Department of Energy
Oak Ridge Operations
Weldon Spring Site
Remedial Action Project Office
7295 Highway 94 South
St. Charles, Missouri 63304

January 6, 1992

Distribution

SMALL MAMMAL SAMPLING PLAN

The subject sampling plan is enclosed for your review. The sampling plan is prepared in response to U. S. Environmental Protection Agency requirements for establishing baseline risk assessments for biota residing on or near the Weldon Spring Site Remedial Action Project (WSSRAP), as part of the Comprehensive Environmental Response, Compensation and Liability Act Remedial Investigation/Feasibility Study process.

This plan includes sampling small mammals such as rats, mice and shrew located on WSSRAP and surrounding areas to determine general population numbers, species presence, and any abnormalities which may be occurring within individuals of these species or communities of small mammals.

If you have any comments, please contact Alan D. Gibson.

Sincerely,

Stephen H. McCracken
Project Manager
Weldon Spring Site
Remedial Action Project

Enclosure:
As stated

cc w/o enclosure:
Jim Powers, PMC

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DOE/OR/21548-248
CONTRACT NO. DE-AC05-86OR21548

SMALL MAMMAL SAMPLING PLAN

Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

DECEMBER 1991 **REV. 0**

U.S. Department of Energy
Oak Ridge Operations Office
Weldon Spring Site Remedial Action Project

DOE/OR/21548-248

Weldon Spring Site Remedial Action Project

Small Mammal Sampling Plan

Revision 0

December 1991

Prepared by

MK-FERGUSON COMPANY
and
JACOBS ENGINEERING GROUP
7295 Highway 94 South
St. Charles, Missouri 63304

for the

U.S. DEPARTMENT OF ENERGY
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PLAN TITLE: Small Mammal Sampling Plan	

APPROVALS

Department Manager	12-20-91 Date
Quality Assurance Manager	12/23/91 Date
Deputy Project Director	12-24-91 Date
Project Director	12-24-91 Date

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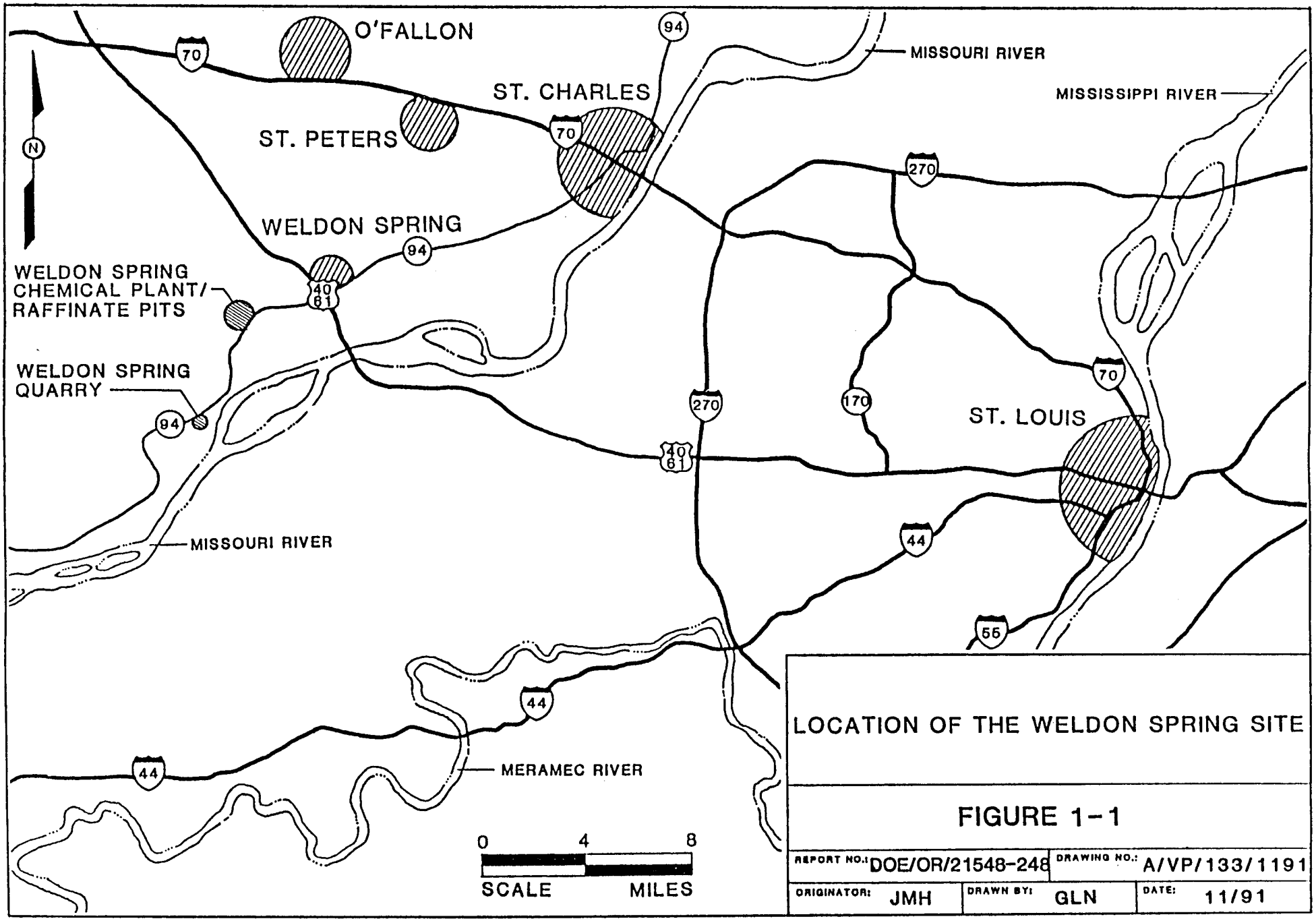
1 INTRODUCTION

The Weldon Spring Site Remedial Action Project (WSSRAP) is being conducted as a Major Systems Acquisition under the Surplus Facilities Management Program (SFMP) of the U.S. Department of Energy (DOE). The major goals of the SFMP are to eliminate potential hazards to the public and the environment that are associated with contamination at SFMP sites and to make surplus real property available for other uses to the extent possible. The WSSRAP consists of two main areas. The Weldon Spring Chemical Plant (WSCP) and the Weldon Spring Quarry (WSQ) (Figure 1-1).

The following sample plan is prepared in response to U.S. Environmental Protection Agency (EPA) requirements for establishing baseline risk assessments for biota residing on or near the Weldon Spring Site Remedial Action Project (WSSRAP), as part of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS) process. This study comprises a portion of the comprehensive, year-round program to monitor the impact of the contaminants from the Weldon Spring site (WSS) on the surrounding region's groundwater, surface waters, and soil properties through multiple pathways, including monitoring for potential exposure to non-receptor human populations. The chemical plant area has largely been characterized as part of the WSCP RI/FS investigation. The WSCP is one of four separate operable units (SOUs) that have been created in order to facilitate the remedial decision making. The other SOUs are quarry bulk wastes, site groundwater, and quarry residuals area. A portion of this sampling plan is directed at the quarry residual areas and is part of the ecological characterization requirements for the residual RI/FS. The quarry residual area includes the quarry proper and surrounding vicinity properties including groundwater. The regulatory requirements are detailed in the *Weldon Spring Quarry Residual Work Plan* (MKF and JEG 1991a). The other areas included in this plan are being studied as part of the on-going environmental monitoring program.

This plan includes sampling small mammal populations located on the WSS and surrounding areas, to determine general population numbers, species presence, and any abnormalities which may be occurring within individuals of these species or communities of small mammals. Small mammals such as mice, rats, and shrew serve as prey species to indigenous and transient species, some of which may be federally or state endangered. Additionally, these small mammals utilize the same resources as larger species, such as deer, which are hunted within this region and are part of the human food chain.



LOCATION OF THE WELDON SPRING SITE

FIGURE 1-1

REPORT NO.: DOE/OR/21548-248	DRAWING NO.: A/VP/133/1191	
ORIGINATOR: JMH	DRAWN BY: GLN	DATE: 11/91

As indicated by Douglas (1989), rodents are recommended for use in ecological monitoring at the population level because they are small, easy to handle, and spend their entire life cycle within a relatively small area. Additionally, the majority of avian and terrestrial carnivores, to a greater or lesser degree, utilize a rodent prey base (Douglas 1989).

Small mammals are prey for birds, snakes, and other mammals. The American kestrel, red-tailed hawk, barred owl, eastern screech owl, and the great horned owl have been sighted in the study area (MKF and JEG 1991b). Small mammals make up no less than 70% of these species' diet (Toland 1985, Wilson 1984). Other birds that prey on small mammals that potentially occur in the study area are listed on the State and/or Federal list of threatened and/or endangered species (Table 1-1).

Snakes that are known to occur within the study areas and prey on small mammals include: the black rat snake, bull snake, kingsnake, red milk snake, eastern yellowbelly racer, copperhead, and the timber rattlesnake (Johnson 1980). Larger mammals include the coyote, red fox, gray fox, skunk, and bobcat. Of the mammals that may be encountered at any of the sites, only the long-tailed weasel is listed on the State list as "rare."

Biouptake studies are conducted to determine possible exposure pathways of radiological and chemical contamination to humans by ingestion of potentially contaminated fish and game. The Project Management Contractor (PMC) began biouptake studies at the WSS in 1987. These studies have included mammals (rabbits, squirrels, and deer), reptiles (snapping turtle),and fish (large mouth bass, crappie, catfish, and sunfish). These studies are typically planned sampling events, but opportunistic sampling is also incorporated into the program. No significant biological uptake of radiological contaminants has been detected in either the fish or small mammals. Fish were also sampled for metals and showed low concentrations of chromium, arsenic, lead, and other metals which were slightly above the detection limit. These concentrations of metals are not a product of the WSS, but have been shown to be attributable to normal bioaccumulation. Radionuclide bioaccumulation factors were low, and conservatively overestimated doses would still result in negligible exposures (MKF and JEG 1989a).

A variety of wastes are present at the WSSRAP, and have been largely identified at the chemical plant during past site investigations and history of use at the WSS. The groundwater, surface water, springs and soils from various locales on the WSSRAP exhibit various amounts of nitroaromatics, inorganic ions, and radiological contaminants. Detailed information can be

Table 1-1 List of Threatened or Endangered Birds of Prey Potentially Occuring in the Study Area

Common Name	Diet on Small Mammals	Abundance[1]	State Status[2]	Federal Status[3]
Bald Eagle	Not usually small mammals	r	E	E
Cooper's Hawk	60-80%	ca	R	-
Northern Harrier	15-25%	u	E	-
Sharp-shinned Hawk	2-6%	ca	R	-
Red-shouldered Hawk	40-60%	r	WL	-
Mississippi Kite	10%	-	R	-

Notes:

[1] Abundance (MDOC 1991a)

u = uncommon, fairly frequent reports, in small numbers
r = rare, sparingly recorded but generally every year
ca = casual, has been recorded but not every year

[2] State Status (MDOC 1991b)

E = Endangered
R = Rare. Rare indicates present in small numbers. If environment worsens, status in Missouri could deteriorate to Endangered
WL = Watch list. Not currently rare or endangered, but has a restricted distribution or has experienced sufficient decline to indicate it may soon become Rare or Endangered.

[3] Federal Status (MDOC 1991b)

E = Endangered throughout range.

obtained in the *Annual Site Environmental Report* (MKF and JEG 1991c) and the *Draft Remedial Investigation Report for the Weldon Spring Site* (MKF and JEG 1991d). As part of the quarry residuals RI/FS investigation, soil, surface water, and groundwater will also be characterized for contaminates. Details of this program are outlined in the *Weldon Spring Quarry Residual Work Plan* (MKF and JEG 1991a).

1.1 Purpose

The purpose of this sampling plan is to determine if contaminants, primarily radionuclides, may be effecting small mammal populations utilizing the Weldon Spring site and vicintiy properties.

Field monitoring of resident small mammal populations can play a major role in defining the extent and scope of environmental impact, because:

- Resident organisms are continuous monitors of environmental quality.
- Accurate qualitative field assessments of natural populations directly measure adverse effects of the environmental parameters.
- Data is amenable to statistical analysis for interpretation.

1.2 Scope of Work

This sampling plan defines field methods for: measuring small mammal populations, obtaining small mammal samples, sample selection, analytical requirement and methods, and quality control measures.

Sampling of small mammal populations will occur during two distinct sampling seasons: winter (February 1992) and spring (April - May 1992). Nineteen sampling sites have been selected as representative of both control and potentially contaminated areas.

Because this will be a very limited study, it will not be possible to detect differences in population densities or fluctuations, nor to accurately assess impact. However, the utilization of background areas selected for the close similarity to the possibly-impacted areas will provide a relative comparison. As noted in an U.S. Environmental Protection Agency (EPA) Risk Assessment Forum, estimation of animal numbers at any one point in time is difficult. Ideally, population surveys should be based on several years of correlative background data and be conducted over an extended time frame, but in most instances this is cost-prohibitive (EPA 1991). The goal is to determine the presence and useage of the area by small mammals and their potential effect on threatened and/or endangered species and game species.

1.3 Objectives

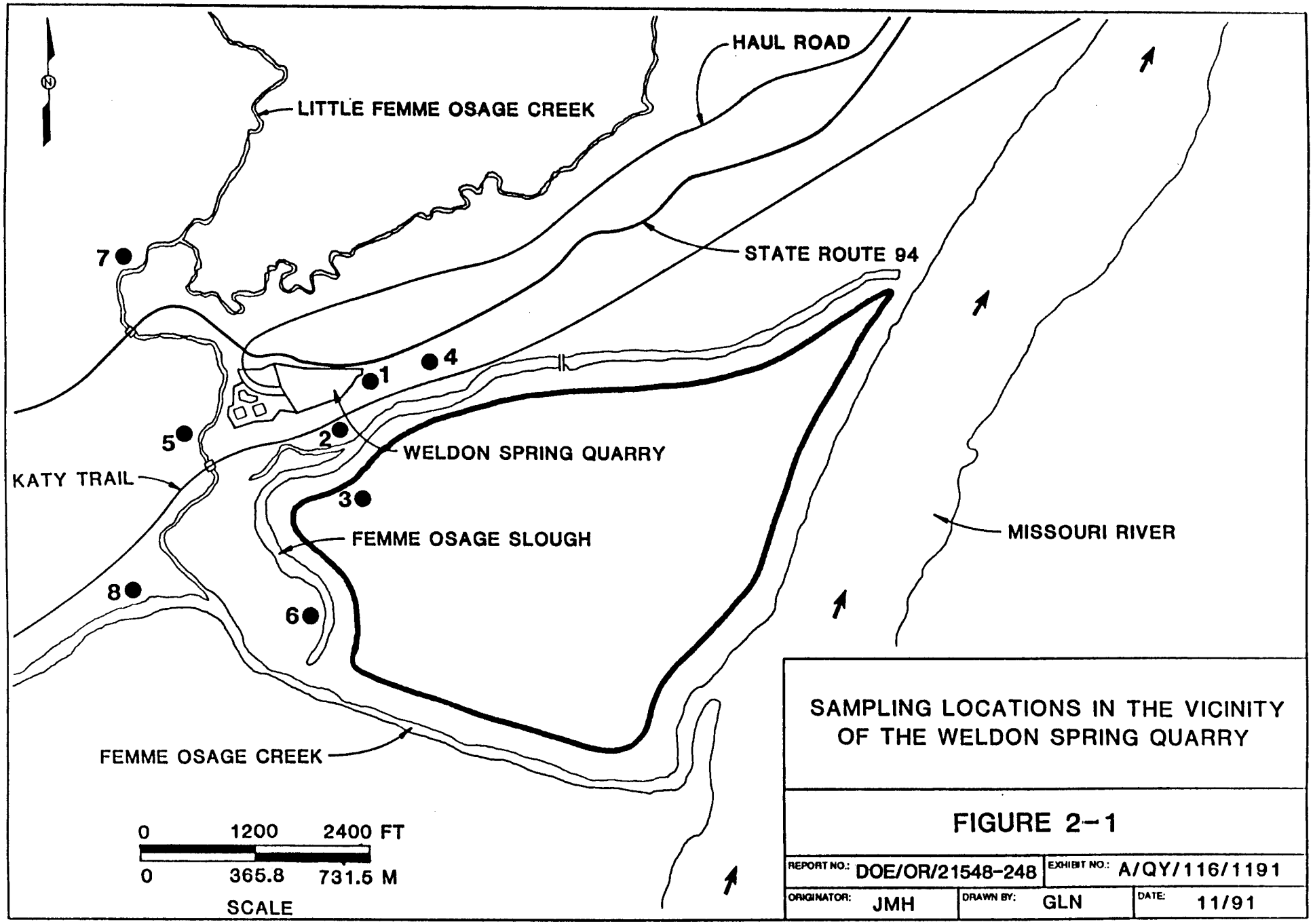
Sampling will be conducted to achieve the following objectives:

- Provide a representative sampling of the taxa of small mammals present on the WSS and the surrounding area to determine approximate population numbers and genera represented.
- Determine usage of study areas by small mammals.
- Characterize background radionuclide levels in resident small mammal populations.
- Continue monitoring of the Weldon Spring Chemical Plant.
- Determine the concentration of radiological residues in selected tissues of resident small mammals located on or near study sites.
- Determine whether tissue obtained from small mammals located within the study areas contain significantly higher levels of radionuclides in excess of background.

2 SAMPLE LOCATION AND IDENTIFICATION

Sites of collection transects are outlined on Figures 2-1, 2-2, 2-3, and 2-4, and include:

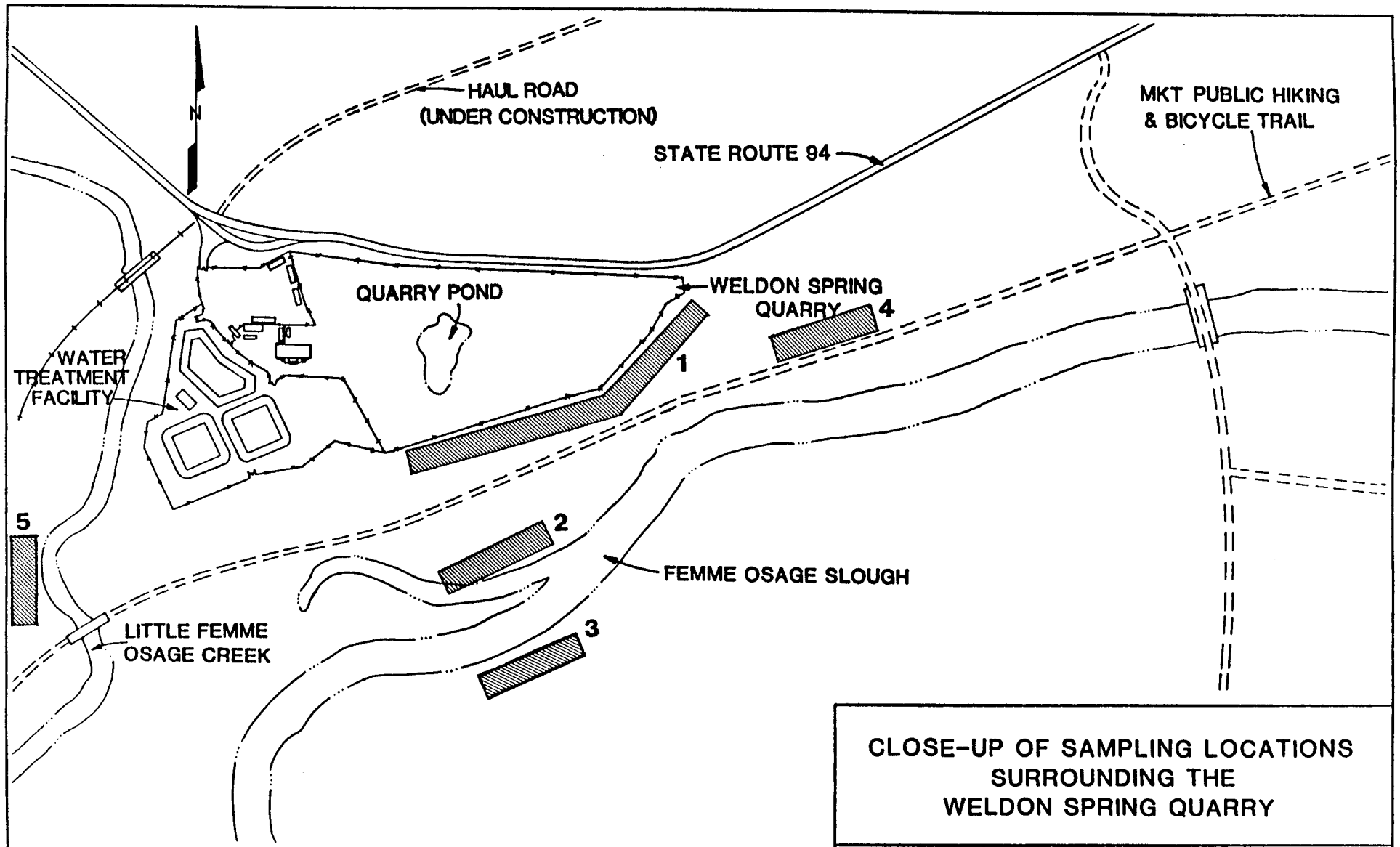
- Site No. 1, perimeter of Weldon Spring Quarry (WSQ) fence.
- Site No. 2, vicinity property No. 9.
- Site No. 3, Agricultural fields.
- Site No. 4, upper southeast drainage of WSQ toward vicinity property No. 9.
- Site No. 5, Little Femme Osage Creek drainage.
- Site No. 6, Bottomland Forest of the southern arm of the Femme Osage Slough.
- Site No. 7, background locality for Sites Nos. 4 and 7.
- Site No. 8, background locality for Site No. 2.
- Site No. 9, upper southeast drainage of Weldon Spring Chemical Plant (WSCP) toward Missouri River.
- Site No. 10, lower southeast drainage of WSCP toward Missouri River.
- Site No. 11, background for Sites Nos. 12 and 13.
- Site No. 12, bottomland palustrine forest near Ash Pond.
- Site No. 13, mixed deciduous (upland) forest, near North Dump
- Site No. 14, Frog Pond and drainage



SAMPLING LOCATIONS IN THE VICINITY OF THE WELDON SPRING QUARRY

FIGURE 2-1

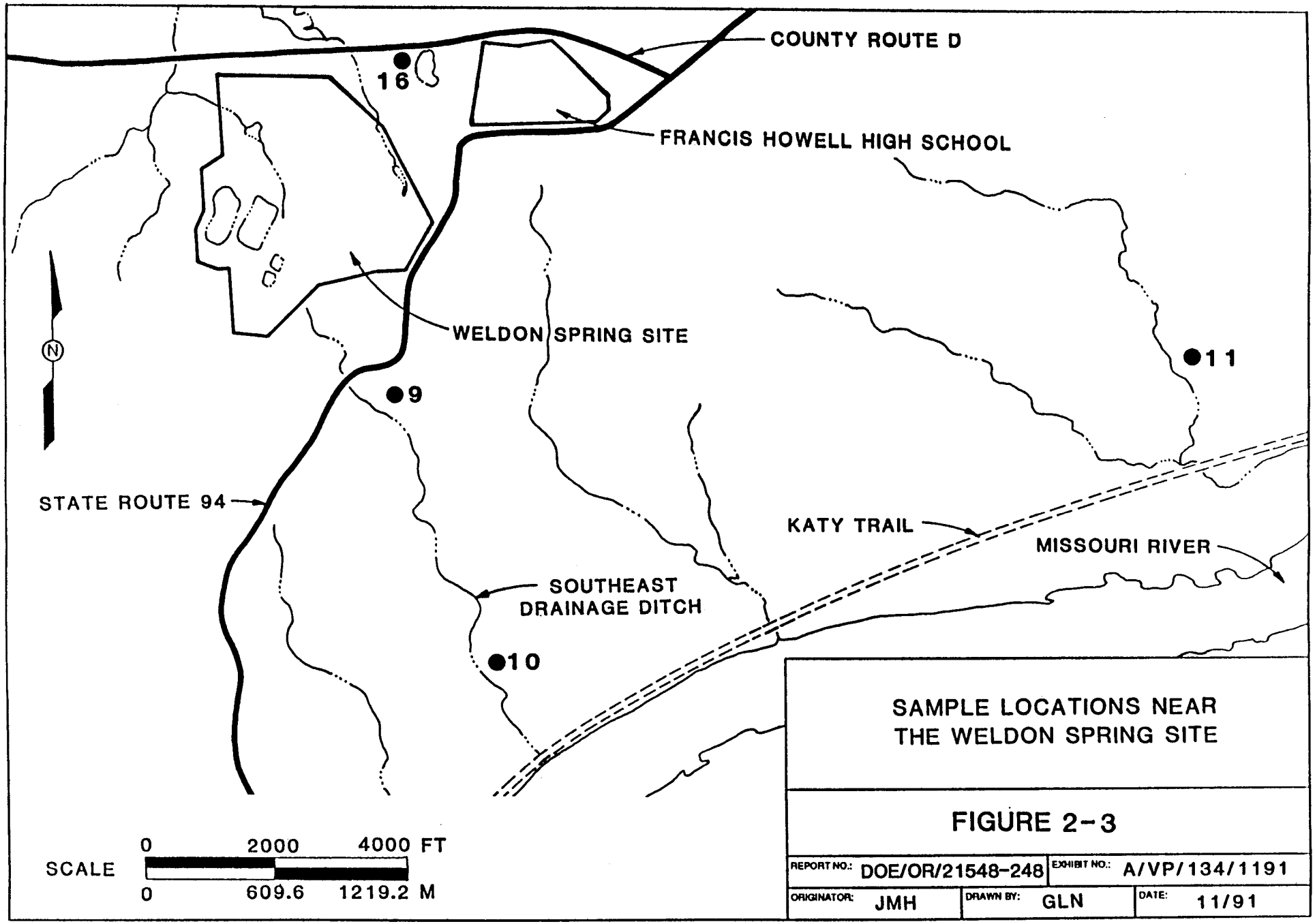
REPORT NO.: DOE/OR/21548-248	EXHIBIT NO.: A/QY/116/1191		
ORIGINATOR: JMH	DRAWN BY: GLN	DATE: 11/91	



CLOSE-UP OF SAMPLING LOCATIONS
SURROUNDING THE
WELDON SPRING QUARRY

FIGURE 2-2

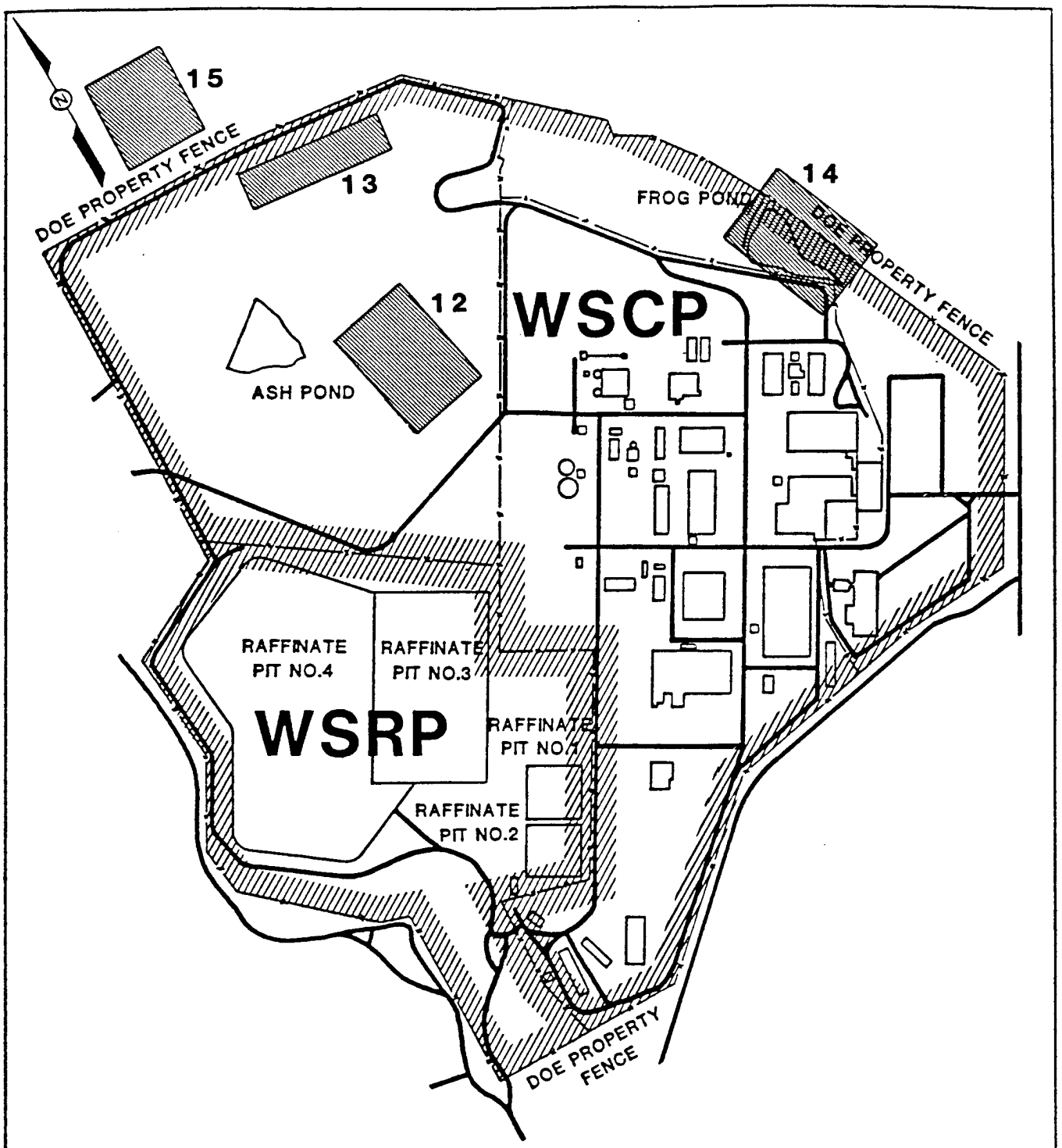
REPORT NO.:	DOE/OR/21548-248	EXHIBIT NO.:	A/QY/117/1191		
ORIGINATOR:	JMH	DRAWN BY:	GLN	DATE:	11/91



SAMPLE LOCATIONS NEAR THE WELDON SPRING SITE

FIGURE 2-3

REPORT NO.: DOE/OR/21548-248		EXHIBIT NO.: A/VP/134/1191	
ORIGINATOR: JMH	DRAWN BY: GLN	DATE: 11/91	



SCALE 0 500 1000 FT
0 152.4 304.8 M

SAMPLING LOCATIONS AT THE WELDON SPRING CHEMICAL PLANT

FIGURE 2-4

REPORT NO.	DOE/OR/21548-248	EXHIBIT NO.	A/CP/165/1191		
ORIGINATOR	JMH	DRAWN BY	GLN	DATE	11/91

- Site No. 15, Ash Pond drainage
- Site No. 16, Lake No. 10, background for Site No. 3

All samples will be collected, identified, and recorded in the same manner.

3 SAMPLE DESIGN AND METHODS

For this study, Sherman live traps are specified, for they are inexpensive, easily transported and set, and can be thoroughly cleaned following recovery from contaminated sites. Trap placement will be along a 100 m transect and the majority of captured small mammals will be returned alive to the field. For purposes of indicating that an animal has been captured, sequentially numbered humane ear tags will be used.

Each sampling period will consist of two trapping days, a two weeks, intervals followed by two more trapping days, for a total of 4 trapping days per period. Live trapping will occur 4 days during February 1992 (1420 trap nights) and 4 days during April - May 1992 (1420 trap nights) for a total of 2840 trap nights. On Day 1 of a given sampling period, the captured animals will have the appropriate data recorded, be ear tagged with sequentially numbered tags, and released. On Day 2, captured animals will again have the appropriate data recorded and released. The last trapping day of each sampling period, 10 snap traps per transect will be set for obtaining samples. The number of snap traps may be increased or decreased by the subcontractor depending upon the densities encountered the pervious trapping days. If possible, four animals (preferably two male, two female) per genera will be selected at random for biouptake of radionuclides. During dissection, reproductive status, litter size, and any abnormalities will be recorded (for each individual) in the logbook. Whole small mammals and organs will be stored at 4°C and sent to an analytical laboratory to be analyzed for total uranium, Thorium 228/230/232 and Radium 226/228. If visible dirt remains, whole specimens will be rinsed off with deionized water. The decision to composite samples will be made by the Contractor at the time of dissection when the amount of samples collected can be assessed. Samples will be placed in plastic bags and labeled. Labels will include the sample date, sample identification number, taxonomic identification, and sample location.

There are 19 sampling areas, each with a 100 m transect. Each transect will have 20 alternating sized traps. Two sizes of Sherman live traps will be used: approximately 8.0 cm x 8.0 cm x 25.5 cm and 10.2 cm x 10.2 cm x 22.9 cm. Traps will be placed at 5 m intervals along each transect within the indicated areas on Figures 2-2 through 2-5. No transect will be established within 100 m of any other transect. Bait will be peanut butter balls or other appropriate bait. Modification of this pattern will be dictated by such site-specific constrains as slope, presence of water/sludge or extremely wet conditions, and will be determined by the contractor at time of trap deployment. Once in the field, two transects may be placed at a site

if deemed possible by the contractor. Transects must be at least 100m apart to ensure that the same population is not being sampled. If the number of transects is increased then the number of trap nights will be increased to a maximum of 5,680 trap nights.

During the February sampling period, traps will be established in the field transects in late afternoon and collected within two hours. Traps will be partially filled with cotton to provide nesting material to prevent loss of animal due to hypothermia. If an animal is found dead in a trap, it will be returned to the laboratory for dissection and included in data. During the April sampling period, traps will be established in the field transects on the afternoon previous to the morning retrieval of animal from the traps, if weather permits. If cold weather occurs, February sampling protocol will be observed. Traps will not remain in the field between sampling periods.

3.1 Small mammal field data

The following field data will be recorded on the small mammal survey form (Appendix A), and includes:

- Taxonomic identification of species.
- Sex.
- Age (juvenile, subadult, adult).
- Reproductive condition.
- Total body weight (g).
- Length of foot (mm).
- Length of tail (mm).
- Length of right ear (mm).
- For Day Two, notation if animal is recaptured from previous day.
- Trap number and size.

3.2 Soil Sampling

Soil samples will be taken at each transect after the last sampling period. Each transect will have four distinct samples. Four soil samples will be collected along each transect from trap Numbers 1-5, 6-10, 11-15, and 16-20. The sample will be taken from a depth of 0-6 in. using a bucket auger. Environmental Safety and Health (ES&H) Standard Operating Procedure

(SOP) 4.4.5s will be followed. The equipment must be decontaminated between each sample (ES&H 4.1.3s). All information will be recorded on a Soil/Sediment Sampling Form (Appendix B).

3.3 Quality Assurance Samples

Quality control samples will be obtained for every 20 samples to assess laboratory performance and analytical precision. These samples will include duplicates, matrix spike, and matrix spike duplicates.

3.3.1 Duplicate Samples

Both soil and tissue samples will have one duplicate sample taken for every 20 samples. The following two-character modifier will be added at the end of the ID number.

Biological tissue	BG-XXXX-XXXXXX-XXXX-DU
Soil	SO-XXXX-XXXXXX-DU

3.3.2 Matrix Spike/Matrix Spile Duplicate Samples

Only soil samples will be required to have matrix spike and matrix spike duplicates taken every 20 samples. The following ID number format will be used.

Matrix spike	SO-XXXX-XXXXXX-MS
Matrix spike duplicate	SO-XXXX-XXXXXX-MD

4 ANALYTICAL REQUIREMENTS

Small mammals used for biouptake samples will be field screened for radioactive contamination prior to shipment from the Weldon Spring Site Remedial Action Project (WSSRAP) for further analysis. Laboratories performing analyses for the WSSRAP are required to have an approved quality assurance laboratory plan and procedures.

Data Quality Requirements (DQRs) are quantitative statements of selection, accuracy, and precision which specify the quality of data needed to support specified data uses. DQRs for this effort will be consistent with those established for routine environmental monitoring which are documented in the *Environmental Data Administration Plan* (EDAP) (MKF and JEG 1990). Specific DQR's for this sampling plan are listed in Appendix B. Percision will be 90% and a detection limits of 1.0 pCi/l.

Based on the WSSRAP's consistent exercise of quality assurance measures, in the form of both quality control sample collection and standard operating procedures, this survey will report all routine monitoring data and results.

4.1 ANALYTICAL PARAMETERS

Small mammals:	Total Uranium
	Thorium 228/230/232
	Radium 226/228
Soil:	Isotopic Uranium
	Thorium 228/230/232
	Radium 226/228
	Nitroaromatics
	Arsenic
	Mercury
	Lead
	Cadmium
	Barium
	Selenium
	Silver
	Zinc

4.2 Collected Specimens, Laboratory Shipment, and Chain of Custody

Samples, both soils and small mammals, will be shipped by the contractor to a contract laboratory for analysis. Sample chain of custody will comply with WSSRAP SOP ES&H 4.1.2. Shipment and packaging samples will follow Regulatory Compliance Procedures RC-11. Laboratories will conform to standard quality assurance (QA) requirements.

Sample identification will conform to ES&H procedure 4.1.1, *Numbering System for Environmental Samples and Sampling Locations*. The sample numbering structure is BG-XXXX-XXXXXX-XXXX for biological samples and SO-XXXX-XXXXXX for soil samples. See appendix C for sample identification.

5 DATA REPORTING

From the data obtained in the field, species present and approximate population numbers will be calculated. The Hill's diversity index shall be used to calculate the diversity indices.

$$NA = \sum_{i=1}^{S} (pi)^{1/(1-A)}$$

Information gathered from analysis of small mammal populations will be compared with chemical and radionuclide sampling reports from WSSRAP and from other locales nearby. Data collected from study areas and from background samples will be interpreted and tested under various statistical methods. These methods will determine whether small mammals located on or near the Weldon Spring Site Remedial Action Project (WSSRAP) are being effected by chemical and/or radiological contaminants. One of two statistical tests will be used to make the determination: the Student's t-test, or the Mann-Whitney U-test. The basis of determination of which statistical test to use is whether the distribution of small mammal populations can be assumed to be normal, and whether the variances of all sample populations are equal. Preliminary testing of normality and variance will be made by W-test and F-test. W-test data reported as not detectible (ND), or below detection limits (DL), shall be quantified as DL/2 per EPA guidance (EPA 1991).

All data will be presented in a report prepared following the *Format Guide for Formal Reports*, Rev. 2. (MKF and JEG 1991e).

6 DATA ADMINISTRATION

Data will be reviewed and quality control samples compared following standard operating procedures (ES&H 4.9.1a, RC-31a) and the *Environmental Data Administration Plan* (MKF and JEG 1990).

Quality Assurance procedures will follow the guidelines established in the *Environmental Quality Assurance Program Plan* (MKF and JEG 1991f).

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WSSRAP Procedures

ES&H 1.1.4s - *Logbook Procedures*
ES&H 4.1.1 - *Numbering System for Environmental Samples and Sampling Locations*
ES&H 4.1.3s - *Sampling Equipment Decontamination*
ES&H 4.1.2s - *Chain of Custody*
ES&H 4.4.5s - *Soil/Sediment Sampling*
ES&H 4.9.1a - *Environmental Monitoring Data Verification*
RC-11 - *Transportation and Tracking of Material*

APPENDIX A
SMALL MAMMAL SURVEY FIELD SHEET

SMALL MAMMAL SURVEY FIELD SHEET

DATE:
LOCATION: #1 #2 #3 #4 #5 #6 #7 #8 #9 #10 #11 #12 #13 #14 #15 #16 #17 #18 #19
COLLECTOR(S):_____
COMMENTS:

TRAP NO.	SPECIES	ID NO.	RECAP Y/N	SEX M/F	AGE A/SA/J	MASS REPROD		LENGTH (mm)				COMMENTS
						(G)	P/L/V/ST	TOTAL	TAIL	FOOT	EAR	

BLBR = Blarina brevicauda
CRPA = Cryptotis parva
SCAQ = Scalopus aquaticus
REME = Reithrodontomys megalotus
MUMU = Mus musculus

TAST = Tamias striatus
PELE = Peromyscus leucopus
PEMA = Peromyscus maniculatus
MIOC = Microtus ochrogaster
RANE = Rattus norvegicus

GEBU = Geomys bursarius

Data Entry: Date: _____ Initials: _____ File: _____

APPENDIX B
SOIL-SEDIMENT SAMPLING FORM

WELDON SPRING SITE REMEDIAL ACTION PROJECT
7295 Highway 94 South
St. Charles, Misosuri 63304
(314) 441-8086

SOLI/SEDIMENT SAMPLING FORM

SAMPLE NUMBER: _____ DATE: _____

LOCATION: _____

PERSONNEL: _____

_____

SAMPLE COLLECTION METHOD: _____

SAMPLE TYPE: DEPTH COMPOSITE GRAB OTHER _____

SAMPLING EQUIPMENT DECONTAMINATION METHODS: _____

SAMPLE DESCRIPTION:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Signature _____ Date: _____

APPENDIX C
SAMPLE IDENTIFICATION NUMBER FORMAT

SAMPLE IDENTIFICATION NUMBER FORMAT (BG-XXXX-XXXXXX-XXXX)
(SO-XXXX-XXXXXX)

A. Sample type = 2 characters

BG = Biological
SO = Soil

B. Sample location = 4 characters

01_ = Site No. 1
02_ = Site No. 2
03_ = Site No. 3
04_ = Site No. 4
05_ = Site No. 5
06_ = Site No. 6
07_ = Site No. 7
08_ = Site No. 8
09_ = Site No. 9
10_ = Site No. 10
11_ = Site No. 11
12_ = Site No. 12
13_ = Site No. 13
14_ = Site No. 14
15_ = Site No. 15
16_ = Site No. 16

(Biological)

__BB = Blarina brevicauda
__CP = Cryptotis parva
__RM = Reithrodontomys megaiotus
__SA = Scalopus quaticus
__TS = Tamias striatus
__PL = Peromyscus lleucopus
__PM = Peromyscus maniculatus
__GB = Geomys bursarius
__MO = Microtus ochrogaster
__RN = Rattus norvegicus
__MM = Mus musculus

(Soil)

__1_ = Transect 1
__2_ = Transect 2
___A = Samples from area between traps 01-05
___B = Samples from area between traps 06-10
___C = Samples from area between traps 11-15
___D = Samples from area between traps 16-20

C. Data Code = 6 characters

XX___ = Month (01-12)
__XX__ = Day (01-31)
____XX = Year

D. Individual identification (ear tag number-biological)
= 4 characters (0001 thru 1000)

0001 = Individual number 1
0010 = Individual number 10
0100 = Individual number 100

E. Quality Assurance Samples = 2 character modifiers

Duplicate	= XX-XXXX-XXXXXX-DU
Matrix Spike	= XX-XXXX-XXXXXX-MS
Matrix Spike Duplicate	= XX-XXXX-XXXXXX-MD