary for the St. Louis Airport Site (SLAPS)*, St. Louis, Missouri. May.
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- USACE, 1998e. *Engineering Evaluation/Cost Analysis (EE/CA) for the Hazelwood Interim Storage Site (HISS)*, St. Louis, Missouri. May.
- USACE, 1999. *Environmental Monitoring Guide for the St. Louis Sites*, St. Louis, Missouri. Final, December.
- USACE, 2000a. *Sampling and Analysis Guide for the St. Louis Sites*, St. Louis, Missouri. Final, September.
- USACE, 2000b. *Feasibility Study for the St. Louis North County Site*. Regulatory Review Draft, August.
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### Data Entry/Cross Reference Form

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