140-EOA-GAM-00019
SL-1235

Department of Energy

St. Louis Site Office
9170 Latty Avenue
Berkeley, MO 63134
(314) 524-4083

July 29, 1997

(Name)
(Address)
(City/State/Zip)

Dear (Name):

In May of this year, senior staff from the EPA, the State of Missouri, St. Louis City and County, and the Department of Energy met to workout agreements that will accelerate the cleanup of the radioactive waste sites in the St. Louis area. Based upon recommendations made by the St. Louis Remediation Task Force, a commitment was made to demonstrate a high priority for the St. Louis Airport Site (SLAPS) by beginning work this year. Of course, any decision to move forward with cleanup at the airport site must include input from the public.

Attached for your review and comment is a draft copy of an Engineering Evaluation/Cost Analysis (EE/CA) which proposes to excavate contaminated material from the western end of SLAPS, nearest Coldwater Creek, and along McDonnell Blvd. This document also proposes the construction of a "load-out facility" that will enhance our ability to transport excavated materials out of state and achieve the capacity needed to load and ship materials for future full-scale excavations of the site.

In addition to the "no action" alternative, the EE/CA includes two action alternatives to the basic proposal described above. One alternative would remove all material from the western end of SLAPS and from ditches south of McDonnell Boulevard to an unrestricted use standard and haul it out of state for disposal. The other would remove the same material to an unrestricted use standard, stockpile lesser contaminated material, expand excavation activities to include ditches north of McDonnell Boulevard and transport and dispose of more highly contaminated materials out of state.

It is my belief that either of the above two alternatives will result in a significant step forward in the cleanup of the SLAPS. The public comment period is July 30, 1997 through August 28, 1997. A public meeting will be held on August 13, 1997 from 7:00 p.m. to 9:00 p.m. at the Hazelwood Civic Center, 8969 Dunn Road, Hazelwood, MO 63042. We look forward to your participation and input.

Sincerely,

SH McCracken

Stephen H. McCracken
St. Louis Site Manager

Enclosures
jln

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LIST OF ACRONYMS AND ABBREVIATIONS

AEA	Atomic Energy Act
AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirements
BNI	Bechtel National Incorporated
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
COC	contaminants of concern
COE	Corps of Engineers
cm	centimeters
cy	cubic yards
DOE	Department of Energy
DOT	Department of Transportation
EE/CA	Engineering Evaluation/Cost Analysis
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FFA	Federal Facilities Agreement
ft	foot/feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
ha	hectare(s)
HISS	Hazelwood Interim Storage Site
IRIS	Integrated Risk Information System
km	kilometer(s)
l/day	liters per day
m	meter(s)
mg/l	milligrams per Liter
MDNR	Missouri Department of Natural Resources
MED	Manhattan Engineer District
mi	mile(s)
MRA	Multiple Resource Area
mrem	millirem
MSL	mean sea level
NEPA	National Environmental Policy Act
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
ppb	parts per billion
Ra	radium
RCRA	Resource Conservation Recovery Act
RI	remedial investigation

SHPO	State Historic Preservation Officer
SAIC	Science Applications International Corporation
SLAPS	St. Louis Airport Site
SLDS	St. Louis Downtown Site
SOR	Sum of Ratios
SVOC	semivolatile organic compound
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
Th	thorium
U	uranium
VOC	volatile organic compounds
VP	vicinity property
yr	year(s)

EXECUTIVE SUMMARY

Background

This document has been prepared by the U.S. Department of Energy's (DOE's) Formerly Utilized Sites Remedial Action Program (FUSRAP). An action is described herein that addresses the presence of residual radioactive material in the soils of the St. Louis Airport Site (SLAPS) in St. Louis, Missouri.

From 1942 to 1957, uranium and radium were extracted from ore at the Mallinckrodt Chemical Plant in downtown St. Louis, known as the St. Louis Downtown Site (SLDS). During this time and until 1967, SLAPS (see Figure 2-1) was used to store process byproducts that contained residual radioactive materials. As a result of this past open storage, Coldwater Creek, which winds around the west of SLAPS, received radioactively contaminated sediment. The potential for transport of these contaminants by surface water from SLAPS has been greatly reduced by the placing a soil covering over the central portion of the site. However, some residual material is still available for transport by storm flow within the ditches draining SLAPS and in the groundwater. SLAPS is currently well vegetated and has been inactive as a storage site since 1967.

A Federal Facilities Agreement (FFA) (DOE 1990) was negotiated by the U. S. Environmental Protection Agency (EPA) [Region VII] and DOE in 1990. That agreement describes the process that will be used to remediate all the St. Louis Sites and lists the responsibilities of each agency. Three properties within the St. Louis Sites are on the National Priorities list (SLAPS, SLAPS vicinity properties, and Hazelwood Interim Storage Site (HISS)/Futura Coatings); therefore, all the St. Louis sites will be addressed in accordance with the procedures developed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Values of the National Environmental Policy Act (NEPA) have also been integrated into the process.

Radiological and chemical characterization surveys and field investigations were conducted at the St. Louis sites from 1977 through 1992 to determine the nature and distribution of radiological and chemical contaminants and to characterize the geological and hydrogeological features.

Objectives

The proposed action described in this document was developed to achieve three principal goals:

1) to provide a clean buffer zone adjacent to Coldwater Creek,
2) to protect Coldwater Creek by further controlling surface water migration of contaminants to Coldwater Creek, and
3) to demonstrate tangible progress at the site.

The planned removal actions will contribute to risk reduction and the efficient performance of the long-term remedial action when it is ultimately determined for the site. Although final cleanup criteria have not been established for this site, it is anticipated that the majority of the area cleaned up by this action will not require additional efforts. However, final cleanup criteria, once selected, could require additional efforts in areas excavated in this removal action. This action is being undertaken primarily to minimize the potential for migration of contaminated sediments to Coldwater Creek under current and anticipated site conditions as excavation of the site proceeds.

Alternatives

Three alternatives are assessed by this document. The no-action alternative is required to be included by CERCLA as a baseline against which other alternatives may be compared. A second alternative evaluates removal of contaminated materials from areas adjacent to Coldwater Creek and off-site disposal of the more radioactively contaminated soils. The third alternative examines removal of only a portion of the soils described under Alternative 2. However, all contaminated materials would be shipped to a licensed off-site disposal facility under Alternative 3. Alternatives 2 and 3 include constructing of a loading facility at SLAPS, which would support the processing of excavated soils in future removal or remedial actions prior to off-site disposal.

Alternative 1 - No Action

This alternative consists of leaving SLAPS in its current condition. The SLAPS is currently being monitored for both surface and air releases of radionuclides as well as intermittent groundwater monitoring. While no new measures would be taken to reduce exposure or prevent migration of contaminants from the property, SLAPS would continue to be monitored and maintained.

Alternative 2 - Removal of Radioactively Contaminated Soil with Off-site Disposal and Limited Material Stockpiling

This alternative would remove radioactively contaminated fill materials immediately adjacent to Coldwater Creek and along the ditches north and south of McDonnell Boulevard. Material would be removed in accordance with DOE Order 5400.5, which specifies that the guideline for radionuclide concentrations for radium and thorium in soil is 5 picocuries per gram (pCi/g) above background in the top 15cm of soil and 15 pCi/g above background in any subsequent 15 cm layer. A corresponding concentration for uranium 238 would be 50 pCi/g. This standard is referred to as the 5/15/50 guideline. The Sum of Ratios for a mixture of radionuclides would apply and is explained in greater detail in Section 4.1.2. The removal will also strive for unrestricted use clean-up levels for nonradiological contaminants of concern. Material exceeding the 5/15/50 guidelines but below 50 pCi/g for Ra^{226}, 100 pCi/g for Th^{230}, or 150 pCi/g for U^{238} would be temporarily stockpiled and all other contaminated materials would be shipped to a licensed out-of-state disposal facility. For the purposes of this document, the 50/100/150 contaminated levels are referred to as moderately contaminated and are considered to be an initial indication of a minimum cleanup standard under any future use scenario.

The excavation would span the entire north-south width of the site and beginning just east of the gabion wall (i.e., the gabion wall would remain in place), it would be approximately 70 feet wide (see Figure 4-1). The excavated area would be backfilled with clean clay material, then a berm would be constructed on the eastern edge of the excavation to minimize runoff into the excavated area. Sediments in the ditch between the SLAPS fence and McDonnell Boulevard would be removed from the confluence with the creek east along the length of the site. The flow in the northern drainage areas of SLAPS (see Figure 2-8) will be redirected through an engineered channel along the northern boundary of the site in order to enhance the effectiveness of the clean buffer zone between SLAPS and the creek. In the construction of the engineered channel, the three ditches draining the northern area of SLAPS shown in Figure 2-8 would be connected, so that no flow from SLAPS would pass under McDonnell Boulevard into the Ballfields' ditches.

Under Alternative 2, sediments in the ditch north of McDonnell Boulevard would be removed from the confluence with the creek upstream to the culvert crossing under McDonnell Boulevard (approximately 800 feet). Alternative 2 would also include the construction of a new, larger rail loading facility at SLAPS. This facility would increase the throughput of soil over the existing Eva Road facility in preparation for large scale excavation of the SLAPS site. The facility would take advantage of the existing rail bed at the site. The facility would include soil staging, conditioning, and rail car loading areas to facilitate large-scale efficient loading and transportation operations. The Eva Road facility would continue to be used during the removal action until the new facility was completed.

This action will contribute to reducing health risks under any future use scenario.

Alternative 3- Removal of Radioactively Contaminated Soil and Off-site Disposal

Under Alternative 3, all contaminated materials exceeding the 5/15/50 guidelines would be shipped out-of-state to a licensed disposal facility. Excavation of more highly contaminated material north of McDonnell Boulevard would be postponed to a future date. Alternative 3 would also include constructing a new, larger rail loading facility at SLAPS.

This action will contribute to reducing health risks under any future use scenario.

Health Risk and Costs

The cost of Alternative 2 is estimated at $8.110 million, and $8.327 million for Alternative 3. Worker exposure during excavation has been estimated to be 258 mrem for Alternative 2 and 206 mrem for Alternative 3. Exposure for both alternatives are well below the federal limit of 5,000 mrem/year for radiological workers (20 *CFR* 835). This exposure estimate is conservative because the assessment assumed no control measures would be taken (e.g., wetting soil to control dust and using personal protective equipment) and because the statistical treatment of small data sets tends to provide high estimates of exposure concentrations.

1. INTRODUCTION

1.1 REGULATORY AUTHORITY

Congress established the Formerly Utilized Site Remedial Action Program (FUSRAP) in 1974 under the authority of the Atomic Energy Act (AEA) of 1954 to identify, evaluate, and, if necessary, clean up former sites associated with Manhattan Engineer District (MED)-related radiological operations. In general, MED-related operations and subsequent related activities released radioactive residues to the soil at these sites at levels which do not allow release of the property without radiological restrictions.

Actions taken to cleanup United States Department of Energy (DOE) FUSRAP sites are regulated under several different federal guidelines. Executive Order 12580 delegates to DOE the authority for removal actions at DOE sites, whether or not the sites are on the National Priorities List. Authority for responding to releases or threats of releases from a hazardous waste site is addressed in Section 104 of CERCLA. Under CERCLA Section 104(b), DOE is authorized to undertake such investigations, surveys, testing, or other data gathering deemed necessary to identify the existence, extent, and nature of the compounds that might threaten human health and the environment. In addition, DOE is authorized to undertake planning, engineering, and other studies or investigations appropriate to directing response actions to prevent, limit, or mitigate the risk to human health and the environment.

1.2 THE SITE

The St. Louis Airport Site (SLAPS) is a portion of the larger St. Louis FUSRAP sites. The St. Louis site is comprised of a number of properties in the St. Louis area including the St. Louis downtown site (SLDS), the Ballfields, the SLAPS vicinity properties (VPs), the Latty Avenue vicinity properties, and the Hazelwood interim storage site (HISS). This document addresses an action to be taken on the SLAPS property only.

Between 1946 and 1966, SLAPS was used to store MED/Atomic Energy Commission- (AEC-) residue material generated by uranium separation processes at Mallinckrodt Chemical Works. These residues included ore raffinate, which was stored on the ground, and radium-bearing residues which were stored in drums. A barium cake residue was also stored on the ground at the site. Other wastes brought to SLAPS included used dolomite liner and recycled magnesium fluoride liner, tailings from a process to recover uranium from magnesium fluoride slag, 50,000 empty drums, 3,500 tons of radioactively contaminated metal scrap, 2,400 drums containing miscellaneous residues, uranium-containing sand, and radioactive scrap materials. Some of these materials were placed in pits dug on SLAPS.

The ore residues at SLAPS were sold by the federal government to Continental Mining and Milling Company in 1966. By 1967, the stored residues had been moved by Continental Mining and Milling from SLAPS to another site at 9200 Latty Avenue in Hazelwood, Missouri for later shipment to Canon City, Colorado. The barium sulfate material stored at SLAPS was taken to an abandoned quarry at Weldon Spring, Missouri. This quarry was subsequently remediated under CERCLA authority. All onsite structures at SLAPS were razed and buried onsite and 1 to 3 feet of clean fill was spread over the entire site to reduce radiation exposure rates to levels in compliance with standards in place at that time.

1.3 SCOPE AND OBJECTIVES

The scope of this project includes the following:

1) removal of radioactively contaminated materials in an area at the west end of SLAPS from the gabion wall approximately 70 feet eastward; the ditch along the south side of McDonnell Boulevard (entire length of the site); and under Alternative 2 only, the ditch along the north side of McDonnell Boulevard from Coldwater Creek upstream to the culvert under McDonnell Boulevard (approximately 800 feet).

2) construction of a loadout/staging facility to ship materials to be excavated under separate action(s), primarily from SLAPS and the ballfields.

The proposed actions described in this document were developed to achieve three principle goals:

1) to provide a clean buffer zone adjacent to Coldwater Creek

2) to protect Coldwater Creek by further controlling surface water migration of radionuclides to Coldwater Creek from the ditches at SLAPS, and

3) to demonstrate tangible progress at the site.

This action will remove a portion of the source materials that are associated with the risks established in the Baseline Risk Assessment. While the extent of excavation will not be defined through risk-based analysis, this action is consistent with the anticipated long-term remedy for the site and Task Force recommendations. Although final cleanup criteria have not been established for this site, it is anticipated that the majority of the area cleaned up by this action will not require additional efforts. This action is being undertaken primarily to minimize the migration of contaminated sediments to Coldwater

Creek under current site conditions and anticipated site conditions as excavation of the site proceeds.

The scope of this action was set with the intent of demonstrating tangible progress on SLAPS in the present fiscal year. The scope is therefore, by necessity, limited due to time and cost constraints. Up to $5 million has been made available in the DOE FUSRAP FY97 budget to initiate progress on this project. At least 6,000 yd^3 of contaminated soil is expected to be removed from the site under this action.

1.4 COMPLIANCE WITH REGULATORY REQUIREMENTS

In a removal action under CERCLA, legally applicable or relevant and appropriate requirements (ARARs) need to be attained only to the extent practicable. The extent practicable is to be determined considering the urgency of the situation and the scope of the removal action.

An applicable requirement is a cleanup standard, standard of control or other substantive environmental protection requirement, criterion, or limitation promulgated under federal or state law that specifically addresses a hazardous substance, pollutant, remedial action, location, or other circumstance at a CERCLA site.

A relevant or appropriate requirement is a cleanup standard, standard of control, or other substantive environmental protection requirement, criterion, or limitation promulgated under federal or state law that, while not applicable to the situation, addresses problems or situations sufficiently similar to those encountered at the CERCLA site that its use is well suited to the particular site. A requirement must be both relevant and appropriate to be an ARAR. A requirement is relevant if it addresses a problem similar to that at the site. A requirement is appropriate if it is well suited to the circumstances of the release and the site.

Requirements that may apply to this proposed action are presented in Appendix A. The preliminary identification of ARARs for the proposed action is based on the nature of the radioactive compounds (primarily soils containing radionuclides) and the location of the property.

In addition to ARARs, some guidelines or standards that have not been written into law may also have a direct bearing on the proposed action. These are identified as "to-be-considered (TBC)" requirements and include certain DOE Orders and guidelines.

DOE will comply with all pertinent environmental requirements to ensure protection of human health and the environment during implementation of the proposed action. Appropriate standards from the Occupational Safety and Health Administration

Act and other employee protection laws and guidelines will be followed to ensure worker protection during implementation.

1.5 SCHEDULE

This action is expected to begin during the construction season of 1997 and will be completed in FY98.

2. SITE CHARACTERIZATION

2.1 SITE DESCRIPTION

2.1.1 Location

SLAPS, an unincorporated property in St. Louis County, is bounded on the north and east by McDonnell Boulevard; on the south by Banshee Road and the Norfolk and Western Railroad; and by Coldwater Creek on the west as illustrated in Figure 2-1. SLAPS covers 8.8 ha (22 acres) and is surrounded by security fencing. A water main and gas line cross the northwest corner of SLAPS and run parallel to the property on the north. There are overhead utility lines on the western end of SLAPS.

Coldwater Creek flows for 153 m (500 ft) along the western border of SLAPS. The creek originates 5.8 km (3.6 mi) to the south and continues for 24 km (15 mi) in a northeasterly direction through Hazelwood, Florissant, and unincorporated areas of the county, and along the northern edge of the unincorporated community of Black Jack, until it discharges into the Missouri River. The creek, except for the 1.2 miles it travels under the airport, is accessible to the public (SAIC 1992).

2.1.2 Type of Facility and Operational Status

MED acquired SLAPS in 1946 to store uranium-bearing residuals from SLDS from 1946 until 1966. In 1966, these residuals were purchased by Continental Mining and Milling Company of Chicago, removed from SLAPS, and placed in storage at Latty Avenue under an AEC license. After most of the residuals were removed, site structures were demolished and buried on the property along with approximately 60 truckloads of scrap metal and a vehicle that had become contaminated (EPA 1989). Clean fill material was spread over the disposal area from 0.3 to 1.0 m (1 to 3 ft) to achieve surface radioactivity levels acceptable at that time. In 1973, the U.S. Government and the City of St. Louis agreed to transfer ownership of SLAPS by quitclaim deed from AEC to the St. Louis Airport Authority.

In 1982, a radiological characterization of the ditches to the north and south of SLAPS and of portions of Coldwater Creek (BNI 1983) indicated radioactivity levels exceeding DOE guidelines currently in effect.

The Energy and Water Development Appropriations Act of 1985 (Public Law 98-360) authorized DOE to reacquire the property for use as a permanent disposal site. The need for reacquisition will be determined after completion of the CERCLA process for the St. Louis site. Currently, the St. Louis Airport Authority remains the owner of the property.

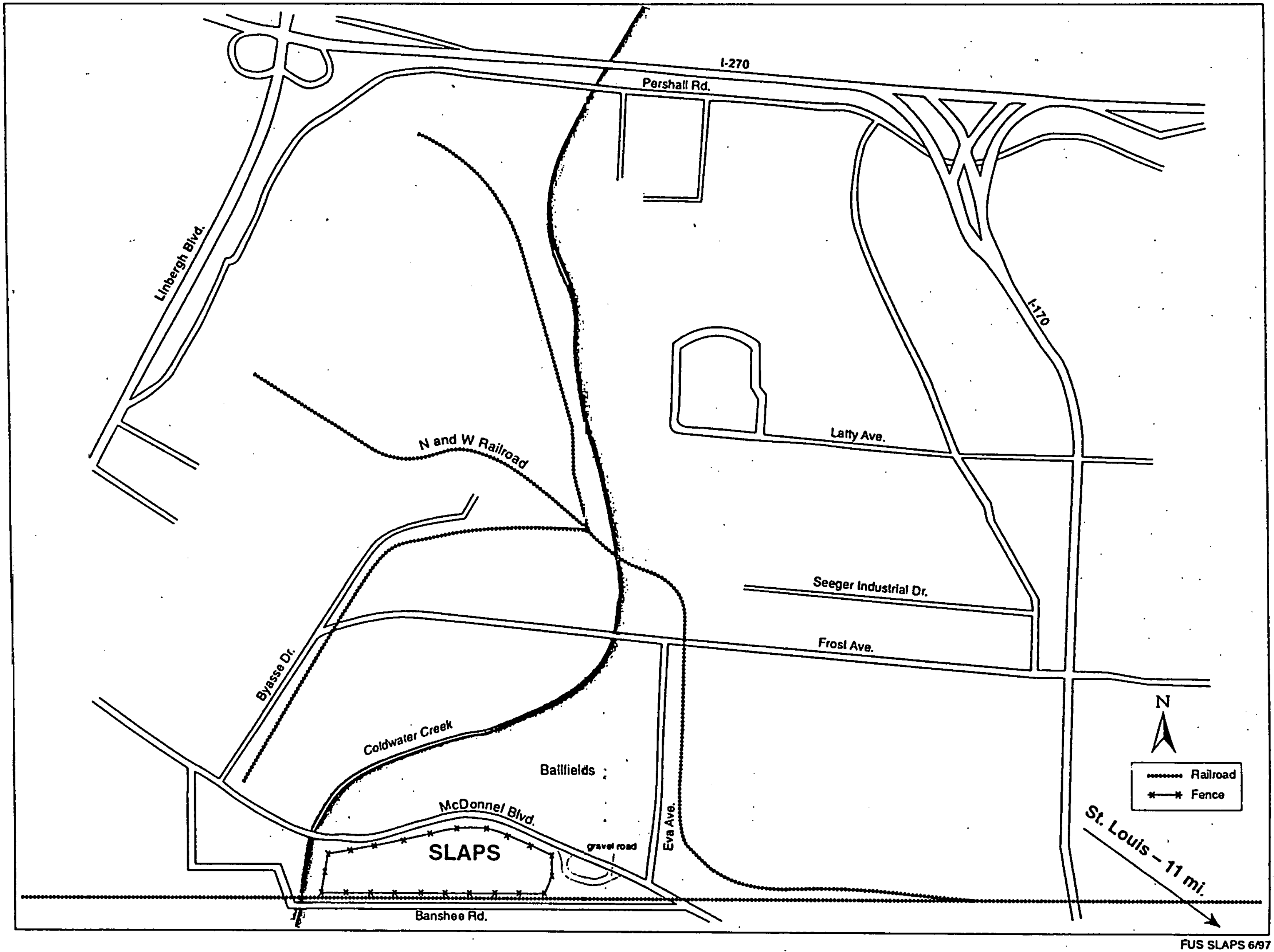

Figure 2-1. Location of SLAPS

In 1986, an extensive radiological and limited chemical characterization of SLAPS determined that radioactive impacts extended as deep as 5.5 m (18 ft) below grade (BNI 1987). A radiological characterization of airport area properties was subsequently conducted from 1986 through 1990 to further define the extent of radioactive contamination and to evaluate possible disposal alternatives.

2.2 ENVIRONMENTAL SETTING

2.2.1 Land Use and Recreational or Aesthetic Resources

SLAPS and the Lambert-St. Louis airport are owned by the City of St. Louis, but are located in unincorporated St. Louis County. Planning and zoning for SLAPS are governed by the adjacent City of Berkeley. SLAPS is currently zoned "M-1" (Light Industrial). This category allows the full range of light industrial uses, such as building material storage yards, utility substations, wholesale warehouses, and some manufacturing activities; and limited commercial uses including offices, financial institutions, and training academies (Zoning Code, City of Berkeley, Section 23.12.1). The south-central and eastern portions of the property are in the approach zones of runways 17 and 24, respectively, of the adjacent Lambert-St. Louis International Airport (BNI 1994a). This proximity to the airport imposes additional restrictions an the SLAPS property related to noise from aircraft and height restrictions in the approach zones. The portion of the site adjacent to Coldwater Creek is zoned "M-1/FP," which indicates that it is also within the Floodplain District.

The airport area is dominated by industrial uses, but because of its proximity to the airport, more than two-thirds of the land within 0.8 km (0.5 mi) of SLAPS is used for transportation-related purposes. The remaining land is used for commercial and industrial uses, as shown in Figure 2-2. South of SLAPS is the Norfolk and Western Railroad, then Banshee Road, and the Lambert-St. Louis International Airport. West of SLAPS is the creek and then the McDonnell-Douglas Corporation property.

2.2.2 Climatology, Meteorology, and Air Quality

Climatological and meteorological conditions in a region greatly influence the relationship between air pollutant emissions and ambient air quality in the area. The region is dominated by warm, moist maritime tropical air masses, which flow northward from the Gulf of Mexico region, and by colder, drier polar air masses, which drift down from the Canadian Provinces.

In general, southerly and northwesterly winds dominate the wind regime of the St. Louis region. Southerly winds predominate from May through November, and northwesterly winds predominate from December through April. Normal annual high and

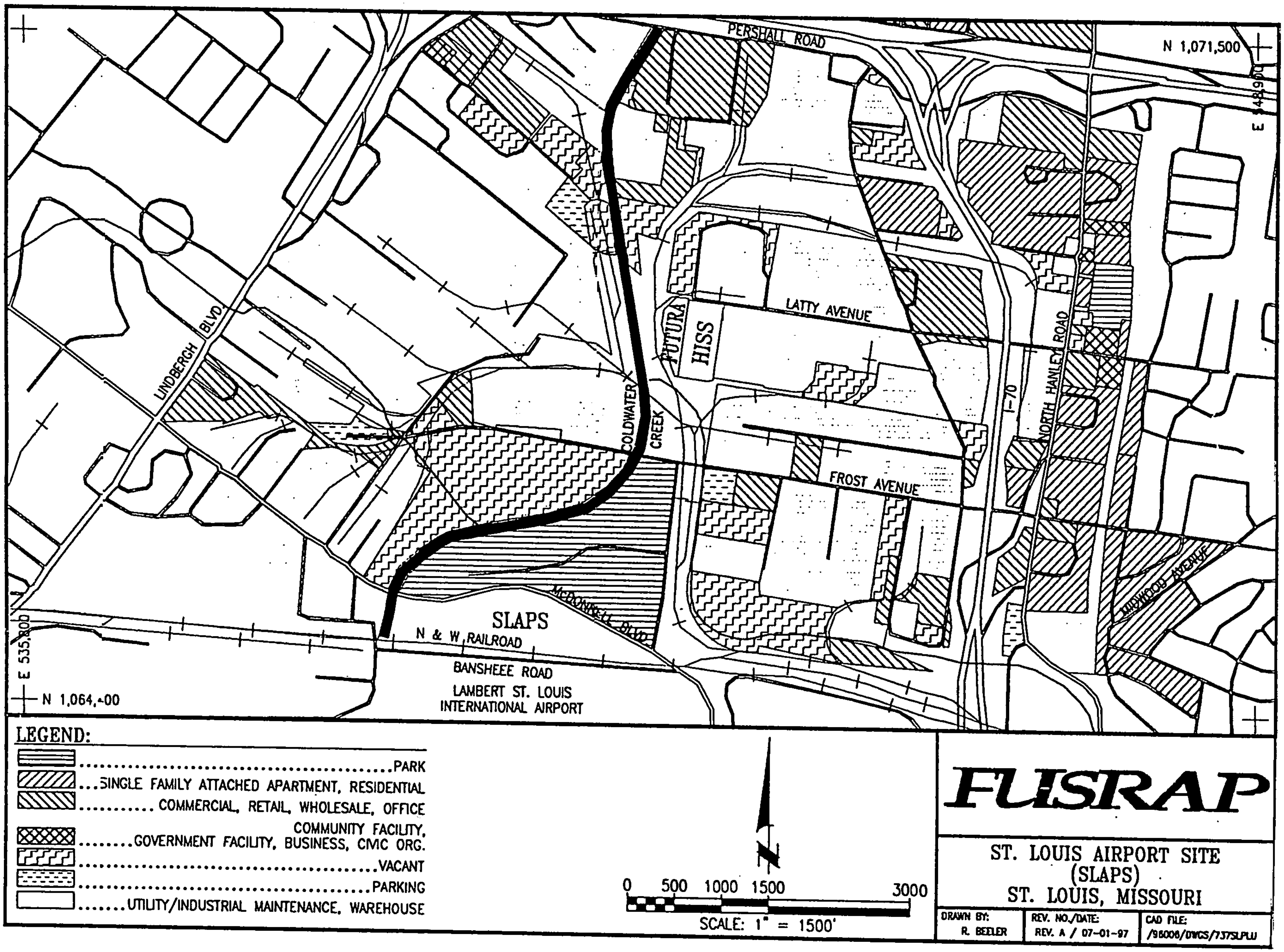

Figure 2-2. Land Use within a 1.6-km (1 mile) Radius of the Airport Area

low temperatures are 31°C and -5°C (88°F and 23°F), respectively. The area averages 91 cm (36 in.) per year in total (water equivalent) precipitation (i.e., rainfall plus melted snowfall). Average annual snowfall is roughly 66 cm (26 in.).

The tornado is the most common form of severe weather observed in this region. From 1916 through 1985, 52 recorded tornadoes occurred in the St. Louis metropolitan area. In 1990, Missouri had 31 storms in 14 storm days, most of them in May and June. Based on the record between 1953 and 1990, Missouri is ranked seventh nationally in the occurrence of tornadoes and averages 11 tornado and 27 storm days per year (NOAA 1990).

Ambient air quality and the conditions for air emission control are at their worst on summer mornings in the St. Louis area because of the pattern of strong temperature inversions at night. Inversion conditions occur during cool, clear nights under low to calm wind speeds. The resulting dense air trapped near the ground resists vertical mixing and creates poor dispersion conditions.

2.2.3 Geology and Soils

The site stratigraphy at SLAPS (Figure 2-3) is divided into six units: a fill layer, three discontinuous units of non-lithified materials ranging in thickness from 15.2 to 24.4 m (50 to 80 ft), and two undifferentiated bedrock units underlying the non-lithified materials. The top fill layer consists of intermixed rebar, scrap metal, reinforced concrete, glass, and slag within loose to compacted silt, sand, and gravel. The fill layer ranges in thickness from 0 to 4.3 m (0 to 14 ft).

The three units underlying the fill represent non-lithified glacial, lake, and loess sediments. Each unit has an average thickness ranging from 2 to 9 m (7 to 30 ft). The uppermost subunit 3T directly overlies subunit 3M. Across the SLAPS area, the 3T subunit varies in thickness from 9 to 27 ft. The next unit is subunit 3M which is approximately 30-ft thick on the western edge of the ballfields, and thins to the east, finally pinching out near the eastern edge of SLAPS. Subunit 3B directly underlies subunit 3M. It is continuous across the SLAPS and thickens towards the east. The results of laboratory soil testing conducted on SLAPS soil are discussed in the Remedial Investigation (RI) report (BNI 1994). The lower non-lithified unit (Unit 4) is clayey gravel with an increasing amount of fine- to very fine-grained sand and occasional sandy gravel at the contact with bedrock. Bedrock at the site consists of Pennsylvanian sandstones, shales, and siltstones or Mississippian limestone. Depth to bedrock ranges from 16.5 m (55 ft) on the east side of SLAPS to a maximum of 27 m (90 ft) toward Coldwater Creek.

Period	Epoch	Stratigraphic Unit	Columnar Section	Thickness (ft.)	Description
Quaternary	Holocene	FILL/TOPSOIL		0-14	**UNIT 1** Fill - Sand, silt, clay, concrete, rubble Topsoil – Organic silts, clayey silts, wood, fine sand.
Quaternary	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.
Quaternary	Pleistocene	GLACIO-LACUSTRINE SERIES: SILTY CLAY		19-75 (3) 9-27 (3T)	**UNIT 3** Silty clay with scattered organic blebs and peat stringers. Moderate plasticity. Moist to saturated. (3T)
Quaternary	Pleistocene	VARVED CLAY		0-8	Alternating layers of dark light clay as much as 1/16 inch thick (3M)
Quaternary	Pleistocene	CLAY		0-26	Dense, stiff, moist, highly plastic clay. (3M)
Quaternary	Pleistocene	SILTY CLAY		10-29	Similiar to upper silty clay. Probable unconformable contact with highly plastic clay. (3B)
Quaternary	Pleistocene	BASAL CLAYEY & SANDY GRAVEL		0-6	**UNIT 4** Glacial clayey gravels, sands, and sandy gravels. Mostly chert.
PENNSYLVANIAN		CHEROKEE (?) GROUP (undifferentiated)		0-35	**UNIT 5** BEDROCK: Interbedded silty clay/shale, ignite/coal, sandstone, and siltstone. Erosionally truncated by glaciolacustrine sequences.
MISSISSIPPIAN		STE. GENEVIEVE (?) LIMESTONE		10+	**UNIT 6** BEDROCK: Hard, white to olive, well-cemented, sandy limestone with interbedded shale laminations.

Source: BNI 1993

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Figure 2-3. Generalized Stratigraphic Column for the Airport Area

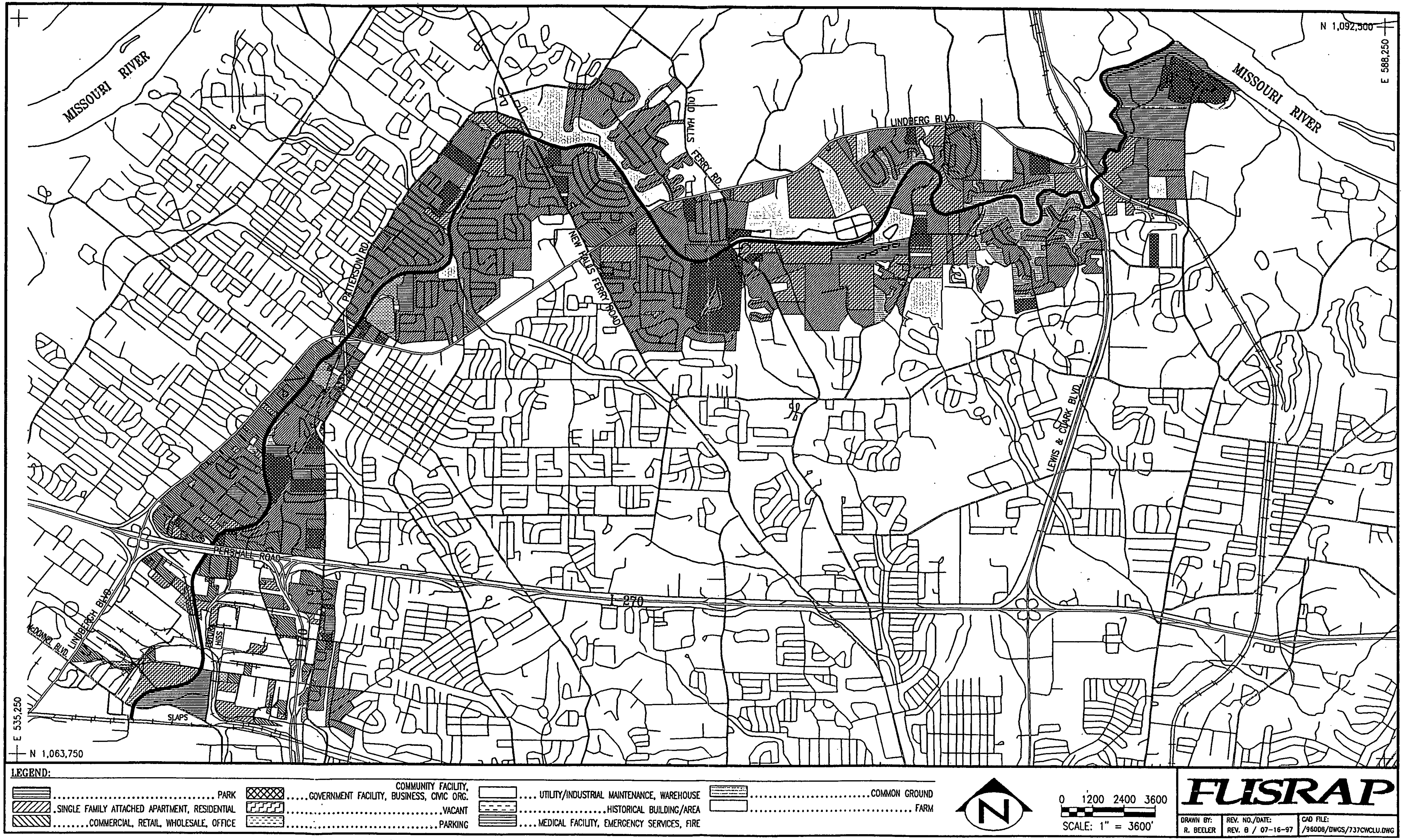

Figure 2-4. Land Use Along Coldwater Creek

2.2.4 Surface Water

Coldwater Creek, which empties into the Missouri River at River Mile 7 (Creek Mile 0) is the primary surface water feature in the airport area. Although Coldwater Creek is not used for drinking water, two municipal water intakes are located on the Mississippi River approximately 8.1 km (5 mi) downstream of where the Missouri River discharges into the Mississippi River, 22 km (12 mi) from the confluence of Coldwater Creek with the Missouri (BNI 1994a).

The main channel is 31.5 km (19.5 mi) long and has relatively short tributary streams. SLAPS is at Creek Mile 13.8. At McDonnell Boulevard, which forms the northern boundary at SLAPS, the drainage area is 32 km^2 (12 mi^2) (Hauth and Spencer 1971). Coldwater Creek, which originates south of SLAPS, generally flows north between the cities of Overland and Florissant, and then east to the Missouri River (Figure 2-4). The total watershed area of Coldwater Creek is 47 square miles. The Missouri River watershed is 529,350 square miles. The annual average flow rate of Coldwater Creek is 41 cfs which is equivalent to 100 million liters/day (66 million gallons/day).

Coldwater Creek is classified as a Class "C" waterway, which means that there are periods when there is no flow in the creek, but permanent pools are always present. Flooding in Coldwater Creek occurs annually. Coldwater Creek is protected for livestock/wildlife watering and aquatic life usage.

The water quality in Coldwater Creek is generally poor. Pollutants enter the stream in storm water from commercial and industrial facilities, residential areas, and the Lambert-St. Louis International Airport. SLAPS runoff also flows into Coldwater Creek. Six facilities permitted under the National Pollutant Discharge Elimination System (NPDES) program discharge directly into the stream. These facilities include three industrial facilities, which discharge cooling water; two small non-industrial sewage treatment facilities; and the large regional Coldwater Creek sewage treatment plant. DOE currently holds a NPDES permit to discharge stormwater from HISS. Recent studies of aquatic life indicate that the stream ecology is severely impacted. The stream has been severely impacted by salt, oil, antifreeze, jet fuel, etc. in stormwater runoff and in addition, high ammonia levels and low levels of dissolved solids have been detected downstream from the sewage treatment plant (COE 1987).

2.2.5 Groundwater

Recharge to the groundwater occurs from precipitation, offsite inflow of groundwater, and creek bed infiltration during high creek stage. Discharge occurs by seepage into Coldwater Creek during low creek stage (BNI 1994a). The vertical flow direction varies across the site and, although not well understood, is influenced by stratigraphic heterogeneity and seasonal fluctuations in recharge and evapotranspiration. The position of the near-surface water tends to be lower in the summer and higher in the winter ranging from less than a meter below existing grade to nearly 3 meters below grade. The near surface maximum average linear velocity is calculated to be 7.8 m/yr (26 ft/yr) (BNI 1994).

2.2.6 Biological Resources

The biological resources description of St. Louis and surrounding areas reflects reconnaissance conducted during daylight hours (0615 to 1630 hours) on May 14 and 15, 1992, and a literature review (primarily, Orzell 1979, St. Louis County Department of Planning 1986, Weston 1979). It covered SLDS, SLAPS, HISS/Futura and vicinity properties, and locations downstream from SLAPS/HISS along Coldwater Creek.

The St. Louis area is located in the Oak-Hickory-Bluestem Parkland section of the Prairie Parkland Province (Bailey 1980) and within the Florissant Basin. Topography is gently rolling with low bluffs north of the Missouri. Presettlement vegetation is characterized by deciduous woodlands intermixed with open prairie (Bailey 1980). The Missouri and Mississippi Rivers are a major influence on the vegetation of the area. Common trees before development included oaks (*Quercus* sp.), hickories (*Carya* sp.), elms (*Ulmus* sp.), sycamores (*Platanus* sp.), cottonwoods (*Populus* sp.), redbuds (*Cercis* sp.), hackberries (*Celtis* sp.), and buckeyes (*Aesculus* sp.) (Bailey 1980). Tall grass prairie species in presettlement times included big bluestem (*Andropogon gerardi*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), and prairie junegrass (*Koleria cristata*) (Weston 1979). Today, little presettlement vegetation exists in the area, including the St. Louis site.

Vegetation at SLAPS as observed in 1992 appears to have changed little since the 1979 Weston survey and is dominated by a grass-forb community that reflects past disturbances. Perennial bromegrass (*Bromus* sp.) and bluegrass (*Poa* sp.) appear to be the dominant grasses. Forbs include thistle (*Cirsiuim arvense*), vetch (*Vicia* sp.), sunflower (*Helianthus* sp.), goldenrod (*Solidago* sp.), and ragweed (*Ambrosia* sp.). Motts of woody shrubs, including sumac (*Rhus* sp.), are present on the southern border. Cottonwoods (*Populus deltoides*) are present on the western border of the creek. Cottonwoods, maples (*Acer* sp.), and other species of deciduous trees are abundant along the creek north of SLAPS.

Song sparrows (*Melospiza melodia*), swifts, and red-winged blackbirds (*Agelaius phoeniceus)* were the most common birds observed during the May 1992 reconnaissance. Three American goldfinch (*Carduelis tristis*) were seen along the creek woodlands north of SLAPS. In addition, a Mississippi kite (*Ictinia mississippiensis*) was observed hunting in the park and a red-tailed hawk (*Buteo jamaicensis*) was seen perched in a cottonwood just north of SLAPS. Gopher (*Geomys* sp.) holes were numerous, and more than 10 cottontail rabbits (*Sylvilagus* sp.) were observed on SLAPS. Squirrels (*Scirurus* sp.) were observed in the woodlands lining Coldwater Creek. Raccoon (*Procyon lotor*) tracks were observed on mud flats by the creek just north of SLAPS. A pair of mallards (*Anas platyrhynchos*) were observed on the creek approximately 91 m (300 ft) downstream from SLAPS.

Because of the poor water quality from the chemical and physical pollutants in the creek, biological resources in and along Coldwater Creek are less diverse than those of similar creeks in rural areas. No significant amounts of continuous vegetation are found in the watershed, and the quality of the remaining forests is rated "marginal" (Parker and Szlemp 1987). Coldwater Creek is lined with cottonwoods, maples, elms (*Ulmus* sp.), black locust (*Robinia* sp.), box elder (*Acer nequndo*), beech (*Fagus* sp.), and mulberry (*Morus* sp.). Trees intermittently shade the creek, and herbaceous vegetation is composed of vines, forbs, and grasses. The largest vegetated areas occur downstream from the airport area, closer to the mouth of Coldwater Creek.

Previous surveys identified 19 benthic and 6 fish taxa (Nash 1982, Parker and Szlemp 1987). Benthic organisms were dominated by tubificids and chironomids, which are tolerant of organic pollution. Fathead minnows (*Pimephales promelas*) represented 97 percent of the 221 fish collected during a survey (Parker and Szlemp 1987). This species tolerates waters with low oxygen, high temperatures, and turbidity, which characterize much of the creek.

2.2.7 Threatened and Endangered Species

The only federal and state designated, endangered or threatened species that may occur within the area of the proposed action (see Appendix B: U.S. Department of Interior and Missouri Department of Conservation letters) are the pallid sturgeon (*Scaphirhynchus albus*) and bald eagle (*Haliaeetus leucocephalus*). Pallid sturgeon are found in both the Mississippi and Missouri Rivers, but Coldwater Creek does not provide adequate water quality or quantity for them. Bald eagles are known to stay through the winter in the region. It is doubtful that they use the airport area because of poor habitat quality (i.e., sparse vegetation, significant noise and human activity, and limited hunting opportunities along Coldwater Creek).

No sign of these species or their activities was present on the site. The habitat suitable for bald eagles is limited on and near SLAPS (Weston 1979, Parker and Szlemp 1987). In addition, in a Coldwater Creek Feasibility Study and Environmental Impact

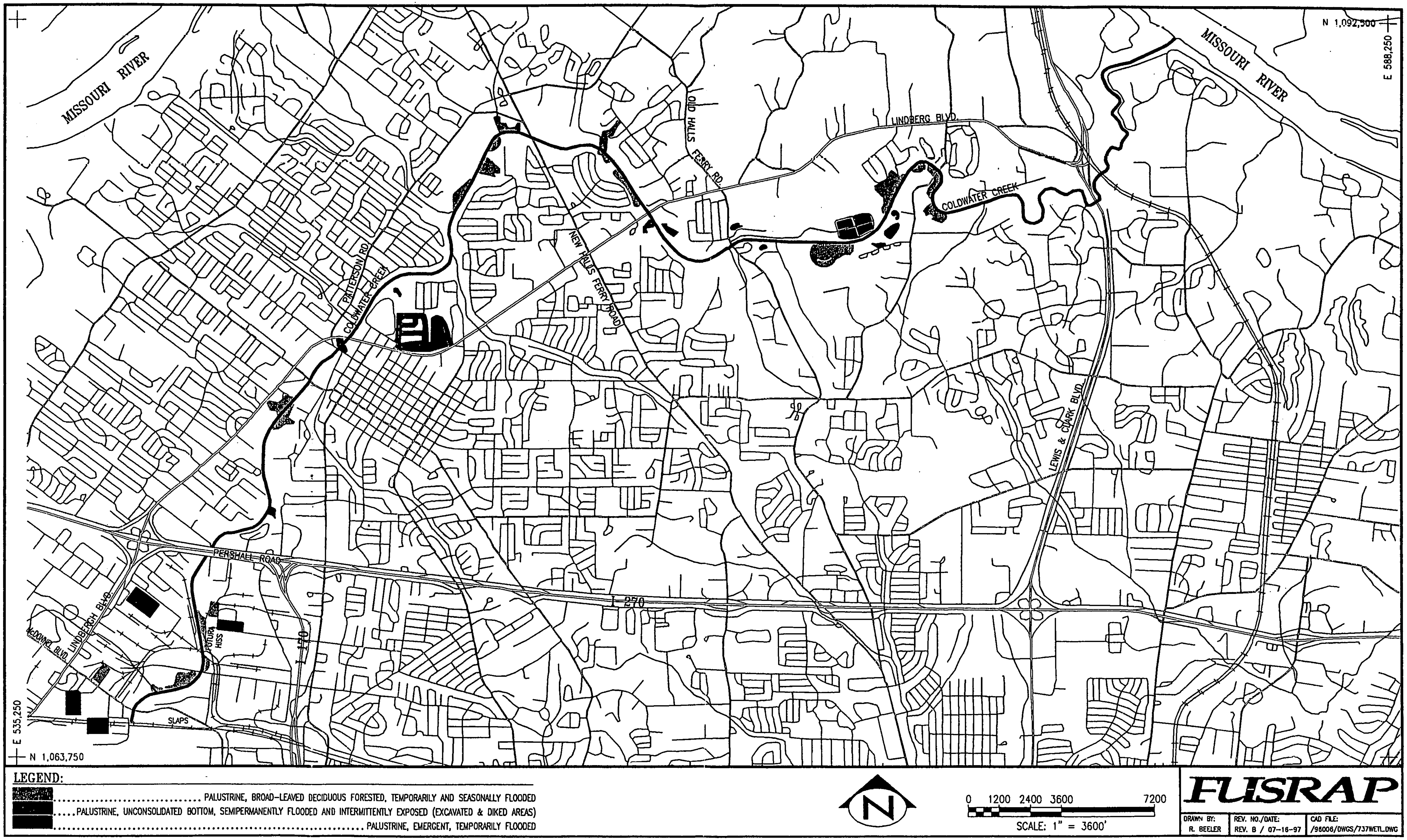

Figure 2-5. Occurrence of Federally Designated Wetlands Along Coldwater Creek

Statement conducted by the Army Corps of Engineers (COE), the Fish and Wildlife Service stated that it is "highly unlikely" that the proposed COE project on Coldwater Creek would affect any federally listed species (COE 1987). As a point of reference, the COE proposed project outlined in that study involved a substantially greater amount of land clearing and stream bed disturbance than any action that might be taken at SLAPS.

2.2.8 Wetlands and Floodplains

The Fish and Wildlife Service has identified four remnant wetlands, totaling approximately 32 ha (80 acres), along Coldwater Creek between SLAPS and HISS/Futura (Figure 2-5). These wetlands, located on the creek bank, are classified as Palustrine/Forested/Broad-leafed/Deciduous/Temporarily Flooded. The site visit in May 1992 confirmed that broad-leafed forest communities are present in the wetland areas.

Although soil units mapped along Coldwater Creek between SLAPS and Futura were not identified as typically hydric in the county soil survey, hydric soils can occur in any of the soil associations in St. Louis County. The Nevin-Urban soil association underlying the wetlands along Coldwater Creek can possess hydric properties including poor drainage, mottling, and shallow water table depth. The May 1992 site visit confirmed that the wetland areas have signs of seasonal flooding.

The elevation at SLAPS varies from approximately 155 to 161 m (530 to 510 ft) from east to west and land surface ranges from 4.5 to 6 m (15 to 20 ft) above Coldwater Creek (BNI 1992b). Generally, the property surface is flat; however, since the fill placed over the property in the early 1970s was not spread evenly, compaction, revegetation, differential settling and erosion have created an irregular surface (BNI 1992b). The 100-year flood level at SLAPS is 159 m (522 ft) above MSL [Federal Emergency Management Agency (FEMA 1983)]. Figure 2-6 shows the extent of the 100-year floodplain at the SLAPS.

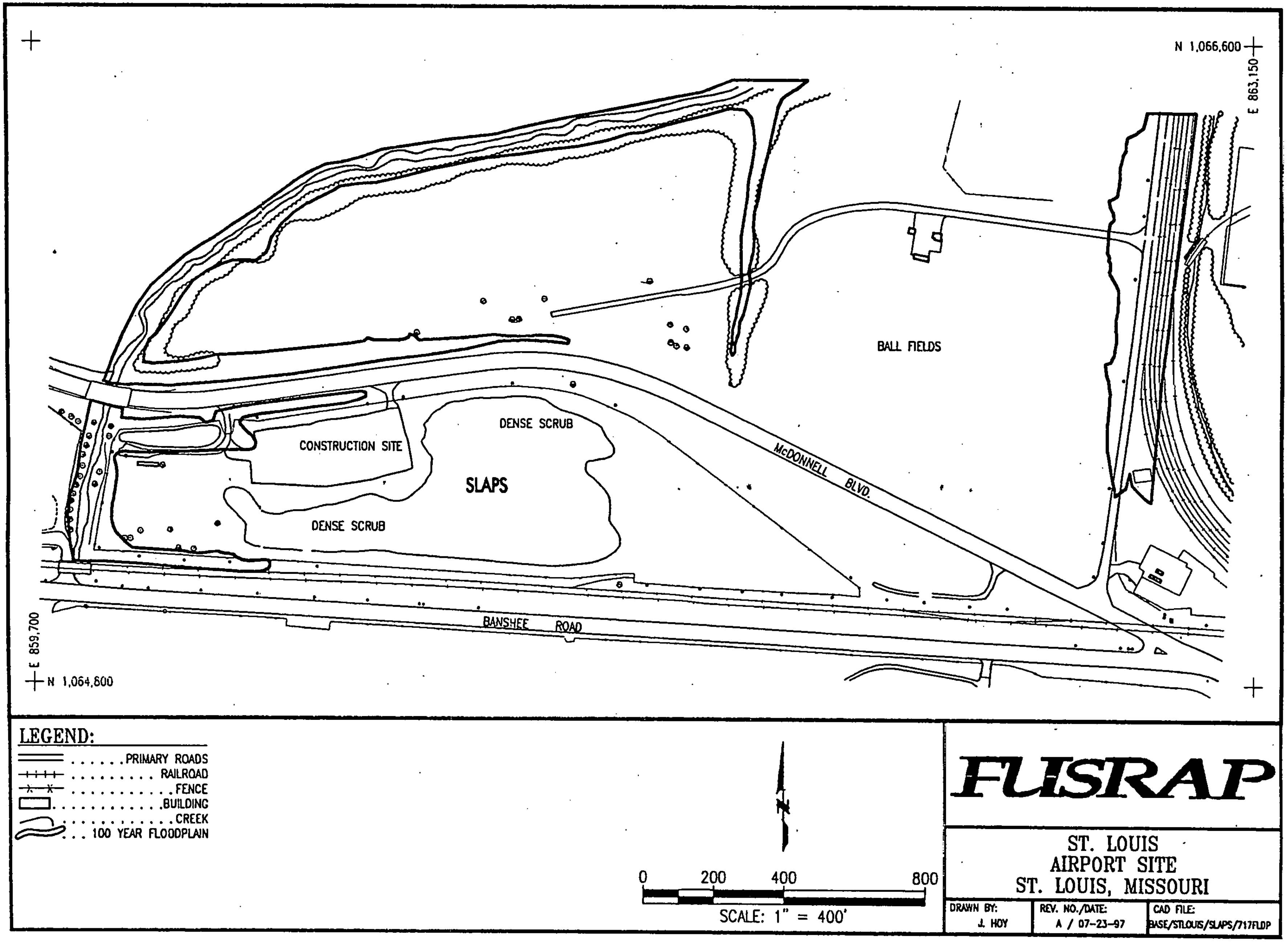

Figure 2-6. Extent of the 100-Year Floodplain at SLAPS

2.2.9 Historical, Archeological and Cultural Resources

No archaeological or historical sites included in the National Register of Historic Places are located within a 1.6 km (1 mi) radius of the airport area. The closest National Register listings are the Meyer House and Daniel Bissell House, located 3.2 km (2 mi) to the north and 6.4 km (4 mi) to the east of SLAPS, respectively. The State Historic Preservation Officer (SHPO) did not identify any known cultural resources within SLAPS (Appendix B, concurrence signature on letter from DOE to SHPO). In addition, SHPO determined that an in-field cultural resource assessment of the site was not warranted because of previous disturbance of the property (Weston 1979).

The Coldwater Creek drainage basin has some archaeological and historical interest. Archaeological discoveries suggest that humans have occupied the region for at least 10,000 years, and 13 prehistoric Indian sites within the basin are registered with the Missouri SHPO (COE 1987). The Division of Parks and Historic Preservation within Missouri Department of Natural Resources (MDNR) conducted the most recent archaeological survey (May/June 1985) of the Coldwater Creek drainage basin in order to recover location data concerning prehistoric and historic resources in areas threatened by construction activity. The University of Missouri Archaeological Survey collaborated with MDNR to perform the reconnaissance field work and to prepare the *Cultural Resource Survey*, which reported the field survey findings.

The reconnaissance survey covered 800 ha (2,000 acres) of portions of the Coldwater Creek drainage basin. Although previous surveys had recorded 34 archaeological sites, development activities in the drainage basin have since destroyed 33 of these sites. Consequently, the 1985 survey concentrated on discovering and defining previously unrecorded resources, 52 new sites in all. MDNR identified seven camp sites within 0.40 km (0.25 mi) of Coldwater Creek that could be affected by remedial or construction activity along the creek banks (Harl 1992). The closest of these sites is located 6.4 km (4 mi) downstream of SLAPS in the area between I-270 and the New Halls Ferry Road. In addition, MDNR also made 16 isolated finds including both prehistoric and historic remains that were associated with other artifacts. No known archaeological sites are located adjacent to Coldwater Creek between I-270 and SLAPS. This area has been and is being used for industrial and recreational activities. SLAPS has been used as a waste management area in the past.

Numerous historical sites are located along Coldwater Creek. The most prominent of these historical sites is the City of St. Ferdinand Multiple Resource Area (MRA), which is located approximately 3.4 km (2 mi) downstream of SLAPS and is listed on the National Register. MRA is the oldest settled area in St. Louis County, and it is composed of 124 historically significant properties, dating from 1790 to 1940. Although the area is primarily residential and features 93 single family dwellings, a small commercial area survives and includes 15 buildings with historical significance. The western portion of the

MRA, including the St. Ferdinand Church and Shrine, are located within 0.40 km (0.25 mi) of Coldwater Creek.

The St. Ferdinand Central Historic District (hereafter referred to as "St. Ferdinand") is contained with the MRA. St. Ferdinand (now Florissant) has no single period of outstanding historical significance; however, the town illustrates the historical development from the time of Spanish and French colonization, through the German immigration and urban expansion of the nineteenth century, to the present day. St. Ferdinand is located approximately 335 m (1,100 ft) east of Coldwater Creek, and consequently, many of the town's buildings that have been nominated for inclusion on the National Register of Historic Places lay within the Coldwater Creek floodplain (Harl 1992).

The St. Ferdinand's Shrine Historic District is not contained within the St. Ferdinand MRA, but it is regarded as the most prominent of all of the St. Ferdinand historical sites. The shrine is located approximately 61 m (200 ft) east of Coldwater Creek and west of Fountain Creek, and is located within the 100-year floodplain. The shrine buildings mark one of the earliest outposts of the Catholic church in U.S. territory and are listed in the National Register of Historic Places.

Consultation with the St. Louis County Department of Parks and Recreation revealed another historical site along Coldwater Creek. The Bockrath-Wiese House is located in St. Ferdinand Park approximately 46 m (150 ft) from the creek's eastern bank 5.3 km (3.3 mi) downstream from the SLAPS. The Wiese House was built prior to 1870 by Henry Bockrath, a German immigrant, and is presently owned by the City of Florissant. Because of its significance as an example of a Missouri-German vernacular farmhouse, it has been nominated for inclusion on the National Register of Historic Places. Activities undertaken pursuant to this EE/CA will not adversely impact any historic properties.

2.3 PREVIOUS REMOVAL ACTIONS

No previous removal actions have been performed at SLAPS.

2.4 NATURE AND EXTENT OF CONTAMINATION

A remedial investigation was conducted to determine the nature and extent of contamination, and to characterize the geological and hydrogeological features of the St. Louis sites. Analytical results for radiological and chemical characterization surveys are summarized in the RI report (BNI 1994a). In addition, the SLAPS property was studied to determine its suitability as the location for an engineered disposal facility for waste from the St. Louis site (BNI 1994b). Radiological characterization included near-surface gamma measurements, downhole gamma logging, and analysis of over 400 soil samples for U^{238}, Ra^{226}, Th^{232} and/or Th^{230}. Sediment samples from the ditches were also collected and analyzed for the same radionuclides.

2.4.1 Characterization Results

Radiological Results

Analytical results for soil at SLAPS revealed extensive contamination across the site as presented in Table 2-1 and illustrated in Figure 2-7. As can be seen from an inspection of Table 2-1, although both the north and south ditches have radioactive contamination, the ditches to the north of SLAPS are more heavily impacted than those to the south in terms of the maximum detected activity. Although average concentrations in the ditches are of similar magnitude, Th^{230} in the north ditch is twice that in the south ditch.

Chemical Results

Table 2-2 shows the chemical data for SLAPS. The data are based on 90 samples taken in 30 borings drilled in SLAPS. For metals, only the results above U.S. background were reported (BNI 1989). Due to the paucity of the available chemical data, it is difficult to draw conclusions regarding the nature or extent of chemical contaminants at SLAPS; however, based on this limited data, there does not appear to be a widespread problem with chemical contaminants at SLAPS. Three organic compounds (toluene, trans-1,2-dichloroethene, and trichloroethene) were detected in a small percentage of the borings that were analyzed for chemicals. There were a total of 6 target chemicals detected in TCLP tests. These are shown in Table 2-3 along with the TCLP limits. Lead and mercury exceeded TCLP limits in 1 sample each (not the same sample) out of the 34 TCLP analyses. The samples in which lead and mercury exceeded the maximum allowable concentration were the only samples in which lead and mercury exceeded the detection limits. Selenium was found to exceed the maximum allowable concentration in 1 sample. It was detected in the leachate of 14 samples with an average concentration of 0.167 mg/L. The maximum allowable concentration for selenium is 1 mg/L. The next highest concentration after the maximum of 1.18 mg/L was 0.411 mg/L. Based on these results, it is not anticipated that this action will generate mixed waste.

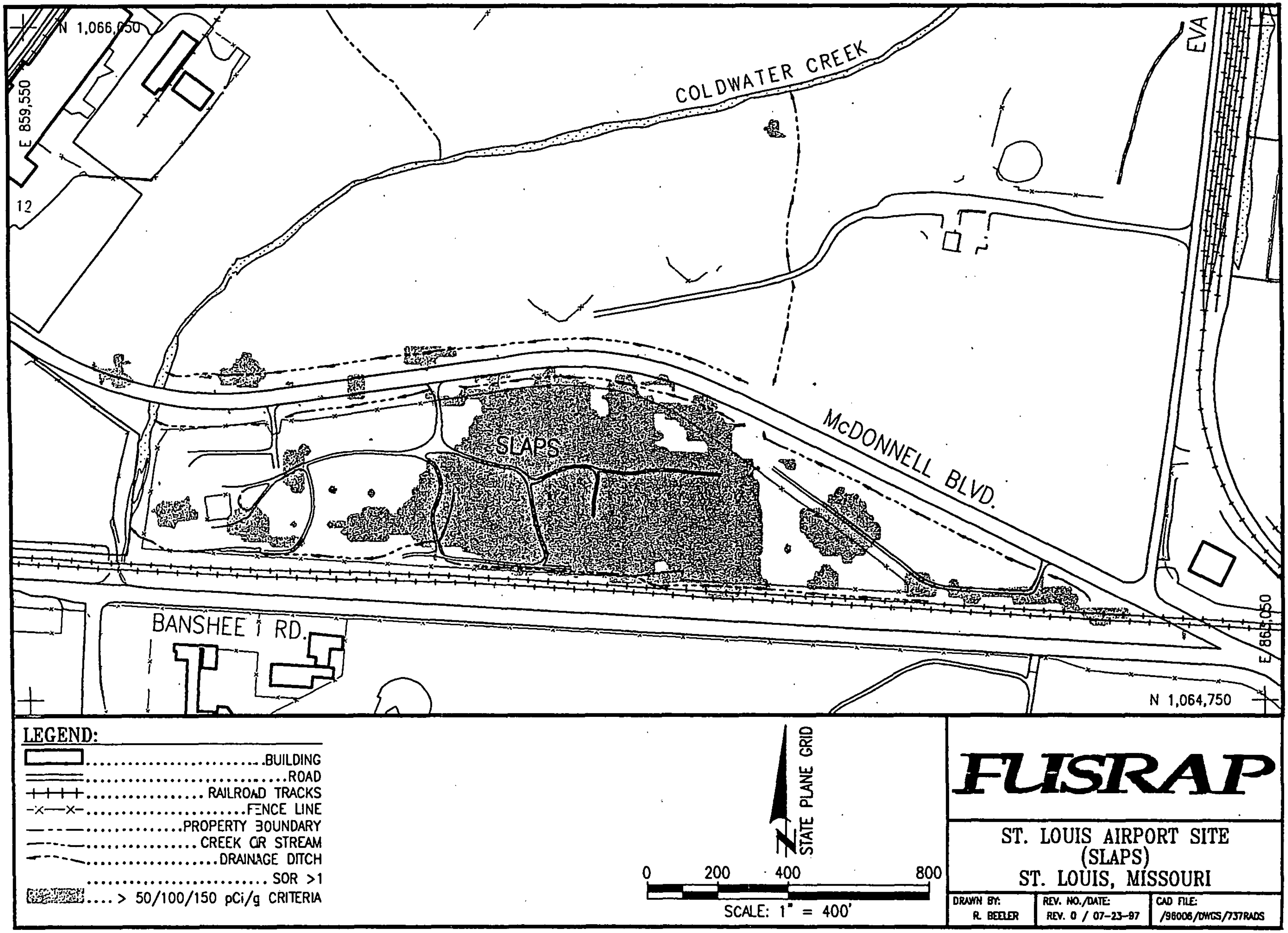

Figure 2-7. Areas of Elevated Radionuclides on the Ballfield

Table 2-1. Residual Radioactivity in Soil at SLAPS and in the Ditch Along Side SLAPS

a) Radionuclide concentration for all SLAPS soil samples (pCi/g)

Analyte	Minimum detection	Maximum Detection	Mean	Number of Detections / Number of Samples
Ra226	0.5	5,620	58.4	221/448
Th230	0.0	2,600	134	225/226
Th232	0.3	63	3.40	137/447
U238	0.5	1,600	59.1	60/447

b) Radionuclide concentration for all north ditch samples, pCi/g

Analyte	Minimum detection	Maximum Detection	Mean	Number of Detections/Number of Samples
Ra226	0.7	130	4.32	192/198
Th230	0.9	15000	228	178/178
Th232	0.7	6	1.88	174/197
U238	1.1	66	12.3	60/197

c) Radionuclide concentration for all south ditch samples, pCi/g

Analyte	Minimum detection	Maximum Detection	Mean	Number of Detections/Number of Samples
Ra226	0.7	28	3.01	105/108
Th230	1.5	1400	108	70/70
Th232	0.4	4	1.83	93/108
U238	1.2	94	13.4	44/108

Table 2-2. Summary Statistics for Chemical Constituents in Soil at SLAPS

Chemical	Concentration (mg/kg)			Number of Detections Above Background[a] out of 90 Samples	Average Background Concentrations in Missouri Soil[b]
	Mean[c]	Min.	Max.		
Antimony	7.07	53.2	53.2	1	.52
Arsenic	164.00	50.8	237	3	8.7
Barium	7,140	1,000	13,600	5	580
Cadmium	1.42	1.00	50.4	16	<1.0
Chromium	3240	3240	3240	1	54
Cobalt	654	41.9	6050	23	10
Copper	896	135	4,400	12	13
Fluoride	44.8	32.4	62.9	4	270
Lead	644	268	1,200	6	20
Magnesium	12,100	21	26,900	31	2,600
Molybdenum	21.3	17.7	255	14	<3.0
Nickel	3,890	1,460	7,570	4	14
Selenium	14.1	19.6	183	4	0.28
Sulfate	860	860	860	1	NA
Toluene	102	1.5	1,200	26	
Trans-1,2-dichloroethene	3.4	1.3	7.7	5	
Trichloroethene	5.45	1.6	15	6	
Vanadium	758	630	862	3	69
Zinc	2,490	657	4,330	2	49

[a]BNI 1987. Comparison to background referenced to background reported in *Health and Control Aspects of Coal Conversion* by N. Braunstein (1981).
[b]ANL 1993. Baseline Risk Assessment referenced Missouri background to *Geochemical Survey of Missouri* by R. Tidball (1984), except for antimony and thallium.
[c]Average includes nondetects at ½ the detection limit, if reported.

Table 2-3. Summary Statistics for TCLP Results in Soil at SLAPS

Chemical	Concentration (mg/L)			Number of Detections out of 34 Samples	Maximum Concentration in Leachate (mg/L)
	Mean[a]	Min.	Max.		
Barium	1.52	0.536	3.400	34	180
Cadmium	0.0103	0.0051	0.211	8	1.0
Lead	0.0476	0.135	.135	1	5.0
Mercury	0.00011	0.43	0.43	1	0.2
Selenium	0.167	0.105	1.18	14	1.0
Heptachlor	0.00009	0.00004	0.00043	8	0.008

[a]Average includes nondetects at ½ the detection limit, if reported.

2.4.2 Volume of Soil Impacted by Radioactive Materials

At SLAPS, radioactivity in excess of DOE 5400.5 guidelines is generally within 1.5 m (5 ft) of the surface. The volume of contaminated soil to be excavated from the area along Coldwater Creek is 3,120 yd^3, from the ditch south of McDonnell Boulevard is 3,556yd^3, and from the ditch north of McDonnell Boulevard is 5,243 yd^3 (Alternative 2 only).

2.4.3 Areas Potentially Affected By Actions at the Site

Coldwater Creek has been impacted by site residues via runoff from SLAPS. Although levels of measured radionuclides in surface water samples from Coldwater Creek were generally consistent with background levels and lower than current and proposed EPA guidelines, sediments containing radionuclides above background concentration are found in the creek. Sampling along Coldwater Creek has shown that contaminated sediments occur irregularly and bank soil radioactivity is spotty. One of the objectives of this removal action is to control sediment migration into Coldwater Creek in order to further reduce the potential for contaminated material from SLAPS to reach the creek.

Stormwater drainage from SLAPS flows through ditches adjacent to SLAPS and discharges directly into Coldwater Creek (Figure 2-8). The ditches may be receiving contaminated sediments as surface water moves from SLAPS to the creek. One objective of the action proposed in this document is to reduce the potential for mobilizing sediments by providing a clean buffer adjacent to Coldwater Creek and directing surface water flow on SLAPS through a stabilized engineered channel.

There is potential for groundwater beneath the site to be contaminated by radioactive constituents from the soil. Radionuclides migrate very slowly through groundwater (BNI 1994b), consequently, if radionuclides do get into the groundwater they normally require a very long time to move beyond the site. The rate of this movement is highly dependent on the chemical and physical conditions in the aquifer.

The south-central and eastern portion of SLAPS lies directly in the path of an approach to Runways 17 and 24 at the St. Louis airport. Any action that is taken would consider this in the design process to ensure that the action does not create a hazard to air traffic. Actual height limits would be specified by the St. Louis Airport Authority at the time a specific proposal is presented (Cullivan 1997).

2.5 STREAMLINED RISK EVALUATION

The purpose of this action is to reduce sediment runoff to Coldwater Creek and provide a clean buffer adjacent to the creek. A baseline risk assessment has been

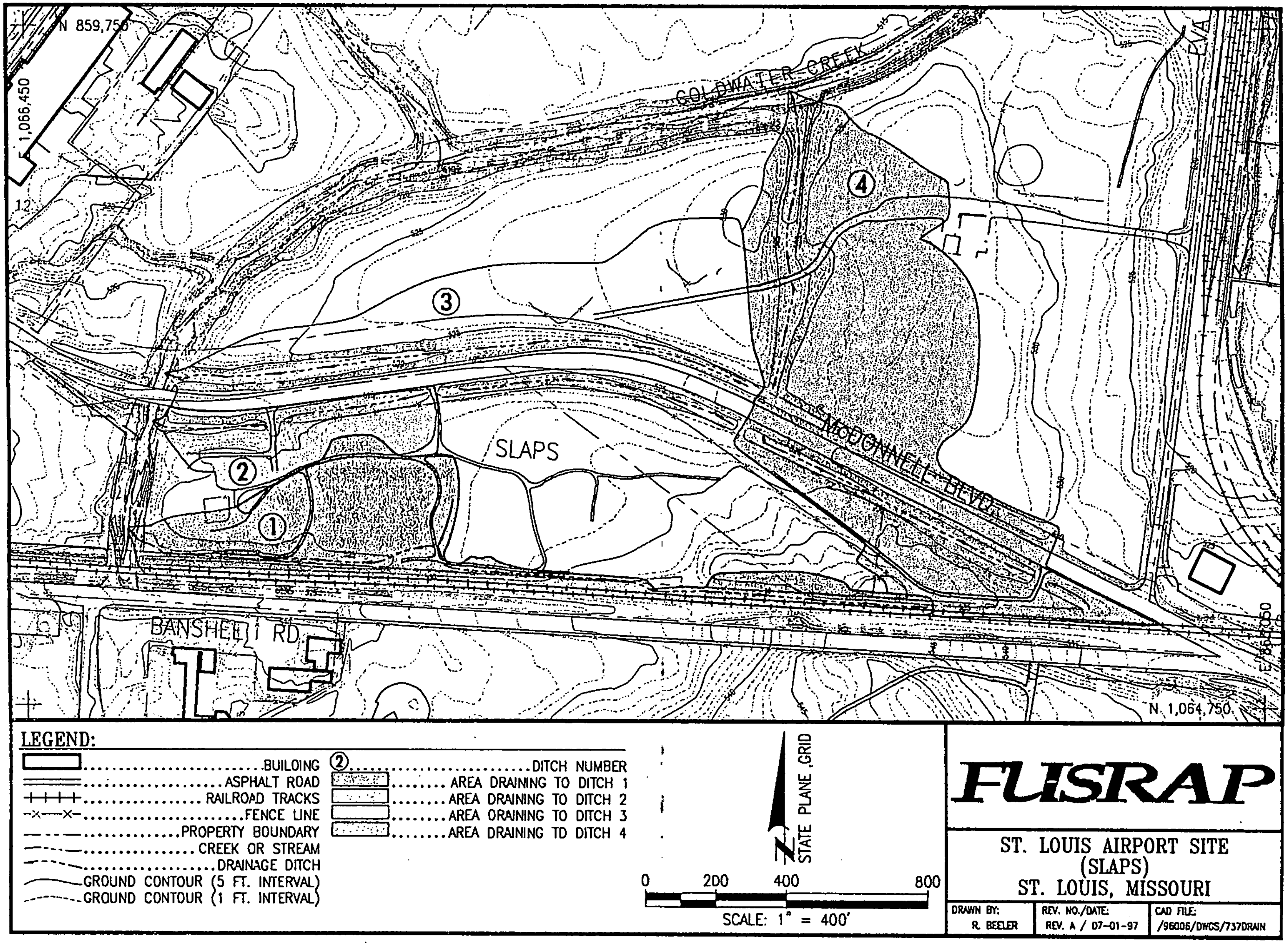

Figure 2-8. Drainage at SLAPS

completed for the St. Louis sites including SLAPS and Coldwater Creek (DOE 1993). Results from the risk assessment for SLAPS, Coldwater Creek, and the ditches are shown in Table 2-4. This action will remove source materials and therefore will incrementally reduce the risks established in the Baseline Risk Assessment. While the extent of excavation will not be defined through risk-based analysis, this action is consistent with the anticipated long-term remedy for the site. An evaluation of risk to remedial workers and the public during implementation of the action has been undertaken in this EE/CA (Appendix C) as part of the evaluation of short term effectiveness.

Table 2-4 Results of Baseline Risk Assessment

Receptor	Radiological Carcinogenic Risk	Chemical Carcinogenic Risk	Hazard Index
SLAPS Trespasser	9.4×10^{-5}	1.0×10^{-6}	0.051
SLAPS Maintenance Worker	1.1×10^{-3}	4.0×10^{-6}	0.070
Ditch Construction Worker	4.4×10^{-4}	3.9×10^{-6}	0.21
Coldwater Creek Recreational User	3.0×10^{-6}	4.6×10^{-6}	0.067

3. IDENTIFICATION AND ANALYSIS OF ALTERNATIVES

In this section, the technologies potentially applicable to achieve the objectives described in this document are identified and evaluated. In Section 4. alternatives derived from those technologies are briefly discussed and evaluated as to their effectiveness. feasibility, and cost.

3.1 TECHNOLOGIES POTENTIALLY APPLICABLE TO THE PROPOSED OBJECTIVES

The preliminary identification of technologies discussed in this section is not all inclusive, but provides a brief overview of relevant technologies that could be applied to protect human health and the environment. These technologies have been screened on the basis of site-specific conditions and the current understanding of radionuclide distribution at SLAPS.

3.1.1 Institutional Controls

Access restrictions involve the use of physical barriers and/or institutional controls to reduce the potential for exposure to materials that would otherwise need to be removed to protect human health or the environment. Physical barriers such as fences are easy to implement and can, in some circumstances, be protective of human health and the environment. They are not generally effective in controlling the source or migration of soil particles. Because this area is already fenced, access restrictions will not be further considered in this action. Institutional controls such as deed restrictions would be appropriate under certain circumstances to restrict certain uses of the site. For example. residential or agricultural use might be restricted or prohibited. Deed restrictions could also designate what types of modifications to the site would need prior approval. Deed restrictions may be an element of any long-term remedy if radioactive materials are left on site above DOE guidelines for release without radiological restrictions. However, because this is not a final action, deed restrictions are not appropriate and will not be further considered.

3.1.2 Containment

Surface water control is a containment technology that will be considered for satisfying the objectives of this removal action. Containment using engineered structures to restrict the movement of impacted soils or surface water is applicable to this site. Dikes and berms are embankments engineered to divert water from a specific area. They provide short- and long-term protection by diverting flow to drainageways away from the contaminated area.

Interim storage involves the temporary placement of excavated material until it can be transported and disposed out-of-state or until a final disposal option is determined. This option has been used at several FUSRAP sites [including the Hazelwood Interim Storage Site (HISS)]. Interim storage of selected contaminated materials will be retained for further consideration.

Disposal involves the permanent placement of excavated materials in a facility which has been engineered for protection of human health and the environment and long-term reduction of the mobility of the radioactive materials. There are several types of facilities that meet or could meet these requirements: a FUSRAP-exclusive facility, a commercial facility, and/or a government facility. Currently no FUSRAP-exclusive facility exists and government facilities are very costly. Thus, commercial disposal is the only permanent disposal option retained for this removal action.

3.1.3 Removal

Removal is also an easily implemented action that can be done with standard construction techniques and conventional equipment. It is also a technique that has been used successfully on similar FUSRAP projects in the past. Because the proposed action in this document involves only soil and ditch sediment, excavation is identified as the applicable removal technique.

3.1.4 Treatment

Treatment technologies as applied to the environmental field are many and varied. However, only a few are applicable to radioactive materials. The few that are effective in either removing radioactivity or reducing its mobility, toxicity, or volume fall into two categories. One type of treatment uses either physical or chemical processes to remove the radioactive materials from the soil matrix. A second type of process that uses either physical or chemical processes immobilizes the radioactive particles within a solid matrix, thus reducing their mobility.

DOE is evaluating technologies for the remediation of SLAPS in a separate action. DOE has issued a Request for Proposals for technology demonstrations at the end of FY97. Any selected demonstrations would be scheduled for FY98. These activities are not applicable to the actions described in this EE/CA, but the technology performance and cost data from the field demonstration will be used by DOE to evaluate remedial alternatives for the remaining contamination at the SLAPS site.

4. ANALYSIS OF ALTERNATIVES

4.1 DESCRIPTION OF THE ALTERNATIVES

DOE Order 5400.5 specifies that the guideline for radionuclide concentrations for radium and thorium in soil is 5pCi/g above background in the top 15cm of soil and 15pCi/g above background in any subsequent 15 cm layer. A corresponding concentration for U^{238} would be 50pCi/g. The Sum of Ratios (SOR) for a mixture of radionuclides would apply. The SOR is a mathematical model that reduces the allowable concentration of an individual radionuclide when multiple radionuclides are present so that the 5/15/50 guideline is not exceeded. The SOR calculation will be based on DOE Order 5400.5 as follows:

SOR=

$$\frac{\overset{\text{(whichever greater)}}{(Th^{230} \text{ or } Ra^{226})} - (\text{background})}{5/15} + \frac{\overset{\text{(whichever greater)}}{(Th^{232} \text{ or } Ra^{228})} - (\text{background})}{5/15} + \frac{(U^{238}) - (\text{background})}{50}$$

Soils with a SOR value greater than 1 (i.e., exceed the 5/15/50 guideline) are considered radioactively contaminated.

4.1.1 Alternative 1 - No Action

This alternative consists of leaving SLAPS in its current condition. The SLAPS is currently being monitored for both surface and air releases of radionuclides as well as intermittent monitoring of the groundwater. While no new measures would be taken to reduce exposure or prevent migration of contaminants from the property, SLAPS would continue to be monitored and maintained.

4.1.2 Alternative 2 - Removal of Radioactively Contaminated Soil with Offsite Disposal and Limited Temporary On-site Stockpiling

The objective of this alternative is to remove radioactively contaminated (SOR>1) fill materials immediately adjacent to the creek and to provide a buffer zone between the creek and the remainder of the SLAPS. To achieve this objective, this alternative would remove contaminated soil nearest Coldwater Creek on the west end of SLAPS. The excavation would span the entire north-south width of the site and beginning just east of the gabion wall (i.e., the gabion wall would remain in place) it would be approximately 70 feet wide (Figure 4-1). It is anticipated that the excavation will proceed to one foot beneath the original grade unless field conditions warrant either continuing or stopping. Any decision to modify the excavation design would be made in association with MDNR and EPA. Conditions that could lead to a modification of the excavation might include

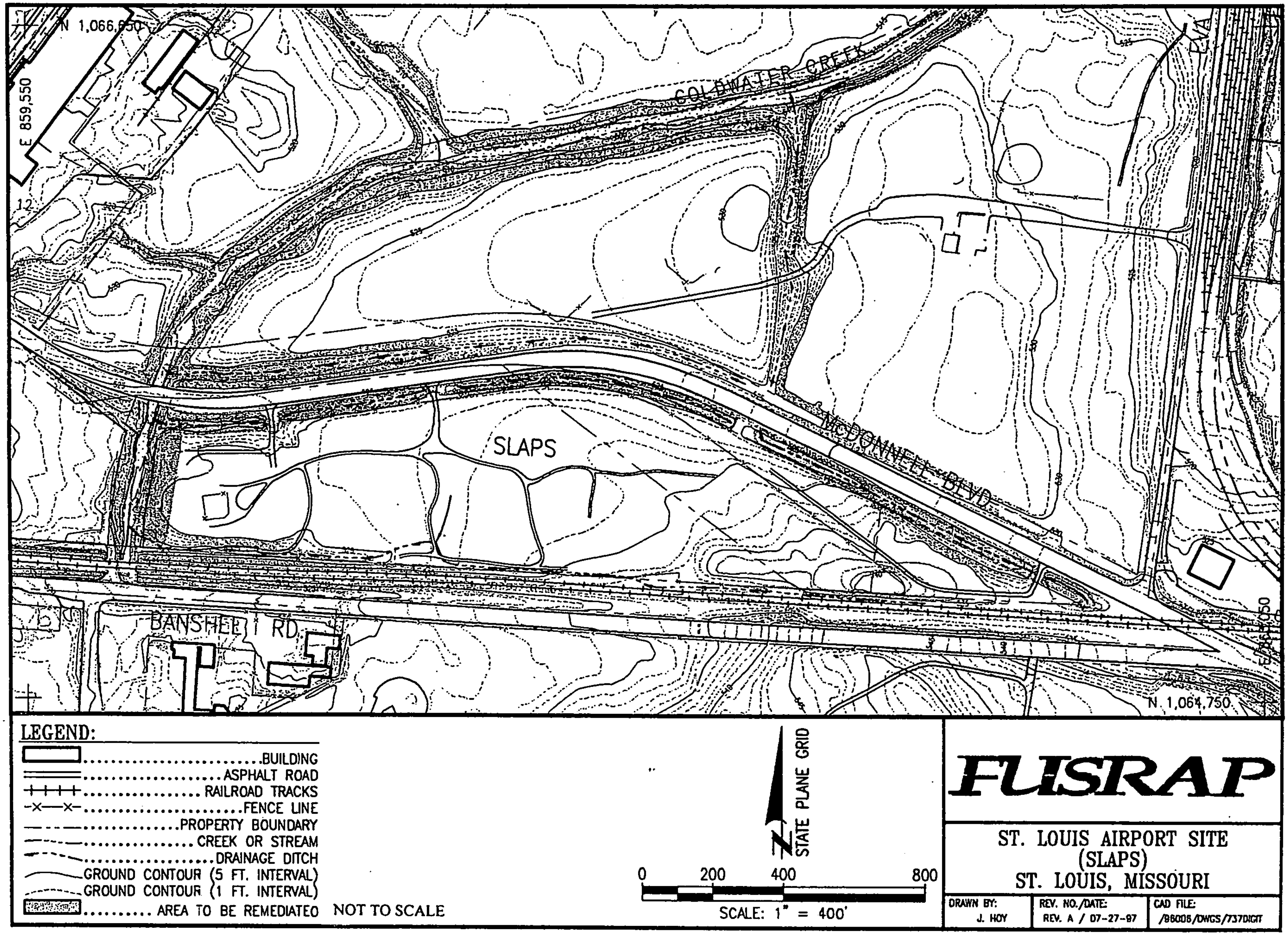

Figure 4-1. Location of Soil and Sediment to be Removed Under Alternative 2

large quantities of groundwater in the excavation pit, the presence of unexpected Figure 4-1 contaminants, or the presence of unexpected quantities of known contaminants of concern (COC). DOE will strive for unrestricted use clean-up levels for non-radiological COCs in the absence of final risk based clean-up criteria. If encountered, small volumes of groundwater will be placed on the contaminated portions of the SLAPS. No water from the excavation will be discharged to Coldwater Creek. The excavated buffer area will be backfilled with clean clay material, then a berm will be constructed on the eastern edge of the excavation to minimize runoff into the excavated area.

Contaminated soils (SOR>1) from the entire length of the ditch along the south side of McDonnell Boulevard will be excavated. Contaminated soils from the ditch on the north side of McDonnell Boulevard from Coldwater Creek upstream to the culvert crossing (approximately 800 feet) will also be excavated. These ditches will be replaced with rip-rap channels to provide a stabilized drainageway. While constructing the engineered channel, the three ditches draining the north of SLAPS as shown in Figure 2-8 will be connected so that no flow will pass under McDonnell Boulevard into the Ballfields ditches. Uncontaminated soils that must be excavated to construct the ditch will be placed on SLAPS. A geotextile barrier will be placed beneath the rip-rap to minimize future migration of contaminated soil to the subsurface. The removal of contaminated soil and the placement of rip-rap will eliminate the contaminated materials that are closest to Coldwater Creek and minimize the amount of material that is available for transport by surface water runoff.

Material exceeding the 5/15/50 guidlines (DOE Order 5400.5) but below 50 pCi/g for Ra^{226}, 100 pCi/g for Th^{230}, or 150 pCi/g for U^{238} (approximately 5,700 yd^3) would be temporarily stockpiled and all other contaminated materials would be shipped to a licensed out-of-state disposal facility. For the purposes of this document, the 50/100/150 contaminated levels are referred to as moderately contaminated and are considered to be an initial indication of a minimum cleanup standard under any future use scenario. The moderately contaminated soil would be stockpiled on SLAPS until it could be transported and disposed out-of-state or until a final disposal option is determined.

The Eva Road loading facility is less than 100 m (300 ft) from the southeastern corner of SLAPS. The facility has a bermed concrete storage pad for staging soil prior to loading onto gondola cars for shipment. Airborne dust is suppressed by using a water spray to keep soils moist. This facility has a capacity for handling up to 6 railroad cars per day. Each railroad car can hold up to 57 m^3 (75 yd^3), limiting shipment from this facility to 344 m^3/day (450 yd^3/day). This limitation imposes minimal impact under this removal action because it is anticipated that 11,919 yd^3 of contaminated soil would be excavated as a result of this alternative, and only 5,880 m^3 (7,646 yd^3) of the material excavated would be shipped. However, the limitations of the Eva Road facility may hinder progress when larger removal or remedial actions are attempted.

Because of this limitation on future larger actions, Alternative 2 includes the construction of a new rail loading facility at SLAPS. This facility would increase the throughput of soil over the Eva Road facility, so that soil loading capacity will not be an impediment to future large scale projects. The facility will take advantage of the existing rail bed at SLAPS. The facility will include soil staging, conditioning, and rail car loading areas to facilitate large-scale efficient loading and transportation operations. The Eva Road facility would continue to be used during the removal action until the new facility was completed. Wastes staged at SLAPS would be limited to material originating from SLAPS and SLAPS vicinity properties, including the Ballfields. The facility would be a temporary structure and would be decommissioned following completion of SLAPS and vicinity properties remedial activities.

Additional characterization will be performed prior to and during excavation in order to better identify contaminated material within the buffer area and to establish chemical and radiological concentrations in the area. Hand held instruments to be used include: SPA-3 or equivalent and FIDLER for radiological; photo ionization detector or H-Nu for organics; and LIBS for metals. The excavation is to be checked using hand held instruments 2 times per day. The readings will be on a regular grid of 5 meter centers. Ten percent of the readings will be confirmed by laboratory analysis. In areas where MED/AEC organic COCs are not mixed with radiological contaminants, screening samples will be taken daily. Samples will be analyzed for rapid turnaround (24-hour). In areas where MED/AEC metals of concern are not mixed with radiological contaminants, the LIBS will be used for screening twice a day on the same 5 meter grid as for radiological samples. Confirmatory radiological and chemical sampling will be done daily for 10% of the final screening locations for the day. In areas nearing the boundary of mapped contaminants (outside the last contaminated sample), radiological contaminants will be screened 4 times a day. Screening will be done with hand held instruments on a 5 meter grid. In areas nearing the boundary of mapped contaminants (outside the last contaminated sample), 10% of the last set of radiological screening readings will be confirmed with laboratory analysis each day.

Background values for the vicinity will also be determined during this characterization effort. Approximate locations for background sampling proposed by MDNR are shown in Figure 4-2 (Garstang 1997). Final locations will be determined in the field with concurrence from EPA and MDNR.

4.1.3 Alternative 3 - Removal of Radioactively Contaminated Soil with Offsite Disposal

The scope of Alternative 3 is the same as Alternative 2 with two exceptions. The first is the use of the site for temporary stockpiling of moderately contaminated soils. Under Alternative 3, all contaminated soils (SOR>1) would be sent to a licensed offsite

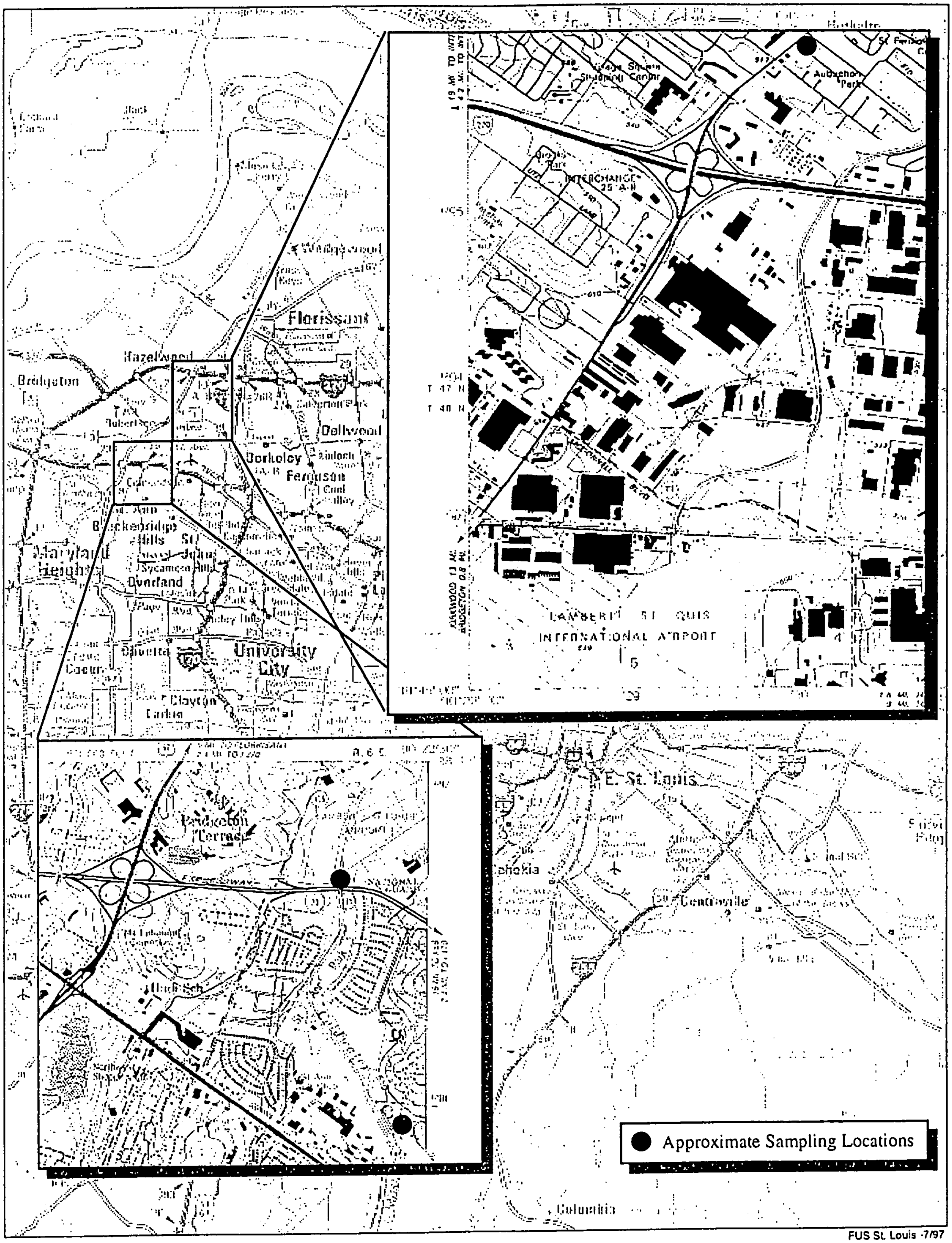

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Figure 4-2. Background Sampling Locations

disposal facility. The second exception is that under Alternative 3, the contaminated sediments in the ditch north of McDonnell Boulevard would remain in place. The elimination of the north ditch from this alternative is necessary to ensure adequate funding is available to pay for offsite disposal of the moderately contaminated soils that were identified for temporarily onsite stockpiling under Alternative 2. Based on the limited data available, the ditch north of McDonnell Boulevard is estimated to contain 5,200 yd^3 of soils with the following reasonable maximum exposure (RME) concentrations: Ra-226 - 42 pCi/g, Th-230 - 2,299 pCi/g, Th-232 -1.1 pCi/g, and U-238 - 26 pCi/g. Therefore, relative to Alternative 2, this alternative results in more highly-contaminated soils remaining onsite.

4.2 EFFECTIVENESS

4.2.1 Protection of Human Health

Alternative 1 would provide no additional protection of human health and the environment. There is currently no clean buffer zone between the creek and SLAPS and the potential for sediment runoff from SLAPS to Coldwater Creek would continue. The no action alternative is included in this analysis for comparison against other alternatives consistent with CERCLA regulations and National Environmental Policy Act (NEPA) values. Table 4-1 presents a tabular evaluation of the alternatives.

Alternatives 2 and 3 will only have a small direct positive impact on human health because portions of the ditches are located outside the SLAPS fence. However, the area affected by the action is small relative to the total impacted area at SLAPS. Alternative 2 and 3 would have the positive impact of making future remedial actions proceed more rapidly and, with respect to future remediation at SLAPS, reduce the possibility of an injury occurring during transportation of soil offsite to the Eva Road facility because the excavated soil could be loaded onto railroad cars without ever leaving SLAPS. This would also have a positive impact on cost. Following this action, SLAPS will still contain a significant volume of soil to be excavated under any end use scenario. The ability to load material at SLAPS would eliminate the need for a procession of trucks crossing McDonnell Boulevard to transport the soil to the Eva Road facility. The construction of the loading facility would eliminate traffic congestion and risk impacts to the community during implementation of future remedial or removal actions in which larger volumes of soil are excavated and shipped for permanent disposal.

There is a small chance of health impacts due to dust inhalation during the removal. During removal activities, the most likely pathway for an employee of a nearby property incurring a radiation dose would be from breathing dust containing radionuclides. If no respiratory protection were used, the primary dose to remedial action workers would also be from breathing dust containing radionuclides. The inhalation dose to workers was

Table 4-1. Comparative Analysis of Removal Action Alternatives

Alternative	Effectiveness: Health Impacts	Effectiveness: Environmental Impacts	Implementability: Feasibility	Implementability: Availability	Implementability: Administrative Feasibility	Cost
1. No Action	No Change. Potential for impacts due to sediment runoff from SLAPS to Coldwater Creek.	No direct impacts. Has potential for impacts due to stormwater transport of contaminated sediments. Potential also exists for increased future risk due to site changes.	Not Applicable	Not Applicable	Unacceptable. Does not achieve objectives and would not address state and local concerns.	Has potential for increased future cost if site conditions change
2. Removal to Commercial Disposal, temp storage of selected soils, regrade north and south ditches, drainage control at SLAPS. Construct Soil Loading Facility	Minimal impacts that would be mitigated during action.	Minimal impacts that would be mitigated during action. Prepares site for next action by reducing the potential for migration of sediments during extensive excavation.	Technically Feasible.	Available	Achieves all objectives and is expected to satisfy state and local concerns. Due to height restrictions in the runway approach zones, soil loading operation would need to be closely coordinated with the Airport Authority. Potentially not administratively feasible	$8.110 million
3. Removal to Commercial Disposal, regrade south ditch, drainage control at SLAPS,	Minimal impacts that would be mitigated during action.	Minimal impacts that would be mitigated during action. Prepares site for next action by reducing the potential for migration of	Technically Feasible	Available	Achieves all objectives and is expected to satisfy state and local concerns. Due to height restrictions in the runway approach zones, soil loading operation would need to	$8.327 million

Construct Soil Loading facility.	sediments during more extensive excavation.	be closely coordinated with the Airport Authority. Potentially not administratively feasible.

estimated to be 138 mrem for Alternative 2 and 96 mrem for alternative 3 on the basis of no respiratory protection. Workers would also receive a dose from gamma radiation estimated at 79 mrem for Alternative 2 and 70 mrem for Alternative 3. Incidental ingestion of soil would increase the worker dose by an additional 46 mrem for Alternative 2 and 38 mrem for Alternative 3. These dose estimates are likely to be overstated because no worker personal protection measures are considered in this assessment. A complete description of the dose estimate derivation is provided in Appendix C. Doses to the public from gamma radiation would be negligible because the exposure rate decreases very rapidly with increasing distance from the source. Doses due to inhalation and ingestion to the workers would be controlled by the use of appropriate personal protective equipment, although such equipment would have little effect on gamma dose. Dust suppression measures such as keeping materials moist during excavation and handling would greatly reduce the inhalation dose both to the workers and to the public. Monitors would be installed during activities to determine airborne particulate concentrations so that compliance with pertinent requirements and protection of worker health and safety could be ensured. Appropriate measures would be taken at all excavation sites to ensure the health and safety of the public.

Doses to the general public during transport of the excavated material would be minimal due to precautions taken at the construction site and along the transportation route. Precautions will be taken to avoid spillage during transport. Any spills would easily be picked up and reloaded onto the vehicles, thus minimizing any long-term risk to the public. Recent similar activities have resulted in no spillage of materials. Alternative 2 and 3 would further reduce the possibility of doses to the public in future actions at SLAPS as a result of the construction of an onsite loading facility.

Traffic and noise will be associated with the trucks removing the waste material and bringing in the cover soil. Because the area is an industrial area and includes several transportation-based companies, there is already considerable truck and rail traffic as well as the activity of the nearby airport. The trucks involved in the transportation of soil would represent a minimal increase in traffic and noise due to the extremely short distance between the site and the Eva Road loading facility. The impact on local traffic safety would also be minimal. These effects would be further mitigated upon completion of the construction of the loading facility.

4.2.2 Protection of the Environment

The no action alternative allows the continuation of potential environmental impacts such as stormwater transport of radioactive particles to Coldwater Creek. The potential exists for increased risks in the future associated with site changes undertaken by the owners.

Alternatives 2 and 3 are expected to reduce potential effects on the local environment from surface runoff. During excavation and backfilling, some minor impacts on surface water could occur. Disturbed areas would be subject to wind and water erosion and could potentially affect the water quality of Coldwater Creek in the short term. These temporary effects would be mitigated by using good construction practices The effects would be reduced by minimizing the length of time an area is exposed before being backfilled and re-vegetated. Good construction practices would include misting to keep soil damp, as previously mentioned, to minimize wind erosion, silt fences to trap sediment during rainfall events, and covering soil piles with tarps or other liners when no activities are occurring on piles.

Following completion, the improvements to the drainage on SLAPS should have beneficial effects. Approximately 5,800 m^3 (7,600 yd^3) of contaminated material would be removed from SLAPS and adjacent ditches and the potential for migration of radionuclides into the creek due to surface runoff would be reduced. However, Alternative 2 would remove more highly-contaminated soils from the site than Alternative 3.

Resuspension and dispersal of dust generated during Alternatives 2 and 3 could have short term effects on the local air quality. Dust suppression techniques, as discussed above, will be used to control dust emissions.

As a result of construction activities undertaken for Alternatives 2 and 3, local wildlife would be disturbed. The existing plant species are neither unique nor restricted in distribution and the excavated areas would be quickly re-vegetated. Implementation of these alternatives would have no long-term impact on either the plant life or wildlife in the area.

No threatened or endangered species would be affected by these alternatives because critical habitats for listed species have not been identified at SLAPS (DOE 1992).

Construction of a rail loading facility at SLAPS would not have a significant impact on the environment except to the extent that future removal and remedial actions would be expedited by the larger soil handling capacity.

4.2.3 Achieving Remedial Action Objectives

Alternative 1 does not achieve the remedial action objectives as set forth in Section 2.

The excavation alternatives (2 and 3) both achieve the remedial action objectives set forth in Section 2.

- The potential for radioactive constituents migrating from the site would be reduced.
- Surface water drainage from SLAPS would be controlled.
- Transport of impacted sediments into Coldwater Creek would be minimized.
- The potential for human contact, ingestion or inhalation of radioactive material from Coldwater Creek would be reduced.

4.3 IMPLEMENTABILITY

The decision on whether an action is implementable is based on an evaluation of three factors: technical feasibility, availability of resources, and administrative feasibility. Technical feasibility is a measure of whether it is technically or physically possible to do the proposed action. Availability of resources is a measure of whether the necessary material and personnel are available. Administrative feasibility is evaluated on the basis of whether the proposed action is desirable to the parties and whether it meets criteria set forth by the agencies responsible for overseeing the proposed action.

4.3.1 Technical Feasibility

Technical feasibility does not apply to Alternative 1 since no action would be taken.

Alternatives 2 and 3 are technically feasible. Similar excavation projects have been done in the past and have presented no special difficulty. Disposal at a commercial facility also is a standard industry practice which presents no special barriers to implementation. Temporary stockpiling of moderately contaminated soils described under Alternative 2 has been done in the past and represents no special difficulty. Berms and surface water control are also standard technologies for which many vendors are available.

4.3.2 Availability of Resources

Availability of resources does not apply to Alternative 1.

All of the material and personnel necessary to implement Alternatives 2 and 3 are readily available. Only standard technologies are involved in these alternatives and these services are available through a large number of vendors. Adequate disposal capacity is available to receive the excavated materials.

4.3.3 Administrative Feasibility

Alternative 1 would not be desirable because it does not satisfy local or state concerns. Stakeholders have expressed a strong preference for conducting an action at SLAPS to protect Coldwater Creek and demonstrate tangible progress in cleaning up the site.

Alternatives 2 and 3 could be more difficult to implement administratively because of the construction of the railcar loading facility. In addition to the need to obtain permits for construction, there are also restrictions pertaining to the allowable height of structures erected in the path of the approach to airport runways. These restrictions could constrain construction on the eastern or south-central regions of SLAPS. The height of any structure built on any portion of SLAPS would have to be approved by the St. Louis Airport Authority prior to construction.

4.4 COST

No costs beyond what is now being spent for monitoring and maintenance at SLAPS would be incurred by Alternative 1.

Alternative 2 has been estimated to cost $8.110 million. Alternative 3 has been estimated to cost $8.327 million. A summary of the costs elements and description of the cost estimating methodology is presented in Appendix D.

5. PUBLIC PARTICIPATION: HOW TO PARTICIPATE IN THE DECISION-MAKING PROCESS

The public is encouraged to review this document during the public comment period which begins July 30, 1997 and ends August 28, 1997. DOE will evaluate and respond to all significant comments received during this period. DOE is especially interested in input regarding a preferred option and any considerations for carrying out the cleanup remedy.

Final selection of the cleanup remedy will not be made until comments have been evaluated and concerns have been addressed. Written comments should be addressed to:

Mr. Stephen H. McCracken
DOE Missouri Site Office
9710 Latty Avenue
Berkeley, MO 63134

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APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

LOCATION STANDARDS

Standard, Requirement, Criteria or Limitation	Citation	Description of Requirement	ARAR Status	Comment
Floodplain Management and Protection	Executive Order N. 11988	Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the maximum extent possible, the adverse impacts associated with direct and indirect development of a floodplain.	TBC[1]	Applicable to the extent that any development in a floodplain occurs.
Floodplain Management and Protection	40 CFR 6.302(a) and (b), Appendix A	Procedures on floodplain management and protection.	Applicable	Applicable to the extent that any excavation activities occur in the floodplain.
DOE Compliance with Floodplain/Wetland Review Requirement	10 CFR 1022 (1992)	Implements Executive Order 11990.	Applicable	Applicable if floodplain is affected by removal action.
Dredge or Fill Requirements (Section 404)	40 CFR Parts 230 and 231 33 CFR 320-330	Requires permits for discharge of dredged or fill material into waters of the United States, which may include floodplains. General regulat[illegible] policies on perm[illegible]ng.	Applicable	Substantive requirements apply to on-site action if the Army Corps of Engineers determines that the floodplain is a "waters of the United States." It makes this determination in accordance with rules at 33 CFR Part 328.
Governor's Executive Order, Floodplains	Order No. 82-19	Potential effects of actions taken in a floodplain should be evaluated to avoid adverse impacts.	TBC[1]	Applicable to the extent that any excavation activities occur in the floodplain or jurisdictional wetlands.

*Not formally ARAR or TBC because it is not an environmental requirement. However, the requirement is worth mentioning and including in this Table because each action must conform with these requirements.
[1]To be considered
[2]Relevant and appropriate

Standard, Requirement, Criteria or Limitation	Citation	Description of Requirement	ARAR Status	Comment
Non-Environmental Standards for Height Restrictions for Construction in Navigable Airspace				
Federal Aviation Administration - Objects Affecting Navigable Airspace	14 CFR Part 77	This Part establishes height standards for determining obstructions in navigable airspace, and sets forth requirements for notice to the FFA of certain proposed construction or alterations.	Applicable	Applicable if constructing the loading facility in a runway zone. These requirements may be more restrictive than local requirements.
Height Restrictions for Unincorporated St. Louis County	County Zoning Ordinance 1003.161	This Section establishes height limitations for structures and trees near aircraft landing approach areas and airport maneuvering areas of 20:1 for certain areas, 34:1 for certain areas, 40:1 for certain areas and 7:1 for transitional zones.	TBC[1]	These height restrictions need to be observed, unless the Federal restrictions are more stringent. St. Louis County is one of five government entities bordering the SLAPS whose height restrictions may affect construction at the site.
Height Restrictions of the City of Bridgton	City of Bridgeton Zoning Ordinance Section 5.2	Height Restriction for the approach zone to an airport is the height that would interfere with the path of aircraft using a glide angle of twenty to one (20:1) from the end of the runway.	TBC[1]	Bridgeton is one of five government entities bordering the SLAPS whose height restrictions may affect construction at the site.
Height Restrictions of the City of St. Anne	City of St. Anne Zoning Ordinance	St Anne has no special restrictions for approach zones to airports. General restrictions are 45 feet for buildings and 60 feet for signs.	TBC[1]	St. Anne is one of five government entities bordering the SLAPS whose height restrictions may affect construction at the site.

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[1]To be considered
[2]Relevant and appropriate

Standard, Requirement, Criteria or Limitation	Citation	Description of Requirement	ARAR Status	Comment
Height Restrictions of the City of Berkeley	City of Berkeley Zoning Ordinance Section 23.12	Berkeley relies on FFA regulations for the approach zone to the airport. For M-1 zoned areas, the general height restriction is 6 stories or 90 feet.	TBC[1]	Berkeley is one of five government entities bordering the SLAPS whose height restrictions may affect construction at the site.
Height Restrictions of the City of Hazelwood	City of Hazel-wood Zoning Ordinance	For the light industrial areas, the height restriction is up to 8 stories or 100 feet plus a letter from the FAA allowing that building, depending on location.	TBC[1]	Hazelwood is one of five government entities bordering the SLAPS whose height restrictions may affect construction at the site.

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[1]To be considered
[2]Relevant and appropriate

ACTION STANDARDS

Standard, Requirement, Criteria or Limitation	Citation	Description of Requirement	ARAR Status	Comment
DOE Requirements				
Radioactive Waste Management	DOE Order 5820.2A, Chapter 3	Specifies requirements for the management, treatment and disposal of DOE low-level radioactive waste.	TBC[1]	Although not promulgated standards, these requirements are mandatory for DOE.
Radiation Protection of the Public and the Environment	DOE Order 5400.5	This Order establishes dose limits for exposure of members of the public and implements the ALARA policy; contains requirements for managing radioactive materials; and establishes requirements for decontamination and release of property, and management of wastes therefrom.	TBC[1]	The provisions of this Order have been published as a proposed rule on March 23, 1993 at 58 Fed. Reg. 16268, to be codified at 10 CFR Part 834. As recently as August 1995 DOE has requested comments on the proposed rule. No final actions have been taken with regard to the rule.
Radiation Protection for Occupational Workers	10 CFR Part 835	Specifies occupational radiation protection standards and program requirements for DOE and DOE contractor operations. Includes basic dose limits of 5000 mrem/year for radiation workers and 100 mrem/year for the public, and derived air concentration limits for radionuclides in air; requires all radiation exposures to be reduced ALARA.	TBC[1]	The proposed action woul comply with these requirements.
Environmental Protection, Safety, and Health Protection Standards	10 CFR Part 830	Establishes requirements for quality assurance for environmental protection, safety and health standards; applicable to all DOE and DOE contractor operations.	Applicable	These rules are the only provisions of DOE Order 5480.4 to be promulgated as rules.

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[1]To be considered

[2]Relevant and appropriate

Standard, Requirement, Criteria or Limitation	Citation	Description of Requirement	ARAR Status	Comment
Price-Anderson Act, amendment to the Atomic Energy Act	42 USC 2282(a)	DOE Orders related to nuclear safety are enforceable against most DOE contractors, subcontractors, and vendors.	Applicable	Applicable if related to nuclear safety.
Packaging and Transportation Safety	DOE Order 460.1, Expires 9/27/99	Specifies requirements for the labeling and packaging of these substances in addition to requirements found in 49 CFR.	TBC[1]	
Federal Requirements				
Clean Air Act - National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities	40 CFR Part 61 Subpart H	Emissions of radionuclides from any DOE facility to the air shall not exceed levels that would result in an effective dose equivalent of 10 mrem/year	R&A[2]	Applicable to airborne emissions from DOE owned or leased facilities. SLAPS is neither owned nor leased by DOE.
Clean Air Act - National Emission Standards for Radon Emissions from Department of Energy Facilities	40 CFR Part 61 Subpart Q	No source at a DOE facility shall emit more than 20 pCi/m^2-s of radon-222 as an average for the entire source, into the air. Facilities are exempted from source reporting requirements under 40 CFR 61.10.	R&A[2]	Applicable to DOE owned or leased facilities. This requirement needs to be part of any Federal Facilities Agreement reached between EPA and DOE.
Clean Water Act - National Pollutant Discharge Elimination System (NPDES)	40 CFR Parts 122-125	Provides that a permit need be obtained to discharge pollutants from point sources into waters of the state. A point source is any discernible conveyance from which pollutants are or may	Applicable	Under CERCLA, permit requirements are waived for on-site actions. A discharge is "on-site" if the receiving water body is in the area of contamination or is in very close proximity to the site and

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[1]To be considered
[2]Relevant and appropriate

Standard, Requirement, Criteria or Limitation	Citation	Description of Requirement	ARAR Status	Comment
		be discharged.		necessary for implementation of the response action, even if the water body flows off-site. If the permit requirement is waived, substantive requirements must still be met.
Clean Water Act - Effluent Limitations for Discharge of Radioactive Pollutants to Surface Waters	40 CFR 440.32(b)	Provides that discharge of pollutants from mines as liquid effluent must meet the following limits: <10 pCi/L of dissolved Ra-226 in any one day or <3 pCi/L of dissolved Ra-226 averaged over 30 consecutive days; <30 pCi/L of total Ra-226 in any one day or 10 pCi/L of total Ra-226 averaged over 30 consecutive days; and 4 mg/L of uranium in any one day or 2 mg/L of uranium averaged over 30 consecutive days.	R&A[2]	These limits reflect best practicable control technology (BPT) controls for pollutants in mine drainage from uranium, radium and vanadium ore mines. They can be used as guidelines for amounts of radioactivity allowed to be discharged through the ditch.
RCRA Generator Requirements	40 CFR Part 262	A person must test waste to determine whether the waste is hazardous. If hazardous, certain requirements must be observed.	Applicable	Applicable in that waste must be characterized before sending it for disposal.
RCRA Hazardous Waste Characterization	40 CFR Parts 260 and 261	These rules prescribe how to determine whether a waste is a solid or hazardous waste subject to regulation.	Applicable	Applicable in that waste must be characterized before sending it for disposal.

*Not formally ARAR or TBC because it is not an environmental requirement. However, the requirement is worth mentioning and including in this Table because each action must conform with these requirements.
[1]To be considered
[2]Relevant and appropriate

Standard, Requirement, Criteria or Limitation	Citation	Description of Requirement	ARAR Status	Comment
State Environmental Requirements				
Water Quality Standards	10 CSR 20-7.031(4)(I)	This rule provides that all streams shall conform with state and federal limits for radionuclides established for drinking water supply.	Applicable	Any discharge into Coldwater Creek cannot cause the level of radionuclides in the Creek to exceed limits established for drinking water supply.
Primary Drinking Water Standards (MCLs for Radionuclides)	10 CSR 60-4.060	This rule provides that the MCL for radium-226 and radium-228 shall be: -combining Ra-226 and Ra-228, 5 pCi/l; -gross alpha particle activity including Ra-226 but excluding radon and uranium = 15 pCi/l.	Applicable	Any discharge into Coldwater Creek from the ditches cannot cause the level of radionuclides in the Creek to exceed these limits.
State NPDES Permit Program	10 CSR 20-6.010	This rule sets forth terms and conditions for the State NPDES permit program.	R&A[2]	Even if an NPDES permit is not required under CERCLA, substantive requirements for the permit must be met for a point source discharge. The State of Missouri administers the NPDES permit program.
Water Quality Certification	10 CSR 20-6.060	This rule specifies how to obtain State certification for a Section 404 action.	R&A[2]	No permit is required. State certification is not required. It is advisable to consult with the state to ensure that the discharge of fill material does not violate Clean Water Act Section 401(a)(1) and complies with Clean Water Act Section 404(b)(1) guidelines.

[*]Not formally ARAR or TBC because it is not an environmental requirement. However, the requirement is worth mentioning and including in this Table because each action must conform with these requirements.
[1]To be considered
[2]Relevant and appropriate

Standard, Requirement, Criteria or Limitation	Citation	Description of Requirement	ARAR Status	Comment
Standards Applicable to Generators of Hazardous Waste	10 CSR 25-5.262	This rule sets forth standards for generators of hazardous waste.	Applicable	Applicable if hazardous waste is present. Most of the Federal requirements are incorporated by reference.
Land Disposal Restrictions	10 CSR 25-7.268	This rule establishes standards and requirements that identify hazardous wastes that are restricted from land disposal.	Applicable	Applicable if hazardous waste is present. The two Federal requirements included previously in this Table are incorporated by reference.
***Federal Non-Environmental Requirements**				
OSHA - General Industry Standards	29 CFR Part 1910	Specifies the 8-hour time-weighted average concentration for various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.	*	Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below the concentration. Workers performing activities must have completed specific training requirements under 40 CFR 300.150.
OSHA - Safety and Health Standards	29 CFR Part 1926	Specifies the type of safety equipment and procedures to be followed during site remediation.	*	All appropriate safety equipment will be on-site, and safety procedures would be followed during on-site activities under 40 CFR 300.150.
OSHA - Recordkeeping, Reporting, and Related Regulations	29 CFR Part 1904	Outlines the recordkeeping and reporting requirements for an employer under OSHA.	*	These requirements apply to all site contractors and subcontractors and must be followed during all site work under 40 CFR 300.150.
Hazardous Material Transportation Regulations (HMTR)	49 CFR Part 171	Definitions of hazardous materials, wastes, substances, reportable quantities, etc.	*	Must be used to determine applicability of specific hazardous materials or waste transportation requirements, regardless of destination.

*Not formally ARAR or TBC because it is not an environmental requirement. However, the requirement is worth mentioning and including in this Table because each action must conform with these requirements.
[1]To be considered
[2]Relevant and appropriate

Standard, Requirement, Criteria or Limitation	Citation	Description of Requirement	ARAR Status	Comment
HMTR	49 CFR Part 172	Provides information and requirements addressing shipping paper descriptions, marking and labeling of packages, placarding of vehicles, and requirements for emergency response information.	*	
Nuclear Regulatory Commission (NRC), Standards for Protection Against Radiation, Transfer for Disposal and Manifests	10 CFR 20.2006	Provides that transfer of radioactive waste intended for land disposal be accompanied by a manifest and be conducted in accordance with specified regulations.	Applicable	Applicable only to commercial disposal.
NRC, Transfer of Source or Byproduct Material	10 CFR 30.41 for byproduct material; 10 CFR 40.51 for source material.	Provides that the transferor must verify that the transfer license authorizes receipt of the type, form and quantity of byproduct or source material to be transferred, before transferring byproduct or source material to a specific licensee of the Commission, an Agreement State, or a general licensee registered with the Commission or an Agreement State.	Appli-cable	Applicable only to commercial disposal.

*Not formally ARAR or TBC because it is not an environmental requirement. However, the requirement is worth mentioning and including in this Table because each action must conform with these requirements.
[1]To be considered
[2]Relevant and appropriate

APPENDIX B

CORRESPONDENCE

102559

American Indian Center of Mid-America

4115 Connecticut, St. Louis, Missouri 63116

1-314-773-3316

April 2, 1993

David Adler
Department of Energy
Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831-8723

Mr. Adler:

This message comes to express our concerns on the FUSRAP clean up of the two sites in St. Louis.

Historical St. Louis is known to hold sacred remains of our ancestors. We, the ancient population of the Native peoples who reside here, are today represented by approximately 6,000 Native Americans. In that number 41 different tribes are represented.

Being aware that the procedure for the clean up of these two sites in the St. Louis area is being drafted, the St. Louis Native American Community offers our assistance. The preservation of our culture is based on our historical, traditional, religion. The graves of our ancestors which are skeltal remains as well as certain funeral items are our link in a very sacred way.

We look forward to working with you.

Sincerely,

Evelyne R. Voelker
Evelyne R. Voelker
Executive Director
American Indian Center

ERV/tk

cc Dr. Richard Ambrose

101417

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Columbia Field Office
608 East Cherry Street
Columbia, Missouri 65201

1993 MAR -8 PM 1:40

IN REPLY REFER TO:

FWS/AES-CMFO

MAR 5 1993

Mr. Dave G. Adler
Department of Energy
Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831-8723

Dear Mr. Adler:

This responds to your December 10, 1993, letter requesting information regarding the baseline environmental conditions in the vicinity of the St. Louis Site, for the management and clean-up of radioactive contamination, in St. Louis, St. Louis County, Missouri. We regret not replying sooner, as we have been short staffed.

We have enclosed copies of the National Wetlands Inventory Maps for all three sites based on our understanding of specific locations taken from directions you outlined in your letter. We found some forested wetlands which lie within or adjacent to the properties and have highlighted them for your review.

No federally-listed endangered or threatened species occur in the proposed project areas. However, please contact the Missouri Department of Conservation (P.O. Box 180, Jefferson City, Missouri 65101) concerning state-listed rare and endangered species.

We regret that, without a site visit and a tremendous amount of field evaluation, it is impossible to assist in a detailed description of the local aquatic and terrestrial flora and fauna, existing ecosystems, and the range and habitats of the ecosystem inhabitants. We suggest a thorough review of the properties by your team followed by discussions with local Missouri Department of Conservation personnel.

We appreciate the opportunity to review this project. Should you have questions concerning these comments, or if we can be of further assistance, please contact Ms. Kelly Srigley Werner at the above address, or by telephone at (314)876-1911.

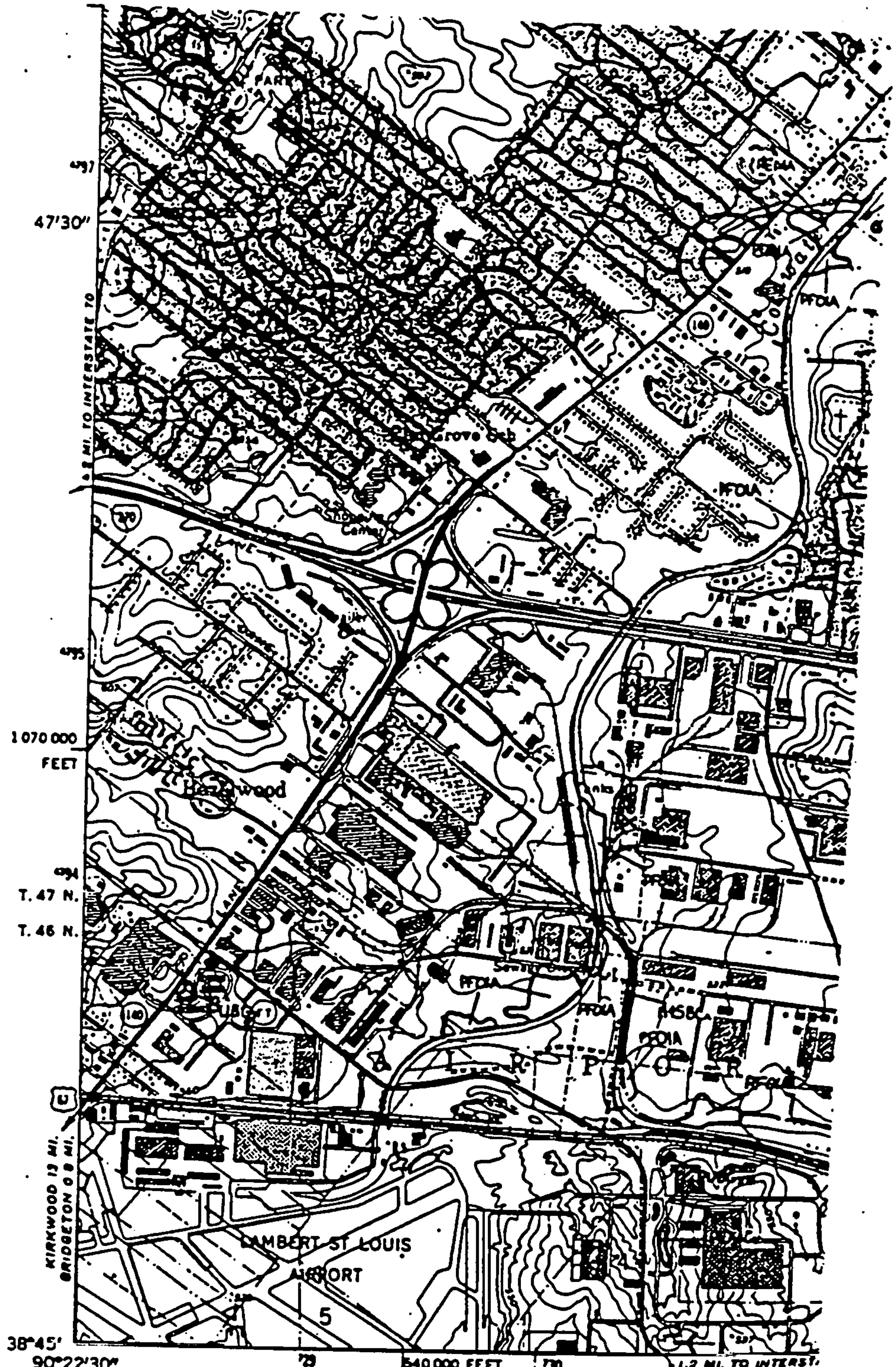
Sincerely,

Jerry J. Brabander
Field Supervisor

Enclosure

cc: MDC; Jefferson City, MO (Attn: Dan Dickneite)
MDC; Jefferson City, MO (Attn: Dennis Figg)
EPA; Kansas City, KS (Attn: Kathy Mulder)

KSW:ksw:1210/SLRWRNXA



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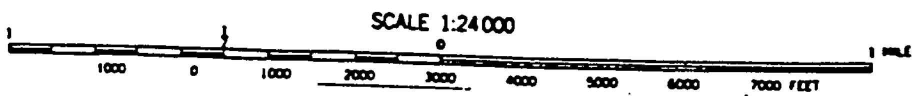


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PARK
ST LOUIS CITY +
Municipal Dock
Brooklyn
FALLON PARK

089094

MISSOURI DEPARTMENT OF CONSERVATION

MAILING ADDRESS
P.O. Box 180
Jefferson City, Missouri 65102-0180

STREET LOCATION
2901 West Truman Boulevard
Jefferson City, Missouri

Telephone: 314/751-4115
JERRY J. PRESLEY, Director

May 7, 1992

Mr. David G. Adler
Site Manager
Former Sites Restoration Division
Department of Energy
P. O. Box 2001
Oak Ridge, TN 37831

Dear Mr. Adler:

In response to your April 24, 1992 request for information on local aquatic and terrestrial flora and fauna at the St. Louis site, we queried the Heritage Data Base.

Enclosed are printouts from the database that include lists of rare and endangered species likely to occur in St. Louis County, and known fish and wildlife species likely to occur in St. Louis County. The lists include 37 rare and endangered species and 538 fish and wildlife species. In addition, I have enclosed a list of sensitive species and high quality natural communities known from St. Louis County.

The absence of further occurrences of sensitive species and natural communities does not mean that they do not occur within the impacted area, merely that no additional information is known at this time. This report should not be regarded as a final statement on the presence or absence of rare or endangered species or high quality natural communities; only an on-site inspection can verify the absence of existence of such species or communities.

I hope this response meets your needs.

Sincerely,

W. H. Dieffenbach

WILLIAM H. DIEFFENBACH
ASST. PLANNING DIVISION CHIEF

WHD:jct

Enclosure

94 · 053

Department of Energy
Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831—

1994 FEB 23 AM 9: 10

FEB 14 1994
HISTORIC PRESERVATION PROGRAM

January 31, 1994

Mr. Michael S. Weichman
Senior Archaeologist, S.H.P.O.
Division of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Dear Mr. Weichman:

DOE is in the process of issuing a Feasibility Study for remedial action at the St. Louis Site, in accordance with CERCLA. Because the St. Louis Site project areas (downtown and airport) have undergone extensive disturbance during their long tenure as industrial sites, an archaeological survey will not be required for this project. However, the Mallinckrodt Downtown Site (SLDS) buildings will be analyzed for existing historic resources. Thus, DOE is conducting a cultural resources survey (CRS) of 16 buildings on the Mallinckrodt Chemical Company site in accordance with Section 106 requirements. This survey will include archival research in the State Historic Preservation Office archives, local and state libraries and historic societies, and in the Mallinckrodt site archives. On-site investigation and photography of the 16 buildings will also be conducted. A CRS report will be prepared which will contain a contextual historical narrative of the site, building descriptions, evaluation of the buildings for NRHP eligibility (which will be made both as individual sites and/or contributing buildings to an historic district related to Mallinckrodt Chemical Company, an important industrial corporation in St. Louis), analysis of impacts of the proposed project, and recommendations as necessary.

As stated in the Feasibility Study, the Department of Energy is performing the CRS and is committed to tailoring its remediation efforts to be in accordance with the requirements of Section 106 historical buildings resources that might be identified through the survey. This survey will satisfy the state historic preservation requirements for the project.

If you have any questions, please call me at (615) 576-9634.

Sincerely yours,

[signature]

David G. Adler, Missouri Site Manager
Former Sites Restoration Division

SHPO Concurrence:
[signature] 1 Feb 1994

92-501PL/012194

Department of Energy - St. Louis County

Two species occur in/along the Mississippi River and Missouri River in the vicinity of the sites identified by the Department of Energy.

Pallid sturgeon (Scaphirhynchus albus) is state and federal listed Endangered.

Overwintering bald eagles (Haliaeetus leucocephalus) are state and federal listed Endangered.

A complete list of sensitive species and high-quality natural communities is also provided. Except for the two species listed above, it is unlikely that any other Rare or Endangered species would be affected at these project sites.

In addition, a Procedures printout of all animals of St. Louis County is included.

Note: The list of animals of St. Louis is not included in this document due to the length of the list. Anyone may view this list by accessing the Heritage Data Base or by contacting the PDCC department at Bechtel International, Inc., Oak Ridge, Tennessee 37831; file number 089094.

APPENDIX C
DOSE ASSESSMENT

INTRODUCTION

A radiological dose estimate of worker exposure during proposed removal activities at the St. Louis Airport Site (SLAPS) was performed for the Engineering Evaluation/Cost Analysis (EE/CA) to provide a basis for evaluation of overall protection of human health and short-term effectiveness. The following sections discuss the major components of the dose assessment, including scenario definition, data evaluation, exposure assessment, and dose characterization.

SCENARIO DEFINITION

The proposed action is not intended to be a final action. The intent of the proposed action is to minimize potential migration of contaminated sediment to Coldwater Creek and to demonstrate significant progress in remediation at SLAPS. Consequently, no baseline dose or dose following completion of the proposed action was computed. This dose assessment focuses on the evaluation of risk to the remedial worker implementing the proposed action. Three alternatives are considered.

The first alternative, no action, would not perform any interim actions on the site until the final disposition of SLAPS is agreed upon among the public, DOE and the regulators. No dose will be calculated for this alternative because no worker exposure occurs as a result of selection of the no action alternative.

The second alternative would involve excavation of soil exceeding DOE unrestricted release guidelines (SOR > 1) beginning at the western end of SLAPS behind the gabion wall and extending 70 feet to the east. Soil exceeding 50 pCi/g Ra-226, 100 pCi/g Th-230 or 150 pCi/g U-238 would be shipped offsite for disposal. Material below the 50-100-150 criteria but above SOR ≥ 1 would be stored onsite until final criteria are agreed upon. The ditches on the north side of SLAPS would be excavated and combined to prevent any flow under McDonald Boulevard from SLAPS. The ditches would be widened to handle all of the northern drainage from SLAPS without bank scour. Sediment exceeding DOE guidelines in the ditch on the opposite side of McDonnell Boulevard (Ballfields ditch) would be excavated from the confluence with Coldwater Creek to the west culvert beneath McDonnell Boulevard.

The third alternative would excavate the same material as in the first except that the ballfields ditch would be left undisturbed, but in this alternative, all the material excavated that exceeds the DOE guidelines would be shipped offsite. Because loading the material onto trains would not result in exposures different from constructing a pile, there would be no significant difference in dose due to storage or shipment between Alternatives 2 and 3.

DATA EVALUATION

To assess potential doses to the remedial worker during implementation of the proposed action, the SLAPS data set was manipulated to collect a subset of data that would be representative of the concentrations in the soil that the worker would be exposed to during excavation. Because the areas of excavation include three separate areas with differing levels of contamination, exposures were assessed separately for the 70 foot buffer zone, the ditches between SLAPS and the fence, and the Ballfields ditch.

To assess the buffer zone, the data in that area were queried to assemble a data subset which would include only data within 70 feet of the creek bank, including data from the ditch north of the site. Datapoints from this subset were then rejected if the concentrations above background were below the criterion:

$$\frac{\underset{(whichever\ is\ greater)}{Ra\text{-}226\ or\ Th\text{-}230}}{5/15\ pCi/g} + \frac{\underset{(whichever\ is\ greater)}{Ra\text{-}228\ or\ Th\text{-}232}}{5/15\ pCi/g} + \frac{U\text{-}238}{50\ pCi/g} \geq 1 \qquad (1)$$

in which 5 pCi/g represents the DOE guideline for release without radiological restrictions in the top 15 cm (6 in.) of soil and 15 pCi/g represents the guideline for soil deeper than 15 cm. Using the Statistical Analysis System software, background concentrations were subtracted from the data, then the maximum value, minimum value, average value, and 95% upper confidence limit (UCL_{95}) on the mean were calculated from the data within the area of the excavation. The UCL_{95} is a statistical concept representing the value at which the average concentration of a randomly drawn set of samples from the area will not exceed the UCL_{95} 95% of the time. The reasonable maximum exposure (RME) concentration is determined by subtracting background from the UCL_{95}. Background concentration is subtracted from the data because guidelines on permissible exposure limits are based on dose above background. For the St. Louis area, average background concentrations have been established at 1 pCi/g for Th-232, 0.9 pCi/g for Ra-226, 1.3 pCi/g for Th-230, and 1.1 pCi/g for U-238. U-235 and its decay products were assumed to be present at a concentration of 4.6% of the U-238 activity (0.051 pCi/g), its natural relative abundance.

The data in the Ballfields ditch were screened by eliminating all sample points in the Ballfields ditch set east of the culvert passing under McDonnell Boulevard, and by aggregating all remaining sample points exceeding the DOE guidelines as explained in Eq. 1 above and any points in the same boring shallower than the points exceeding these criteria. The RMEs on this material were calculated as the representative exposure concentration for the worker excavating the ditch north of McDonnell Boulevard.

The data for the ditches on the north side of SLAPS (south of McDonnell Boulevard) were not screened because the purpose of the excavation is to control surface water flow at SLAPS, so the exposure concentrations to the worker would not be affected by any cleanup criteria. RMEs were calculated using all sample data (above and below DOE crieria) collected from the ditches.

Radioactive materials originating from the MED activities in St. Louis tend to deviate from their natural relative abundances because the processes generating these wastes were intended to separate uranium from the other materials in the ores. As a result, some radionuclides are present at different concentrations than the parent elements. Relative abundances have been determined for the actinide series on the basis of their ratio to Ra-226 at SLAPS (Liedle 1990). The baseline risk assessment for St. Louis (ANL 1993) set Ac-227 at a concentration of 92% of Ra-226 and Pa-231 at a concentration equal to Ra-226. In the uranium series, Pb-210 was assumed present at a concentration of 1.7 times the concentration of Ra-226. For the thorium series, the baseline risk assessment set Ra-228 to a concentration of 28% of Th-232 and Th-228 at 85% of the Th-232. Concentrations of the radionuclides used in the calculations are shown in Table C-1. Concentrations of unmeasured radionuclides in background (i.e. concentrations in unprocessed soil) were assumed to be in secular equilibrium with their parent elements.

EXPOSURE ASSESSMENT

The scenario considered for the dose assessment was the remedial worker. The fraction of time the remedial worker spends on SLAPS was calculated on the basis of information contained in the cost estimate and volume calculations for the proposed action. The estimated volume of contaminated material in the 70 foot zone east of the creek is 3,120 yd^3. Allowing a 20% overexcavation factor, and assuming a 45.5 yd^3/hr excavation rate as used in the cost estimates,

$$\frac{3{,}120\ yd^3 \times 1.2}{45.5\ yd^3/hr} = 82\ hours \qquad (2)$$

or 8.6-8 hour work days. This equates to an onsite yearly time fraction of

$$\frac{69\ hours}{24\ hours/day \times 365\ days/year} = 0.0094 \qquad (3)$$

The volume to be excavated from the ditches south of McDonnell Boulevard has been estimated to be 5500 yd^3 required to combine the three ditches into one and widen it to accommodate a ten year flood. The time required for this work is

$$\frac{5{,}500\ yds^3 \times 1.2}{45.5\ yd^3/hr} = 145\ hours \qquad (4)$$

Table C-1. RME Concentrations of Radionuclides in the Source Term

Radionuclide	UCL-95 Concentration	Calculated Concentration	Background	RME
SLAPS Buffer				
Ac-227		540	0.051	540
Pa-231		587	0.051	586.9
Pb-210		997.9	0.9	997
Ra-226	587		0.9	586.1
Ra-228		4.4	1	3.4
Th-228		13.3	1	12.3
Th-230	120		1.3	119
Th-232	15.7		1	14.7
U-234		293	1.1	292
U-235		13	0.051	13
U-238	293		1.1	292
SLAPS Ditch				
Ac-227		5.2	0.051	5.1
Pa-231		5.6	0.051	5.6
Pb-210		9.5	0.9	8.6
Ra-226	5.6		0.9	4.7
Ra-228		0.55	1.0	<0
Th-228		1.7	1.0	0.7
Th-230	374		1.3	373
Th-232	2.0		1.0	1.0
U-234		14	1.1	13
U-235		1	.051	1
U-238	14		1.1	13
Ballfields Ditch				
Ac-227		39.6	.051	39.5

Radionuclide	UCL-95 Concentration	Calculated Concentration	Background	RME
Pa-231		43	.051	42.9
Pb-210		73.1	0.9	72.2
Ra-226	43		0.9	42.1
Ra-228		0.58	1	<0
Th-228		1.8	1	0.8
Th-230	2300		1.3	2299
Th-232	2.1		1	1.1
U-234		27	1.1	26
U-235		1	0.051	1
U-238	27		1.1	26

and the yearly time fraction is

$$\frac{145\ hours}{24\ hours/day \times 365\ days/yr} = .017\ year \qquad (5)$$

Finally, the volume to be excavated from the ditch north of McDonnell Boulevard is estimated to be 5,243 yd^3. The time required to excavate this volume is 138 hours for a time fraction of 0.016.

Site and scenario specific data used in the model are shown in Table C-2. Values were left at default if no site or scenario specific value was known, if the default value matched the specific value, or if in the modeler's judgement the site specific value would have no impact on the outcome of the calculation.

The pathways considered in the analysis include gamma irradiation, inhalation, and incidental ingestion of soil. No other pathways are considered significant to the remediation worker. The analysis assumed no protective measures are taken to limit exposure. In actual practice, remedial workers are provided protective equipment such as respiratory protection, disposable coveralls, and gloves. These protective measures have not been incorporated into this analysis, thus, inhalation and ingestion of soil are overestimated.

Table C-2. Site and Scenario Specific Parameters

Parameter	SLAPS Buffer	North Ditch	South Ditch	Source
Area of Contaminated Zone (m^2)	3906	4691	5484	Geographic Information System (GIS) software
Thickness of Contaminated Zone (m)	2	1	1	SLAPS: default Ditches: shallow impact except near radium pits
Precipitation (m/yr)	0.91	0.91	0.91	ANL 1993
Inhalation Rate (m^3/yr)	12,300	12,300	12,300	Yu, Loureiro et al. 1993. Typical mix of outdoor activities
Mass Loading for Inhalation (g/m^3)	1.8E-4	1.8E-4	1.8E-4	Typical dust loading due to construction, 30% respirable.
Onsite time fraction	0.0094	0.016	0.017	See text for formulae
Soil ingestion Rate (g/yr)	175	175	175	EPA 1991 construction and landscaping activities

DOSE CHARACTERIZATION

Potential doses to the remedial worker were assessed using the Residual Radioactivity (RESRAD) computer model (version 5.61) (Yu, Zielen et al. 1993). The results of the assessment are presented in Table C-3. Doses for Alternative 2 were computed by summing all three of the doses from the separate areas. Doses for Alternative 3 were computed by summing only the SLAPS buffer and the north SLAPS Ditch.

The estimated dose for Alternative 2 (complete excavation with onsite storage of some material) is 258 mrem while the estimated dose for Alternative 3 (excavate at SLAPS only and ship to offsite disposal) is 206 mrem.

These doses are likely to be overstated because, as noted previously, no credit was taken for measures to protect the workers such as personal protective equipment and dust suppression techniques which would significantly reduce exposure from the ingestion and inhalation pathways. In addition, the concentrations were likely overstated due to the statistical treatment of small data sets, especially in the Ballparks ditches where only 8 samples were available.

Table C-3 Dose Contributions for Radionuclides and Pathways (mrem)

Pathways	SLAPS Buffer	SLAPS Ditch	Ballfields Ditch
Gamma	69	1.2	8.5
Inhalation	90	6.1	37
Soil Ingestion	37	1.2	8.1
Total	197	8.5	53

References

Argonne National Laboratory (ANL) 1993. *Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site, St. Louis, Missouri.* DOE/OR/23701-41.1, Oak Ridge, Tennessee, November.

EPA 1991. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance "Standard Default Exposure Factors" Interim Final.* OSWER Directive 9285.6-03, Washington, D.C., March.

Liedle, S.D., 1990. *Input for St. Louis Baseline Risk Assessment Study.* Letter from S.D. Liedle (Bechtel National, Inc., Oak Ridge, Tennessee) to M. Pichel (Argonne National Laboratory, Argonne, Illinois), May 29.

Yu, C., C. Loureiro, J.-J. Cheng, L.G. Jones, Y.Y. Wang, Y.P. Chia, and E. Faillace 1993. *Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil.* ANL/EAIS-8, Argonne, Illinois, April.

Yu, C., A.J. Zielen, J.-J. Cheng, Y.C. Yuan, L.G. Jones, D.J. LePoire, Y.Y. Wang, C.O. Loureiro, E. Gananapragasam, E. Faillace, A. Wallo III, W.A. Williams, and H. Peterson 1993. *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0.* ANL/EAD/LD-2. Argonne National Laboratory, Argonne, Illinois, September.

APPENDIX D
COST ESTIMATE

PREDECISIONAL DRAFT - DO NOT CITE

Table D-1.
SLAPS INTERIM ACTION EE/CA

PARAMETER	Excavation w/ offsite disposal & stockpiling Alt 2	Excavation w/ offsite disposal (SOR>1) Alt 3	No Action Alternative 1
TOTAL Remedial Action Construction COST: (FY97$)	$8,109,311	$8,326,829	$0
Total Contaminated Insitu Volume (Insitu CY)	11,919	6,676	6,676
Excavation Volume, Total (insitu cy)	14,302	8,011	0
Excavation Volume, Total (exsitu cy)	17,878	10,013	0
Total Ditch excavation volume (insitu cy) (clean + cont)	15,500	15,500	
Ditch riprap volume	7,000	5,500	
Ditch S. of McDonnell impacted volume (assumes 2', entire ditch)	3,556	3,556	
N. of NcDonnell Blvd ditch soil Volume (Impacted insitu CY)	5,243	0	
Volume for temp storage (clean from s. ditch) (exsitu cy)	0	14,931	
Volume for temp storage n. ditch+ Plug(exsitu cy)(contaminated)	5,702		
Volume for temp storage (exsitu cy)(clean + contaminated)*	5,702	14,931	
Expansion Factor, Soil	1.25	1.25	1.25
Expansion Factor, Asphalt / Concrete	1.25	1.25	1.25
Expansion Factor, Rubble	1.25	1.25	1.25
Density, Soil (tons/insitu cy)	1.6	1.6	1.6
Density, Asphalt / Concrete (tons/insitu cy)	2.1	2.1	2.1
Density, Rubble (tons/insitu cy)	2.1	2.1	2.1
Soil Disposal Volume, Total (exsitu cy)	7,646	10,013	
Disposal / Transport Volume (exsitu cy)	7,646	10,013	
Disposal Rate (small) ($/cy)	$ 162.00	$ 162.00	
Loading Rate ($/cy)	$ 25.00	$ 25.00	
Gondola (St. Louis) ($/ton)	$ 67.00	$ 67.00	
Gondola Transportation %	100%	100%	
Intermodal Transportation %	0%	0%	
Available construction weeks per year	44	44	44

All Unit rates are BY96$

* This includes all material excavated but not shipped off-site. Contaminated and clean material will be stored seperately.

SL-1235

00-2324

Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the St. Louis Site, Missouri

U.S. Department of Energy