FINAL

ENVIRONMENTAL MONITORING IMPLEMENTATION FOR THE ST. LOUIS SITES FOR FY00

ST. LOUIS, MISSOURI

DECEMBER 1999

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

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

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ACRONYMS AND ABBREVIATIONS

ADAR	Annual Data and Analyses Report
AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
AOC	area of contamination
AR	Army Regulation
ARAR	Applicable or Relevant and Appropriate Requirement
AS	accessible soils
ASL	any-use-source soil level
AWQC	Aquatic Water Quality Criteria
BMP	Best Management Practice
BNAE	base/neutral and acid extractable
BRA	baseline risk assessment
BS	buildings and structures
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
cfs	cubic feet per second
CFR	Code of Federal Regulations
CPOC	contaminant of potential concern
CWA	Clean Water Act
dBA	decibel
DCE	dichloroethene
DCG	derived concentration limit
DMR	discharge monitoring report
DOCHMC	Department of Community Health and Medical Care
DoD	U. S. Department of Defense
DOE	U. S. Department of Energy
DOI	U. S. Department of Interior
dpm	disintegration per minute
DQO	data quality objectives
EE/CA	Engineering Evaluation/Cost Analysis
EIS	Environmental Impact Statement
EMS	Emergency Medical Service
EPA	U. S. Environmental Protection Agency
EMG	Environmental Monitoring Guide
EMIFY	Environmental Monitoring Implementation Fiscal Year
ER	Engineer Regulation
ESA	Endangered Species Act
ESP	electrostatic precipitator
FFA	Federal Facilities Agreement
FR	Federal Register
FS	Feasibility Study
FUSRAP	Formerly Utilized Sites Remedial Action Program
FWS	Fish and Wildlife Service

ACRONYMS AND ABBREVIATIONS (cont'd)

FY	Fiscal year
GRA	general response action
GW	ground water
HEPA	high-efficiency particulate air
HHPRG	human health preliminary remediation goal
HISS	Hazelwood Interim Storage Site
HUD	U. S. Department of Housing and Urban Development
Inc.	Incorporated
IDW	investigation derived wastes
ISA	initial screening of alternatives
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MDA	minimum detectable activity
MDNR	Missouri Department of Natural Resources
MED	Manhattan Engineer District
MSD	Metropolitan Sewer District
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NORM	naturally-occurring radioactive material
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
O&M	operations and maintenance
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Act
OSWER	Office of Solid Waste and Emergency Response
PAM	North County Potential Contaminants of Concern Assessment Memorandum (PAM)
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PCOC	potential contaminant of concern
POTW	publicly owned treatment works
PP	proposed plan
PRG	preliminary remediation goal
ppb	parts per billion

ACRONYMS AND ABBREVIATIONS (cont'd)

ppm	parts per million
QA/QC	quality assurance/quality control
RA	Remedial/ Removal Action
RCRA	Resource Conservation and Recovery Act
rem	radiation dose unit
RESRAD	Residual Radiation computer modeling system
RI/FS	remedial investigation/feasibility study
RME	reasonable maximum exposure
ROD	Record of Decision
IS	inaccessible soils
s	second
SAG	Sampling and Analysis Guide
SARA	Superfund Amendments and Reauthorization Act
SHPO	State Historic Preservation Office
SHRTSC-NCEA	Superfund Health Risk Technical Support Center- National Center for Environmental Assessment of EPA.
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
TBC	to be considered
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TOC	toxic organic compound
UMTRAP	Uranium Mill Tailings Remedial Action Project
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
WL	working level
WQC	Water Quality Criteria

1.0 INTRODUCTION

1.1 PROGRAM OVERVIEW

This Environmental Monitoring Implementation of Fiscal Year 2000 (EMIFY00) applies to the St. Louis Sites (SLS) within the Formerly Utilized Sites Remedial Action Program (FUSRAP). These sites are the St. Louis Downtown Site (SLDS), St. Louis Airport Site (SLAPS), and the Hazelwood Interim Storage Site (HISS). 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 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).

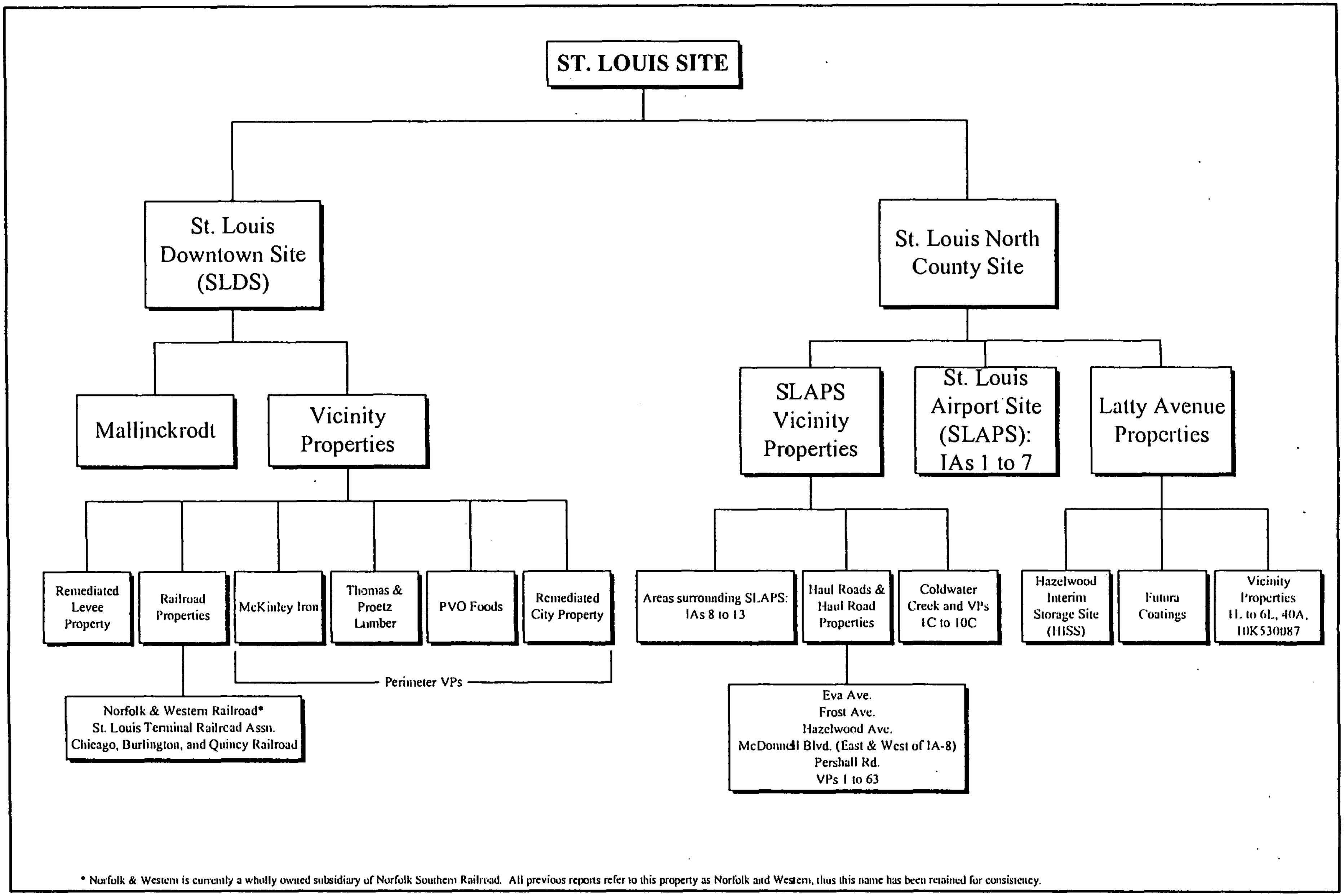
This EMIFY00 documents serve as a component of an integrated approach to collecting environmental data at the SLS. It is recognized that monitoring requirements and data objectives for the SLS will change as a result of promulgation of new regulations, issuance of permits or meet substantial requirements, and implementation of removal and 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, 1999b.). The *Environmental Monitoring Guide* (EMG) (USACE, 1999c) 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 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 Data and Analysis Report (ADAR) for each calendar year.

The remainder of Section 1 contains a summary description of the SLS and the status of the environmental restoration activities at each location.

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 FY2000.

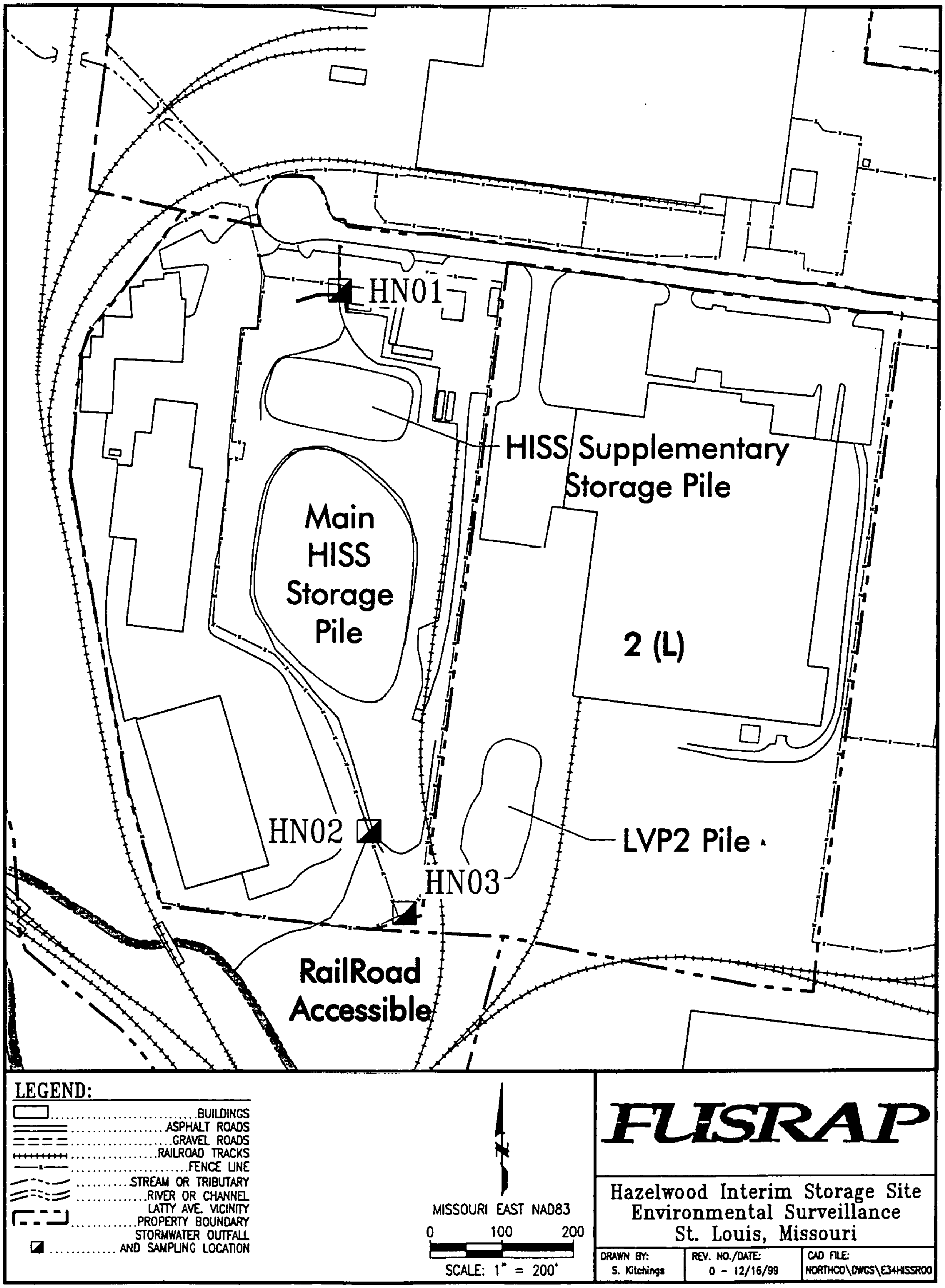
Section 3 presents the various types of monitoring to be conducted at the SLS.

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.



* Norfolk & Western is currently a wholly owned subsidiary of Norfolk Southern Railroad. All previous reports refer to this property as Norfolk and Western, thus this name has been retained for consistency.

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



FUSRAP

Hazelwood Interim Storage Site
Environmental Surveillance
St. Louis, Missouri

DRAWN BY:	REV. NO./DATE:	CAD FILE:
S. Kitchings	0 - 12/16/99	NORTHCO\DWGS\E34HISSR00

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

2.0 OBJECTIVES AND EVALUATION GUIDELINES FOR THE ENVIRONMENTAL MONITORING PROGRAM FOR 2000

2.1 PROGRAM OBJECTIVES FOR FY00

The objectives for environmental monitoring during FY00 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 Best Management Practice (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 will be identified in Section 3.0 were selected from permit conditions or best professional judgment based on historical site studies, results of the *North County Potential Constituents of Concern Assessment Memorandum* (PAM) (USACE, 1999a) and the CERCLA decision documents.

2.2 EVALUATION GUIDELINES FOR ENVIRONMENTAL MONITORING DATA

Data acquired under this EMIFY in FY00 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 2000 Ground-water Data

Criteria and guidelines for evaluating ground-water data obtained under this EMIFY00 in are derived from environmental regulatory programs. 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 to evaluate ground-water monitoring data. The evaluation criteria are provided in Table 2-1.

Table 2-1. Evaluation Criteria for Ground-Water Data

Constituent	MCL, Secondary MCL or MCLG[a]	Ground-Water Quality Criteria[a]
Chloride (mg/L)	250[b]	
Fluoride (mg/L)	4 (2[b])	4
Nitrate (as Nitrogen) (mg/L)	10	10
Nitrite (as Nitrogen) (mg/L)	1	
Total nitrate and Nitrite (as Nitrogen) (mg/L)	10	
Sulfate(mg/L)	250[b]	
Aluminum (mg/L)	0.05-0.2[b]	
Antimony (mg/L)	0.006	0.006
Arsenic(mg/L)	0.05	0.05
Barium (mg/L)	2	2
Beryllium (mg/L)	0.004[c]	0.004
Cadmium(mg/L)	0.005	0.005
Chromium(mg/L)	0.1	0.1
Cobalt (mg/L)		1
Copper (mg/L)	1.0[b] (1.3[c])	1.3
Cyanide (as free Cyanide) (mg/L)	0.2	
Iron (mg/L)	0.3[b]	0.3
Lead (mg/L)	0.015 (0[c])	0.015
Manganese (mg/L)	0.05[b]	0.05
Mercury (mg/L)	0.002	0.002
Selenium (mg/L)	0.05	0.05
Silver (mg/L)	0.15[b]	0.05
Thallium (mg/L)	0.002 (0.0005[c])	0.002
Zinc (mg/L)	5[b]	5
pH	6.5-8.5[b]	
Color (color units)	15[b]	
Asbestos (million fibers/L)	7	
Total Dissolved Solids (mg/L)	500[b]	
Aroclor-1016(mg/L)	0.005 (0[c])	0.002
Aroclor-1221(mg/L)	0.005 (0[c])	0.002
Aroclor-1232(mg/L)	0.005 (0[c])	0.002
Aroclor-1242(mg/L)	0.005 (0[c])	0.002
Aroclor-1248(mg/L)	0.005 (0[c])	0.002
Aroclor-1254 (mg/L)	0.005 (0[c])	0.002
Aroclor-1260 (mg/L)	0.005 (0[c])	0.002
1,2,4-Trichlorobenzene (mg/L)	0.07[c]	0.07
2,4,5-Trichlorophenol(mg/L)	2.6	2.6
2,4,6-Trichlorophenol(mg/L)	0.002	0.002
2,4-Dichlorophenol (mg/L)	0.093	0.093
2,4-Dimethylphenol(mg/L)	0.54	0.54
2,4-Dinitrophenol(mg/L)	0.07	0.07
2-Chlorophenol (mg/L)	0.1	0.001
Anthracene (mg/L)		9.6
Benzo(a)anthracene (mg/L)		4.40E-06
Benzo(a)pyrene (mg/L)	0[c]	0.0002

Table 2-1. Evaluation Criteria for Ground-Water Data (cont'd)

Constituent	MCL, Secondary MCL or MCLG[a]	Ground-Water Quality Criteria[a]
Benzo(b)fluoranthene (mg/L)		4.40E-06
Benzo(k)fluoranthene (mg/L)		4.40E-06
Bis(2-chloroethyl)ether (mg/L)		3.00E-05
Bis(2-ethylhexyl)phthalate (mg/L)		0.006
Butyl Benzyl Phthalate(mg/L)		3
Di-n-butyl Phthalate (mg/L)		2.7
Diethyl Phthalate(mg/L)		23
Dimethyl Phthalate (mg/L)		313
Fluoranthene (mg/L)		0.3
Fluorene (mg/l)		1.3
Hexachlorobenzene (mg/L)		0.001
Hexachlorobutadiene (mg/L)		4.50E-04
Hexachlorocyclopentadiene (mg/L)	0.05	0.05
Isophorone (mg/L)		0.036
N-Nitrosodiphenylamine (mg/L)		7.00E-07
Naphthalene (mg/L)		0.02[b]
Nitrobenzene(mg/L)		0.017
Pentachlorophenol (mg/L)	0[c]	0.001
Phenol (mg/L)		0.3
Pyrene (mg/L)		0.96
1,1,1-Trichloroethane (mg/L)	0.2[c]	0.2
1,1,2,2-Tetrachloroethane (mg/L)	0.00017 (0[c])	0.00017
1,1,2-Trichloroethane (mg/L)	0.005	0.005
1,1-Dichloroethene (mg/L)	0.007	0.007
1,2-Dichloroethane (mg/L)	0.005 (0[c])	0.005
1,2-Dichloropropane (mg/L)	100	100
Para-dichlorobenzene (mg/L)	0.075	
1,1-Dichloroethlyene (mg/L)	0.007	
Cis-1,2,-Dichloroethlyene (mg/L)	0.07	
o-Dichlorobenzene (mg/L)	0.6	
Monochlorobenzene (mg/L)	0.1	
Trans-1,2-Dichloroethlyene (mg/L)	0.1	
Dichloromethane (mg/L)	0.005	
Acrylamide (mg/L)	0[c]	
Alachlor	0[c]	
Chlordane	0[c]	
Dibromochloropropane	0[c]	
1,2-Dichloropropane	0[c]	
Epichlorohydrin	0[c]	
Ethylene Dibromide	0[c]	
Heptachlor	0[c]	
Heptachlor Epoxide	0[c]	
Toxaphene	0[c]	
AldicarAldicarb Sulfoxideb	0[c]	
Aldicarb Sulfone	0[c]	
Atrazine	0[c]	
Carbofuran	0[c]	
2,4 D	0[c]	

Table 2-1. Evaluation Criteria for Ground-Water Data (cont'd)

Constituent	MCL, Secondary MCL or MCLG[a]	Ground-Water Quality Criteria[a]
Lindane	0[c]	
Dalpon	0[c]	
Di (2-ethylhexyl) Adipate	0[c]	
Dinoseb	0[c]	
Diquat	0[c]	
Endothall	0[c]	
Endrin	0[c]	
Glyphosate	0[c]	
Oxamyl	0[c]	
Picloram	0[c]	
Simazine	0[c]	
Benzene (mg/L)	0.005 (0[c])	0.005
Bromomethane (mg/L)	0.01	0.01
Carbon Tetrachloride (mg/L)	0.005 (0[c])	0.005
Chlorobenzene (mg/L)	0.1	0.1
Ethylbenzene (mg/L)	0.7	0.7
Methylene Chloride (mg/L)	0.005 (0[c])	0.005
Styrene (mg/L)	0.1	0.1
Tetrachloroethene (mg/L)	0.005	0.005
Toluene (mg/L)	1	1
Trichloroethylene (mg/L)	0.005	0.005
Vinyl Chloride (mg/L)	0.002 (0[c])	0.002
Xylenes, Total (mg/L)	10	10
Gross Alpha (pCi/L)	15	
Ra-226 +Ra-228 (pCi/L)	5	

[a] Source: MCL or MCLG and Secondary MCL= 40 CFR 141 and 40 CFR143, respectively
Ground -Water Criteria source: 10 CSR 20-7 Table A Class VII

[b] Criteria are secondary MCLs

[c] MCLG - as noted otherwise if MCL exists

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

The MDNR has issued a 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 EMIFY00 in. Additionally, Aquatic Water Quality Criteria (AWQC) for Class I and V streams under 10 CSR 20-7 may be guidelines for evaluation of the storm-water discharge and 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 and III. These various criteria are presented in Table 2-2.

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

Constituent	Ambient Water Quality Criteria	SLAPS Discharge Limit-Based Criteria	SLDS Discharge Limit-Based Criteria	HISS Discharge LimitBased Criteria
Total Organic Carbon (mg/L)				NL[a]
Total Organic Halogens (mg/L)				NL[a]
Specific Conductance (mmhos/cm^3)				NL[a]
Chemical Oxygen Demand (mg/L)		120		
Oil and Grease (mg/L)	10	15		
Total Petroleum Hydrocarbon (mg/L)		10		
Total Settleable Solids (mL/L/hr)		1.5	5	1.5
Aluminum (mg/L)	0.75			
Arsenic (mg/L)	0.02	0.1		
Beryllium (mg/L)	0.005			
Cadmium (mg/L)	0.094	0.94		
Chromium (mg/L)	0.28	0.28		
Copper (mg/L)	0.084	0.084		
Iron (mg/L)	1			
Lead (mg/L)	0.15	0.19		
Mercury (mg/L)	0.0024			
Nickel (mg/L)	6.9			
Selenium (mg/L)	0.005			
Silver (mg/L)	0.011			
Total Uranium (pCi/L)[c]		NL[a]		NL[a]
Zinc (mg/L)	2.073			
Chloride (mg/L)	860			
Fluoride (mg/L0		4		
Ethyl Benzene (mg/L)	0.32			
Total Radium (pCi/L)[c]		NL[a]	5 (Ra226- Ra228)	NL[a]
Radium 226 (pCi/L)[c]	5.0	NL[a]		NL[a]
Radium 228 (pCi/L)[c]	5.0	NL[a]		NL[a]
Total Thorium (pCiL)[c]		NL[a]		NL[a]
Thorium 230 (pCi/L)[c]		NL[a]		NL[a]
Thorium 232 (pCi/L)[c]		NL[a]		NL[a]
Gross Alpha (pCi/L)		NL[a]	15[b]	NL[a]
Gross Beta (pCi/L)		NL[a]	50	NL[a]
Protactinium 231 (pCi/L)		NL[a]		

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

Constituent	Ambient Water Quality Criteria	SLAPS Discharge Limit-Based Criteria	SLDS Discharge Limit-Based Criteria	HISS Discharge LimitBased Criteria
Actinium 227 (pCi/L)		NL[a]		
Lead 210 (pCi/L)				NL[a]
2,4-Dichlorophenol (mg/L)	0.007			
2-Chloronaphthalene (mg/L)	4.3			
Fluoranthene (mg/L)	0.3			
Hexachlorocyclopentadiene (mg/L)	0.0005			
Phenol (mg/L)	0.1			

NL = No limit

[a] Monitoring only requirement

[b] Includes contributions from Thorium and Uranium

[c] 10 CFR 20 limits apply and are more restrictive:

Sources: AWQC - 10 CRS 20-7, Table A class I and III.

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.

2.2.3 Evaluation Guidelines for Coldwater Creek Sediment Data

Environmental monitoring data for Coldwater Creek sediments obtained under this EMIFY in 2000 will be evaluated with respect to background concentrations. The background concentrations considered for evaluation of sediment data were developed for *the North County Potential Constituents of Concern Assessment Memorandum (PAM)* (USACE, 1999a). 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 [b]

		EPA			NOAA	
Constituent	**Background Criteria**	**SQC**	**SQB**	**EqP SQB**	**TEL**	**PEL**
Aluminum (mg/kg)	11300					
Antimony (mg/kg)	7.85					
Arsenic (mg/kg)	18				5.9	17
Barium (mg/kg)	279					
Beryllium (mg/kg)	0.56					
Boron (mg/kg)	9.9					
Cadmium (mg/kg)	0.9				0.596	3.53
Calcium (mg/kg)	28900					
Chromium (mg/kg)	15.7				37.3	90
Cobalt (mg/kg)	11.9					
Copper (mg/kg)	20				35.7	197
Iron (mg/kg)	25800					

Table 2-3. Evaluation Criteria for Sediment Data [b] (cont'd)

		EPA			NOAA	
Constituent	**Background Criteria**	**SQC**	**SQB**	**EqP SQB**	**TEL**	**PEL**
Lead (mg/kg)	79.7				35	91.3
Magnesium (mg/kg)	18400					
Manganese (mg/kg)	4690					
Mercury (mg/kg)					0.174	0.486
Molybdenum (mg/kg)	22.7					
Nickel (mg/kg)	32.9				18	35.9
Potassium (mg/kg)	1220					
Selenium (mg/kg)	0.65					
Silver (mg/kg)	2.6					
Sodium (mg/kg)	268					
Thallium (mg/kg)	0					
Uranium (mg/kg)	7.52					
Vanadium (mg/kg)	30.5					
Zinc (mg/kg)	278				123	315
1,2,4-Trichlorobenzene (mg/kg)				9.6[b]		
1,2-Dichlorobenzene (mg/kg)				0.33[b]		
1,3-Dichlorobenzene (mg/kg)				1.7[b]		
1,4-Dichlorobenzene (mg/kg)				0.340[b]		
2,4-Dimethylphenol (mg/kg)				0.029[c]		
2-Methylnaphthalene (mg/kg)				0.130[b]		
2-Methylphenol (mg/kg)				0.012[b]		
4-Methylphenol (mg/kg)				0.67[c]		
Acenaphthene (mg/kg)						
Acenaphthylene (mg/kg)						
Anthracene (mg/kg)	0.23			0.220[b]		
Benzo(a)anthracene (mg/kg)	0.3			0.110[b]	0.031	0.385
Benzo(a)pyrene (mg/kg)	0.34			0.140[b]	0.031	0.782
Benzo(b)fluoranthene (mg/kg)	0.31					
Benzo(g,h,i)perylene (mg/kg)	0.39					
Benzo(k)fluoranthene (mg/kg)	0.29					
Benzoic Acid (mg/kg)				0.650[c]		
Benzyl Alcohol (mg/kg)				0.057[c]		
Bis(2-ethylhexyl)phthalate (mg/kg)	0.23			890.0[b]		
Butyl Benzyl Phthalate (mg/kg)	0.25			11.0[b]		
Chrysene (mg/kg)	0.57				0.057	0.862
Di-n-butyl Phthalate (mg/kg)			11	11.0[b]		
Di-n-octyl Phthalate (mg/kg)						
Dibenzo(a,h)anthracene (mg/kg)	0.23					
Dibenzofuran (mg/kg)			2	0.420[b]		
Diethyl Phthalate (mg/kg)				0.60[b]		
Dimethyl Phthalate (mg/kg)						
Fluoranthene (mg/kg)	0.7	2.9		6.2[d]	0.111	2.36
Fluorene (mg/kg)			0.54	0.540[b]		
Hexachloroethane (mg/kg)				1.0[b]		
Indeno(1,2,3-cd)pyrene (mg/kg)	0.35					
Naphthalene (mg/kg)			0.48	0.240[b]		
Phenanthrene (mg/kg)	0.28	0.85		1.8[d]	0.41	0.515
Phenol (mg/kg)				0.42[c]		
Pyrene (mg/kg)	0.66				0.053	0.875
1,1,1-Trichloroethane (mg/kg)				0.030[b]		
1,1,2,2-Tetrachloroethane (mg/kg)				1.4[b]		
1,1,2-Trichloroethane (mg/kg)				1.2[b]		
1,1-Dichloroethane (mg/kg)				0.027[b]		
1,1-Dichloroethene (mg/kg)				0.031[b]		
1,2-Dichloroethane (mg/kg)				0.250[b]		
1,2-Dichloropropane (mg/kg)						
1,3-cis-Dichloropropene (mg/kg)				5.10E-04		
2-Butanone (mg/kg)	0.023			0.27[b]		
2-Hexanone (mg/kg)				0.022[b]		

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 in a year. exclusive from dose from background	Compliance with this standard will be demonstrated using a combination of TLDs. passive Rn 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 Rn 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. <u>Reporting</u> 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.

3.0 ENVIRONMENTAL MONITORING ACTIVITIES FOR FY00

This section describes the periodic sampling and analysis selected for 1999 to achieve the objectives of the EMP. These EMIFY00 activities will be implemented in conjunction with the program objectives defined as the EMG and program protocols described in 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 Work Descriptions (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.
- 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.
- 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 and concentrations. 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 3-4 shows the approximate charcoal canister locations on the HISS and VP 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 in off-site locations 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 the SLAPS and HISS sites 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.

Background monitoring locations will be selected at similar locations to those monitored with TLDs but unaffected by radioactive materials use. Two outside locations will be selected for measuring of background exposure rate. One of the outside locations will be representative of open areas, such as those at SLAPS and HISS, where background exposure is primarily due to terrestrial and cosmic radiation exposure. The second outside location should be selected in an area, similar to the SLDS/Mallinckrodt, Inc., where the effect of building shielding and building materials may influence the background exposure.

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 or demolition of buildings. 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 and/or working levels, as appropriate. Radon alpha track detectors will generally be located with the TLDs at site perimeters. Additional QC duplicates will be used to evaluate measurement precision.

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

Site	Monitoring Location	Sample ID[a]	Media/Sample Type	Frequency	Parameters	Driver/Purpose
HISS	6		TLD	Quarterly	External gamma	EMP - public exposure
	6		Alpha track	Semiannual	Ra-222;+ decay	EMP - public exposure
	4		PM	Weekly + operation specific	Particulate radionuclides	EMP - NESHAP
	100 cans (min)		Charcoal canisters	1/yr (one round only)	Radon Flux	40 CFR 192 - waiver
SLAPS	6		TLD	Quarterly a	External gamma	EMP - public exposure
	Background for SLAPS and HISS		TLD & alpha track	Quarterly and semiannual respectively	External gamma	
	6		Alpha track	Semiannual	Ra-222;+ decay	EMP - public exposure
	5		PM	Wweekly + operation specific	Particulate radionuclides	EMP - NESHAP
SLDS	7 perimeter samples		TLD and alpha track	Quarterly and semiannual respectively	External gamma	EMP - public exposure
	1 Background		TLD and alpha track	Semiannual	External gamma	
	0					

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

[a] Sample identifications to be determined

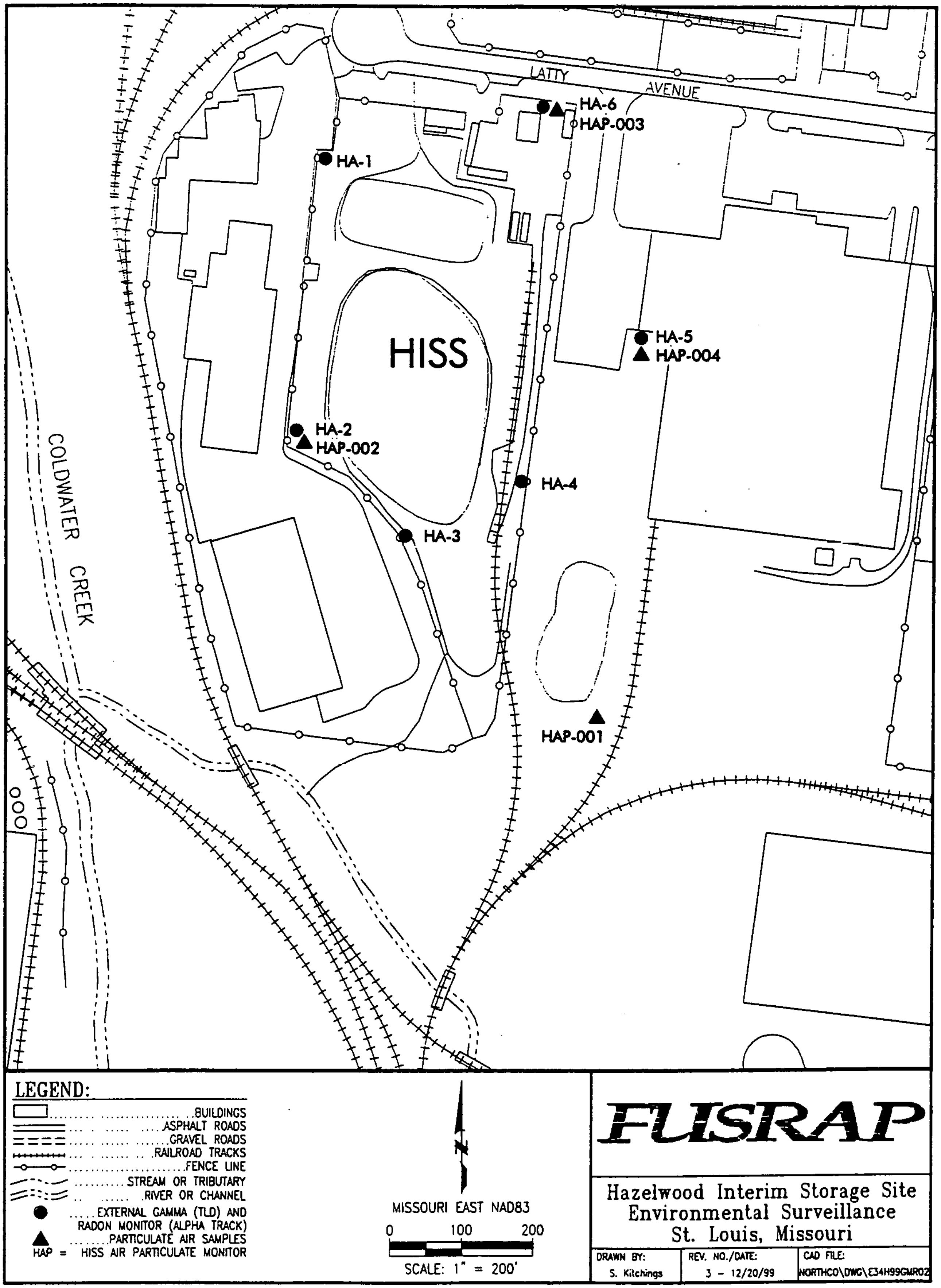


Figure 3-1. External Gamma, Radon-222, and Particulate Air Monitoring Stations at HISS

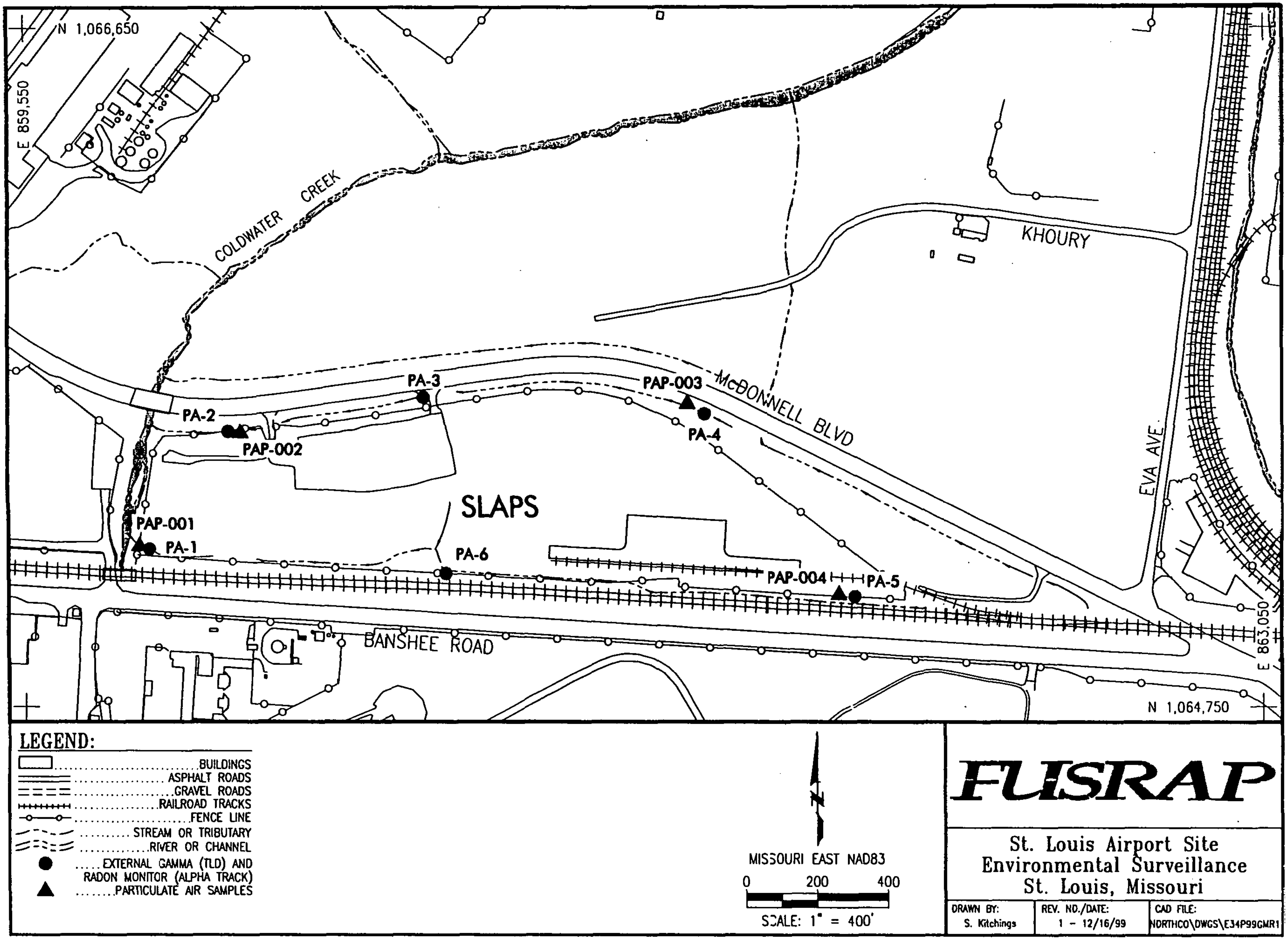
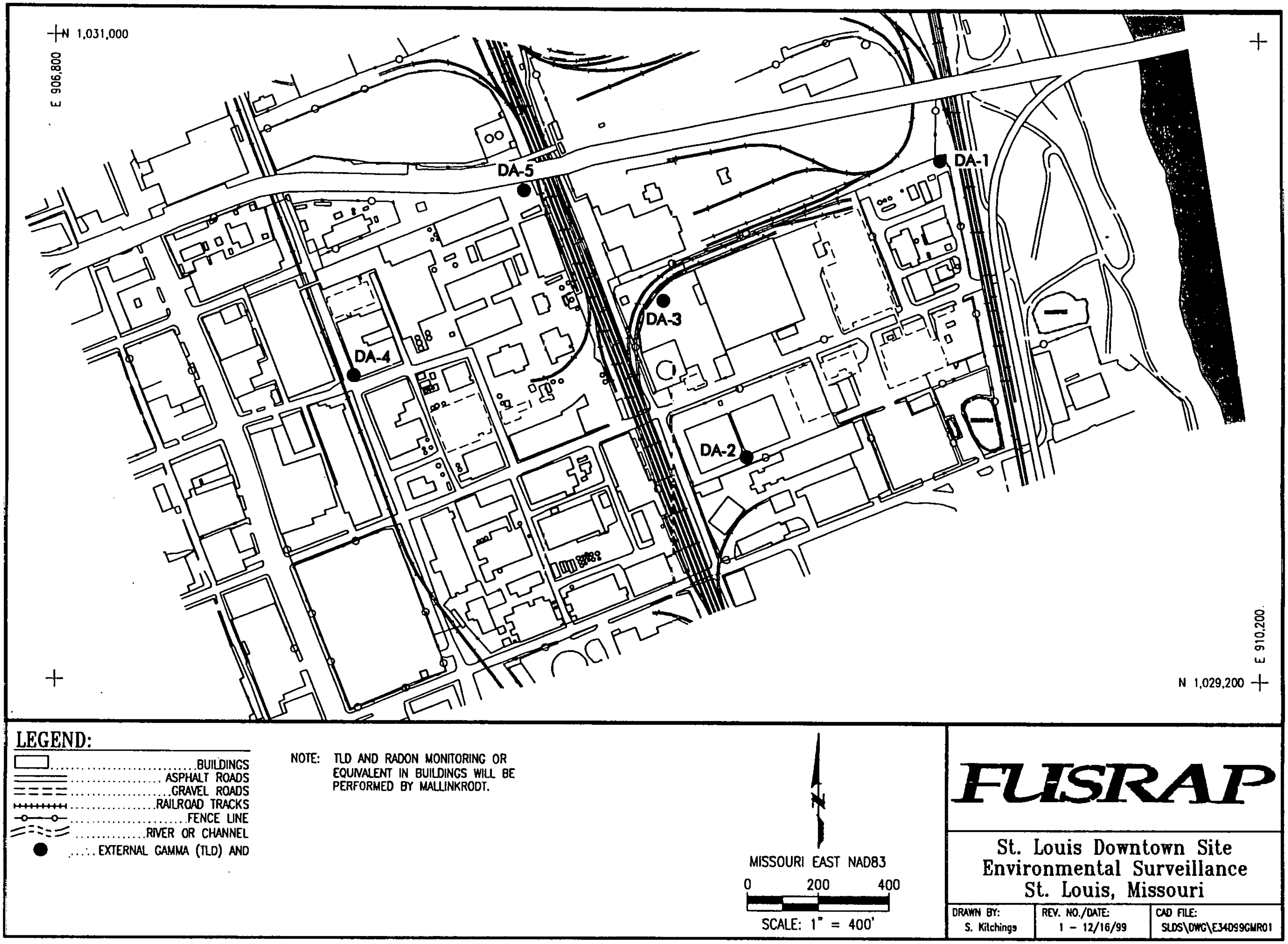


Figure 3-2. External Gamma, Radon-222, and Particulate Air Monitoring Stations at SLAPS



LEGEND:

▭	BUILDINGS
═	ASPHALT ROADS
╌	GRAVEL ROADS
┼┼┼┼	RAILROAD TRACKS
—○—○—	FENCE LINE
≈	RIVER OR CHANNEL
●	EXTERNAL GAMMA (TLD) AND

NOTE: TLD AND RADON MONITORING OR EQUIVALENT IN BUILDINGS WILL BE PERFORMED BY MALLINKRODT.

FUSRAP

St. Louis Downtown Site
Environmental Surveillance
St. Louis, Missouri

DRAWN BY:	REV. NO./DATE:	CAD FILE:
S. Kitchings	1 - 12/16/99	SLDS\DWG\E34D99GMR01

Figure 3-3. External Gamma and Radon-222 Monitoring Stations at SLDS

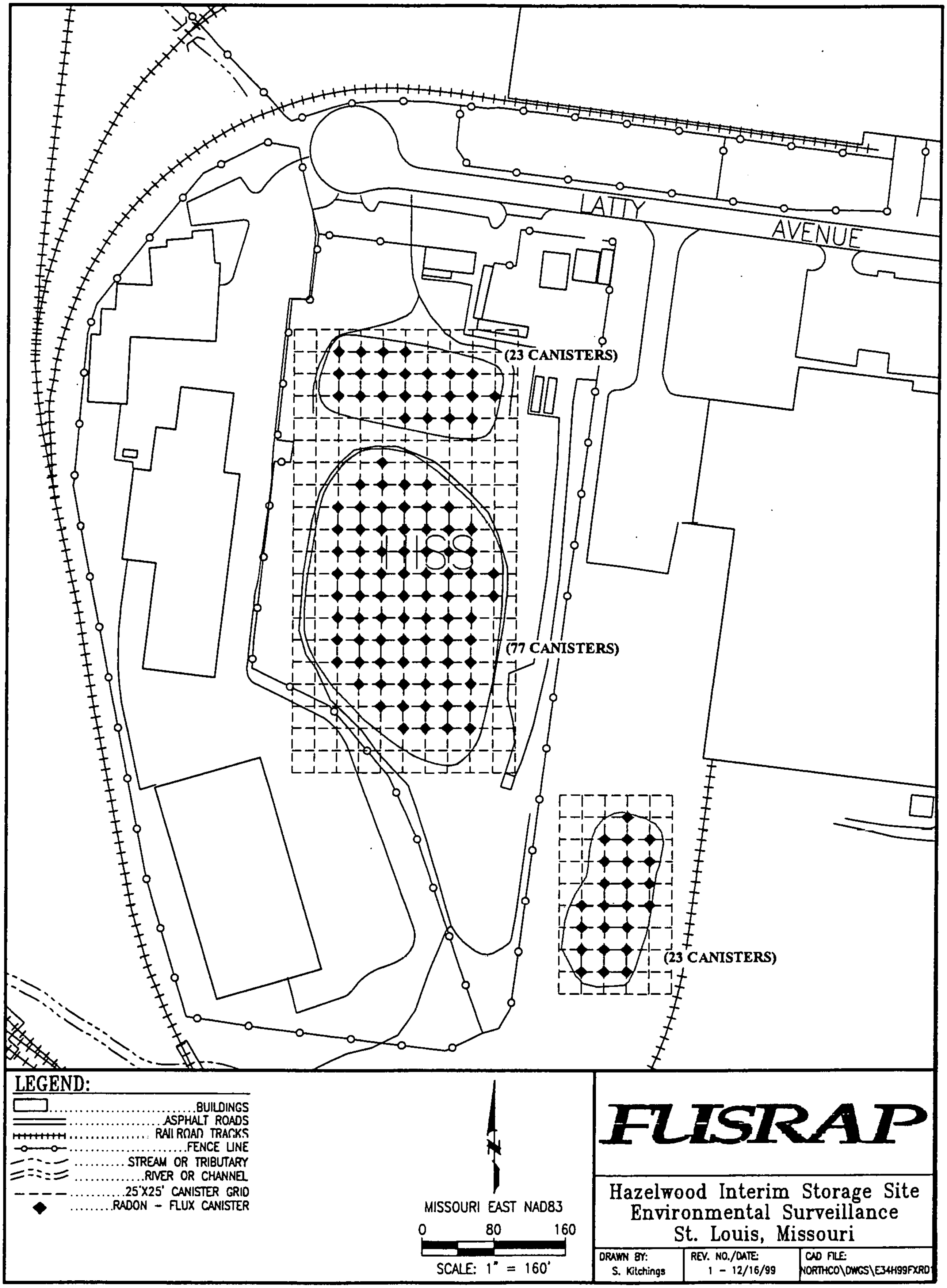


Figure 3-4. Approximate Radon Flux Monitoring Stations at HISS

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 intercept any airborne emissions at points that are likely to be highest at the fence line. Additional monitoring locations were relatively evenly spaced around the perimeter. A background location will be selected at a convenient outside location, unaffected by radioactive materials use

Radon Flux Monitors (Charcoal Canisters)

Charcoal canisters will be used at HISS to evaluate the radon flux off the piles of uranium byproduct pending initiation of RA activities to remove the piles. A minimum of 100 canisters will be placed in a grid pattern on the piles and the results evaluated to ensure the radon emissions from the piles are within the required limits. Measurements less than the EPA criterion of 20 $pCi/m^2/s$ 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.). Documentation of Radon flux monitoring is not required in areas below Radon parameters of 40 CFR 192 and 10 CFR 40.

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 intercept any 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 airborne particulate radionuclides. Additional particulate air samplers may be placed around the parameters of the work zone during remedial activities.

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 every two weeks, 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.

It is anticipated that only one round of radon flux monitoring will be conducted at HISS. Remedial activities are scheduled to begin at HISS in 1999; therefore, it is expected that only one round of sampling will be conducted before the pile is opened for remediation. 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.

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 radionuclide concentrations at the SLS are mainly uranium series nuclides. Each site has pockets of contamination that may contain predominantly Ra-226 or U-238 or Th-230, thus each radionuclide must be separately assessed. The air sampling and analysis program is set up to monitor for the radionuclides and/or the decay products known to be present.

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 *HISS Engineering Evaluation/Cost Analysis* (HISS EE/CA) (USACE 1998f).

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 various areas showing higher concentrations of U-238, Th-230, and Ra-226. The maximum concentration levels for individual radionuclides can be found in the *Feasibility Study for the St. Louis Downtown Site, St. Louis Missouri* (SLDS FS) (USACE 1998b).

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

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/year. 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 five feet above the ground surface at both fence line and off-site locations.

Radon Alpha Track Detectors

Radon gas concentrations are measured using alpha track detectors that are designed to collect Radon-222 isotopes. 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 flux measurements involve the absorption of radon-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 making radon flux measurements:

- Measurements shall not be initiated with 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 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. High volume air pumps, with typical flow rates of 30-50 L/min (8-13 gpm), draw ambient air through a 47mm particulate filter. The filter must have a high efficiency for removal of sub-micron particles. The air pumps are equipped with measurement devices, i.e., rotameters, to monitor air flow rates. 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 adequate 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.

A randomly selected 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. 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.

3.1.7 Data Processing and Radiological Dose Calculations

Each measurement will have an associated error. The method detection limit at the 95% confidence level will also be proved for each analysis. Results will be reviewed and approved in accordance with laboratory analysis protocols and the SAG for the SLS. Data process is specific for meeting each of the regulatory commitments.

Data Processing for NESHAP Air Emissions (40 CFR 61 Subpart I)

Compliance with this standard will be demonstrated through the use of the EPA computer code COMPLY (or equivalent) and/or measurement of radionuclide air concentrations at critical receptor locations. If computer modeling is used, an annual evaluation of the source term input parameters will be conducted to determine compliance with the 10 mrem/yr standard. If measurement of radionuclide concentrations at critical receptor locations is performed, the criterion of 10 mrem/yr will be evaluated using the environmental surveillance data from these locations. The basis for this is contained in 40 CFR 61.107(b)(5), which allows environmental measurements of radionuclide air concentrations at critical receptor locations when conditions of §61.107 are met, including prior EPA approval.

Doses caused by radon and decay products formed after the radon is released from the facility are not included in the determination of dose for 40 *CFR* 61 subpart I. Therefore, only the particulate monitoring data will be used. The general procedure will be to calculate the average annual concentration from each particulate air monitoring station for each nuclide. The average air concentrations are then compared to the values from 40 *CFR* 61 Appendix E, Table 2, Concentration Levels for Environmental Compliance. The sum-of-the-fractions for all nuclides will demonstrate compliance with the 10 mrem/year criterion.

Calculation of the average annual concentration for each of the particulate radionuclides analyzed if performed using the equation below. This annual average must be determined for each for the radionuclides and each of the air stations at the site;

$$C_iVG = \left(\sum C_i - \frac{days}{365} \right) \frac{365}{\sum days}$$

Where:

C_iAVG = the average annual concentration for nuclide i ($\mu Ci/cm^3$).

C_i = the measured concentration for nuclide i, for the sampling period ($\mu Ci/cm^3$).

days = the number of days in the sampling period.

365/Σdays = a correction to the average needed when sample collection was not available for the entire 365 days. This may be needed when a sample is damaged in the field or the pump fails and the sample collection time is not known.

Compliance with the emissions standard will be demonstrated in accordance with guidance contained in 40 CFR 61.108 (b)(5)(iv) using the following equation:

$$\sum\left[\begin{array}{l}\left(\frac{C_i - AVG_{U-234}}{7.7E-15}\right)+\left(\frac{C_i - AVG_{U-235}}{7.1E-15}\right)+\left(\frac{C_i - AVG_{U-238}}{8.3E-15}\right)+\left(\frac{C_i - AVG_{Th-228}}{3.1E-15}\right)+\\ \left(\frac{C_i - AVG_{Th-230}}{3.4E-15}\right)+\left(\frac{C_i - AVG_{Th-232}}{6.7E-15}\right)+\left(\frac{C_i - AVG_{Ra-226}}{3.3E-15}\right)+\left(\frac{C_i - AVG_{Ra-228}}{5.9E-15}\right)\end{array}\right]$$

Where:

the values in the denominator are the concentration values from 40 CFR 61, Appendix E, Table 2, (μCi/cm^3) and assumed to equate to a dose equivalent of 10 mrem/yr.

If the summation from the equation is less than one, then compliance with the 10 mrem/yr emissions criterion is demonstrated. Data calculations will be reported to the EPA by March 31 for the previous year's data.

Data Processing for UMTRCA Emissions (40 CFR 192 Subpart A)

Individual radon flux measurements in units of pCi/m^2/s off the HISS piles and general areas at SLAPS will be tabulated, and the mean for the measurements calculated in accordance with 40 CFR 61, Appendix B, Method 115.

$$J_s = \frac{J_1 x A_1 + J_2 x A_2 \ldots\ldots}{A_t}$$

Where:

J_s = mean flux for the total pile/surface of the impoundment (pCi/m^2/s),
J_I = flux measurement i (pCi/m^2/s),
A_i = area region i (m^2), and
A_t = total area of the pile/surface of the impoundment (m^2).

If the mean flux for the pile/surface impoundment is less than 20 pCi/m^2/s then compliance with the standard is met and the pile liner is effectively retaining the radon.

The radon alpha track detectors located on the site perimeter will be used to determine if the site meets the 0.5 pCi/L limit. The detector results will be tabulated and a yearly average for each location calculated. The annual average concentration is then compared to the 0.5 pCi/L standard contained in 40 CFR 192 Subpart A. If each of the location's annual concentrations is less than 0.5 pCi/L, then compliance is demonstrated.

Data Processing for Dose to Members of the Public (10 CFR 20.1301)

Since the limit of 100 mrem/yr in this standard excludes background, net measurements will be calculated for all measurements. This will be very important since radon naturally present in the background typically accounts for greater than 100 mrem/yr exposure.

The total effective dose equivalent (TEDE) from direct exposure and air pathways is calculated as the sum of the net TLD measured dose, the net radon measured dose, and the airborne particulate radionuclide dose. The highest measurement location at each site will be used to demonstrate compliance.

$$TEDE = DDE + CEDE_{radon} + \sum CEDE_{i}$$

Where:

$TEDE$ = Total effective dose equivalent, mrem

DDE = Deep dose equivalent (highest net TLD), mrem

$CEDE_{radon}$ = Committed effective dose equivalent from radon calculated from alpha track measurements, mrem

$CEDE_{i}$ = Committed effective dose equivalent from nuclide i, calculated from particulate air concentrations, mrem

3.1.7.1 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.

3.1.7.2 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 follow:

- Identify potential impacts to ground-water quality resulting from remedial action activities.
- Ensure compliance with applicable or relevant and appropriate requirement (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 geology and hydrogeology of each site can by found in prior decision documents, and the EMG (1999c).

Objectives for SLDS:

- Evaluate ground-water contaminant occurrence and migration within the lower hydrostratigraphic zone (B Unit); emphasis on the uppermost B unit 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 reevaluation process.
- Resolve the ground-water head, relative to that of the Mississippi River.

Ground water at the SLDS is found within three horizons (or hydrostratigraphic units, HZs): the upper soil unit, referred to as the A Unit; the lower soil unit, referred to as either the Mississippi River Alluvial Aquifer or the B Unit; and the limestone bedrock, referred to as the C Unit (Figure 3-5). The A Unit 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. The long-term industrial filling of the site and the current industrial setting are also factors in the consideration that the A Unit, the most shallow hydrostratigraphic horizon, is not a drinking water resource. The use of the B Unit 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 B Unit. However, the B Unit does qualify as a potential source of drinking water under the *Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy* (USEPA, 1986). The C unit surface slopes from the western uplands to the river. The limestone bedrock has a nearly horizontal bedding, which slopes only a few degrees to the east. Solution channels and fractures dominate the water routes through the bedrock. Uplands recharge of the C unit flows downgradient to the river valley providing recharge to the B Unit, the Mississippi Alluvial Aquifer. The C unit would be an unlikely water supply source, as it is deeper and a less productive hydrostratigraphic unit.

The EMP 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. These methodologies were presented in December 1999.

Objectives for St. Louis Airport Site and Vicinity Properties:

- 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 reevaluation.

There are five hydrostratigraphic zones (HZ) recognized beneath SLAPS. The surficial deposits include topsoil and anthropogenic fill (Unit 1) and the Pleistocene glacially-related

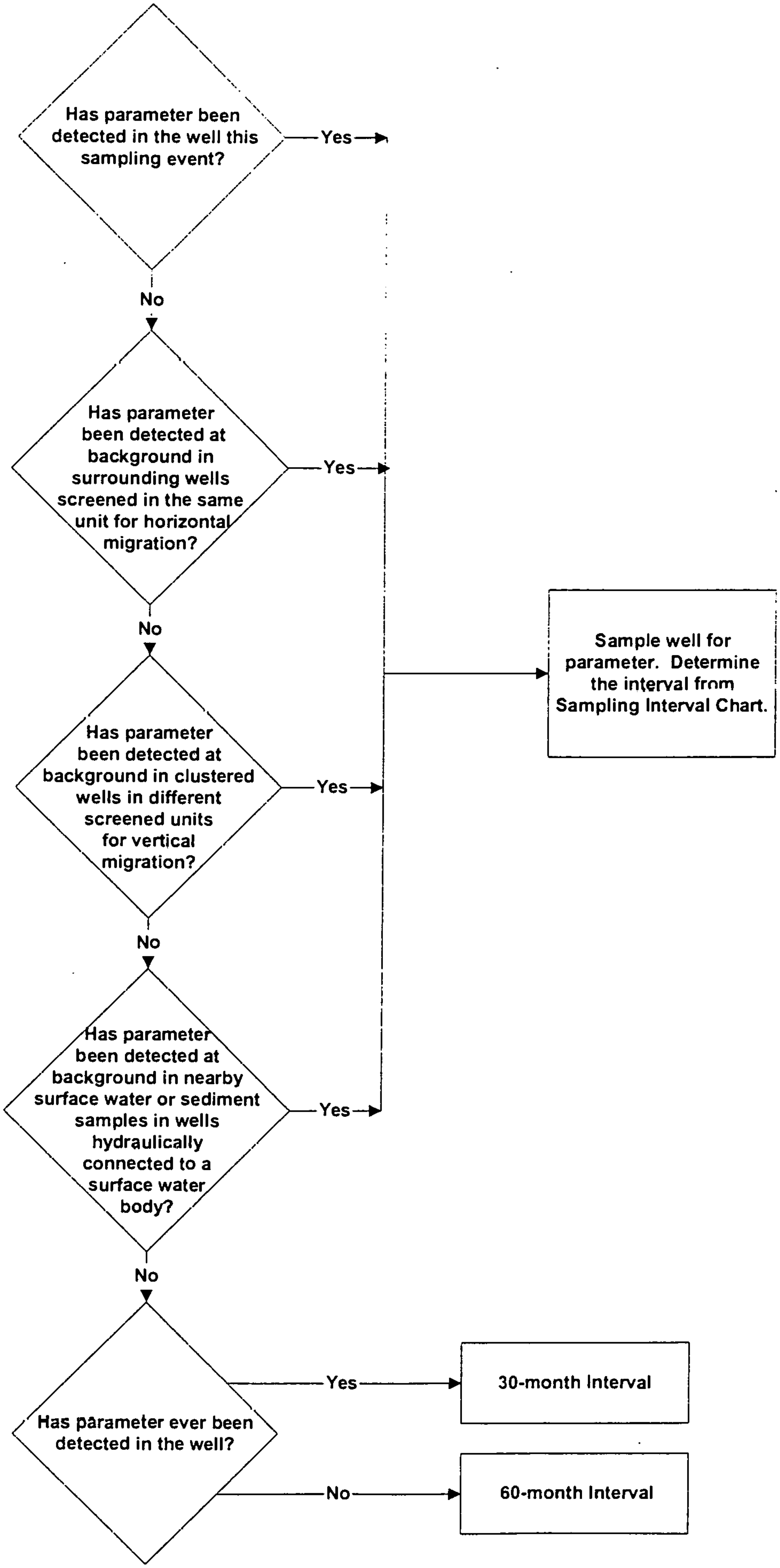


Chart 3-1. Sampling Parameter Chart

2.4.5-Trichlorophenol. 2-Chloronaphthalene, 2-Nitroaniline. Dimethylphthalate. Acenaphthylene. 2.6-Dinitrotoluene. 3-Nitroaniline. Acenaphthene. 2.4-Dinitrophenol. 4-Nitrophenol. Dibenzofuran. 2.4-Dinitrotoluene. Diethylphthalate. 4-Chlorophenyl-phenyl ether. Fluorene. 4-Nitroaniline, 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.

6. **Geochemical Parameters** include Alkalinity. Nitrate as N. Sulfate. Chloride. Sodium. Potassium. Calcium. Magnesium. Iron.

7. **Herbicides** include 2.4-D, 2.4-DB. 2.4.5-TP (Silvex), 2.4.5-T. Dalapon. Dicamba, Dichloroprop. Dinoseb. MCPA. MCPP. 4-Nitrophenol. Pentachlorophenol.

8. **Contaminant Migration Specific Indicator Parameters TBD.**

The EMG well network for HISS is identified in Figure 3-9. 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. These methodologies were presented in December 1999.

3.2.2 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 of this Environmental Monitoring Implementation Plan (EMIFY), with the exception of St. Louis Downtown Site (SLDS). The Record of Decision (ROD) requirements determined ground-water monitoring rationale at SLDS. The programs identified in this EMIFY will be implemented after ground-water characterization activities have been completed at each site.

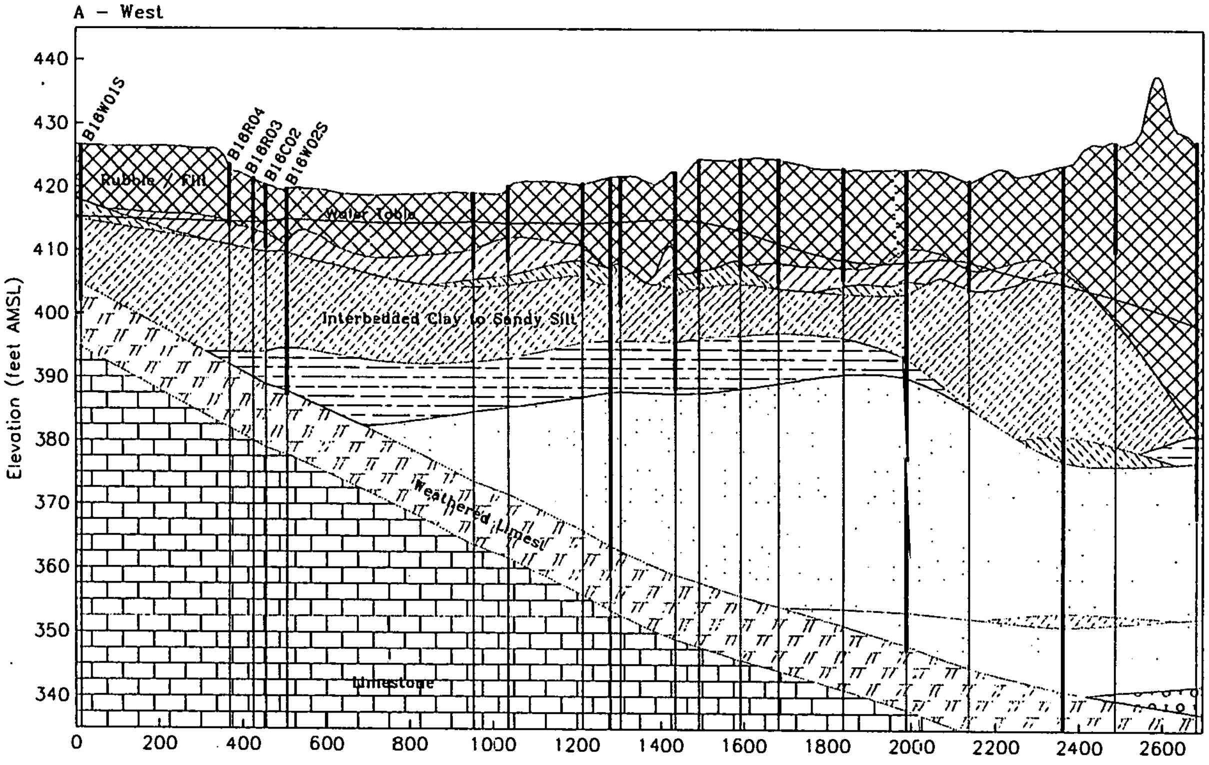
Analytes targeted for monitoring will include constituent of potential concern (COPCs) or contaminant of concerns (COCs) in regards to SLDS as identified in the Remedial Investigation/ Feasibility Study (RI/FS) and other CERCLA documents and selected indicator constituents with high mobility that may serve as early indicators of contaminant migration.

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

3.2.3 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 EMIFY monitoring well network at each site will undergo laboratory analytical analysis for the parameters were previously identified in Table 3-3.

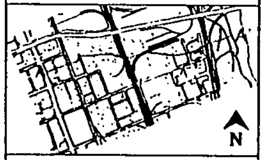
Details regarding the analytical testing methods to be used for chemical analysis of ground-water samples are presented in SAG.



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, Missouri

Drawn By: R. Smith

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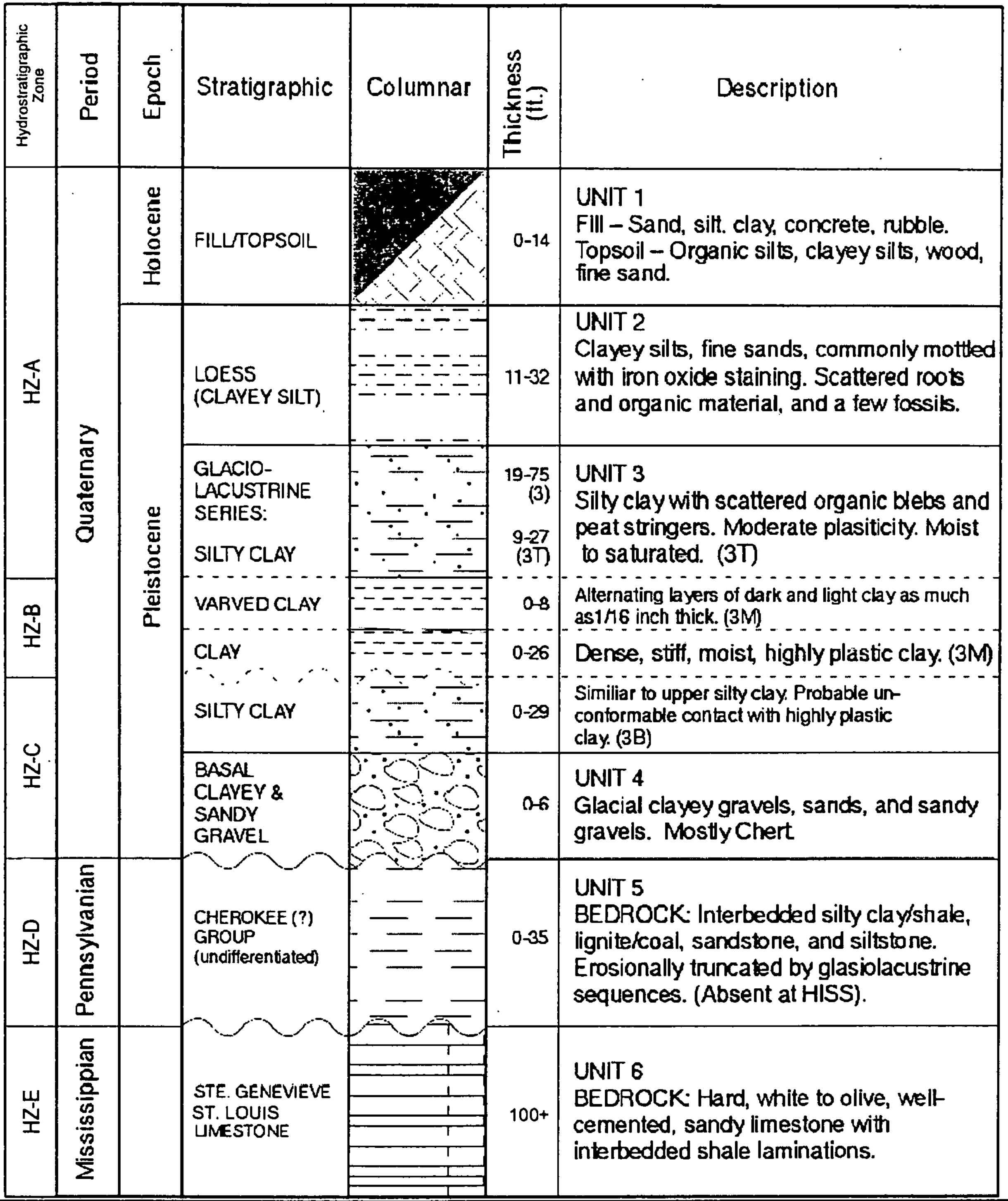
Figure 3–5. Hydrostratigraphic Cross–Section of the SLDS Area



Hydrostratigraphic Zone	Period	Epoch	Stratigraphic	Columnar	Thickness (ft.)	Description
HZ-A	Quaternary	Holocene	FILL/TOPSOIL		0-14	UNIT 1 Fill – Sand, silt. clay, concrete, rubble. Topsoil – Organic silts, clayey silts, wood, fine sand.
		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 plasiticity. Moist to saturated. (3T)
HZ-B			VARVED CLAY		0-8	Alternating layers of dark and light clay as much as1/16 inch thick. (3M)
			CLAY		0-26	Dense, stiff, moist, highly plastic clay. (3M)
HZ-C			SILTY CLAY		0-29	Similiar to upper silty clay. Probable unconformable contact with highly plastic clay. (3B)
			BASAL CLAYEY & SANDY GRAVEL		0-6	UNIT 4 Glacial clayey gravels, sands, and sandy gravels. Mostly Chert.
HZ-D	Pennsylvanian		CHEROKEE (?) GROUP (undifferentiated)		0-35	UNIT 5 BEDROCK: Interbedded silty clay/shale, lignite/coal, sandstone, and siltstone. Erosionally truncated by glasiolacustrine sequences. (Absent at HISS).
HZ-E	Mississippian		STE. GENEVIEVE ST. LOUIS LIMESTONE		100+	UNIT 6 BEDROCK: Hard, white to olive, well-cemented, sandy limestone with interbedded shale laminations.

SOURCE: BNI 1993.

NOT TO SCALE

FUSRAP

St. Louis Airport Site
Environmental Surveillance
St. Louis, Missouri

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

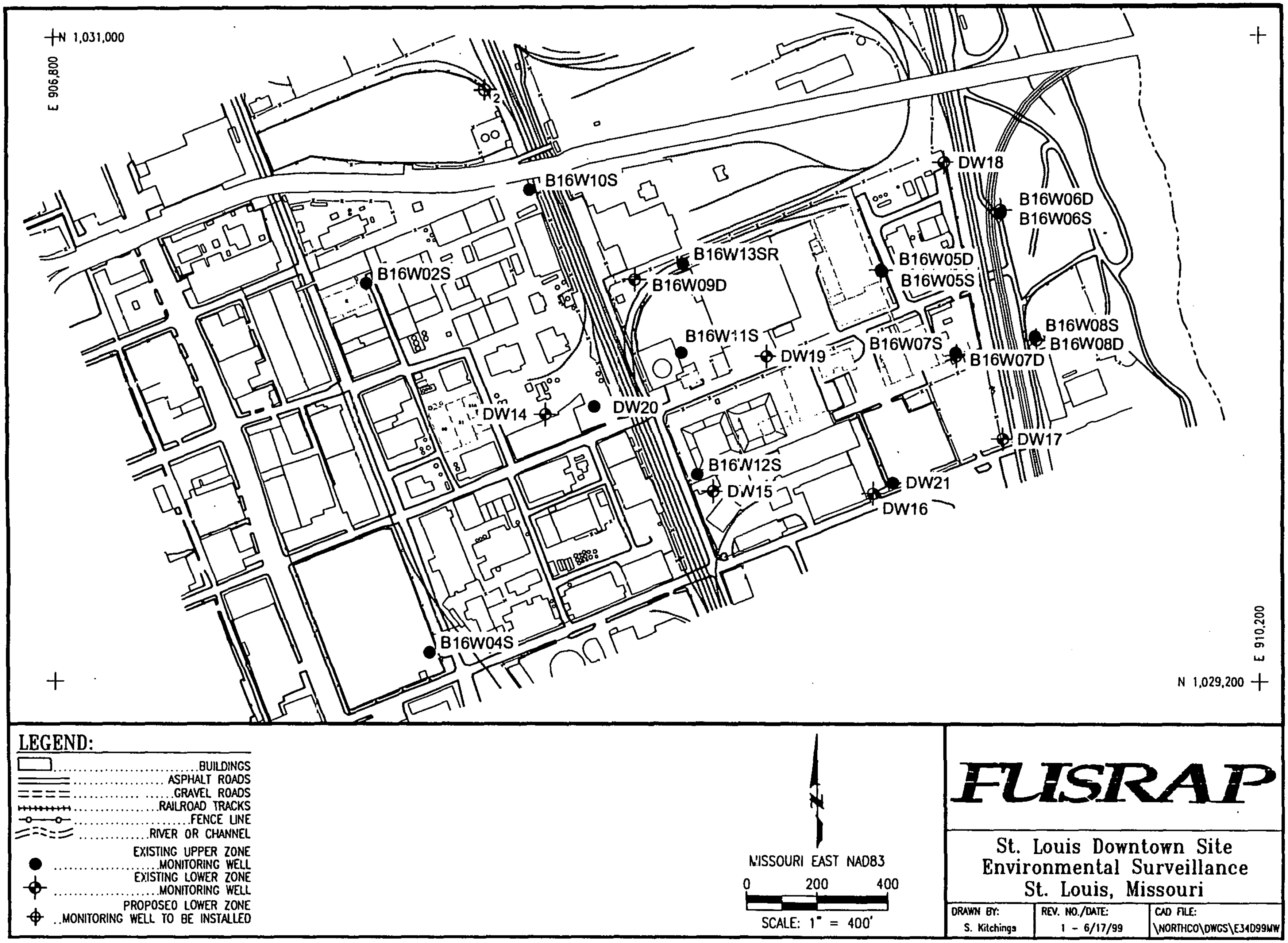


Figure 3-7. Monitoring Well Locations for Ground-water Monitoring at SLDS

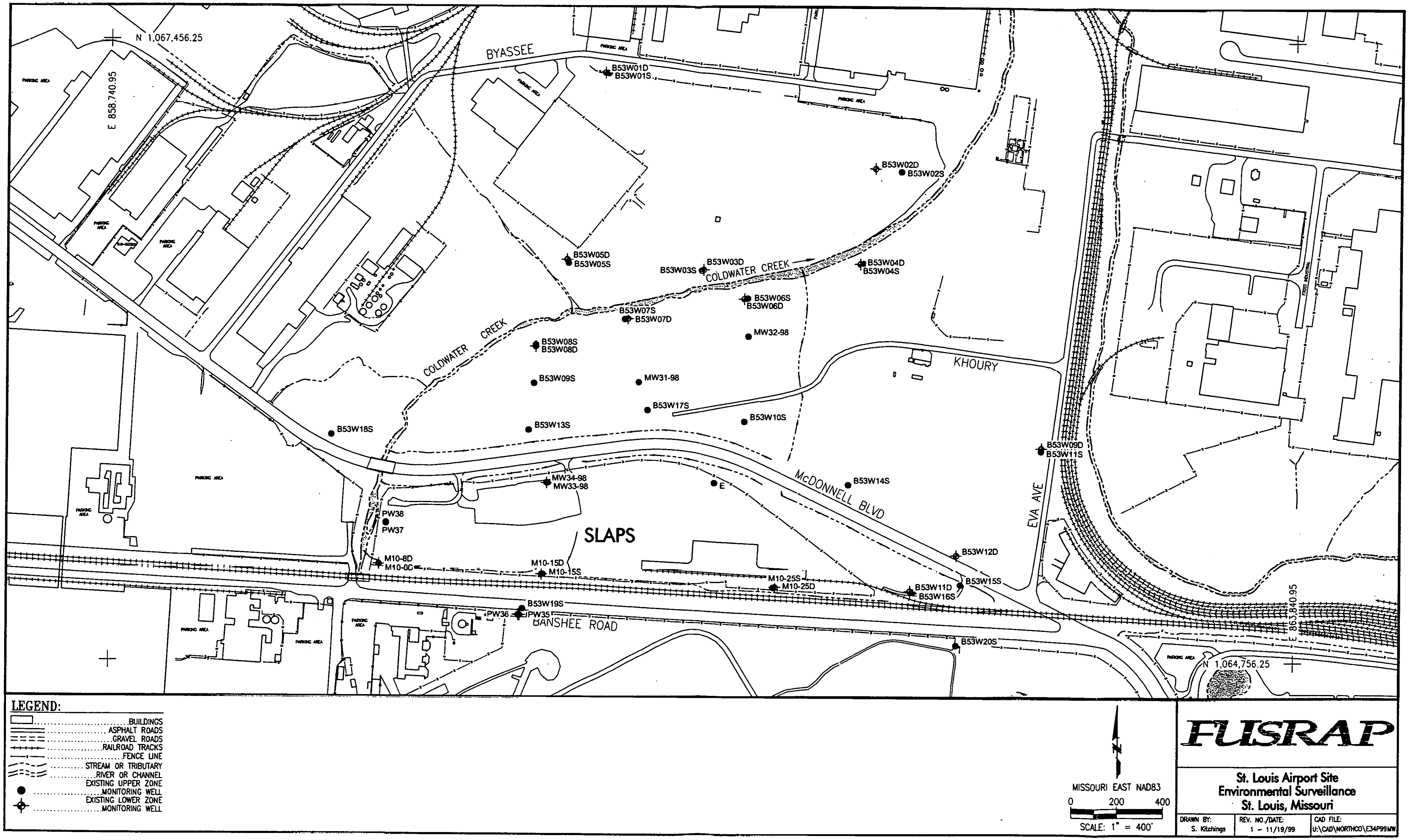
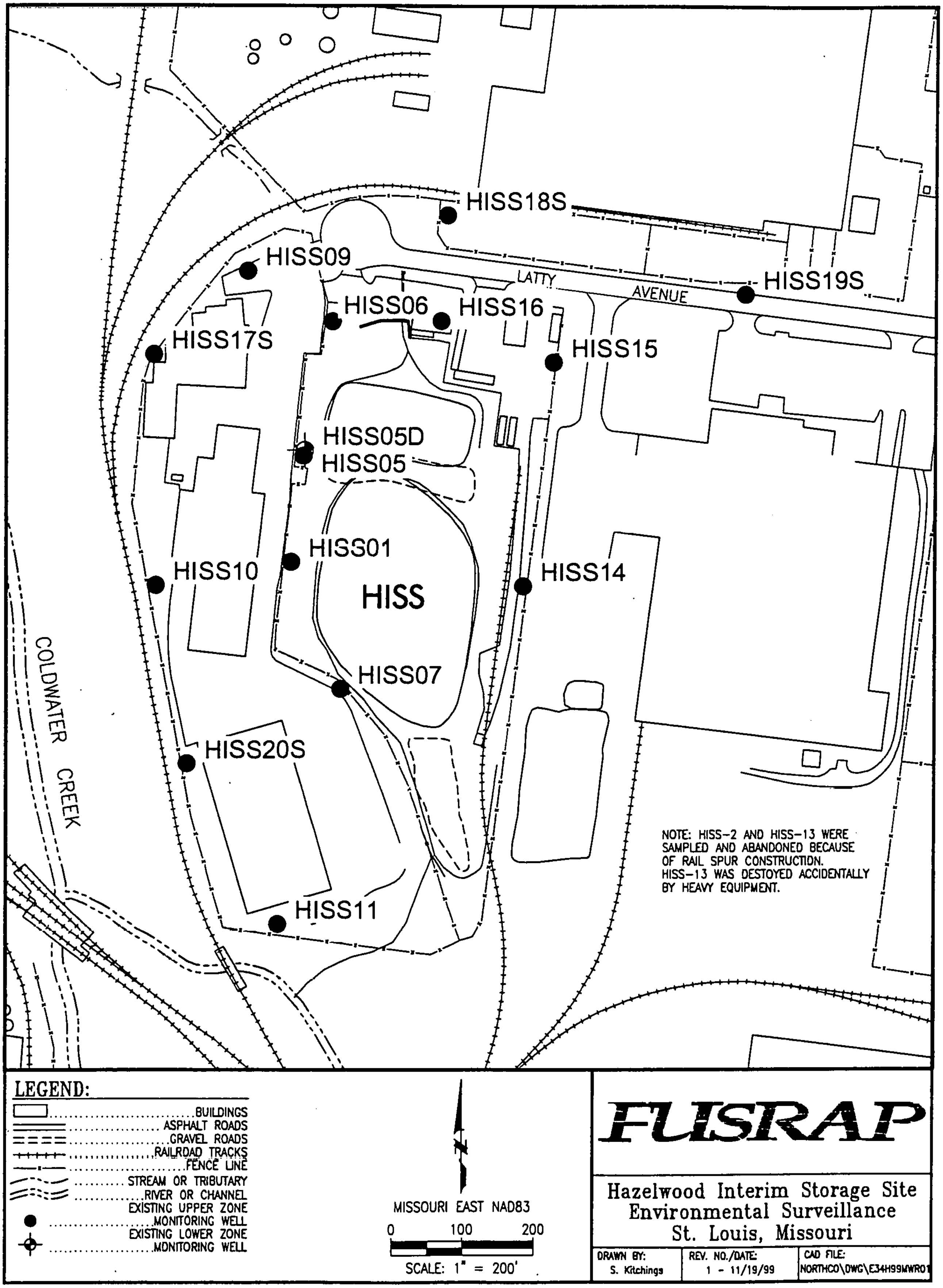


Figure 3-8. Monitoring Well Locations for Ground-water Monitoring at SLAPS and Vicinity Properties



NOTE: HISS-2 AND HISS-13 WERE SAMPLED AND ABANDONED BECAUSE OF RAIL SPUR CONSTRUCTION. HISS-13 WAS DESTOYED ACCIDENTALLY BY HEAVY EQUIPMENT.

Figure 3-9. Monitoring Well Location for Ground-water Monitoring at HISS

Purging and sampling of ground-water monitoring wells will be accomplished using 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 addition, field measurements of headspace gas concentration and radioactivity will be recorded during collection of ground-water samples.

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. All ground-water samples collected for chemical analysis of metal parameters will be collected filtered, and unfiltered samples, if turbidity is above 50NTU.

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 applicable or relevant and appropriate requirement (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 SLDS:

- Monitoring storm-water discharge in accordance with MSD issued discharge authorization letter. The SLDS Record of Decision (ROD) selected excavation of accessible soils from the Plant areas and sediments within the on-site sewers. During these activities, run-on and infiltration that enters the excavation, water from soil drying, and decontamination water will result, that may be discharged to the publicly owned treatment works (POTW) under a separate permit specific to soil remedial actions.

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 in 1-3.

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. These locations were previously shown on Figure 1-4.

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 best management practice (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 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.

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. Surface Water and Sediment Monitoring Location, Frequencies, and Parameters

Site	Monitoring Location	Sample ID	Media/Sample Type	Frequency[a]	Parameters[b]	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
SLAPS	#001	PN01	Storm water/grab	Monthly – list 2	List 2	NPDES	Active	Permit: PENDING
	#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: ug/L – once/month
	Sedimentation Basin	P004	Grab	Weekly (see notes: List 1)	Radionuclide vs TSS	EMG		PCi/L – per event
CWC	Location 1	CWC002	Surface water-sediment	Semi-annual – list 3	List 3	EMG	Inactive	
	Location 2	CWC003	Surface water-sediment	Semi-annual – list 3	List 3	EMG	Inactive	
	Location 3	CWC004	Surface water – sediment	Semi-annual – list 3	List 3	EMG	Inactive	
	Location 4	CWC005	Surface water – sediment	Semi-annual – list 3	List 3	EMG	Inactive	
	Location 5	CWC006	Surface water – sediment	Semi-annual– list 3	List 3	EMG	Inactive	
	Location 6	CWC007	Surface water – sediment	Semi-annual– list 3	List 3	EMG	Inactive	
SLDS								Currently not taking samples for environmental monitoring purposes

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

[a] Definition of Frequency Lists

List 1 includes Settleable solids-monthly; Total rainfall – daily (24-hr); Flow rate – daily (24 hr); 1st quarter – Mar; 2nd quarter – Jun; 3rd quarter – Sept; 4th 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.

[b] Definitions for Parameters

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

2. **Vocs** 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,-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, Freon

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

4. **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, Gamma-Chlordane, Toxaphene, Arochlor-1016, Arochlor-1221, Arochlor-1232, Arochlor-1242, Arochlor-1248, Arochlor-1254, Arochlor-1260

Definition of Parameter Lists

List 1 includes Rainfall (in), Flow (MGD), Settleable solids (mL/L/hr), Specific conductance (umhos/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 (ug/L), Radium (total) (pCi/L and (ug/L), Thorium (total) (pCi/L) and (ug/L), Uranium (total) (pCi/L) and (ug/L), Protactium 231 (pCi/L), Actinium 227 (pCi/L), Radon (pCi/L), pH.

List 3 includes TAL metals, SVOCs, VOCs, Chloride, Nitrate, Sulfate, Oil and grease, Th-230, Th-232, Ra-226, Ra-223, U-234, U-238, Field Parameters, TSS.

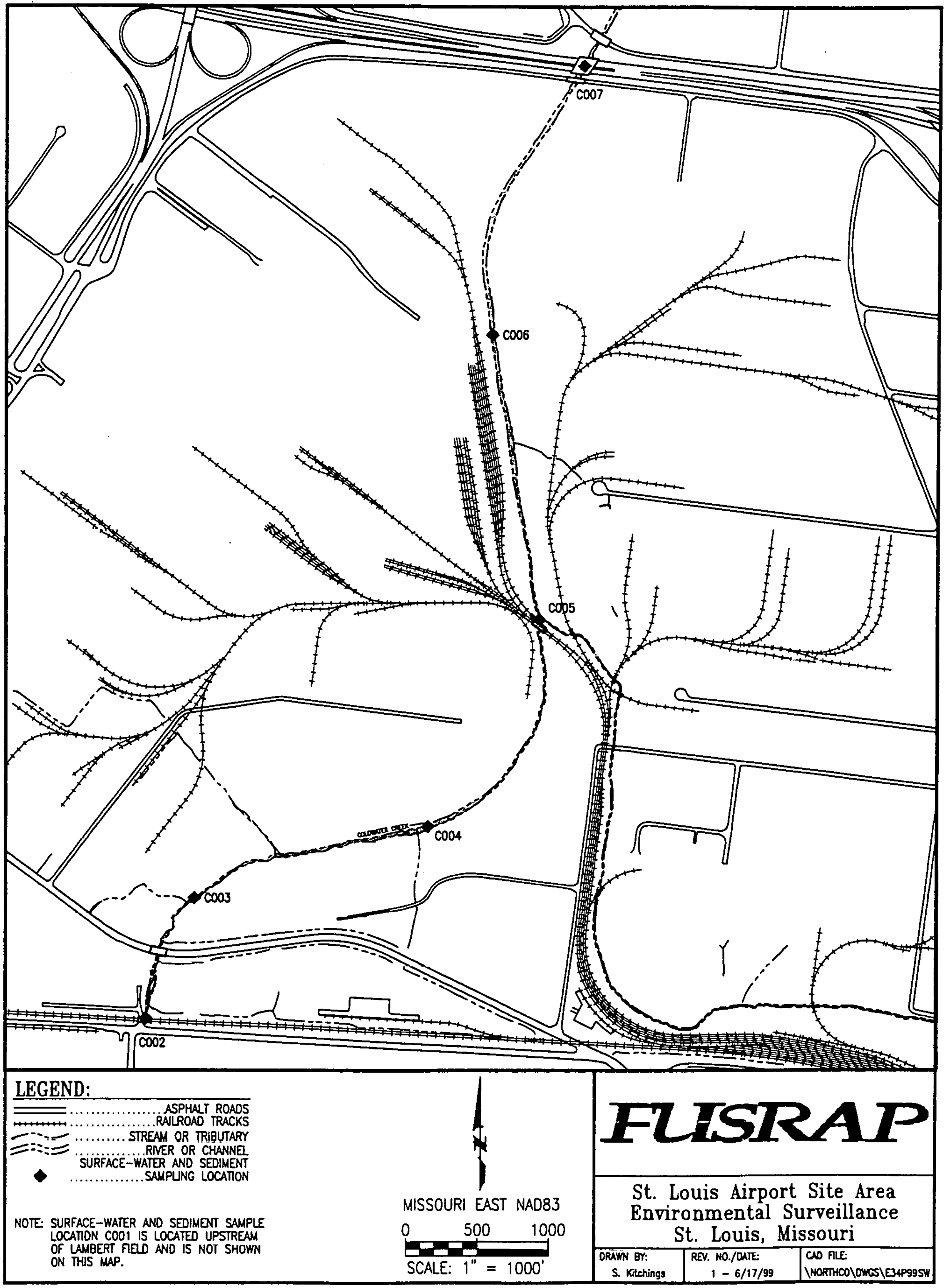


Figure 3-10. Surface-water and Sediment Sampling Locations at Coldwater Creek

4.0 PROGRAM PROTOCOLS

4.1 ORGANIZATION

The 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, 1999b). 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 specificd 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 EMIFY will be managed in accordance with the requirements of the SAG.

5.0 REFERENCES

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Cataloging Form

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L. *Author:* ____________________

M. *Author's Company:* PM-R

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R. *Include in the ARF?* ☐

S. *Include in the AR?* ☐

T. *Filed as Confidential/Privileged?* ☐

U. *Document Format (Choose one):*
- Paper ☑
- Electronic ☐
- Photographic ☐
- Audio-visual ☐
- Cartographic/Oversize ☐
- Microform ☐

V. *Filed in AR Volume Number:* __________

W. *Physical Location (Choose One):*
- Central Files ☑
- Records Holding Area ☐
- Microfilm Vendor ☐
- Department of Energy ☐
- In ARF ☐
- In AR ☐

X. *Associated with Document(s):* ____________________