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Environmental Impact Assessment of the Former Airport Storage Site of the Atomic Energy Commission

St. Louis County, Missouri

Oak Ridge National Laboratory
Nuclear Division
Union Carbide,
Oak Ridge, Tennessee

July 1979

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ENVIRONMENTAL IMPACT ASSESSMENT OF THE FORMER AIRPORT STORAGE SITE OF THE ATOMIC ENERGY COMMISSION ST. LOUIS COUNTY, MISSOURI

OAK RIDGE NATIONAL LABORATORY
NUCLEAR DIVISION
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OAK RIDGE, TENNESSEE

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TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF TABLES
(continued)

LIST OF FIGURES

LIST OF FIGURES
(continued)

SECTION 1

SUMMARY

Wastes generated from uranium processing and other activities between 1947 and 1967 were stored at a 21.7 acre site located adjacent to and directly north of the St. Louis - Lambert International Airport. In addition, about sixty truck loads of contaminated scrap metal and a contaminated vehicle were buried on site. During 1966 and 1967, most of the stored residues were sold for their mineral contents and removed from the site. As part of the Airport Authority's acquisition permit, all on-site structures were razed and buried on-site. Contaminated soil from the barium sulfate residue storage area was removed to an abandoned quarry at Weldon Springs, Missouri; one to three feet of clean fill was spread over the site.

The property was conveyed to the Airport Authority specifically for aeronautical use, and for the development, improvement, operation or maintenance of the airport. The deed specifies that the property not be leased, sold, salvaged or disposed of by the Airport Authority or used for other than airport purposes without the written consent of the Administrator of the FAA.

The primary purpose of this Environmental Impact Assessment (EIA) is to evaluate the adequacy of the Quit-Claim Deed, used to protect public health, safety and environmental quality. The assessment evaluates two proposed actions: (1) the use of this deed to control present radiation exposure from the site, and (2) the use of the deed to control anticipated radiation exposure from the site after the burial of approximately 18,300 to 50,000 yd^3 of contaminated material from a former AEC/NRC licensed site (the Latty Avenue site) located about 3/4 mile northeast of the airport storage site. Four alternatives to the proposed actions are also evaluated: (1) complete site decontamination with removal of radioactive material to an unidentified location; (2) release of the site for "unrestricted use" with no further action; (3) release of the site for "unrestricted use" after burial of contaminated material from the Latty Avenue site; and (4) continued restriction of the site with no development of the site permitted.

The site slopes gently to the west toward Coldwater Creek which borders the site. Groundwater recharge occurs to the east and on the site itself and flows toward this creek. Due to the underlying lacustrine (lake bed) deposits, most groundwater which infiltrates the site empties into Coldwater Creek. Stormwater runoff from the site also drains into this creek, either by direct overland flow or through drainage ditches which parallel the site. Water quality and quantity of Coldwater Creek, are

however, most influenced by runoff from developed areas (the airport, industrial and residential areas, etc.) and industrial and municipal discharges. The stream provides excellent dilution potential even under low flow conditions.

The site flora and fauna are characteristic of disturbed areas (old fields), while the wildlife habitat of the site is considered of low value. There is little in the way of aquatic life in Coldwater Creek because the stream is highly stressed by low water quality and highly variable stormwater flows. Endangered species are not known to inhibit or utilize the site or Coldwater Creek. No wetlands occur within the site or this segment of Coldwater Creek.

The predominant land use in the vicinity of the site is industrial or airport related. The site and much of the adjacent area are zoned for industrial use. A ball park is located adjacent to the northern border of the site and Brown Road, while the closest residential area (75-100 people) is located about 1/2 mile due west of the site. Land use plans project a slight increase in industrial and residential development of vacant open space area within one-mile of the site. There are no cultural or archaeological resources known to exist on-site or within a reasonable distance from the site.

Land use plans, regulations and deed restrictions strongly restrict development of the site. Zoning regulations allow industrial use of the site with flood plain restrictions for the west end of the property. Air Navigational Space Regulations of the St. Louis County Zoning Ordinance restrict the height of objects within the central and eastern two thirds of the site. FAA regulations further restrict or prohibit the construction, erection, alteration, or growth of any structure, tree or other object in the approach area of the runways that interfere with the use, operation, or future development of the airport. Recent County and Airport Master Plans propose airport expansion on or up to the site, involving runway or light system use of the area.

A topographic and radiological survey of the site was completed upon completion of this cleanup (1971). At this time, ground surface dose rates were generally less than 0.05 mrad/hr (none exceeded 1.0 mrad/hr) (ORNL 1978 and Table 4-1). The most recent radiological survey of the site and its environs (Haywood et al, 1978) identified surface soil levels of U-238 from background to 600 pCi/g, and Ra-226 from two to 460 pCi/g. For comparison, the 1976 survey (Ryan et al, 1978) identified U-238 levels from background to 890 pCi/g and Ra-226 from background to 1300 pCi/g. Concentrations of Ac-227 ranged from background to 1100 pCi/g. The highest levels of surface contamination found during both surveys were off-site, in and around the drainage ditch along the northern perimeter of the site. The results of external gamma and beta-gamma exposure measurements (Haywood et al, 1978; EG&G, 1977; Ryan et al, 1978) confirm the existence of contamination in and around these ditches.

External gamma radiation levels at one meter ranged from background to 300 μR/hr; while beta-gamma radiation levels at one centimeter ranged from 0.02 to 4.6 mrad/hr. Other areas of surface contamination were scattered throughout the site.

Subsurface contamination of U-38 and Ra-226 were similar to the levels identified for surface soils. Soils within the western portion of the site were more contaminated, reflecting past burial of contaminated materials. In general, most subsurface contamination was within the top six feet of soil.

Groundwater collected from test holes drilled on- and off-site (Haywood et al, 1978) showed U-238 contamination; Ra-226 and Th-230 at background levels; and an elevated level of Pb-210 in one hole. Samples of water and sediments taken from Coldwater Creek during both surveys identified background levels of these radionuclides.

Outdoor concentrations of Rn-222 were also sampled by Haywood et al (1978). Concentrations averaged 0.33 pCi/l which are comparable to background levels. Radon emanation rates were calculated to be 0.08 to 14 pCi/ square meter-sec.

Radiological impacts from the first proposed action (use of the deed to control present radiation from the site) include (1) accumulation of contamination in soil and sediments from surface water runoff and erosion; (2) potential accumulation of Rn-222 and its daughters in buildings in concentrations which exceed guidelines; and (3) possible exposure from on-site surface contamination. The Quit-Claim Deed limits on-site impacts by preventing excavation and drilling and requires that external radiation exposures be maintained at acceptable levels. It does not control exposure from present off-site contamination. Impacts from groundwater use, resuspension of particulates, outdoor exposure to Rn-222 and its daughters, and mechanical redistribution of radionuclides are not anticipated.

No significant non-radiological impacts are anticipated from the first proposed action. Minor loss in vegetation and wildlife habitat, generation of fugitive dust, erosion, and noise may result from activities required to reduce external radiation to acceptable levels and to clean-up off-site contaminated areas.

Radiological impacts from the second proposed action (use of the deed to control anticipated radiation exposure from the site after burial of the Latty Avenue material) include (1) short term impacts resulting from disposal of the 18,300 to 50,000 yd^3 of contaminated material according to the NRC (1978) plan and the conceptual engineering study (Appendix I), and (2) long term impacts associated with future use of the site and potential migration of contamination off-site. Impacts anticipated for the first proposed action will also be expected from

implementation of this proposed action. However, the burial of the Latty Avenue material on-site could increase these exposures. The Quit-Claim Deed will not control or prevent excavation of this material if buried above the 1971 topographic survey reference contour specified in the deed. If such excavation were to occur, possible impacts from Rn-222 and its daughters accumulating in buildings constructed directly on or with this material and/or resuspension of particulates could conceivably exceed limits.

Short term non-radiological impacts under this proposed action will also be increased by burial activities. Erosion, fugitive dusts, noise, loss of vegetation and wildlife habitat will occur to a greater extent during the burial activities. However, as with the first proposed action, the magnitude of these impacts will be minor. No significant long term non-radiological impacts are anticipated from this proposed action.

Mitigating measures which could be employed to reduce exposures or impacts resulting from implementation of either of the proposed actions include: (1) decontaminating off-site ditches to levels consistent with as low as reasonably achievable (ALARA) objectives; (2) stabilizing the site to limit future erosion; (3) providing maintenance to the stabilized site; (4) requiring any building constructed on-site to comply with 10 CFR 712 or prohibiting on-site buildings; (5) altering the deed to prohibit on-site excavation without prior written NRC approval; and (6) utilizing the site as a police driver training facility as specified by Graves (1978). With implementation of either of the proposed actions and these mitigating measures, the contamination and exposures related to the site should be within guidelines and standards.

The environmental impacts of the four alternatives considered are:

Alternative 1 - Complete Site Decontamination With Removal of Material to an Unidentified Location - calls for excavating contaminated soil located on- and off-site and contaminated scrap and building rubble previously buried on-site. The major advantage of this alternative is that the site could be released for unrestricted use. The disadvantages are: short term impacts could be considerable; radiation impacts could result at the disposal site; and site clean-up would be extremely expensive. The expense is probably not warranted since use of the property will remain limited by airport zoning restrictions.

Alternative 2 - Release for "Unrestricted Use" With No Further Action - calls for removal of restrictions in the Quit-Claim Deed pertaining to radiological concerns. Under this alternative, current levels of exposure and off-site migration could greatly increase through unrestricted use of the site. An advantage of this alternative is that no further action or cost would be required. A disadvantage is that the potential impacts concerning exposure to and/or migration of radioactive material off-site would be greatly increased.

Alternative 3 Release of the site for "Unrestricted Use" After Burial of Contaminated Material From the Latty Avenue site - calls for disposal of Latty Avenue material according to the NRC (1978) plan and the conceptual engineering study (Appendix I), coupled with the restriction release of Alternative 2. Cost effective disposal of this material would be the advantage of Alternative 3. The disadvantages of this alternative would be the same as those of Alternative 2, magnified by the addition of this contaminated material.

Alternative 4 - Continued Restriction of the Site With No Development of the Site Permitted - would require repossession of the site by the government and convertion of it to a government storage facility for total land use control, restriction on-site exposure, and control of off-site migrations. Under this alternative only casual exposures would be received by individuals visiting or monitoring the site. The main advantage of this alternative is the elimination of possible on-site doses from "unrestricted use", while the major disadvantage is the prohibition of the direct use or development of the site.

Selection of either of the proposed actions over Alternatives 1 or 4 has to be evaluated within the objectives of the Department of Energy Formerly Utilized Sites Remedial Action Program - to develop remedial action protocols for the management of contaminated sites in a manner that not only is cost effective in protecting public health and environmental quality, but also permits further use of these sites and resources.

SECTION 2

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 PURPOSE

The Division of Environmental Control Technology of the Office of Assistant Secretary for the Environment, Department of Energy (DOE) is conducting a program to identify radiological conditions at sites utilized by the Manhattan Engineer District and Atomic Energy Commission during the early development of nuclear energy. The primary goal of this program - referred to as the Formerly Utilized Sites Remedial Action Program (FUSRAP) - is to develop remedial action protocols for the management of contaminated sites in a manner that not only is cost effective in protecting public health and environmental quality but also will permit further use of these sites and resources. At the majority of these sites, DOE is authorized only to characterize radiological conditions, to assess alternative remedial actions, and to recommend actions and specifications which will permit the release of these sites for unrestricted use. The purpose of this Environmental Impact Assessment (EIA) is to evaluate the adequacy of present restrictions on site activities as specified in the Quit-Claim Deed used to convey the St. Louis Airport Storage Site (hereafter called the airport storage site or the site) to the St. Louis-Lambert Airport Authority in meeting these goals.

2.2 DESCRIPTION OF THE SITE

The 21.7 acre site is located approximately 15 miles northwest of downtown St. Louis and directly north of the Lambert-St. Louis International Airport (Figure 2-1) The airport storage site is bordered by Brown Road to the north and east, Coldwater Creek to the west, and the Norfolk and Western Railroad to the south (Figure 2-2). In 1947 the Manhattan Engineer District acquired the property for the purpose of storing residues generated during uranium processing operations at the Destrehan Street Refinery and Metals Plant. The site was operated by the Manhattan Engineer District and later the Atomic Energy Commission until 1953 when it was turned over to Mallinckrodt Chemical Works.

The Destrehan Refinery utilized pitchblende ores until 1955. The procurement contract with African Metals required the Government to store the pitchblende raffinate (referred to as AM-7) and radium bearing residues (referred to as K-65). The AM-7 was stored at the site on the ground and in the open, while the K-65 was stored at the site in drums. Raffinate residues (AM-10) generated from later operations at the Destrehan Refinery using non-pitchblende feedstock and a barium cake residue (AJ-4) were also stored at the site on the ground and in the open. Other wastes stored on-site included: used dolomite liner and recycle magnesium fluoride liner generated as slag; tailings from an Interim Residue Plant built in 1955 to recover uranium from the magnesium

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FIGURE 2-1

SITE LOCATION MAP

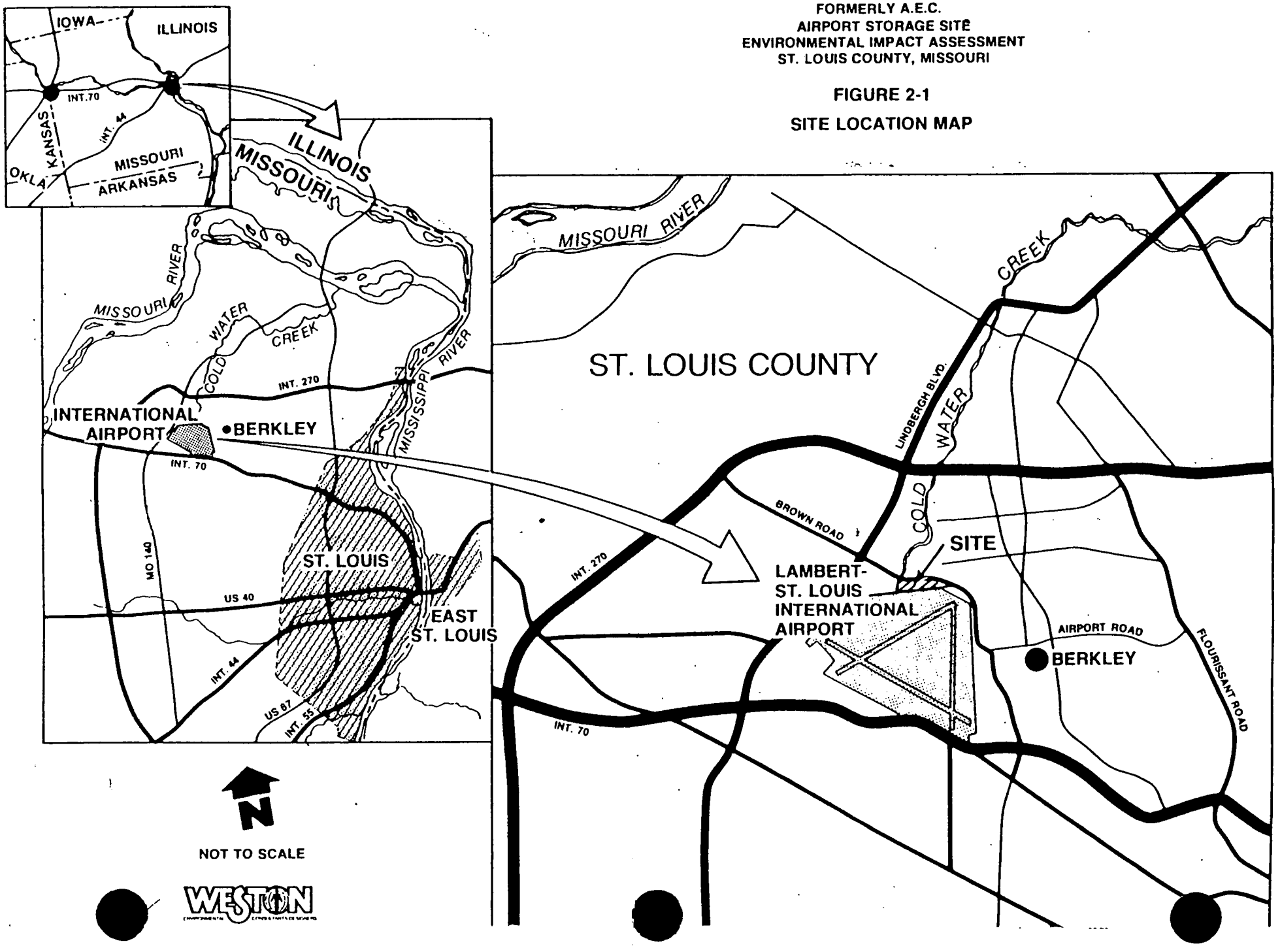


FIGURE 2-2 SITE OVERVIEW — SEPTEMBER 1978

fluoride slag; 50,000 empty drums; 3,500 tons of contaminated steel and alloy scrap; and 2,400 drums containing miscellaneous residues, Japanese uranium containing sand, and contaminated scrap materials. The tailings from the Interim Residue Plant (referred to as C-101) were stored in a large concrete pit originally built to store the radium-bearing residue (K-65). In addition, fifty to sixty truckloads of contaminated metal scrap and a contaminated vehicle were buried in low areas within the western end of the property and later covered with clean fill.

In 1966, the Atomic Energy Commission sold the ore residues stored at the airport storage site to Continental Mining and Milling Company. By 1967, the remaining stored residues were removed from the site to a former AEC/NRC licensed site at 9200 Latty Avenue, Hazelwood, Missouri (hereafter called the Latty Avenue site) approximately 3/4 mile northeast of the airport storage site. After removal of these residues, on-site radiation at ground surface was less than 1.0 mrad/hr; except for the area where barium sulfate residue (AJ-4) was stored. In the AJ-4 area, residual contamination at the ground surface was about 3.0 mrad/hr. In fulfillment of an agreement between the U.S. Government and the St. Louis-Lambert Airport Authority (acquisition permit of 10 November 1969), the barium sulfate residue was removed and deposited at an abandoned quarry at Weldon Springs, Missouri; all on-site structures except the perimeter fence were razed and buried on-site; and one to three feet of clean fill was spread over the entire site to achieve acceptable radiation levels. Topographic and radiation surveys of the site were conducted in November 1971 to document grade elevation and radiation levels over the entire site. Upon completion of this cleanup, on-site ground surface dose rates were generally less than 0.05 mrad/hr. Isolated areas exceeded 0.2 mrad/hr; however, no area exceeded 1.0 mrad/hr. Since 1971, additional fill has been placed on-site to level off low spots for possible future use as a driver training facility for the St. Louis Police Academy. The property has not been otherwise used or maintained by the Airport Authority since the 1971 cleanup was completed. Radiological surveys of the site and its environs were conducted in 1976 (Ryan et al, 1978) 1977 (EG&G, 1978) and 1978 (Haywood et al, 1978). These surveys included sampling of ground and subsurface soils, groundwater and surface water, external beta-gamma dose rate, and external gamma radiation; an aerial gamma radiation survey; and evaluating radon emanation and particulate resuspension. In addition, the topography of the site was resurveyed by Rowland (1977).

2.3 PROPOSED ACTIONS

The proposed actions are: (1) the use of the Quit-Claim Deed to control present radiation exposure from the site, and (2) the use of the Quit-Claim Deed to control anticipated radiation exposure from the site after burial of contaminated material from the Latty Avenue site. (This proposed action is contingent upon transferring the contaminated material from the Latty Avenue site to the airport storage site.) The only difference

between the two proposed actions is that the second includes disposal of approximately 18,300 to 50,000 cubic yards of contaminated material from the Latty Avenue site in accordance with the NRC (1978) and the conceptual engineering study (Appendix I) detailed decontamination plans. The impact of clean-up and transport of Latty Avenue material to the airport site is addressed in the Draft Environmental Impact appraisal related to the further decontamination action of the Latty Avenue contaminated site at Hazelwood, Missouri and Plan 1, Phase 1 Decontamination Plan for Latty Avenue site, NRC, 1978.

The Latty Avenue material will be distributed, graded and compacted for possible use under the proposed Police Academy Driver Training Track area, but not within the 500 year floodplain. Contaminated material which cannot be buried under the asphalt track will be covered by 2 to 4 feet of suitable soil. The NRC (1978) study estimated that 55 working days would be required to move and secure 18,300 cubic yards of Latty Avenue material to the Airport site. Depending upon the final material volume, which may approach 50,000 cubic yards, (current-Radiological Survey of the Latty Avenue Site, Radiation Management Corp.) the working day effort may approach 150 days (Appendix I).

Utilization of specific sections of the Quit-Claim Deed in the proposed actions may require legal interpretation and assignment to an agency(s) for enforcement. Some of the major restrictions of the Quit-Claim Deed (Appendix A; Attachment A-1) that could be applied for the protection of the public are:

Number	Deed Citation	Deed Restriction
1	7.P - (page 6)	"---future use of such tract shall be dependent upon the effectiveness of the cover and fill material in reducing external radiation to acceptable levels."
2	7.P (1)-(page 6)	"There shall be no removal of earth covered by excavation, drilling, or other disturbance without prior notice to the United States Atomic Energy Commission --- provided that this restriction shall apply only to --- the earth more than 12 inches below the site elevations as they existed on October 7, 1971 ---"
3	7.P (2)-(page 6)	"All applicable regulatory requirements of the Atomic Energy Commission or any state agency having regulatory authority over radioactive material shall be complied with."

Number	Deed Citation	Deed Restriction
4	3. - (page 1)	"---coal or mineral rights, reserved to or outstanding in third parties ---"
5	7. - (page 2)	"---any such subsequent transferee assumes all the obligations imposed upon the grantee by the provisions of this instrument."
6	7.A - (page 2)	"That no property transferred --- shall be used, leased, sold, salvaged, or disposed of --- for other than the airport purposes without the written consent of the Administrator of the FAA."
7	7.L - (page 5)	"---the grantee will keep --- an airport layout map --- showing --- (c) the location of all existing and proposed nonaviation areas and of all existing improvements thereon and uses made thereof and such airport layout map and each amendment, revision, or modification thereof, shall be subject to the approval of the FAA ---"
8	7.0 - (page 6)	"---conditions upon the breach of --- which the Government may exercise its option to cause the title --- to revert to it, ---"

Specific actions could range from simply requiring additional fill and continued restrictions of site usage to requiring an NRC license or reversion of the property to the Federal Government, depending upon future legal interpretations and the degree of enforcement of the Quit-Claim Deed.

Some specific examples of actions that could be considered under the Quit-Claim Deed are:

1. Deed restriction No. 1 indicates that any future use of the land shall be dependent upon fill material reducing external radiation to acceptable levels, therefore, the addition and maintenance of clean fill to reduce external gamma ray exposure and/or Rn-222 levels could be required.

2. Deed restriction No. 2 requires notification of AEC (NRC) prior to excavation or drilling. It may be assumed that NRC could therefore prohibit on-site use of well water or any other covered action or require the actions to comply with applicable regulatory requirements (i.e. 10 CFR 40 and thereby 10 CFR 20).

3. All deed restrictions, Nos. 1-8, could possibly be used to restrict future use of the site. The Government Service Administration (GSA), on behalf of the Federal Aviation Administration (FAA), could stipulate which specific actions are acceptable. This could be accomplished through a release of certain deed restrictions which would be recorded in the Property Records.

4. It is possible that deed restrictions Nos. 2 and 3 could be interpreted to prohibit deposition of the Latty Avenue material under the proposed NRC plan (1978) (see Appendix A). This should be evaluated, as deed restriction No. 2 would be circumvented by the NRC plan and access to significant quantities of contaminated material would be permissible unless other deed restrictions (No. 3) are invoked or the deed modified to prohibit excavation of this material through bilateral agreement between the Airport Authority and the Federal Government.

The key aspect of the Quit-Claim Deed is enforcement. For purposes of this assessment only deed restriction Nos. 1 and 2 above were assumed to be enforced. These two restrictions are the only ones that directly provide for radiological protection. Deed restriction No. 3 does prohibit any action which is inconsistent with AEC(NRC) regulatory requirements. However, since this restriction does not define specific measures, none were included in the proposed actions. Other deed covenants restricting land use pertaining to FAA regulations and zoning ordinances may also limit use of the property. For example, the exclusion of structures other than those needed for navigation needs or specifically exempted by the FAA indirectly limit use of the property and, consequently, on-site exposure.

Under both proposed actions, the Airport Authority (or transferee) is charged with the responsibility for the maintenance of the site, complying with deed restrictions and applicable regulations, and insuring that radiation exposures be kept at or below acceptable levels for whatever use is made of the site. Under the Quit-Claim Deed, and as long as the Airport Authority is not licensed to possess source material (see Appendix A), the Federal Government apparently has no responsibility. for monitoring the Airport Authority's (or transferee's) compliance with all deed covenants.

2.4 ALTERNATIVES TO THE PROPOSED ACTION

The following four alternatives have been evaluated:

Alternative 1 - Complete Site Decontamination With Removal of Radioactive Contaminated Material To An Unidentified Location - entails excavating contaminated scrap and building rubble previously buried on-site, and contaminated soil located on-site and in off-site drainage ditches. The intent of this alternative would be to obtain radiation exposure levels for this site as close to background as is economically feasible.

The economic feasibility of this alternative is questionable due to the large quantity of excavation that may be required (assuming 20 acres to a depth of six feet (see Section 3.8), approximately 200,000 cubic yards would have to be removed from the site). In addition, a sufficient volume of clean fill would be required to return the site to its present topographic elevation. The location of an existing rail line adjacent to the site makes transportation by rail to an acceptable site the most probable transportation mode. It is assumed that cost constraints would necessitate selection of a disposal site having rail off-loading facilities.

The main advantages of this alternative are the complete cleanup of the airport storage site, relocation of all contaminated material to an isolated location, and the elimination of the need to monitor compliance with the restrictions in the Quit-Claim Deed. Assuming that the contaminated material would be shipped to a licensed disposal site, NRC criteria for performance objectives for the siting and stabilization of uranium mill tailings (contaminated soil and rubble, in this instance) would have to be met. However, due to the extremely large volume of material involved, this would be a poor utilization of a licensed burial site. If the material were to be moved to a U.S. Government Storage Facility, the NRC performance criteria would also be met. However, in addition to the cost of excavating, hauling, and disposal of the contaminated material there would be costs for on-going maintenance and monitoring programs.

Alternative 2 - Release of the Site For "Unrestricted Use" With No Further Action - entails removal of restrictions in the Quit-Claim Deed pertaining to radiological concerns. Site use, however, would remain restricted by zoning ordinances and FAA regulations. This alternative assumes that the Airport Authority would still have to comply with all state and Federal regulations. However, there would be no reversion of the property to the Federal Government for non-compliance with the covenants of the Quit-Claim Deed. The disadvantage of this alternative is that no assurance is provided the Federal Government that the radioactive contaminated material would remain on-site, that on- and off-site contamination would be minimal, and exposure levels acceptable. Under this alternative it may be necessary for the Airport Authority to be licensed by NRC to possess source material. If a license were to be required, compliance would insure protection of health and the maintenance of environmental quality.

Alternative 3 - Release Of The Site For "Unrestricted Use" After Burial Of Contaminated Material From Latty Avenue Site - is similar to Alternative 2 in its actions except that approximately 18,300 to 50,000 cubic yards of radioactive contaminated material from the Latty Avenue site would be buried above the 500 year floodplain area of the site. The material would then be covered with a minimum of 2 to 4 feet of clean fill in accordance with NRC (1978) plans. Disposal activities would comply with all applicable guidelines and would follow standard engineering practices for disposal of hazardous materials. The removal of covenants of the Quit-Claim Deed pertaining to the control of radiation exposure, i.e., "unrestricted use", and the assumptions that the Airport Authority would still have to comply with all applicable regulations, and might have to be licensed by NRC to possess source material, would also apply to this alternative.

Alternative 4 - Continued Restrictions Of The Site With No Development Of The Site Permitted - entails repossessing of the site by the Government, converting it to a Government Storage Facility, and allowing no private sector or further airport-related development of the site. Government repossession is considered the only way to achieve total control of land use. Advantages to this alternative would be that disposal of Latty Avenue material would be expedited, and the Government would be directly responsible for controlling on-site and off-site exposure to radiation. The major disadvantage of this alternative is that it does not allow other use of the site. As with the proposed actions and all other alternatives, FAA Regulations would still apply to the site.

Table 2-1 summarizes the separate actions that occur in the proposed actions and alternatives.

Table 2-1

Comparison of Actions Within
Proposed Actions and Alternatives

Actions	Proposed Actions 1	Proposed Actions 2	Alternatives 1	Alternatives 2	Alternatives 3	Alternatives 4
Excavation of on-site contaminated material			●			
Removal of on-site contaminated material			●			
Storage of Latty Avenue material on-site		●			●	●
Addition of clean fill on-site with vegetative stabilization*	●	●	●			●
Removal of Deed radiological restrictions			●	●	●	
Unrestricted landuse of site			●	●	●	
Possible source material license required for authority				●	●	
Reversion of site ownership to the U.S. Government						●
No land development of site						●
Mitigating Actions						
Clean up of Brown Road ditch off-site	●	●	●	●	●	●
Disposal of Brown Road material on-site	●	●			●	●
Possible Alteration of Quit-Claim Deed						
Prohibit on-site excavation above 1971 topographical elevation		●			●	●
Prohibit buildings on-site or building compliance with 10 CFR712	●	●				●

*Also a Mitigating Action

●Occurs or Required by Actions or Alternatives

SECTION 3

ENVIRONMENTAL SETTING

3.1 CLIMATE, METEOROLOGY AND AIR QUALITY

Climate and Meteorology - The site has a modified continental climate due to its location near the geographical center of the United States. Major regional air masses influence a four-season climate that has few prolonged periods of extreme cold, heat or humidity. The alternating invasions of St. Louis by warm, moist air from the Gulf of Mexico and cold, dry air from Canada, as well as the passage of frontal systems, generally from the west, produce a variety of weather conditions. In winter daily maximum temperatures are below freezing less than 20 to 25 days a year. Summer daily maximums exceed 90°F on the average 35 to 40 days a year. Normal annual precipitation is a little over 35 inches. The driest months are December - February and the wettest April - June, with one to two week droughts not unusual. Snowfall averages less than 20 inches per winter. Thunderstorms occur on the average between 40 to 50 days per year. A few of these storms are severe with hail and damaging winds. During the entire period of record (1852 to 1978) there have been only four tornadoes in St. Louis which produced extensive damage and loss of life.

National Weather Service Data taken from the Class I Weather Station at Lambert Field in St. Louis shows that the prevailing winds tend to be southerly, having a frequency of occurrence of 11.9 percent from the southern sector, and about 8.4 percent, each from the southeast and south-southeast sectors. The next most prevalent winds derive from the westerly sector and the west-northwest sector, at frequencies of 10.2 and 9.2 percent, respectively. The combined frequency of occurrence from these five sectors (out of a total of sixteen) will amount to about 48 percent of the time (for all atmospheric stability classes). This wind pattern will probably be the most significant dispersion parameter when assessing the impact of potential radionuclide concentration levels on annual downwind dose levels. Local climatological data from St. Louis, including long-term normals, means and extremes are presented in Table 3-1 (NOAA 1977).

Air Quality - Since the site has a continental type climate, low level inversion frequencies at the site will be closely related to the diurnal cycle, where there is a definite tendency for nocturnal stabilization and daytime instability. Estimates of inversion frequency (percent of total hours) are presented in Table 3-2 (Hosler 1961).

Korshover (1960) reported that approximately seven stagnation episodes lasting four days or more occurred in the St. Louis area associated with major anticyclones during the period 1936 to 1956.

Table 3.1

Meteorological Data

Normals, Means, And Extremes

Month	Temperatures °F: Normal: Daily maximum	Daily minimum	Monthly	Extremes: Record highest	Year	Record lowest	Year	Normal degree days Base 65 °F: Heating	Cooling	Precipitation in inches: Water equivalent: Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs.	Year	Snow, ice pellets: Maximum monthly	Year	Maximum in 24 hrs.	Year	Relative humidity (%) (Local time): 00 Hour	06 Hour	12 Hour	18 Hour	Wind: Mean speed m.p.h.	Prevailing direction	Fastest mile: Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover, (tenths), sunrise to sunset	Mean number of days: Sunrise to sunset: Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ¼ mile or less	Temperatures °F: Max: 90° and above	32° and below	Min: 32° and below	0° and below	Average station pressure mb
				30		30					30		30		30		41		41		17	17	17	17	28	16	19	19		18	29	29	29	29	20	20	20	20	17	19	17	17	5
J	39.9	23.6	31.8	76	1970	-14	1977	1065	0	1.89	5.28	1979	0.22	1970	2.43	1979	23.9	1977	11.8	1958	77	82	88	89	10.3	NW	41	NW	1977	34	6.7	8	6	17	8	2	1	2	0	22	27	3	999.5
F	44.2	26.0	35.1	85	1972	-3	1958	837	0	2.06	6.17	1974	0.23	1968	2.36	1959	12.9	1961	8.3	1958	76	80	81	86	10.9	NW	46	NW	1967	33	6.5	7	7	14	7	2	1	2	0	15	25	2	997.8
M	55.0	32.5	43.8	85	1963	-5	1958	682	9	3.05	6.18	1977	1.09	1966	2.65	1977	13.3	1960	10.0	1958	74	81	58	66	11.6	NW	45	NW	1969	36	6.5	7	7	14	8	3	1	2	0	4	14	0	994.1
A	67.0	46.0	56.5	92	1970	22	1975	272	17	3.92	9.09	1970	0.99	1977	2.35	1970	0.3	1971	0.1	1973	70	79	56	63	11.3	NW	45	NW	1966	37	6.5	7	8	15	8	3	1	3	0	0	3	0	995.7
M	76.0	55.3	65.6	91	1972	31	1978	102	128	3.86	7.25	1961	1.02	1971	2.96	1974	0	1966	T	1968	76	83	58	63	9.3	S	42	SW	1977	62	6.1	9	8	14	9	3	1	3	0	0	0	0	995.2
J	84.9	64.6	74.9	98	1971	48	1964	10	307	4.42	8.69	1969	0.47	1959	3.29	1960	0.0		0.0		79	84	57	56	8.8	S	40	SW	1964	68	5.9	9	5	11	9	3	1	3	0	0	0	0	994.4
J	88.4	68.8	78.6	108	1969	51	1972	0	522	3.49	7.61	1958	0.60	1970	3.16	1958	0.0		0.0		78	86	57	56	7.7	S	40	NW	1969	72	5.5	9	7	9	9	2	1	2	0	0	0	0	996.2
A	87.3	67.1	77.2	108	1963	47	1965	01	378	2.87	6.44	1970	0.88	1971	2.66	1974	0.0		0.0		82	89	57	59	7.4	S	38	NW	1966	83	5.4	20	11	10	7	2	1	2	0	0	0	0	997.4
S	80.1	59.1	69.6	100	1971	34	1974	35	173	2.89	6.21	1972	0.78	1980	2.83	1968	0.0		0.0		83	91	61	68	7.9	S	38	SW	1974	83	5.2	21	8	11	8	2	1	2	0	0	0	0	997.5
O	69.8	48.4	59.1	94	1963	23	1976	226	41	2.79	5.77	1968	0.31	1979	2.14	1989	T	1967	T	1985	77	85	55	61	8.5	S	38	SW	1967	65	5.9	13	6	10	8	2	1	2	0	0	0	0	999.3
N	54.1	35.9	45.0	83	1971	1	1964	600	0	2.47	5.74	1968	0.44	1969	2.67	1972	11.5	1951	10.5	1951	79	84	62	68	9.0	S	43	S	1951	48	6.1	9	4	16	8	2	1	2	0	0	0	0	996.5
D	42.7	26.5	34.6	76	1970	-10	1979	942	0	2.04	6.30	1971	0.32	1958	2.57	1971	26.3	1979	12.0	1973	81	85	69	73	10.3	WNW	44	N	1968	43	5.8	7	7	17	10	2	1	2	1	2	0	1	997.8
YR	65.6	46.2	55.9	108	JUL 1966	-14	JAN 1977	4790	1473	33.84	9.09	APR 1970	0.08	AUG 1971	3.29	JUN 1960	26.3	DEC 1979	12.0	DEC 1973	79	84	59	63	9.5	S	60	SW	JUN 1964	59	6.0	103	103	139	109	9	65	11	37	27	109	4	996.6

Means and extremes above are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Highest temperature 115 in July 1954; lowest temperature -23 in January 1864; maximum monthly precipitation 20.45 in August 1946; minimum monthly precipitation 0.00 in November 1865; maximum precipitation in 24 hours 5.78 in August 1946; maximum monthly snowfall 28.8 in March 1912; maximum snowfall in 24 hours 20.4 in March 1890; fastest mile of wind 91 from Northwest in May 1896.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 10 and above at Alaskan stations.
* Less than one half.
T Trace

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiply occurrence.
PREVAILING WIND DIRECTION - Record through 1963.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

Table 3-2

Inversion Frequency*

Winter	35
Spring	30
Summer	34
Fall	44
Annual	35

*Percent of Total Hours.

The St. Louis Air Quality Control Region is not attaining national standards with regard to particulates, sulfur dioxide, carbon monoxide, and photochemical oxidants. The Missouri Department of Natural Resources is developing strategies for control of stationary sources with regard to particulate matter and sulfur dioxide levels. The Department is also developing a transportation plan to control excessive carbon monoxide (CO) and reactive hydrocarbons, the latter of which is considered to be the primary precursor to the oxidant problem. Significant contributions from automobile and transportation traffic at the airport and its vicinity have been assumed by the authorities and may ultimately influence the disposition of the airport site for use with automobile-related activities. However, as State law now stands, the State and city do not have the statutory authority to control indirect pollution sources, such as highway and parking lots. New legislative authority will be required to implement such elements of a transportation control plan and should not influence the use of the site.

3.2 GEOLOGIC ELEMENTS

Regional Geology - The site lies in the Central Lowlands physiographic province of the United States, near the boundary with the Ozark Plateau province. The Central Lowlands are characterized by relatively stable flat-lying rocks of Paleozoic age with gently rolling topography. In contrast, the Ozark Plateau is an elevated, ruggedly dissected plateau of lower Paleozoic rocks. It has been an area of mild uplift since Paleozoic time.

St. Louis is located on the crest of a broad anticline, Waterloo-Dupo-Florissant Trend. There are no major active faults associated with this structure. The Cape Au Gres Fault is a major east-west trending structure located about 30 miles to the north.

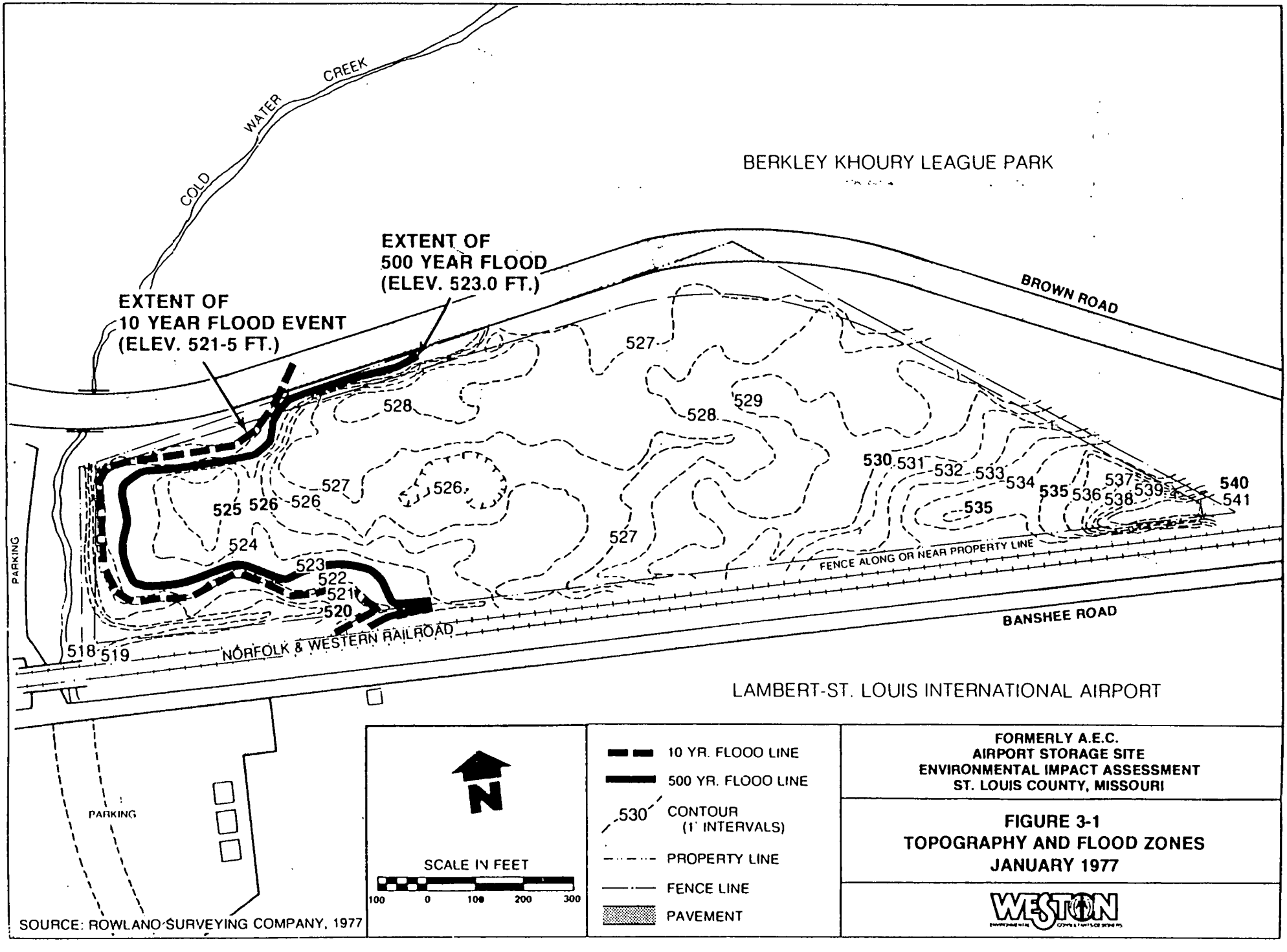
Surficial geology includes Mississippian limestones; Pennslyvanian shales, limestones, and sandstones; Pleistocene silts and clays, and loess; and the Quaternary alluvial deposits of the Missouri and Mississippi Rivers. The bedrock geology consists of essentially flat-lying limestone and dolomite formations. A slight regional northeast dip is

modified by several minor northwest-southeast trending folds and the broad, irregularly shaped Florissant Basin. This basin is a flat lowland of lacustrine (lake bed) deposits of apparent Pleistocene age.

The St. Louis area has experienced numerous seismic events over historic time. A search of reported events between 1795 and 1975 (U.S. Department of Commerce, 1978) within a 30 mile radius around St. Louis revealed 31 events of intensity III through VII (Appendix B). The worst of these would cause damage to structures, but no surface rupture would result. The epicenters of the New Madrid earthquakes of 1811-1812 are located almost 150 miles south of the site. The total destruction caused by these earthquakes would not be expected as far distant as St. Louis. Seismic risk predictions for the St. Louis area indicate the likelihood of moderate damage in the future, as has been experienced in the past.

Site Geology - The present surface of the site slopes gently from east to west at a maximum five percent grade. The site topography is presented in depth in Figure 3-1. Since 1971 the site topography has changed considerably due to erosion and the addition of fill. The site is now generally flat at about 530 feet above mean sea level. The west end of the site has several eroded gullies, while large amounts of fill, mainly rubble from road construction, have been added to the southwest end. The northwest end is still slightly depressed. A depressed drainage ditch runs south of Brown Road along the length of the site. The site is about 20 feet above Coldwater Creek which forms the west boundary. Micro relief of the site is highly variable because of past filling and grading activities. The fill has not been compacted or stabilized with vegetation in a systematic fashion; differential settling and erosion have occurred throughout the site as a result. In some areas, final grading was not performed, while blocky demolition rubble was placed in others. Non-select fill material is presently being stockpiled on the site for future covering operations. The site is elevated compared to its surroundings, including drainage ditches along Brown Road, the railroad right-of-way, and Coldwater Creek. The predominant surface drainage is toward Coldwater Creek.

The site is located in the Pleistocene Florissant Basin, which is filled with up to 100 feet of lacustrine silty clay over limestone bedrock. The clays have a high water content and are more compressible than other sediments. The thickness of the lacustrine clays runs from about 50 to 100 feet beneath the site (Lutzen et al, 1971). Natural soils which were developed on the site and mapped by the Soil Conservation Service (USDA, 1974) are of the Nevin-urban land soil association. This association consists of deep, (three to eight feet thick) gently sloping soils which have developed on shallow lake deposits. They are typically somewhat poorly drained. Soil series of the Nevin association include the Menfro and Nevin soils. Menfro soils are deep and well-drained brown to dark yellowish brown silt loams and silty clay loams. Nevin soils are deep and somewhat poorly drained black and mottled dark greyish brown silty clay loams. Menfro soils were found only in the eastern corner of the property while Nevin covered the rest. Due to the extensive grading and excavation activity which has occurred on the site, the present distribution of the soils may be less than complete.


COLD WATER CREEK
BERKLEY KHOURY LEAGUE PARK
EXTENT OF
500 YEAR FLOOD
(ELEV. 523.0 FT.)
EXTENT OF
10 YEAR FLOOD EVENT
(ELEV. 521-5 FT.)
BROWN ROAD
527
528
529
528
530 531 532 533 534 535 536 537 538 539 540 541
525 526 526
527
526
524
523
522
521
520
535
527
FENCE ALONG OR NEAR PROPERTY LINE
PARKING
BANSHEE ROAD
518 519
NORFOLK & WESTERN RAILROAD
LAMBERT-ST. LOUIS INTERNATIONAL AIRPORT
PARKING
N
SCALE IN FEET
100 0 100 200 300
10 YR. FLOOD LINE
500 YR. FLOOD LINE
530 CONTOUR (1' INTERVALS)
PROPERTY LINE
FENCE LINE
PAVEMENT
SOURCE: ROWLAND SURVEYING COMPANY, 1977
FORMERLY A.E.C.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-1
TOPOGRAPHY AND FLOOD ZONES
JANUARY 1977
WESTON

Limestone bedrock at the site is the Mississippian St. Genevieve limestone. This formation is known to be cavernous where it crops out five miles to the north and where a mature Karst topography is developed on it. Coldwater Creek crosses this Karst terrain between the site and the Missouri River where it empties.

The sequence of filling and removal of radiological wastes at the site has been described in Section 2.2. Present surface cover consists of from zero to eight feet of non-select fill material which is extremely variable in size. (See Figure 3-2.) Particle sizes range from clay to boulder. Asphalt road surface wastes have also been deposited on-site.

Infiltration rates for the fill materials covering the airport site vary from one to five inches per hour. This is due to the variable compaction of the fill material. Published values for infiltration rates are 0.2 to 2.0 inches per hour for the Nevin soil and 0.6 to 2.0 inches per hour for the Menfro soil (U.S.D.A., No. 5 Soil Interpretation Sheet).

3.3 HYDROLOGIC ELEMENTS

Groundwater - Groundwater at the site, obtained from the local paleozoic limestones, is of very poor quality. It typically contains more than 1,000 ppm of dissolved solids and is classified as being saline by the State Geological Survey. In addition, yields from wells in these rocks are very low with reported specific yields being less than two gallons per minute per foot of drawdown. As a result of these factors, groundwater is not generally used in the area around the airport site. According to records of the Missouri Geological Survey Water Resources Report #30, the nearest well is about 1-1/2 miles north of the site. There are no records of any producing wells within a one mile radius of the site. The water needs of the area are met by treated Mississippi River water.

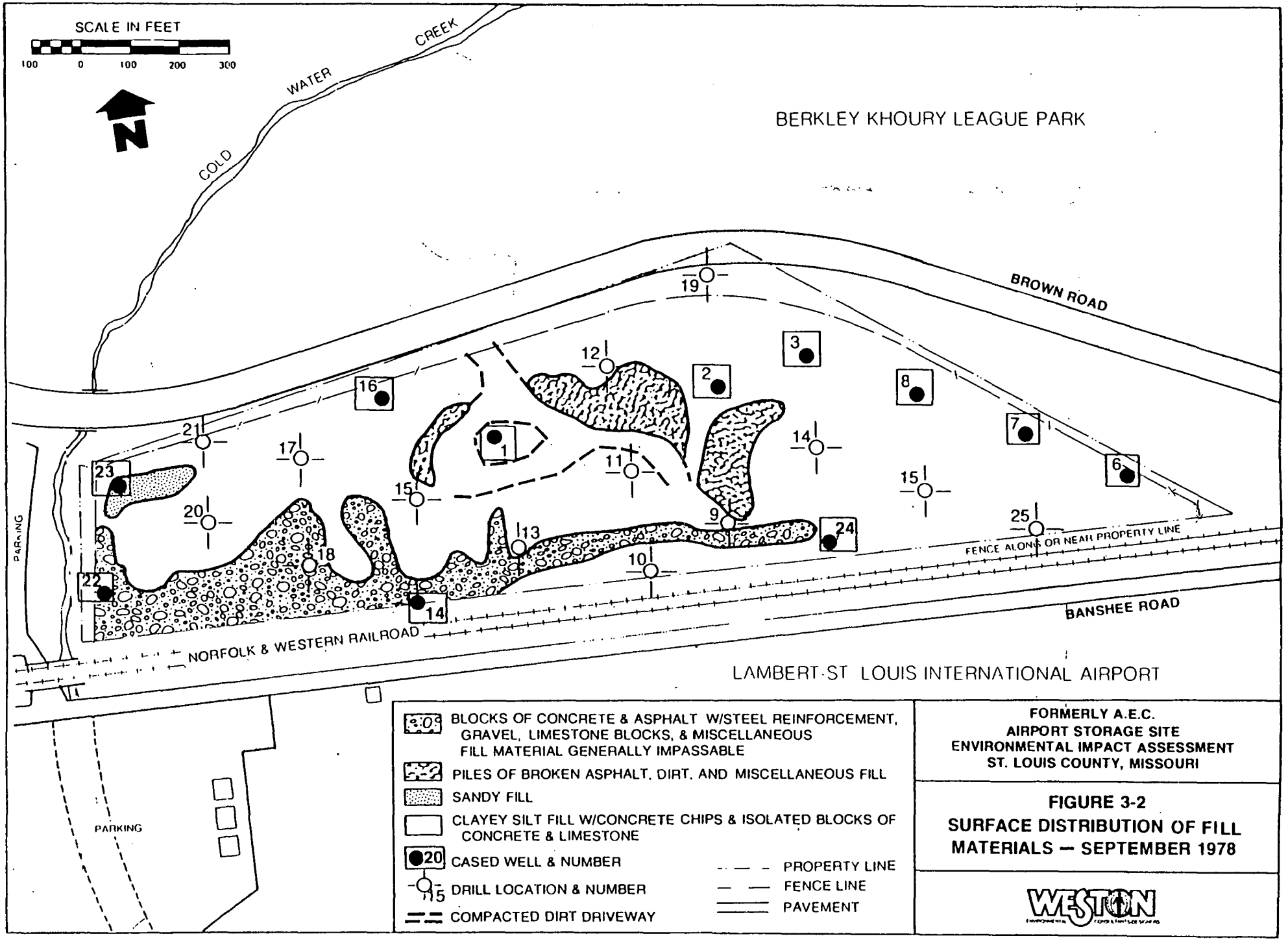
From observations at monitoring points installed on the site, the direction of groundwater flow at the site is from the topographic high area in the east corner toward Coldwater Creek in the west corner (Figure 3-3). Groundwater recharge occurs in the topographic high areas to the east and on the site itself. The net flow indicates that most of the groundwater which infiltrates into the site will discharge into Coldwater Creek.

The rate of groundwater movement has been calculated to be 0.019 feet/day using Darcy's Law:

$$v = \frac{K\ i}{a}$$

where:

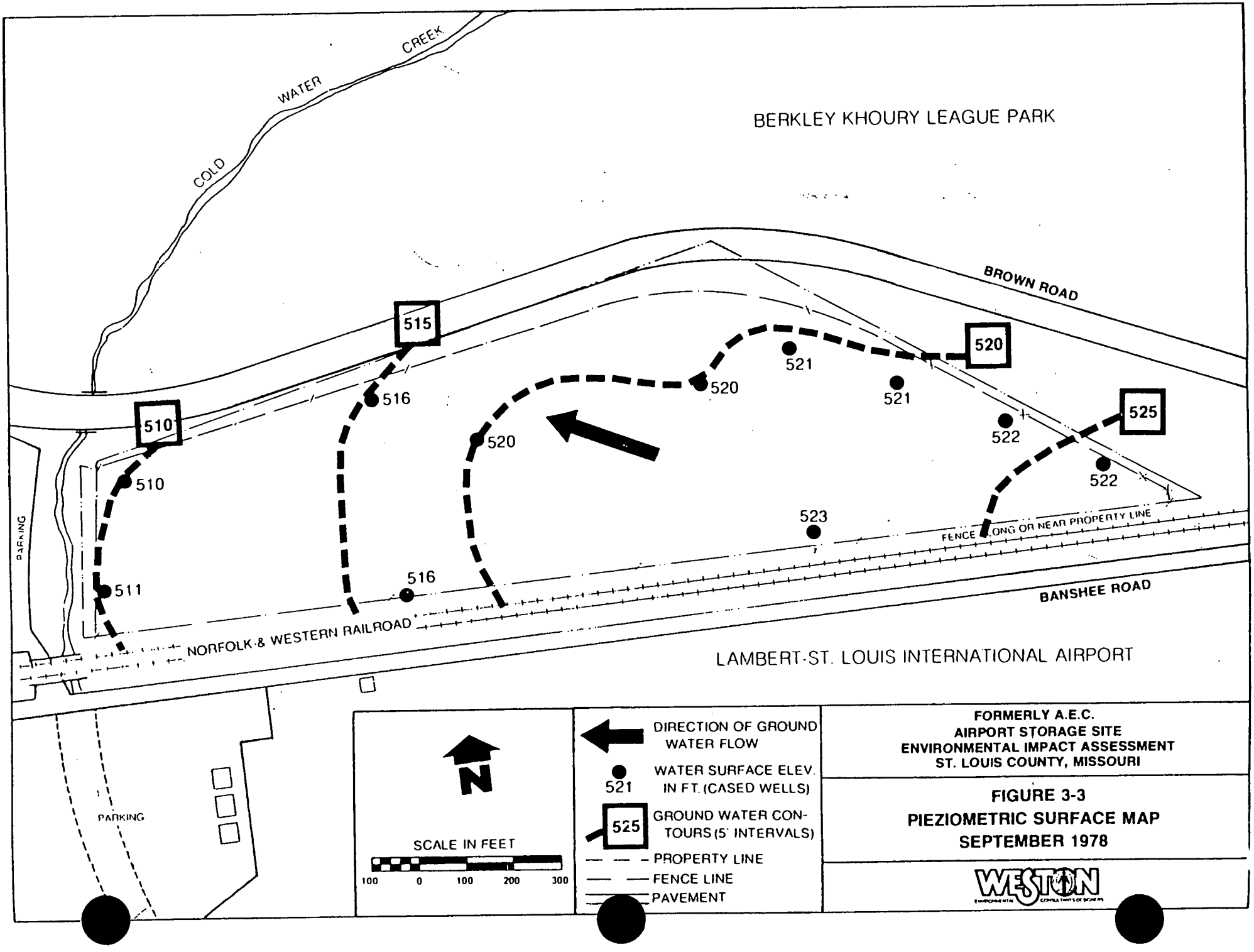
v = groundwater velocity
K = permeability (SCS Soil Interpretation Sheet #5)
i = hydraulic gradient
a = porosity of sediment



FORMERLY A.E.C.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI

FIGURE 3-2
SURFACE DISTRIBUTION OF FILL MATERIALS — SEPTEMBER 1978

WESTON


COLD WATER CREEK
BERKLEY KHOURY LEAGUE PARK
BROWN ROAD
515
520
525
510
516
521
520
521
522
522
510
520
523
FENCE ALONG OR NEAR PROPERTY LINE
PARKING
511
516
BANSHEE ROAD
NORFOLK & WESTERN RAILROAD
LAMBERT-ST. LOUIS INTERNATIONAL AIRPORT
PARKING
N
SCALE IN FEET
100 0 100 200 300
DIRECTION OF GROUND WATER FLOW
521 WATER SURFACE ELEV. IN FT. (CASED WELLS)
525 GROUND WATER CONTOURS (5' INTERVALS)
PROPERTY LINE
FENCE LINE
PAVEMENT
FORMERLY A.E.C.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-3
PIEZIOMETRIC SURFACE MAP
SEPTEMBER 1978
WESTON

Using the calculated groundwater velocity, the average daily groundwater discharge into Coldwater Creek from the site is estimated to average 450 gallons per day.

Surface Waters - Coldwater Creek which borders the site, is approximately 19 miles long. It originates at a small lake in Overland, Missouri, and runs north-northeast through 18 communities in St. Louis County. The specific point of origin is a spring-fed pond. Coldwater Creek eventually drains into the Missouri River four miles above the junction of the Missouri and the Mississippi Rivers. The total watershed area is approximately 36 square miles.

The Coldwater Creek watershed is becoming urbanized at a rapid rate. The creek is predominantly used for the conveyance of significant amounts of stormwater runoff, particularly from the impervious sections of the extensive residential, industrial, and airport land uses in the watershed.

The site is located in the upper half of the watershed. Runoff leaves the site by evaporation, seepage into the groundwater system, or through overland drainage to Coldwater Creek. All of the surface drainage from the site is intercepted by drainage channels along the northern and southern boundaries of the site (along Brown and Banchee Roads), and flows to Coldwater Creek. Surface erosion has resulted in sections of the site becoming bare ground.

No wastewater collection or water distribution systems are known to lie within the site, according to the Metropolitan Sewer District (MSD) in St. Louis and the St. Louis County Water Company. However, a 12 inch water distribution line is located on the southern side of the right-of-way for Brown Road.

There are no facilities on Coldwater Creek that withdraw water for the purpose of providing drinking water. The closest water treatment facility lies on the Missouri River. This facility, however, is upstream of the confluence of Coldwater Creek and the Missouri River. As such, any discharge from the site to Coldwater Creek should not impact drinking water supplies.

The flow in Coldwater Creek at the site is controlled by the culverts through the Lambert-St. Louis International Airport. A Federal Insurance Administration (U.S. Department of Housing and Urban Development) Flood Insurance Study (FIS) has been prepared for the community of Hazelwood, Missouri. This study presents the results of detailed hydrologic and hydraulic analyses for Coldwater Creek. The Hazelwood FIS analyzed flooding conditions for Coldwater Creek to the upstream side of the northern border of the site. The flood data (stream flow and water surface elevations) developed for this study are directly applicable for analyzing on-site flooding conditions (Table 3-3).

Table 3-3

Stream Flow and Water Surface Elevations
for Coldwater Creek at the Airport Storage Site

Flood Recurrence Interval	% Chance of Occurrence in a Given Year	Stream Flow (cfs)	Water Surface Elevation (ft)
10 year	10	4,400	521.5
50 year	2	4,700	522.2
100 year	1	4,800	522.5
500 year	0.2	5,100	523.0

A source of "average-day" flows in Coldwater Creek is a survey performed by WESTON whereby stream discharge was measured for three consecutive days in September 1978. The values that were observed were 10.3, 2.8, and 3.2 cfs. The 10.3 cfs measurement was taken after a rainfall event of 0.2 inch. The average flow in the Creek, based on the last two measurements taken, is approximately 3 cfs during dry periods.

This information is helpful in determining a dilution factor for groundwater flow into Coldwater Creek from the site. The average groundwater flow has been determined to be 450 gallons per day (6.8×10^{-4} cfs). The dilution factor for groundwater flow (stream flow to groundwater flow) for this "average daily" Coldwater Creek discharge is 4400:1.

Based on the water surface elevations presented in Table 3-3, flooding is restricted to the western edge and northwest corner of the property (Figure 3-1); while the deposition of fill in the southwest corner of the site has reduced the flooding potential of this portion of the site. The 500 year flood event (worst case) should cover approximately 5 percent of the site.

The surface water quality of Coldwater Creek is heavily influenced by runoff from the airport and other developed portions of the watershed, and by industrial point sources located downstream of the site (Table 3-4). The segment of Coldwater Creek from the Lambert-St. Louis International Airport to the Coldwater Creek Wastewater Treatment Facility (approximately 5.5 miles) is classified as a "protected stream" (Missouri Department of Natural Resources, 1977). Its designated use is to provide industrial process and cooling waters.

Table 3-4

Point Source Discharges to Coldwater Creek

Facility	Discharge
Coldwater Creek Wastewater Treatment Facility	Treated Wastewater
Lakeside Hills Subdivision	Treated Wastewater
Ford Motor Company	Cooling Water
McDonnell-Douglas	Cooling Water
Diversified Metals	Cooling Water

Discharge requirements state that, "No effluents, except unpolluted cooling water, shall be discharged to protected streams". These streams are covered by the "General Criteria" listed in Table 3-5, but do not have specific requirements with regard to concentrations of given water pollutant constituents.

Table 3-5

General Water Quality Criteria

The following water criteria shall be applicable to all waters of the state at all times. The Clean Water Commission will require all necessary and reasonable measures to prevent water quality from being less than these minimum standards. The waters of the state shall be:

a) Free from substances that will cause the formation of putrescent or otherwise objectionable bottom deposits.

b) Free from oil, scum, and floating debris in sufficient amounts to be unsightly or deleterious.

c) Free from materials that cause color, odor, or other conditions in such degree as to create a nuisance.

d) Free from substances or conditions that have a harmful effect on human, animal, or aquatic life.

The Areawide Waste Treatment Management Study identified alkalinity, ammonia, fecal coliform, iron heavy metals, oils, dissolved oxygen, phenols, phosphate, and total dissolved solids as contributors to the poor water quality of Coldwater Creek (Table 3-6). Results of an extensive sampling program of Coldwater Creek conducted by Coleman (1971) are presented in Appendix C.

Stormwater runoff from the site drains to Coldwater Creek either by direct overland flow or through drainage ditches along Brown Road and the Norfolk and Western Railroad right-of-way. Table 3-7 lists the rainfall amounts and runoff rates for several design storm events based on procedures developed by SCS (1972). Predicted surface runoff from

Table 3.6

Water Quality Problems in the Coldwater Creek Watershed

Constituent Causing the Water Quality Problem	Secondary Contact Recreation	Primary Contact Recreation	Aesthetics	Power Plant Cooling	Industrial Water Supply	Agricultural Irrigation	Wildlife and Lifestock Watering	Public Water Supply	Warm Water Fishery	Cold Water Fishery
Alkalinity					X	X				
Ammonia					X	X		X	X	
Chlorides										
Fecal Coliform	X						X	X		
Iron					X	X		X	X	
Heavy Metals									X	
Oil	X		X					X		
Dissolved Oxygen									X	
Phenols								X	X	
Phosphate			X							
Total Dissolved Solids									X	
Total Suspended Solids										
Temperature										

Source: Areawide waste treatment management study for St Louis City - St. Louis County.

the site is insignificant compared to the flow in Coldwater Creek for the given design storm events (Table 3-3). As such, stormwater runoff pollutant loads from the site should be significantly diluted by the background flow in Coldwater Creek.

Table 3-7

Site Rainfall and Runoff*

Design Event	Rainfall (inches)*	Runoff (cfs)
10 year	5.0	22
25 year	5.7	28
50 year	6.3	34
100 year	7.0	40

*After. U.S. Department of Commerce, 1961.

Given the nature of the existing land use and topography, sediment loading of Coldwater Creek may be as high as 30.7 tons per year from the site (Table 3-8). Due to the narrow and deep cross section of stream channel and the large quantity of surface water runoff, eroded sediments are flushed downstream. The stream bed is eroded and comprised of heavy clay and a gravel/rock substrate.

Table 3-8

Erosion-Sedimentation Volumes From
The Airport Storage Site

Type of Event/Loading	Sediment Loading (tons*)
Average Annual	30.7
Average Daily	0.08
Values Normally Exceeded Once in design storm event:**	
- 20 years	14.3
- 10 years	11.4
- 5 years	10.4
- 2 years	8.6
- 1 year	5.8

*Based on the Universal Soil Loss Equation (EPA, 1976) - See Appendix D
**Total sediment loading from event.

3.4 BIOLOGICAL ELEMENTS

Plant Communities - The site is in north central St. Louis County, located within the area where prairie and forest merge. The Ozark hardwood forest occurs within the hilly upland southwestern portion of the county and extends southward through the lower section of the state. The prairie that once extended into St. Louis from the northwest most likely covered the rolling upland of the northern part of the county including the airport area. In this transition zone, the Ozark flora dominates on broken rocky ground along streams while the prairie flora occupies the more level and open upland.

One area, the Florissant Basin, in particular, was at one time a rich prairie (St. Louis Co., 1973, Lark 1978). The site lies within this shallow depression and the Coldwater Creek watershed which was a lake formed by temporary damming during the glacial period. As the waters dried up, the area developed slowly into a marsh and then a rich prairie.

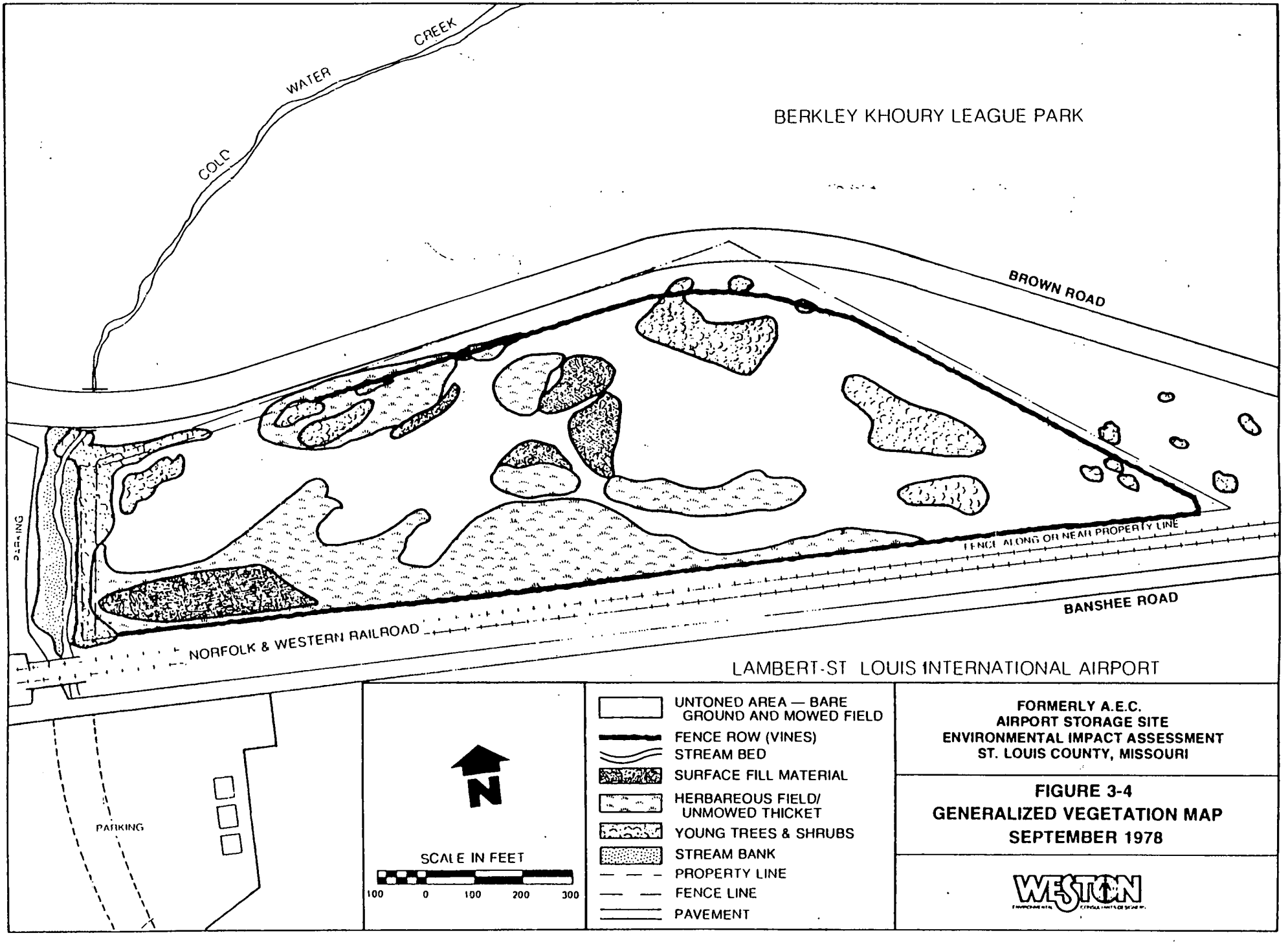
It is most likely, therefore, that the St. Louis-Lambert International Airport area and the airport storage site were tall grass prairie rather than having affinities toward the Ozark woodlands. Dominant plant species of the presettlement prairies included:

Big bluestem	Andropogon gerardi
Indian grass	Sorghastrum nutans
Little bluestem	Andropogon scoparius
June grass	Koleria cristata

The prairie was quickly developed for agriculture and today it is the most restricted vegetation type within the seven county region. Aside from relic prairies on hilly river bluffs, many of the native prairie species may be found in old fields, along railroad rights-of-way and roadsides. Further description of St. Louis habitats may be found in An Introduction to the Biological Systems of St. Louis, 1975.

Although the site may have originally had the greatest affinity for prairie species, it has been greatly disturbed over its long history of land use. It currently could be described as disturbed urban open space. A general vegetation map of the area is given as Figure 3-4.

In late summer the dominant ground cover on the site was sunflower, Helianthus annus; goldenrod, Solidago nemoralis, giant ragweed, Ambrosia trifida, and nodding foxtail, Setaria faberi. For a number of years the airport has maintained the site, through seasonal mowing and cutting of tall trees. Much of the site had been mowed just prior to the field visit in late August. Although herbicides are used on paved areas of the airport nearby, only mowing has been performed on the site. Dense thickets of ragweed, goldenrod and sunflower remain along the rail line edge of the site and on deposited fill areas which could not be mowed.


COLD WATER CREEK
BERKLEY KHOURY LEAGUE PARK
BROWN ROAD
FENCE ALONG OR NEAR PROPERTY LINE
BANSHEE ROAD
NORFOLK & WESTERN RAILROAD
LAMBERT-ST LOUIS INTERNATIONAL AIRPORT
PARKING
N
SCALE IN FEET
100 0 100 200 300
UNTONED AREA — BARE GROUND AND MOWED FIELD
FENCE ROW (VINES)
STREAM BED
SURFACE FILL MATERIAL
HERBAREOUS FIELD/ UNMOWED THICKET
YOUNG TREES & SHRUBS
STREAM BANK
PROPERTY LINE
FENCE LINE
PAVEMENT
FORMERLY A.E.C.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-4
GENERALIZED VEGETATION MAP
SEPTEMBER 1978
WESTON

Scattered trees occur along the fence line south of Brown Road and on the banks of Coldwater Creek. These include red mulberry, box elder, slippery elm and black cherry. Within the site, a small stand of young mulberry, cherry and cottonwood extends from the property line at the west end of the site along Coldwater Creek. Cottonwood is the most successful colonizer found throughout the site, with one tree at the east end of the site measuring 10 inches in diameter. Other colonizing trees include box elder, black willow and tree-of-heaven. A short list of dominant plant species found on the site is presented in Appendix E.

Wildlife and Wildlife Habitat - Although plant species remnant of the former prairie may occur on the site or along the railroad right-of-way, wildlife in the area are most likely those species characteristic of urban open space. The proximity of the vegetation along Coldwater Creek and the open grassland of the adjacent playing fields and airport grounds should strongly affect site fauna.

Grasses and weedy plants of the site support large numbers of grasshoppers, leafhoppers and spiders. American or Fowlers toads as well as garter snakes and box turtles likely occur on the site. The pocket gopher, eastern mole, house mouse and Norway rat are the most likely common small mammals on the site, although short-tail shrews may also be present. In the past, moles and gophers have been reported to cut underground cables at the airport. Rabbits are probably the most commonly visible mammal on the site and surrounding fields.

Coldwater Creek serves as a corridor for wildlife, particularly large mammals. Raccoons, opossum, woodchuck, squirrels, skunks and fox may travel along this corridor daily to use nearby areas such as the site. The extensive fields and edges of the airport grounds also serve as a refuge for these species. In addition, feral dogs have been a problem on the airport in the past. They apparently were able to escape notice on the edges of the airfield and in the culverted portions of Coldwater Creek running under the airport and opening at the west end of the site. During the recent short field survey, one canid scat was found on the site, which consisted entirely of rabbit fur and crustacea parts.

Birds utilizing the site habitats strongly reflect the surrounding fields and stream woodlands. Flocks of grasshopper sparrows were observed on site as were pigeons, mourning doves, redwing blackbirds, grackles, starlings, cardinals and goldfinch. One covy of bobwhite were flushed and one palm warbler and ruby-throated hummingbird were also observed.

Other birds that are likely common to the site include eastern meadowlarks, horned larks, song sparrows, mockingbirds, and robins. Depending on the populations of mice and gophers on the site, red-tailed hawks, rough-legged hawks, kestrel and other raptors common to the airport grounds may visit.

St. Louis lies on the central Mississippi flyway for migrating waterfowl. Canvasback, ring-necked duck, mallard and lesser scaup are a few species that extensively use this flyway. Wetlands on the Missouri and Mississippi rivers and reservoirs surrounding St. Louis provide the greatest majority of habitat for these waterfowl during migration. During spring and fall migration periods, a few ducks have been reported on shallow rainwater pools on the airport. Use of these pools and Coldwater Creek within the site vicinity is probably minimal and insignificant.

Aquatic Life - Coldwater Creek historically (Rains, 1978) has supported little aquatic life (fish or macroinvertebrates) below the airport. Upstream stations, however, have revealed the presence of an aquatic community which may be termed "normal" for an urban stream such as this. Olsen (1970) states that minnows, crayfish, snails, and some aquatic insect larvae were found in the stream section from Overland to the airport. However, as also mentioned by Coleman (1971), this section of the stream is adversely affected by debris and urban refuse dumped into the stream. Coldwater Creek is not fished to any known degree (Missouri Conservation Commission, 1978-personal communication), nor is it used for water-based forms of recreation.

Below the airport, aquatic biota is severely impacted by spills of oil and gasoline (Rains, 1978, personal communication). A one-day, 100-yard, reconnaissance of the stream conducted on 31 August 1978 revealed the presence of only snails (Physa), a few midge larvae (Chironomidae), and two minnows (Pimephales). The substratum, littered with masses of debris and gravel/rock beds, revealed signs of severe oil pollution when disturbed. However, algal species were well represented by diatoms and unicellular green algae which covered stream bed rocks. Short growths of filamentous green algae were observed in riffle zones.

Although industrial discharges to the stream have been significantly curbed since 1960, Coldwater Creek is still adversely affected by airport runoff water, trash and debris, and high volumes of surface runoff from nearby industrial developments. Trash was sighted in trees adjacent to the streambank up to 12 feet above normal stream levels. The poor biological health of the stream is attested to by the lack of normal populations of fish (shiners, catfish, minnows, carp) and macroinvertebrates (mayflies, caddisflies, aquatic beetles, mollusks, and crayfish). Only two studies, both short-term, have been completed in recent years which describe existing aquatic biota (Olsen, 1970 and Coleman, 1971). The results of both of these studies concur on the poor condition of Coldwater Creek below the airport.

Endangered Species - A list of rare and endangered plant and animal species reported to occur within St. Louis County is presented in Appendix F. The status of each species and the likelihood of occurrence on the site are noted. In as much as the site has been heavily disturbed over a long period of time it seems highly unlikely that any of these species currently exist on the site. However, it should be remembered that many rare prairie plants occur today in relic populations in old fields and along railroad rights-of-way such as the site of interest. Compared to

wildlife habitats surrounding the site it is unlikely that any of these species would utilize the site or more importantly, that it may become valuable to their existence. The Pallid shiner could occur in Coldwater Creek, but it is doubtful that it would tolerate the poor water quality of the stream section near the site. Raptors, such as the barn owl, sharp-shinned hawk and peregrine falcon could potentially pass over the site in search of mice, songbirds and pigeons, respectively, but this is considered insignificant.

Wetlands - Most of the wetlands that once existed in the St. Louis area have been lost to drainage for various purposes, including mosquito control, agriculture, urban development, and flood control (Missouri Botanical Garden 1975). Those few remaining occur along the Mississippi predominantly in St. Charles County. No wetland classification is known for the Coldwater Creek Watershed.

Resource Use - The site and the immediate airport vicinity have received little attention in the past from nature or environmentally oriented interest groups. No structured visits or interest in the area has been reported. An exception is the attention of local birders to observe a snowy owl wintering on the airport two years ago. Due to the restricted nature of the site hunting is not allowed.

3.5 LAND USE ELEMENTS (EXISTING AND PROJECTED)

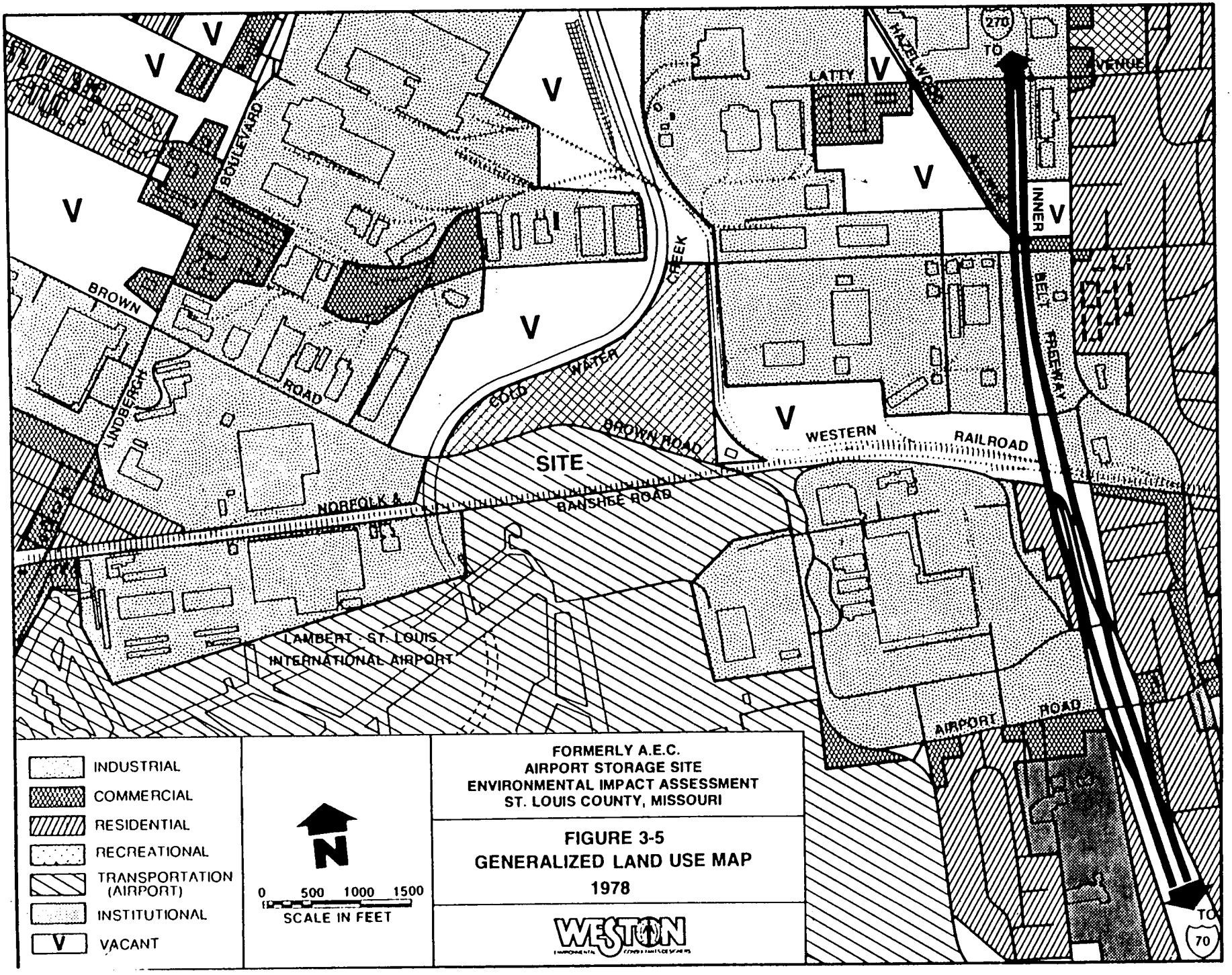
Land Use - Current land uses immediately surrounding the site are shown in Figure 3-5. More than two-thirds of the land within one-half mile of the site is in transportation uses - primarily Lambert-St. Louis International Airport. Table 3-9 presents land use by category.

Table 3-9

Existing Land Use: 1975

Land Use Category	Percent of Total Area Within 0.5 mile	Percent of Total Area Within 1.0 mile
Transportation	69.3	42.0
Industrial	4.1	27.8
Residential	6.4	10.3
Vacant	8.0	9.8
Commercial	11.5	8.8
Public	0.6	1.0
Recreational	0.1	0.3
Total Acres	680.0	3,880.0

Source: Fiscal year 1975, Technical Summary Report: Land Use and Socio-economic Projections. East-West Gateway Coordinating Council.


INDUSTRIAL
COMMERCIAL
RESIDENTIAL
RECREATIONAL
TRANSPORTATION (AIRPORT)
INSTITUTIONAL
V VACANT
N
0 500 1000 1500
SCALE IN FEET
FORMERLY A.E.C.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-5
GENERALIZED LAND USE MAP
1978
WESTON
SITE
LAMBERT - ST. LOUIS INTERNATIONAL AIRPORT
BROWN ROAD
BANSHEE ROAD
NORFOLK & WESTERN RAILROAD
COLD WATER CREEK
BOULEVARD
LINDBERGH
BROWN ROAD
LATTY AVENUE
INNER BELT FREEWAY
AIRPORT ROAD
TO 270
TO 70

Land use immediately adjacent to the site is dedicated to transportation, commercial and recreation uses. Immediately south of the railroad tracks and the street is the Lambert-St. Louis International Airport. To the west and southwest, separated by roads, the McDonnell Douglas Corporation parking lots abut the site with office buildings and other facilities somewhat more removed. North of the site is the Berkeley Khoury League Park which extends to Coldwater Creek. Only the eastern portion of the park is used for formal recreational activities. At the corner of Eva Avenue and Brown Road there is a small truss and lumber company. Ford Motors maintains a large plant about 1/2 mile north of the site; while General Motors, Kruger Co., Georgia Pacific Co., Southern Cross Lumber Co., Diversified Metals Corp., and several other small industrial facilities are located within 1/4 mile of the site.

The land use plans for the area do not show any major land use changes within a 1/2 mile radius of the site. For the area within one mile radius of the site, the major changes anticipated in land use by the year 2000 are an additional 250 acres in residential use and 90 acres for transportation related use, thus utilizing most of the presently available vacant land within this one-mile zone. The St. Louis County General Plan - History Element (August 1973) refers to the Lambert - St. Louis 2000 Plan identifying an extension of Runway 24 to the northeast so that the end of the runway is very close to the site. The Lambert - St. Louis International Airport 1975-1995 Master Plan (1975) does not include this extension but does propose utilizing the Berkeley Khoury League Park area as port for short take-off and landing aircraft.

Population Centers - There are no sizeable population centers within one mile of the site. The nearest population center is comprised of 75 to 100 people residing about 1/2 mile due west of the site in an industrially zoned area of Hazelwood. The nearest population center (about 1,500 people) northwest of the site, is located along Chapel Ridge Drive about one mile from the site; however, most of Hazelwood's population is north of Interstate 270, more than a mile and a half north of the site. By the year 2000, an estimated 1,500 additional people may live within 1 mile of the site.

Employment Centers - There are three major concentrations of employment near the site: McDonnel Douglas Corporation, Ford Motors, and Lambert-St. Louis International Airport operations. McDonnel Douglas which is adjacent to the site employs 32,600 people. Ford Motors and the airport facilities are located 1/2 and one mile from the site respectively.

Transportation - Immediately north of the site is Brown Road, a four-lane State Route, serving as a major access route for the employment centers in the vicinity. Average daily traffic on Brown Road at the site entrance is 17,000 vehicles. The peak hour volume at the same location is 2,000 vehicles or 12 percent of the 24-hour volume. The heavy peak hour traffic near the site is primarily associated with the employment centers located in the vicinity of the site. Traffic accidents on Brown Road increased from 136 in 1976 to 175 in 1977. However, for the first four months of 1978, the number of accidents reported have been slightly reduced (45 in four months).

Recreation - Berkeley Khoury League Park has been developed by the City of Berkeley on land leased from the Airport Authority. The park is mainly used for recreation programs between April and the middle of September. Baseball and softball games are scheduled on weekdays for three hours in the evening (since there are no lights provided) and for eight hours on weekends. The participants for these games include 253 children of 5-17 age group and 200 adults of the 18-40 age group. In addition, there are on the average 20 spectators for each game. Each team plays six home games. Occasionally 5 or 6 elderly couples play golf in the park.

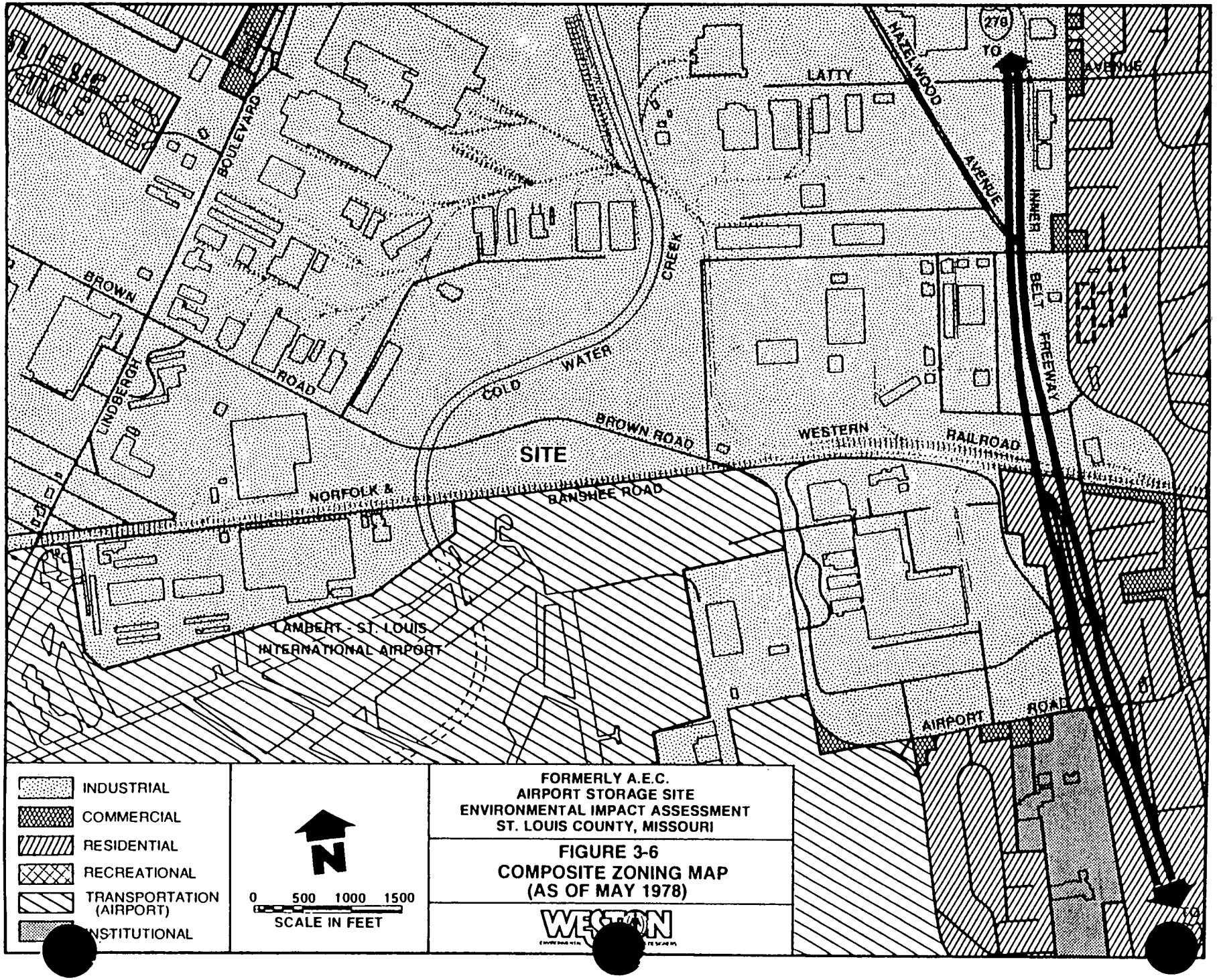
During fall months, there is one soccer game played on both Saturday and Sunday. This involves approximately 75 children between the ages of 5-14 as participants, and approximately 50 spectators for each game. The average time for a soccer game is two hours.

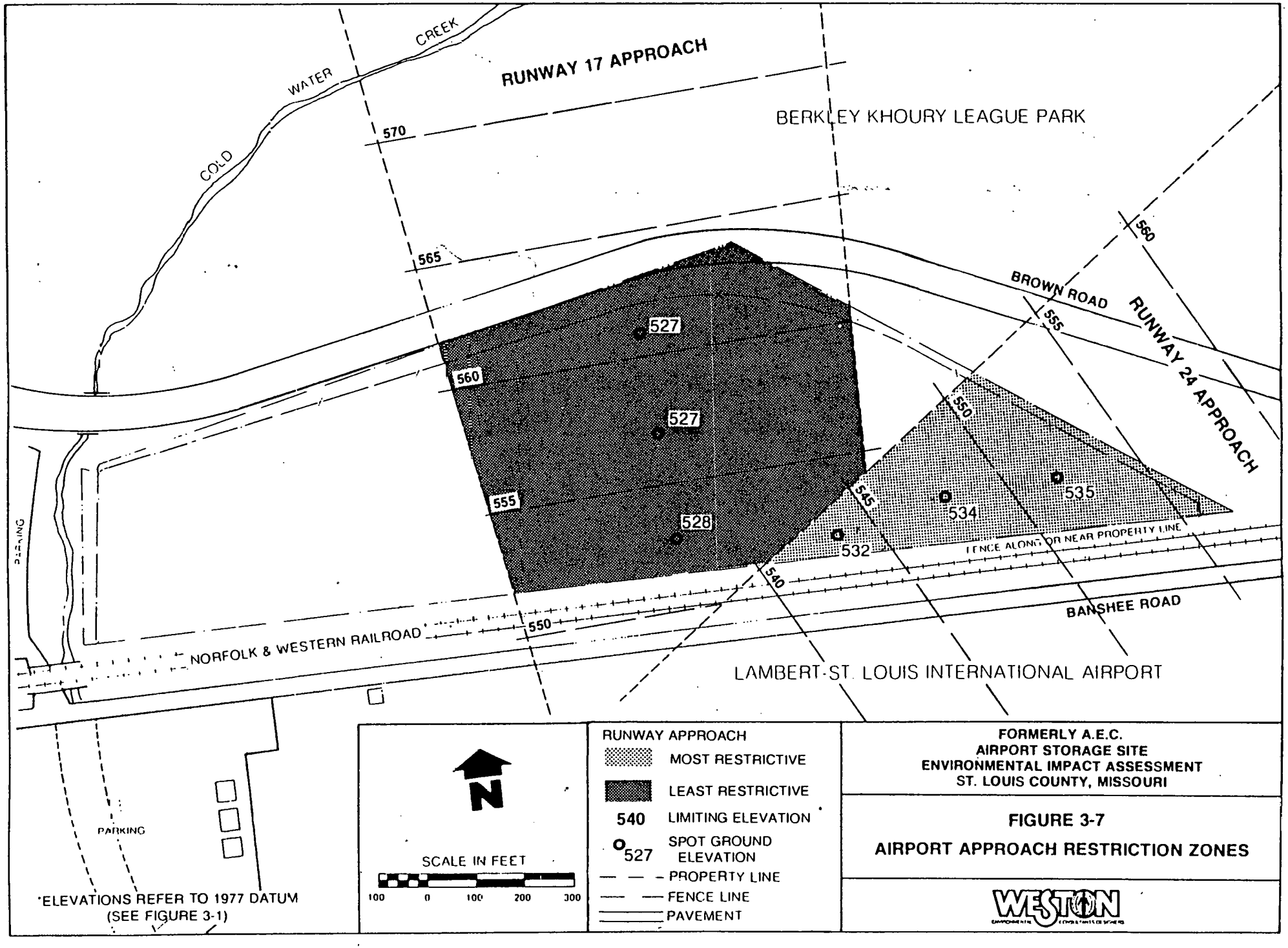
The park is maintained by six volunteers. During games the volunteers work two hour shifts on weekdays and three hour shifts on weekends. Additional maintenance work is periodically conducted by these volunteers which may account for an additional 10-12 hours per week at the park. The volunteers are between 25-55 in age.

Zoning - The site is zoned for M-1 Industrial uses although the western half of the site is also designated as flood plain by the St. Louis County Department of Planning (Figure 3-6, Zoning Map). The portions of Hazelwood adjacent to the site are zoned for either heavy industrial or light industrial development. The area within one mile of the site within the City of Berkeley has been zoned industrial, transportation, commercial and single family dwelling. The single family dwelling area is very close to the one mile limit northeast, east and southwest of the site. At present the eastern two-thirds of the site is under height limitations (see Figure 3-7) imposed by the Air Navigation Space Regulations, St. Louis County Zoning Ordinance. Structures must be less than 12 feet in height at the southern boundary and 33 feet at the northern boundary.

3.6 ARCHAEOLOGICAL - HISTORICAL ELEMENTS

There are no archaeological or historical sites or districts which are included in the National Register of Historic Places within one mile of the site. The Meyer House and Daniel Bissell House located two miles to the north and 4 miles to the east respectively, are the closest National Register listings. The Office of Historical Preservation, Missouri Department of Natural Resources, could identify no known cultural resources within the airport storage site or its environs (Weichman, 1978, Appendix G). In addition, due to previous disturbance to the property, the Office of Historic Preservation does not consider an in-field cultural resource assessment of the site warranted.


LATTY
AVENUE
270
TO
NATIELWOOD
AVENUE
INNER
BELT
FREEWAY
BOULEVARD
CREEK
BROWN
ROAD
LINDBERGH
COLD
WATER
BROWN ROAD
WESTERN
RAILROAD
SITE
NORFOLK &
BANSHEE ROAD
LAMBERT - ST. LOUIS
INTERNATIONAL AIRPORT
AIRPORT
ROAD
TO
INDUSTRIAL
COMMERCIAL
RESIDENTIAL
RECREATIONAL
TRANSPORTATION
(AIRPORT)
INSTITUTIONAL
N
0 500 1000 1500
SCALE IN FEET
FORMERLY A.E.C.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-6
COMPOSITE ZONING MAP
(AS OF MAY 1978)
WESTON


RUNWAY 17 APPROACH
BERKLEY KHOURY LEAGUE PARK
COLD WATER CREEK
570
565
560
555
550
545
540
527
527
528
534
535
532
BROWN ROAD
RUNWAY 24 APPROACH
FENCE ALONG OR NEAR PROPERTY LINE
NORFOLK & WESTERN RAILROAD
BANSHEE ROAD
LAMBERT-ST. LOUIS INTERNATIONAL AIRPORT
PARKING
PARKING
*ELEVATIONS REFER TO 1977 DATUM
(SEE FIGURE 3-1)
N
SCALE IN FEET
100 0 100 200 300
RUNWAY APPROACH
MOST RESTRICTIVE
LEAST RESTRICTIVE
540 LIMITING ELEVATION
527 SPOT GROUND ELEVATION
PROPERTY LINE
FENCE LINE
PAVEMENT
FORMERLY A.E.C.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-7
AIRPORT APPROACH RESTRICTION ZONES
WESTON

3.7 NOISE

Airport Noise - Predicted noise level exposures for the site are presented in the planning study, "Lambert-St. Louis International Airport 1975-1995". (Ralph M. Parsons Company/Gruen Associates, 1975). Such noise levels are given as the Noise Exposure Forecast (NEF). This is a mathematically derived index of the exposure to noise which may be expected in the future. The NEF system includes subjective reactions to noise, such as a few flights per day may not be too bothersome, but many per day of the same noise level may be far more disturbing. Two time periods are used to weight the number of flights (Galloway, W.J. and Bishop, D.E., "Noise Exposure Forecasts: Evolution, Evaluation, Extensions and Land Use Interpretations," FAA-NO-70-9, August 1970).

The NEF 30 and NEF 40 contours were selected as criterion levels for this study based on the following generally accepted interpretation of these values for land use planning:

- Less than NEF 30 - Essentially no complaints expected; noise may interfere with community activities.
- NEF 30 to NEF 40 - Individuals may complain; group action possible.
- Greater than NEF 40 - Repeated vigorous complaints; group action expected.

The site falls in the "below 30" NEF rating, based on the predominant number of flight paths occurring along the two major northwest-southeast runways. This NEF rating basically places the study site into a "background" noise category for future conditions.

However, at present, there is still moderate use being made of the two alternate runways: north-south (No. 17) and northeast-southwest (No. 24). Since the northern terminus of each of the runways is about 1,000 feet from the site, use of these runways for military or propeller aircraft (a common use) or commercial jets (infrequent) raises the NEF rating to the maximum rating of 45. Current noise levels at the site are very high during periods of military jet activity. Such activity will continue into the foreseeable future, primarily due to the presence of McDonnell Douglas and the Air National Guard. Annoyance from military aircraft is far greater than for commercial planes due to the lack of noise suppression on their engines. Future noise levels from commercial aircraft should continue to decrease as more advanced, quieter aircraft are brought into service; the trend for military jets will not show a parallel decrease, however.

Other Noise Sources - The site is affected to a minor degree by noise generated by traffic on Brown Road and by trains on the Norfolk and Western Railroad.

Peak traffic loads adjacent to the site are 2,000 vehicles per hour, with an overall daily (24 hour) average of 17,000 vehicles. This volume of traffic occurs predominantly during the morning and evening rush hours as workers drive to and from the many industries in the area. Although the mix of trucks to cars is not known, local traffic patterns indicate that truck traffic along Brown Road is minimal, primarily for local delivery.

Train movements on the Norfolk and Western average ten operations per day; this includes four scheduled freight through-trains and six local switching operations. These low levels of activity, as well as the industrial-zone 40 MPH speed limit on the Norfolk and Western, dictate that noise levels from the railroad adjacent to the site are low.

3.8 RADIOLOGICAL CHARACTERISTICS

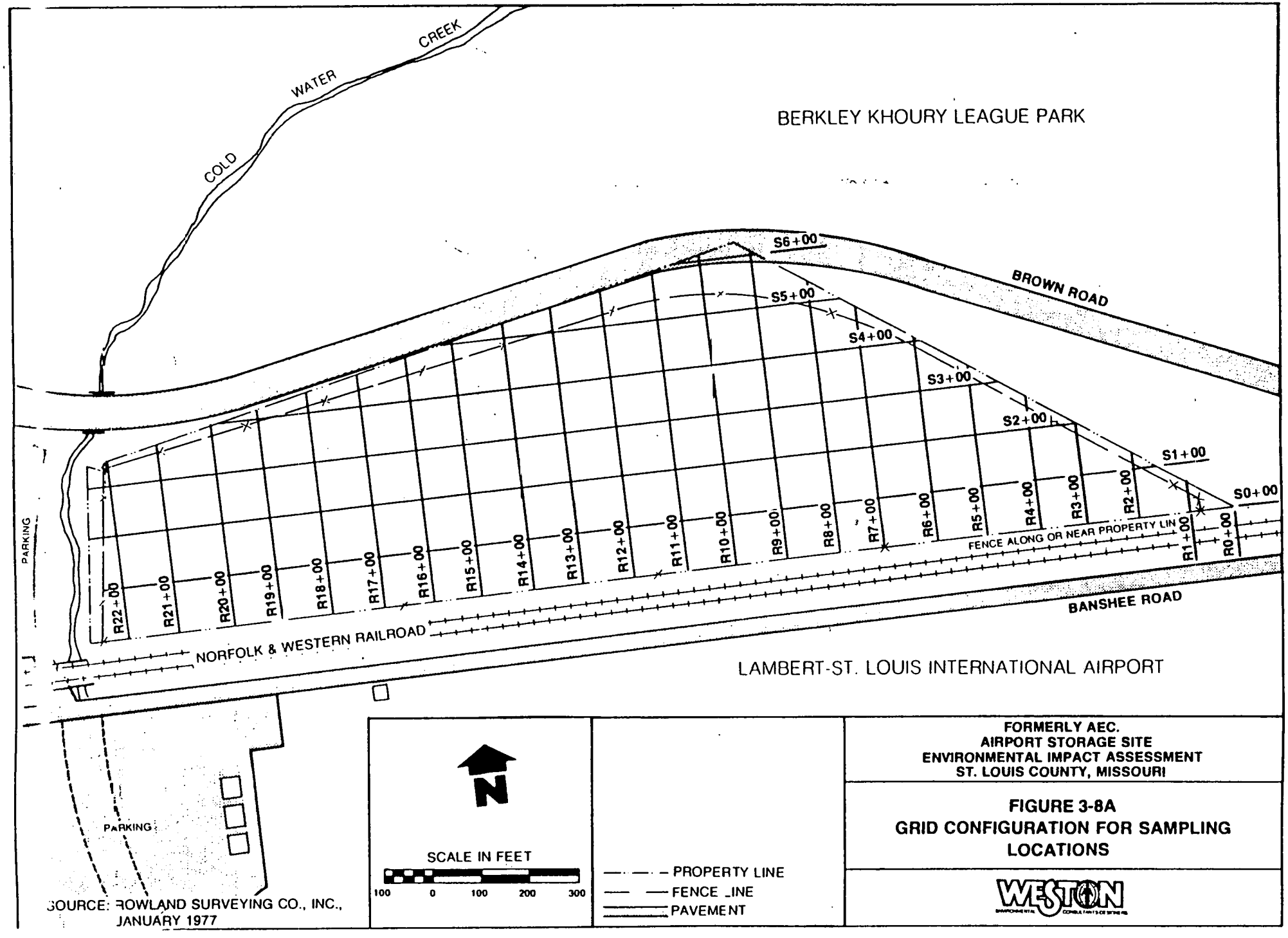
A radiological survey of the site was performed in September of 1978 (Haywood, et al, 1978). Results include evaluation of radon emanation, evaluation of particulate resuspension, well hole "loggings", external beta-gamma and gamma measurements, radon emanation measurements, surface soil analyses, water and water sediment analyses, and groundwater analyses. This survey was a follow-up to the survey performed by ORNL in November of 1976 presented in detail by Ryan, et al (1978). The 1976 survey included sampling of surface soil, subsurface soil, groundwater, and off-site surface water. External beta-gamma dose rate and external gamma radiation measurements were also made. An aerial gamma radiation survey was performed by EG&G (1977). Unless otherwise stated, all references to analytical results are to ORNL analyses.

Surface Soil - The survey in 1978 included 15 surface soil samples, all taken outside the fence near the ditches around Brown Road. All samples were analyzed on a dry weight basis. U-238 concentrations ranged from background levels to 600 pCi/g while Ra-226 ranged from 2 to 460 pCi/g. Only three of the samples showed U-238 concentrations at or above 172 pCi/g.* All but two of the samples showed Ra-226 levels in excess of 5 pCi/g. The results of gamma-ray spectrometry analyses of surface soil samples taken in 1976 are summarized in Figures 3-8 through 3-10. Concentrations of Ra-226 range from a background level of 0.5 pCi/g to a maximum of 1300 pCi/g. Of the 68 measurements for Ra-226 in soil presented in Figure 3-8, 19(28%) are above 5 pCi/g. Six of the 19 samples were taken from inside the fence line, three on the southwest end and three on the east end. The remaining 13 samples were taken outside the fence line along the northern boundary adjacent to Brown Road. From the results of these few samples it may be assumed that the entire property outside of the northern fence, along Brown Road, is above or near the value of 5 pCi/g for R-226.

U-238 concentrations in surface soil samples ranged from a background level of 0.6 pCi/g to 890 pCi/g. Of the 67 measurements for U-238 in soil presented in Figure 3-9, ten were at or above 172 pCi/g. Again, seven of the ten contaminated samples were outside of the fence line along the northern boundary adjacent to Brown Road. The three samples within the fence line indicated contamination of three areas in addition to the six noted from the R-226 analyses. Concentrations of Ac-227 ranged from less than the limit of detection to 1100 pCi/g (Figure 3-10).

Surface soil from the drainage ditch north of Brown Road taken in 1976 was also found to be contaminated (Table 3-10). In the 1976 survey five samples were taken in this ditch across from the western half of the site. These samples contained significant amounts of U-238 (3-72 pCi/g), Ra-226 (1-120 pCi/g), and Ac-227 (1-160 pCi/g). The north ditch is connected to the south ditch by two culverts.

*This corresponds to .05% Uranium, a licensable quantity.


COLD WATER CREEK
BERKLEY KHOURY LEAGUE PARK
BROWN ROAD
S6+00
S5+00
S4+00
S3+00
S2+00
S1+00
S0+00
R22+00
R21+00
R20+00
R19+00
R18+00
R17+00
R16+00
R15+00
R14+00
R13+00
R12+00
R11+00
R10+00
R9+00
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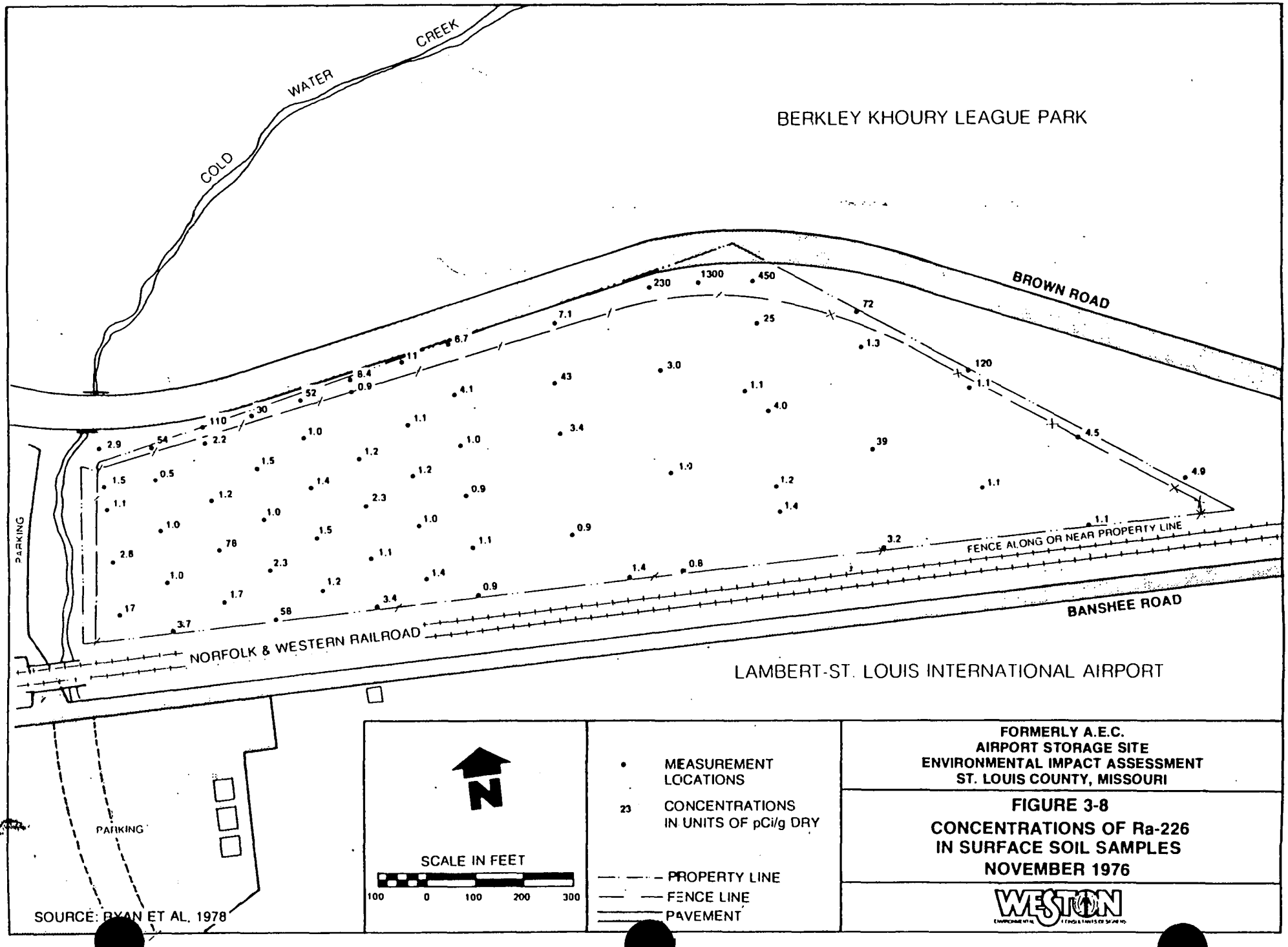
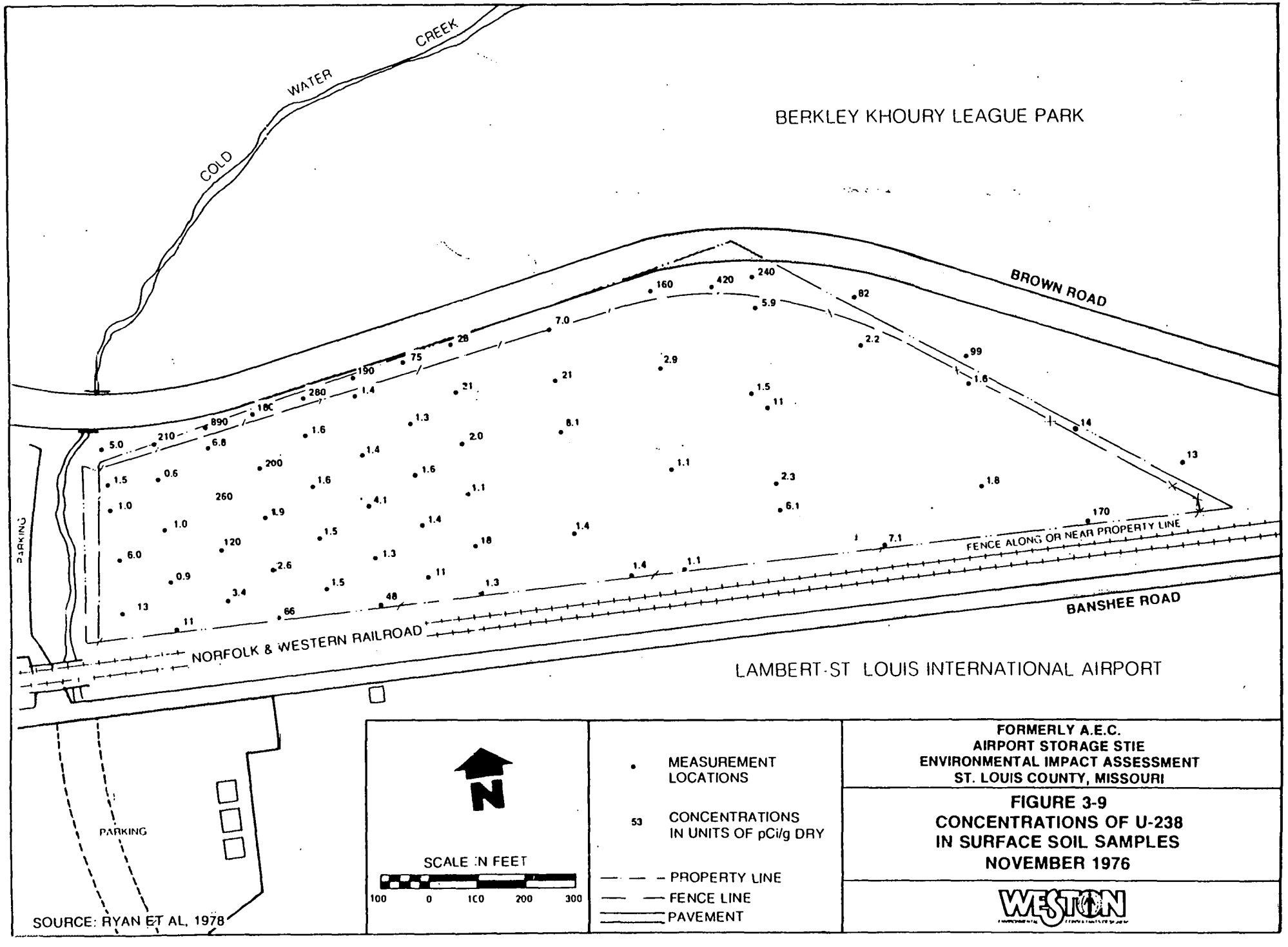
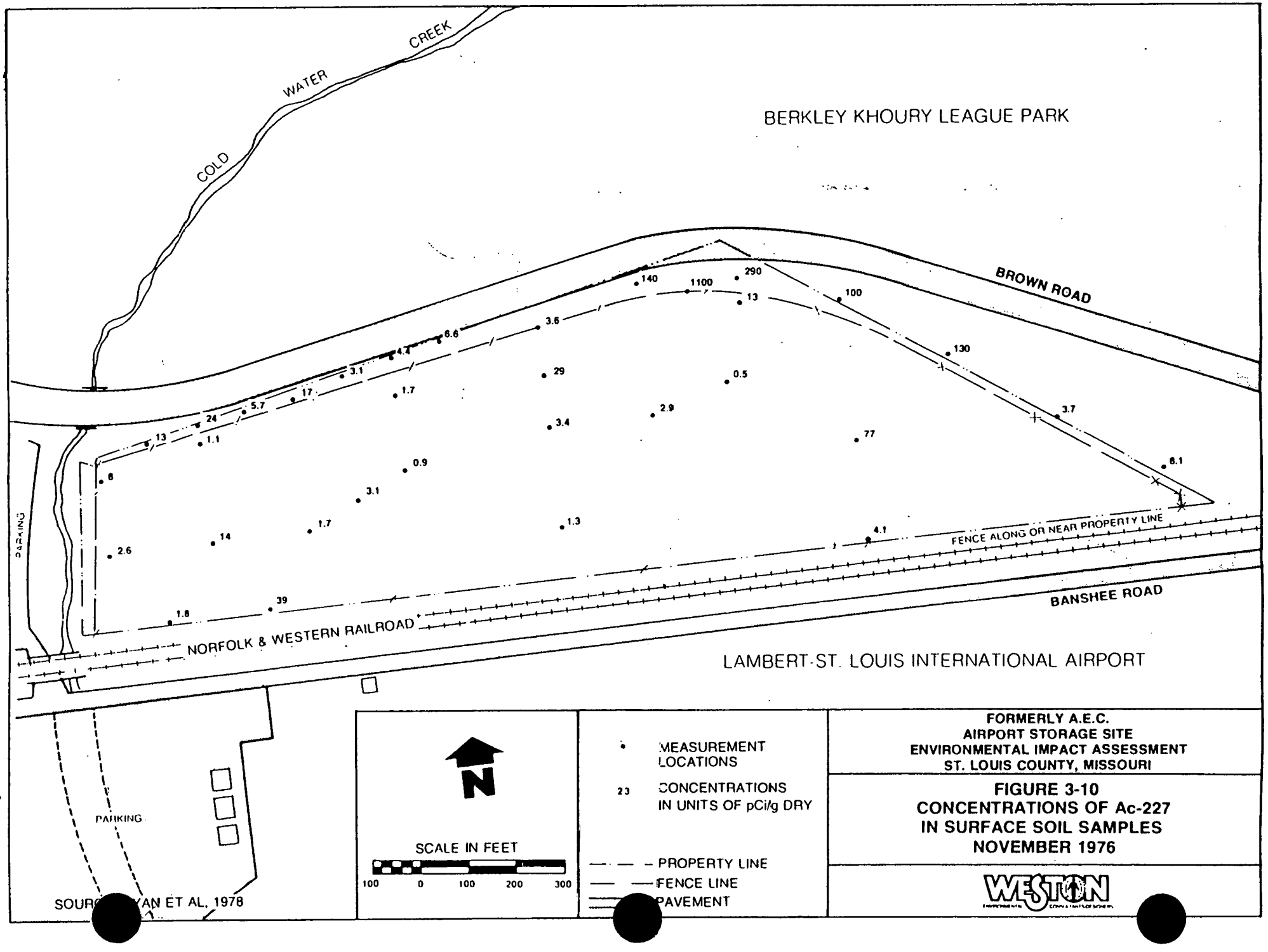
R4+00
R3+00
R2+00
R1+00
R0+00
FENCE ALONG OR NEAR PROPERTY LIN
BANSHEE ROAD
NORFOLK & WESTERN RAILROAD
LAMBERT-ST. LOUIS INTERNATIONAL AIRPORT
PARKING
PARKING
N
SCALE IN FEET
100 0 100 200 300
PROPERTY LINE
FENCE LINE
PAVEMENT
SOURCE: ROWLAND SURVEYING CO., INC., JANUARY 1977
FORMERLY AEC.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-8A
GRID CONFIGURATION FOR SAMPLING LOCATIONS
WESTON


COLD WATER CREEK
BERKLEY KHOURY LEAGUE PARK
BROWN ROAD
PARKING
FENCE ALONG OR NEAR PROPERTY LINE
BANSHEE ROAD
NORFOLK & WESTERN RAILROAD
LAMBERT-ST. LOUIS INTERNATIONAL AIRPORT
PARKING
SOURCE: RYAN ET AL. 1978
N
SCALE IN FEET
100 0 100 200 300
MEASUREMENT LOCATIONS
23 CONCENTRATIONS IN UNITS OF pCi/g DRY
PROPERTY LINE
FENCE LINE
PAVEMENT
FORMERLY A.E.C.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-8
CONCENTRATIONS OF Ra-226
IN SURFACE SOIL SAMPLES
NOVEMBER 1976
WESTON


COLD WATER CREEK
BERKLEY KHOURY LEAGUE PARK
BROWN ROAD
FENCE ALONG OR NEAR PROPERTY LINE
BANSHEE ROAD
NORFOLK & WESTERN RAILROAD
LAMBERT-ST LOUIS INTERNATIONAL AIRPORT
PARKING
PARKING
SOURCE: RYAN ET AL, 1978
N
SCALE IN FEET
100 0 100 200 300
MEASUREMENT LOCATIONS
53 CONCENTRATIONS IN UNITS OF pCi/g DRY
PROPERTY LINE
FENCE LINE
PAVEMENT
FORMERLY A.E.C.
AIRPORT STORAGE STIE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-9
CONCENTRATIONS OF U-238
IN SURFACE SOIL SAMPLES
NOVEMBER 1976
WESTON



SOUR[illegible]YAN ET AL, 1978

Table 3-10

Surface Soil Analysis for Drainage Pathway
North of Brown Road - 1976

Grid Coordinates	Concentration in pCi/g		
	U-238	Ra-226	Ac-227
S7 + 00/R 12 + 00	55	94	160
S6 + 50/R 14 + 00	3.0	1.4	-
S6 + 00/R 16 + 00	13	100	80
S5 + 25/R 18 + 00	72	120	81
S5 + 00/R 20 + 00	18	16	1.5

The most significant area of surface contamination found during both the 1978 and 1976 surveys was outside the site fence, in and around the drainage ditch south of Brown Road. The contamination extended from the west end of the site along the ditch almost to the east end of the site. Other areas of surface contamination were found throughout the site. The west end of the site showed a higher frequency of these contaminated areas.

Subsurface Soil - Subsurface contamination levels were determined through two methods. Samples from well holes were taken at various depths for analysis by gamma-ray spectrometry. Second, a scintillation probe was used to "log" holes (including the 7 from which samples were taken) at various depths. Ra-226 concentrations were estimated by comparing the "logging" results (scintillation probe readings) to the concentrations found through gamma-ray spectrometry.

As part of the 1978 survey 36 subsurface soil analyses were performed (Table 3-11). The samples were generally composited over a range of depths. The observed concentrations of U-238 and Ra-226 were similar to the ranges seen in surface soils. The results of gamma-ray spectrometry analyses of subsurface soil taken in 16 different holes in 1976 are summarized in Table 3-12. The two holes on the east end of the site (Nos. 15 & 16) show no significant contamination. The five holes on the west end showed varying degrees of contamination. Peak concentrations of all nuclides were at a depth of less than three feet in all holes. Many of these depths are no longer appropriate since up to 15 feet of fill has been added on the west end.

The results of well hole "logging" for estimating concentrations of Ra-226 are summarized in Table 3-13 for the 1978 measurements and Table 3-14 for the 1976 measurements. The "logging" results showed that peak concentrations were usually found at less than three feet. Ten of the holes drilled in 1978 showed peak concentrations at depths greater than three feet. The depth of maximum concentration ranged up to 15 feet in one west end hole. However, these depths represent present conditions and cannot be compared with the 1976 results due to the addition of fill between 1976 and 1978. In general, the contamination that was found was within the top six feet of soil.

Table 3-11

Concentrations of U-238 and Ra-226 (pCi/g)
In 1978 Subsurface Soil Samples

Grid Coordinates	Depth (ft)	U-238 (pCi/g)	Ra-226 (pCi/g)
S3+50 R14+00	0 - 5.0	18	14
S3+50 R10+00	0 - 20.0	2.5	2.7
S4+00 R8+00	0 -	--	21
S2+00 R8+00	1.5	64	140
S1+00 R6+00	0 - 20.0	22	7.7
S1+00 R2+00	0 - 20.0	35	<1
S2+00 R4+00	0 - 20.0	69	6
S3+00 R6+00	0 - 20.0	1.7	<1
S1+00 R10+00	0 - 20.0	--	2.8
S0+01 R12+00	2.0	--	62
S2+00 R12+00	1.5	38	130
S4+00 R12+00	2.5	--	64
S1+00 R14+00	0 - 20.0	10	20
S0+50 R16+00	0 - 20.0	18	4.4
S2+00 R16+00	0 - 20.0	1.3	<1
S4+00 R16+00	0 - 20.0	--	<1
S3+00 R18+00	0 - 20.0	96	19
S1+00 R18+00	0 - 20.0	7.1	6.3
S0+01 R20+00	0 - 20.0	8.3	4.7
S2+00 R20+00	0 - 20.0	51	440
S3+50 R20+00	0.5	--	35
S1+00 R22+00	0 - 20.0	18	15
S3+00 R21+50	0 - 20.0	3.6	1.3
S0+50 R4+00	0 - 20.0	4.3	<1
S5+00 R14+00	0 - 20.0	1.8	<1
S6+00 R10+00	0 - 20.0	--	<1
S5+00 R6+00	0 - 20.0	1.2	<1
S4+00 R4+00	0 - 20.0	1.4	<1
S3+00 R2+00	0 - 20.0	--	<1
S4+25 R13+25	0 - 20.0	--	2.9
Ball park	0 - 30	1.4	1.3
Ball park	0 - 20	1.0	<1.0
S4+20 R18+50	0 - 20	1.1	<1.0
S4+00 R5+50	0 - 4"	390	270
S4+00 R5+50	0 - 1.0	38	17
S4+00 R5+50	0 - 2	--	61

Table 3-12

Summary of Subsurface Soil Analyses
1976 Samples

Hole No.	Grid Coordinates	Ra-226		U-238		Ac-227	
		Max. Conc. (pCi/g)	Depth Found (ft)	Max. Conc. (pCi/g)	Depth Found (ft)	Max. Conc. (pCi/g)	Depth Found (ft)
7	S1+80/R20+20	190	1.5-2.0	880	1.5-2.0	180	1.5-2.0
9	S0+90/R20+40	150	0.5-1.0	220	0.5-1.0	39	0.5-1.0
10	S1+80/R20+75	68	1.0-1.5	300	1.5-2.0	20	1.0-1.5
11	S0+25/R22+00	4.8	1.0-1.5	3.6	1.0-1.5	4.4	1.0-1.5
12	S3+50/R21+50	1000	0.5-1.0	300	0.5-1.0	45	0.5-1.0
15	S5+60/R9+20	3.8	0.0-0.5	4.5	0.0-0.5	3.4	0.0-0.5
16	S4+00/R5+75	1.6	0.0-0.5	1.3	0.0-0.5	1.0	0.0-0.5

Table 3-13

Summary of Ra-226 Estimates in Subsurface Soil
1978 Samples

Grid Coordinates	Estimated Extent of Contaminated Soil (ft)	Depth of Maximum Contamination (ft)	Estimated Ra-226 Concentration at Point of Maximum Contamination (pCi/g)	Estimated Average Ra-226 Concentration in Contaminated Region (pCi/g)
S03+00/R14+00	0 - 2.0	1.0	90	40
S03+00/R10+00	1.5 - 3.0	2.0	30	20
S04+00/R08+00	0 - 3.0	1.5	150	60
S02+00/R08+00	0 - 9.0	1.5	170	30
S01+00/R06+00	2.5 - 6.0	4.5	100	40
S01+00/R02+00	2.0 - 2.5	2.0	15	10
S02+00/R04+00	2.5 - 4.0	3.5	30	20
S03+00/R06+00	1.7 - 2.2	2.0	15	15
S01+00/R10+00	1.5 - 4.0	3.0	90	30
S00+00/R12+00	0 - 3.5	2.0	80	35
S02+00/R12+00	0 - 12.0	1.5	180	60
S04+00/R12+00	0 - 3.5	2.5	110	30
S01+00/R14+00	2.0 - 3.5	2.5	60	30
S00+50/R16+00	0 - 0.5	0.5	7	7
	3.5 - 6.5	5.0	300	90
S02+00/R16+00	3.5 - 4.5	4.0	15	10
S04+00/R16+00	0.7 - 1.2	1.0	5	5
S03+00/R18+00	0 - 7.0	5.0	550	140
S01+00/R18+00	4.5 - 8.0	7.0	60	20
S00+50/R20+00	6.0 - 9.0	8.0	30	15
S02+00/R20+00	0 - 6.5	3.5	1200	250
	13.5 - 18.5	15.0	150	40
S03+50/R20+00	0 - 3.5	0.5	50	20
S01+00/R22+00	3.5 - 11.0	8.5	700	250
S03+00/R21+50	1.5 - 2.5	2.0	20	15
S00+00/R08+00	1.0 - 2.0	1.5	15	10
S00+00/R04+00	2.0 - 2.5	2.0	10	10
S05+00/R14+00	0 - 0.5	0.5	20	15
S06+00/R10+00	None			
S05+00/R06+00	None			
S04+00/R04+00	None			
S03+00/R01+50	None			
S06+50/R12+00	0 - 4.0	2.5	110	30
[illegible]+00/R20+00	None			
[illegible]00/R09+00	None			

Table 3-14

Summary of Ra-226 Estimates in Subsurface Soil
1976 Samples

Hole No.	Grid Coordinates	Max. Conc. (pCi/g)	Depth of Estimated Max. Conc. (ft)
1	S2+75/R16+10	11	2.5-3.0
2	S1+75/R16+50	1.6	-
3	S0+50/R15+50	210	2.5-3.0
4	S0+80/R15+50	1100	3.0-3.5
5	S2+60/R18+25	550	5.0-5.5
6	S2+75/R18+50	1400	2.0-2.5
7	S1+80/R20+20	33	1.5-2.0
8	S1+10/R20+60	78	1.0-1.5
9	S0+90/R20+40	24	1.0-1.5
10	S1+80/R20+75	30	1.0-1.5
11	S0+25/R22+00	1.9	-
12	S3+50/R21+50	46	0.0-0.5
13	S3+75/R19+40	11	0.0-0.5
14	S4+50/R9+25	64	1.5-2.0
15	S5+60/R9+20	3.3	-
16	S4+00/R5+75	1.4	-

Groundwater - Eight samples from the holes drilled in September of 1978 were analyzed. The results of radiochemical analyses performed by RMC on these groundwater samples are shown in Table 3-15. All of the holes were drilled off-site in and around the ditches near Brown Road. All holes except No. 30 showed significant U-238 contamination. The radionuclides Ra-226 and Th-230 were not found at significantly higher levels than typical background in any of the eight holes. One hole (No. 28) did show elevated levels of Pb-210. Groundwater samples were taken in 1976 in six well holes at depths of 17 to 35 feet. The results of the radiochemical analyses are presented in Table 3-15. Pb-210 results were elevated in most samples. These results may be biased high due to positive interferences in the method of analysis. U-238 was found at high levels in three of the five west end holes and at a peak concentration of 1200 pCi/l in the one east end hole. Th-230 and Ra-226 were not significantly above background in any hole except the one east end hole which showed elevated levels of Ra-226.

The two surveys are not directly comparable because of significant changes in topography. Only generalized comparisons can be made. Also the 1978 surveys were designed to acquire additional information in some areas not adequately covered by the 1976 surveys. A program for monitor well installation has been designed and approved by ORNL. The locations of the wells were selected to allow for long-term, continuous monitoring of total groundwater discharge at the site and groundwater discharge through the area of presently highest radiological activity.

Coldwater Creek Water and Sediment - Four pairs of water and water sediment samples were taken in 1978 (two downstream, upstream and drainage ditch water). These samples were analyzed for U-238 and Pb-210. All results were indistinguishable from background levels. Surface water and sediment samples were taken from Coldwater Creek at four locations as part of the 1976 survey (upstream, downstream and at both site outfalls). No Ra-226 was detected in any of the samples while U-238 was at essentially background levels. Sediment samples did indicate some buildup of both nuclides at the outfalls only, with the highest levels being detected at the south outfall. The most recent survey of water and sediment was conducted by ORNL during April 1979 and is presented in Appendix J.

External Gamma and Beta-Gamma Measurements - External gamma and beta-gamma exposure measurements were made by ORNL throughout the site and along both sides of Brown Road. Gamma measurements were made with a NaI scintillation probe at a height of 1 meter and at the surface. Beta-gamma measurements were made with a Geiger-Mueller survey meter at a height of 1 cm.

Part of the 1978 follow-up survey included external radiation measurements in the ditches north and south of the site. These measurements included gamma at 1m and at the surface and beta-gamma at 1 cm. The results of these surveys confirmed the existence of contamination in these ditches. The peak gamma radiation level observed was 330 μR/hr at 1m and 580 μR/hr at the surface. The peak beta-gamma dose rate was 1.6 mrad/hr.

Table 3-15

Concentrations of Radionuclides in Groundwater Samples
(Results in Units of pCi/l)

Location	Depth at Which Water Encountered (ft)	U-238	Th-230	Ra-226	Pb-210
Hole No. 7 (1976)* S1+75/R20+15	25	20	1.1	0.5	**
Hole No. 10 (1976) S1+75/R20+75	20	170	1.9		**
Hole No. 11 (1976) S0+60/R22+00	35	4	0.08	0.05	**
Hole No. 12 (1976) S3+45/R21+50	35	4	< 0.05	1.0	**
Hole No. 13 (1976) S3+70/R19+75	25	210	1.6		**
Hole No. 14 (1976) S4+50/R9+75	17	1200	0.15	9.0	**
Hole No. 26 S5+00/R14+00	17	90	< 0.3	1.0	< 4
Hole No. 27 S6+00/R10+00	19	114	< 0.3	1.6	< 5
Hole No. 28 S5+00/R6+00	20	230	< 0.3	<0.2	36
Hole No. 29 S4+00/R4+00	13	87	< 0.3	<0.2	< 4
Hole No. 30 S3+00/R2+00	20	8.4	< 0.4	0.4	< 4
Hole No. 32 Ball Park	19	215	< 0.2	1.4	6.6
Hole No. 33 Ball Park	18	51	0.13	1.6	11
Hole No. 34 S4+20/R18+50	15	230	< 0.3	<0.1	< 5

*Samples 7 through 14 analyzed by ORNL in 1976. Samples 26 through 34 analyzed by RMC in 1978.
**Results biased high due to analytical method used.

Late in the summer of 1977 an aerial survey of gamma radiation levels was made by EG&G Inc. The results of this survey indicated that the center of contamination was in the range of 45 to 62 μR/hr (Figure 3-11). This center was found along the north boundary about the middle of the site. The results, although lower than those obtained by ground survey, confirmed the existence of contaminated material in the ditch. The contamination observed in the west end during the 1976 ground survey was not detected by the aerial survey. This is probably due to the fill added to that end of the site.

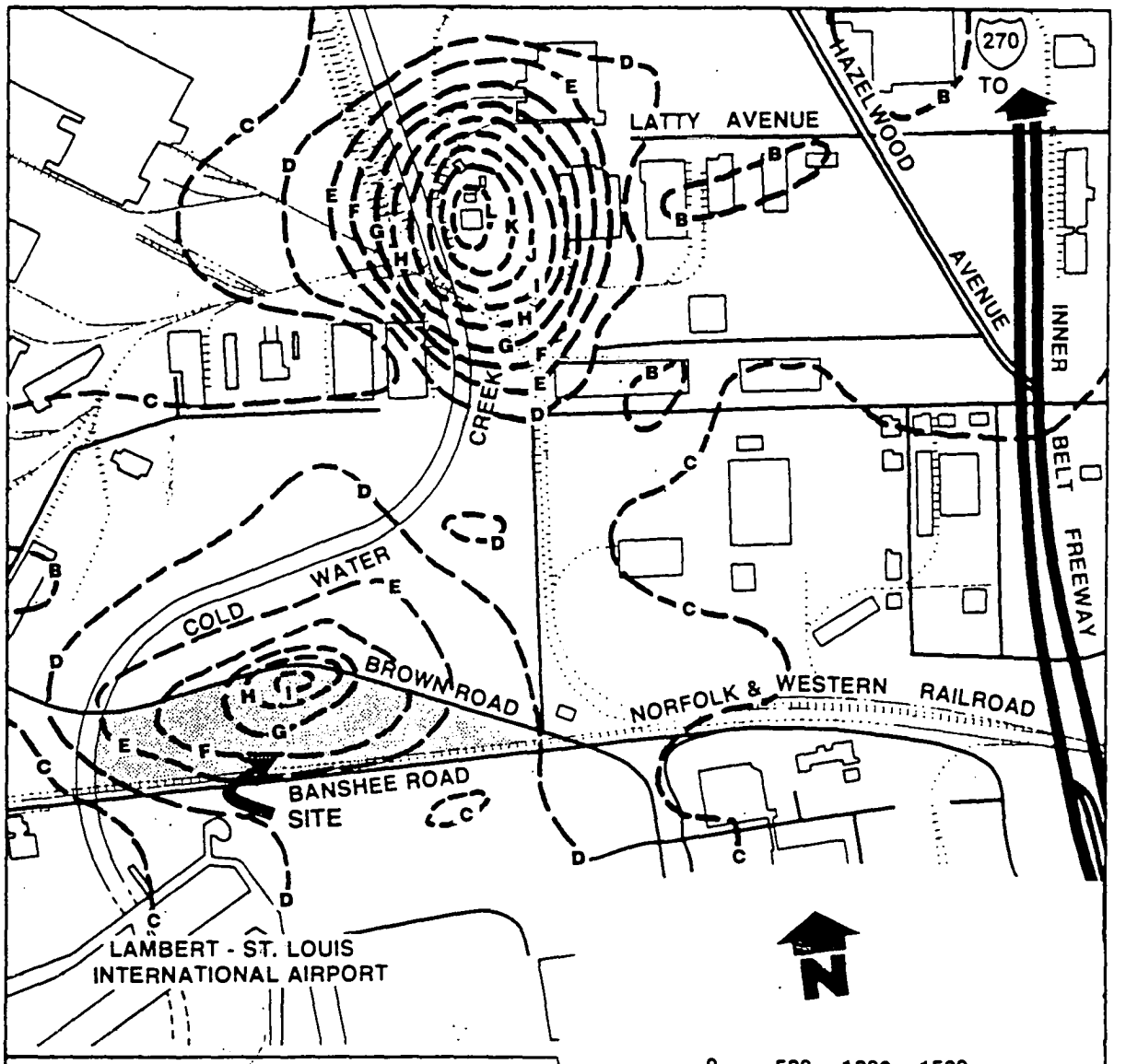
A systematic survey was performed in 1976 by taking measurements at the intersection of the grid points as shown in Figure 3-12. The site was divided into two sections with the west end broken down into 50 foot grids and the east end into 100 foot grids. The results of the gamma and beta-gamma measurements are shown in Figures 3-12 and 3-13 respectively. Both types of measurements revealed contamination in the same general areas. The highest degree of contamination was found along the drainage ditch south of Brown Road. Other large areas of contamination were found on the west end of the site and in the north central portions of the site. Although not shown in these figures, further surveys of the ditches north and south of Brown Road showed contamination in both.

The 1976 survey included measurements in a fine grid area (50 x 50 feet) in the west end of the site where contaminated material was known to have been buried. Each grid was scanned to locate the highest area of contamination. Gamma and beta-gamma measurements were then made at this point. The results are presented in Figures 3-14 and 3-15. Considering the 1978 and 1976 surveys the external gamma radiation levels ranged from background levels to a maximum of 330 μR/hr. Beta-gamma radiation levels ranged from 0.02 to 4.6 mrad/hr.

Radon Measurements - As part of the 1978 follow-up survey outdoor Rn-222 measurements were made near the site as well as Rn-222 emanation rate measurements on-site (Haywood, et al 1978). The results of these measurements are given in Tables 3-16 and 3-17. The measured outdoor concentrations averaged 0.33 pCi/l, which is not significantly different from background. Radon emanation rates ranged from 0.08 to 14 pCi/square meter-sec. These measurements were used to generate area source terms for radon emanating from the site. Using these data, the concentrations of radon in the air were calculated as a function of distance and direction according to techniques given in Haywood, et al (1977).

3.9 BACKGROUND RADIATION LEVELS

The radionuclides of interest at this site are naturally occuring and vary widely with location. Surface soil samples were taken at ten locations throughout Missouri in order to establish background levels of these radionuclides. The radionuclides U-238, Th-232, and Ra-226 were found at about 1 pCi/g in these samples. These results are consistent with those reported by the National Council on Radiological Protection and Measurements for soils (NCRP, 1975). Oakley reported average



EXPOSURE ISOPLETHS

μR/hr AT 1 METER (INCLUDING 3.7 μR/hr COSMIC)

A —	0 TO 6	G —	24 TO 33
B —	6 TO 8	H —	33 TO 45
C —	8 TO 10	I —	45 TO 62
D —	10 TO 13	J —	62 TO 84
E —	13 TO 17	K —	84 TO 116
F —	17 TO 24	L —	116 TO 160

SOURCE: EG&G, 1977

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FIGURE 3-11
AERIAL GAMMA RADIATION SURVEY
1977

WESTON

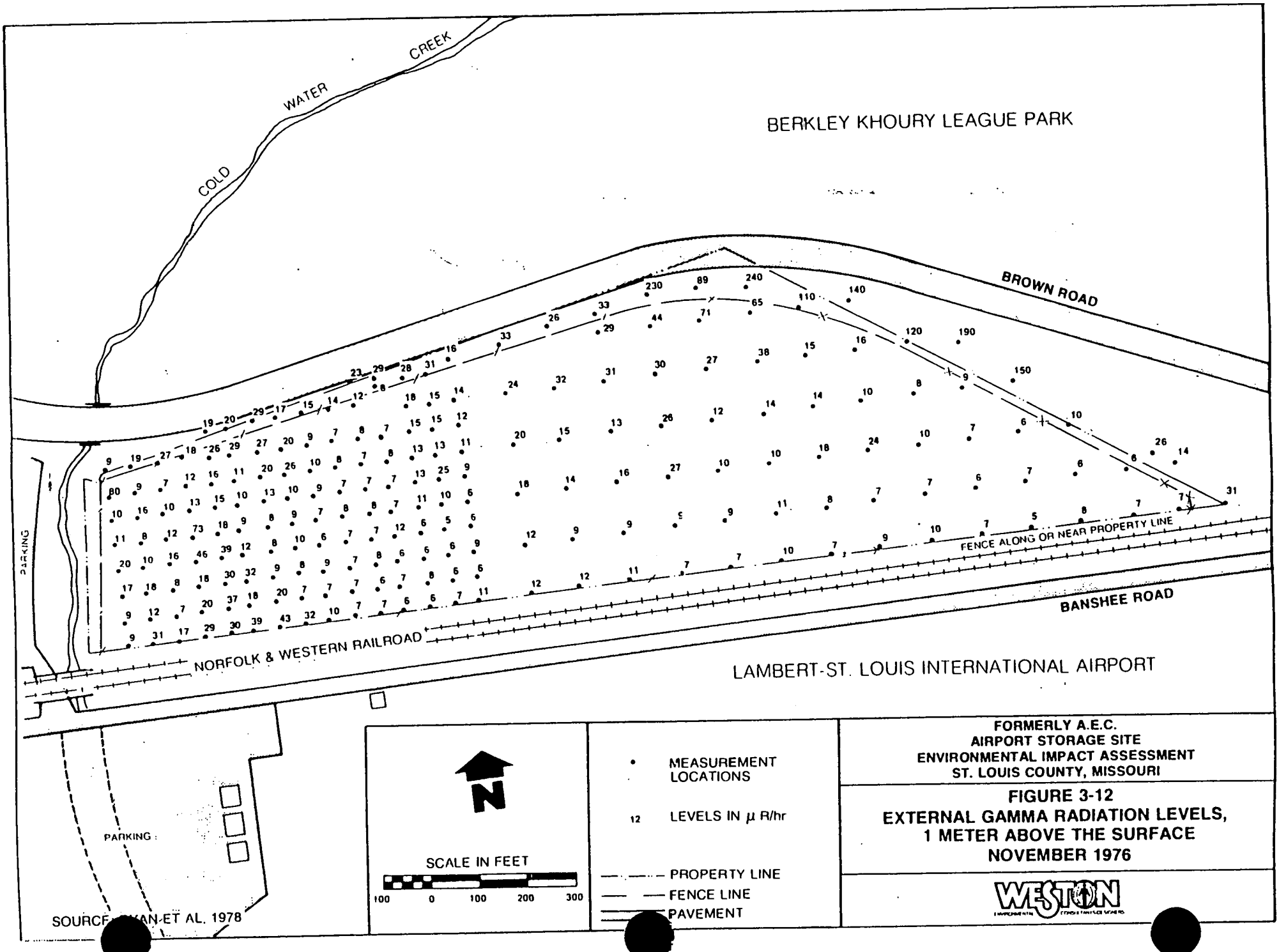
COLD WATER CREEK
BERKLEY KHOURY LEAGUE PARK
BROWN ROAD
FENCE ALONG OR NEAR PROPERTY LINE
BANSHEE ROAD
NORFOLK & WESTERN RAILROAD
LAMBERT-ST. LOUIS INTERNATIONAL AIRPORT
PARKING
PARKING
SOURCE: MAN-ET AL. 1978
N
SCALE IN FEET
100 0 100 200 300
MEASUREMENT LOCATIONS
12 LEVELS IN μ R/hr
PROPERTY LINE
FENCE LINE
PAVEMENT
FORMERLY A.E.C.
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FIGURE 3-12
EXTERNAL GAMMA RADIATION LEVELS,
1 METER ABOVE THE SURFACE
NOVEMBER 1976
WESTON

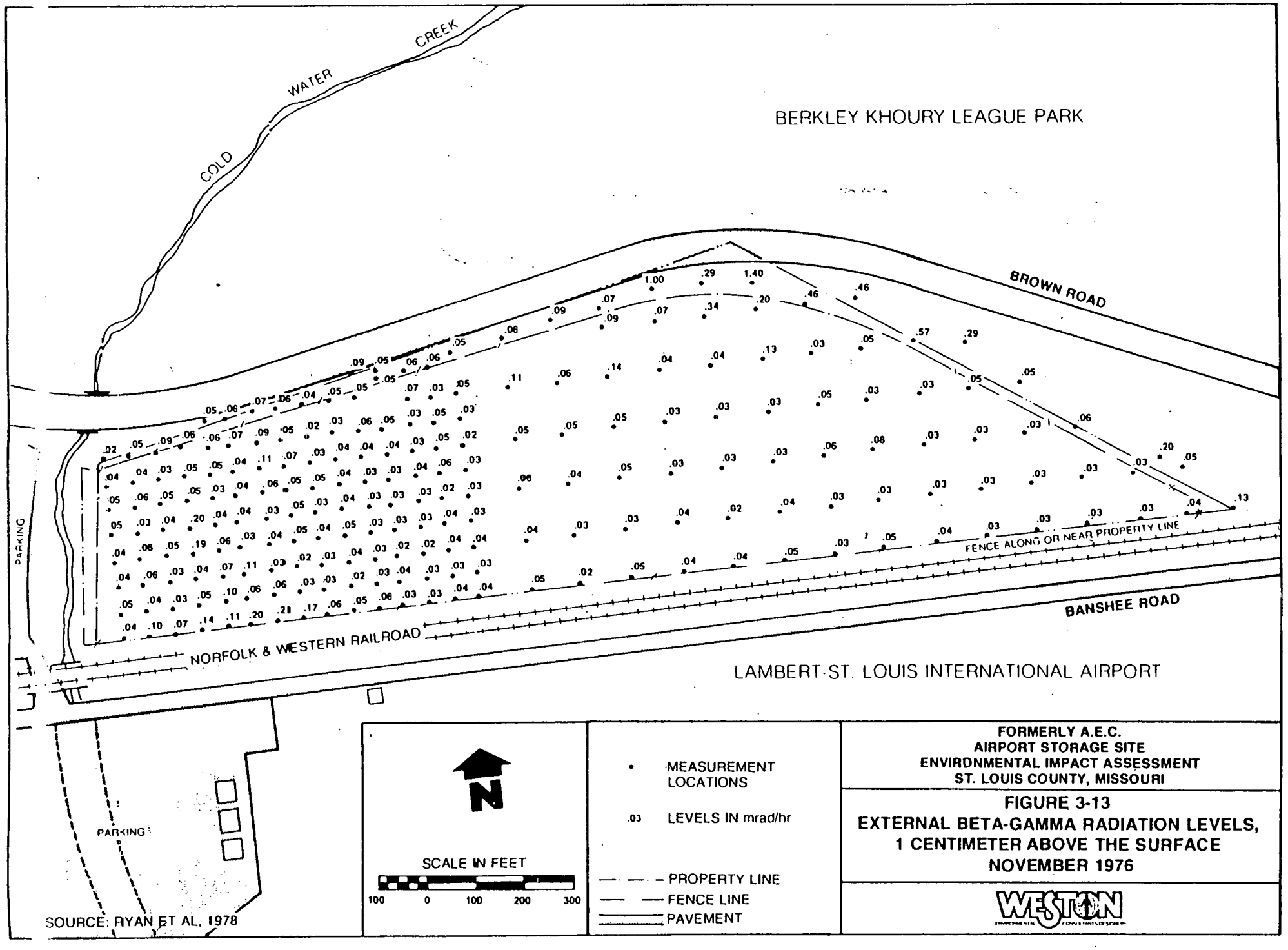

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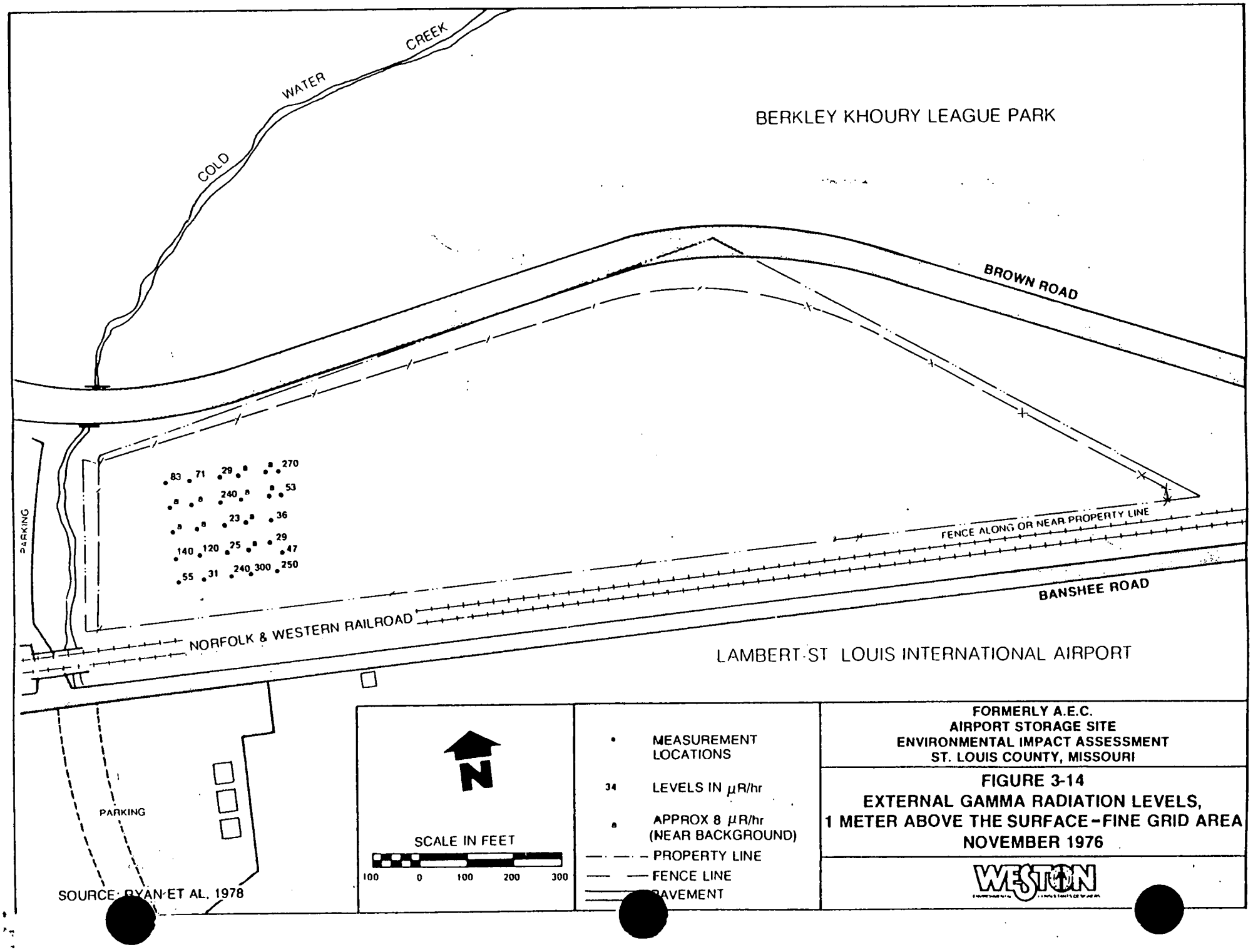
FIGURE 3-13
EXTERNAL BETA-GAMMA RADIATION LEVELS, 1 CENTIMETER ABOVE THE SURFACE NOVEMBER 1976

WESTON


COLD WATER CREEK
BERKLEY KHOURY LEAGUE PARK
BROWN ROAD
FENCE ALONG OR NEAR PROPERTY LINE
BANSHEE ROAD
NORFOLK & WESTERN RAILROAD
LAMBERT-ST LOUIS INTERNATIONAL AIRPORT
PARKING
PARKING
83 71 29 270
8 8 240 8 53
8 8 23 36
140 120 25 29 47
55 31 240 300 250
SOURCE: RYAN ET AL. 1978
N
SCALE IN FEET
100 0 100 200 300
MEASUREMENT LOCATIONS
34 LEVELS IN μR/hr
8 APPROX 8 μR/hr (NEAR BACKGROUND)
PROPERTY LINE
FENCE LINE
PAVEMENT
FORMERLY A.E.C.
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ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI
FIGURE 3-14
EXTERNAL GAMMA RADIATION LEVELS,
1 METER ABOVE THE SURFACE-FINE GRID AREA
NOVEMBER 1976
WESTON

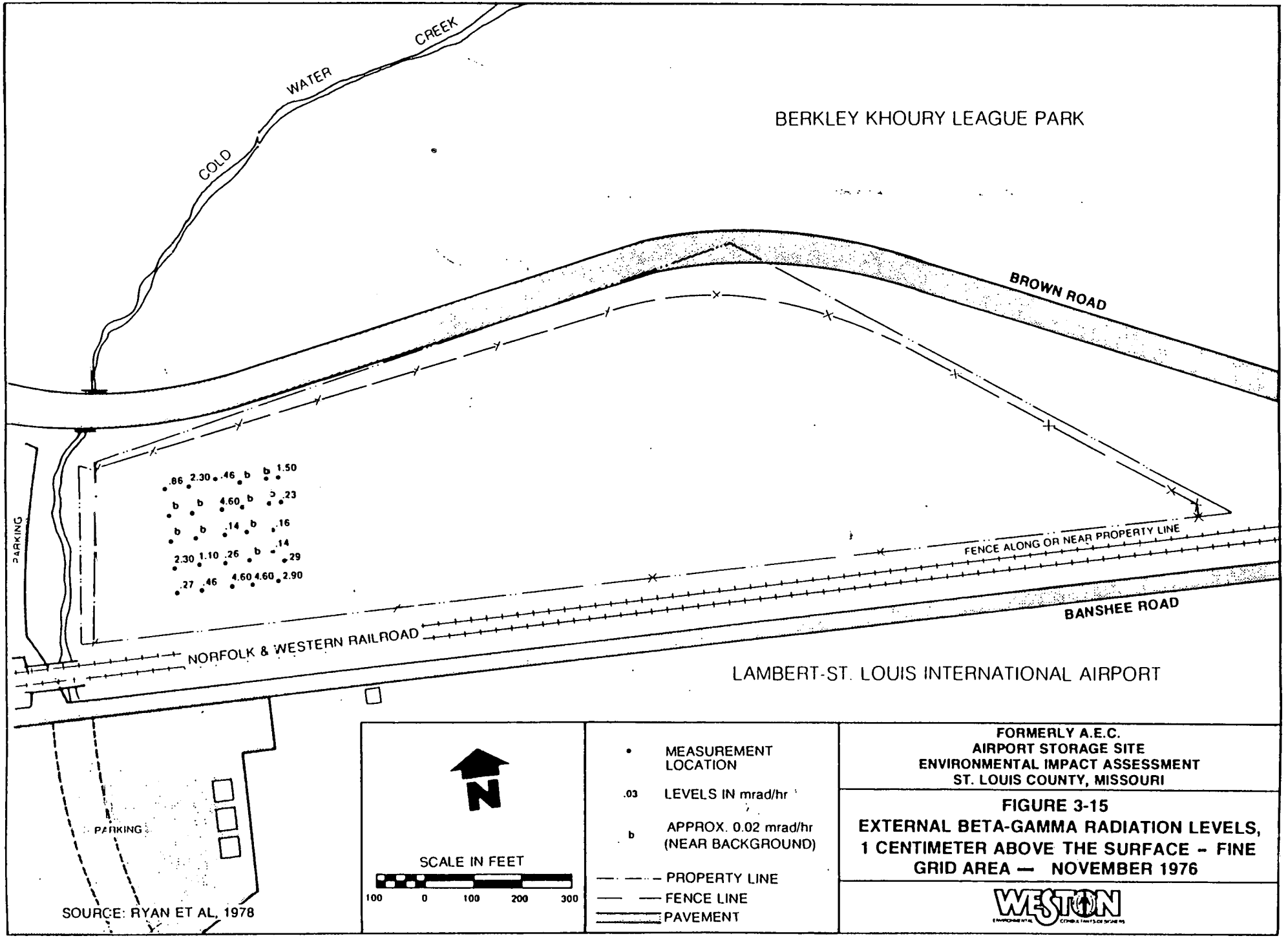
COLD WATER CREEK
BERKLEY KHOURY LEAGUE PARK
BROWN ROAD
.86 2.30 .46 b b 1.50
b b 4.60 b .23
b b .14 b .16
2.30 1.10 .26 b .14 .29
.27 .46 4.60 4.60 2.90
PARKING
FENCE ALONG OR NEAR PROPERTY LINE
BANSHEE ROAD
NORFOLK & WESTERN RAILROAD
LAMBERT-ST. LOUIS INTERNATIONAL AIRPORT
PARKING
SOURCE: RYAN ET AL, 1978
N
SCALE IN FEET
100 0 100 200 300
MEASUREMENT LOCATION
.03 LEVELS IN mrad/hr
b APPROX. 0.02 mrad/hr (NEAR BACKGROUND)
PROPERTY LINE
FENCE LINE
PAVEMENT
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FIGURE 3-15
EXTERNAL BETA-GAMMA RADIATION LEVELS, 1 CENTIMETER ABOVE THE SURFACE - FINE GRID AREA — NOVEMBER 1976
WESTON

Table 3-16

Outdoor Radon Measurements Near the Subsurface Storage Site - 1978

Direction from the Site	Location	Counting Interval (hrs)	No. of Readings	Average Rn-222 Concentration (pCi/liter)	Maximum Rn-222 Concentration (pCi/liter)	Time at Which Maximum Rn-22 Concentration was Measured
North	Across Brown Road in ball-park	6.8	14	0.36	0.99	6:26 pm
East	50 feet east of fence on service road	9.0	18	0.36	0.78	12:39 pm
South	20 feet south of railroad tracks near large bill-board	12.0	24	0.34	0.96	10:31 pm
West	Across Cold-water Creek and fence in McDonnel-Douglas parking lot	10.0	21	0.26	0.61	11:04 am

Table 3-17

Radon Emanation Rates as Measured Using
Charcoal Canisters - 1978

Canister No.	Location	Radon Emanation Rate (pCi/square-meter-sec)
3	S01+00/R20+00	0.28
6	S04+25/R13+25	11
7	S03+50/R10+00	2.6
9	N of Brown Road	0.78
15	S03+00/R18+00	7.7
17	S01+00/R02+00	1.0
18	S01+00/R10+00	7.2
18A	S01+00/R14+00	14
36	S01+00/R06+00	6.6
41	N of Brown Road	0.08

concentrations of uranium and thorium of 0.6 pCi/g and 1.0 pCi/g, respectively for the U.S. in surficial soils (Oakley, 1972). Measurements of gamma-ray exposure rate were made at the ten soil sampling locations. The average of these measurements was 6 μR/hr and the standard deviation (σ) was 1.7 R/hr.

External gamma and beta-gamma radiation measurements were made at four points within five miles of the site. Gamma radiation averaged 8 μR/hr (1m above ground) while beta-gamma radiation (at 1 cm) averaged about 0.02 mrad/hr. Oakley reported a total cosmic and terrestrial dose equivalent for the St. Louis area of 10 μrem/hr (Oakley, 1972). A somewhat higher rate was reported by the EPA for Missouri of 12 μrem/hr (U.S. EPA, 1977). Although they are different units of exposure, the Roentgen (R), rad, and rem are similar for the external radiation considered here. Background Rn-222 measurements were reported for Southwestern U.S. by the EPA (1977). Levels ranged from 0.3 to 0.8 pCi/l in air. No data were available for the St. Louis area.

SECTION 4

POTENTIAL IMPACTS OF THE PROPOSED ACTIONS

4.1 USE OF THE QUIT-CLAIM DEED TO CONTROL PRESENT RADIATION EXPOSURE FROM THE SITE

4.1.1 Radiological Impacts

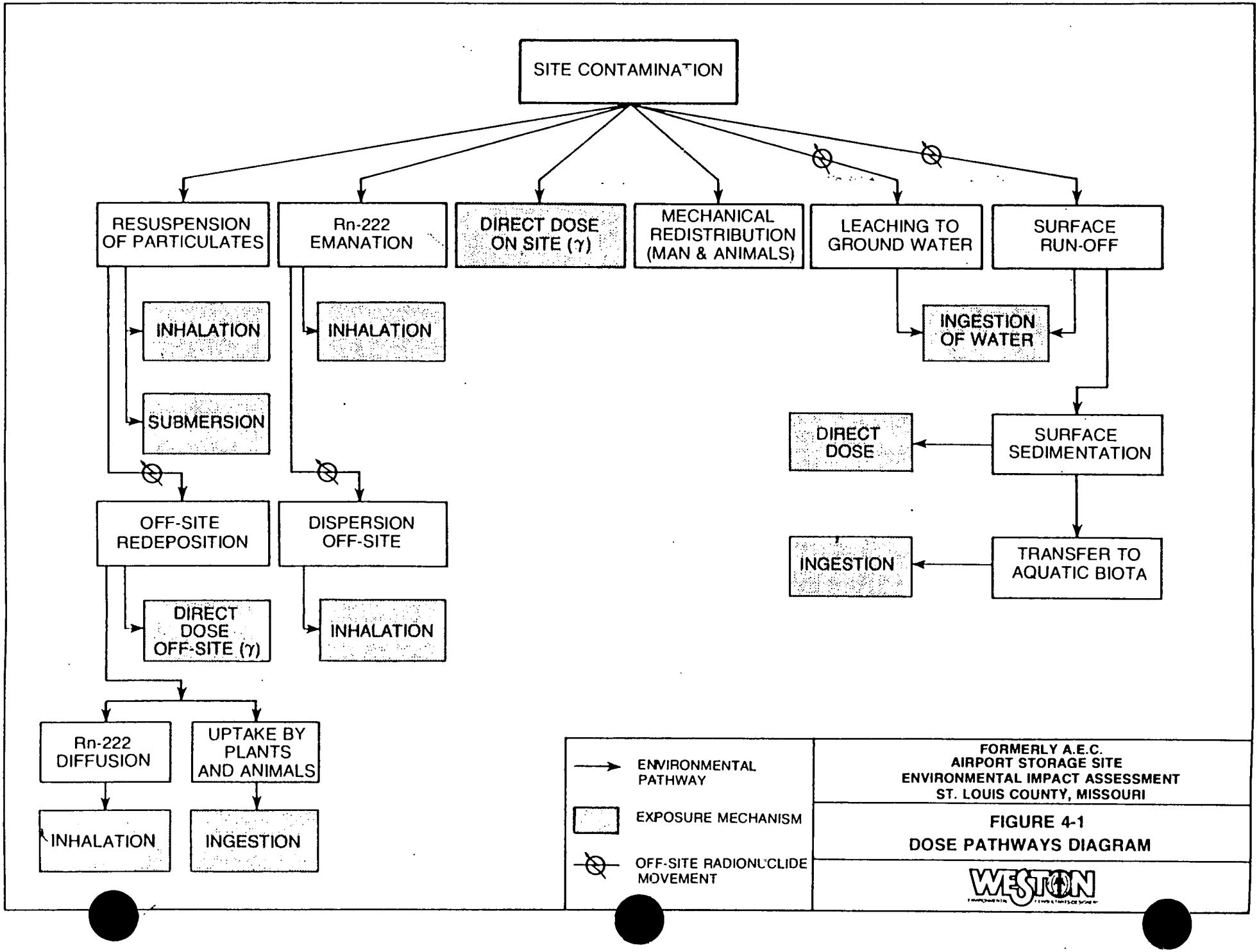
Individuals on and off the airport storage site could receive radiation exposures through a number of environmental pathways as depicted in Figure 4-1. A total of 11 exposure mechanisms through five environmental pathways were considered. The relative importance of each is determined by the degree of contamination; the relative dose effect of the nuclide-pathway combination, the potential or existing usage of the environmental pathway, and regulatory guidelines and standards for the pathway. The radionuclides of concern at this site are U-238, Ra-226, Rn-222, Th-230, Pb-210, Ac-227 and Pa-231, as well as the daughters of these radionuclides.

Pertinent guidelines and standards as they relate to the pathways shown in Figure 4-1 are summarized in Table 4-1. Although some of these guidelines and standards may have no legal bearing on this situation all provide a basis with which radiological parameters of the present site can be evaluated.

Surface Run-Off - Surface run-off can result in exposure to individuals through three major pathways: ingestion of contaminated water, direct doses from surface sediment, and the ingestion of aquatic biota exposed to contaminated surface water. The surface water samples taken indicated no observable contamination. Also the nearest point of surface water use for drinking is greater than 17 river miles away on the Missouri River so that any contamination would be diluted by additional flow of the river. Furthermore, the results of similar analyses on samples from Coldwater Creek downstream near the Latty Avenue site showed no observable contamination. Therefore, ingestion of surface water is unlikely to result in significant exposures.

No edible aquatic biota exists in the immediate area of the site. The dilution of any contamination by the Missouri River would probably negate any buildup of this contamination in aquatic biota. Further, most of the uranium, radium, or thorium reaching the aquatic biota will be concentrated in the skeletal portions of the biota which are inedible. This pathway will probably result in no significant exposure.

The long term buildup of contamination in soil and sediments resulting from run-off is evident from the results of sediment analyses from Coldwater Creek and the drainage ditches north of the site. The on-site ditch along the south border of the site may have been contaminated by direct deposition or by run-off. Seven surface soil samples in the


SITE CONTAMINATION
RESUSPENSION OF PARTICULATES
Rn-222 EMANATION
DIRECT DOSE ON SITE (γ)
MECHANICAL REDISTRIBUTION (MAN & ANIMALS)
LEACHING TO GROUND WATER
SURFACE RUN-OFF
INHALATION
SUBMERSION
INHALATION
INGESTION OF WATER
DIRECT DOSE
SURFACE SEDIMENTATION
OFF-SITE REDEPOSITION
DISPERSION OFF-SITE
INGESTION
TRANSFER TO AQUATIC BIOTA
DIRECT DOSE OFF-SITE (γ)
INHALATION
Rn-222 DIFFUSION
UPTAKE BY PLANTS AND ANIMALS
INHALATION
INGESTION
ENVIRONMENTAL PATHWAY
EXPOSURE MECHANISM
OFF-SITE RADIONUCLIDE MOVEMENT
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ST. LOUIS COUNTY, MISSOURI
FIGURE 4-1
DOSE PATHWAYS DIAGRAM
WESTON

Table 4-1
Comparison of Observations at the Airport Site with Pertinent Regulatory Guidelines and Standards

Media/Pathway	Nuclide	Standard/Guideline	Source	Limit	Max Value Under The Proposed Action	Basis
Soil	U & Th	10 CFR 40 Licensable Quantities	USNRC, 1961	0.05%	0.27%	U-238 in soil from ditch South of Brown Road.
	Ra-226	Definition of Radioactive	Dickson, 1978	5 pCi/g	1300 pCi/g	Ra-226 in soil from ditch South of Brown Road.
	Ra-226	"Deminimus" Level	Schiager, 1977	4-40 pCi/g	1300 pCi/g	Ra-226 in soil from ditch South of Brown Road.
Ground Water*	U-238	10 CFR 20 Maximum Permissible Concentrations	USNRC, 1960	40,000 pCi/l	1200 pCi/l	Water from Well Hole #14.
	Ra-226	In Effluents To Unrestricted Areas		30 pCi/l	9 pCi/l	Water from Well Hole #14.
	Th-230			2000 pCi/l	0.15 pCi/l	Water from Well Hole #14.
	Pb-210			100 pCi/l	45 pCi/l	Water from Well Hole #14.
	Ra-226	Primary Drinking Water Standards	USEPA, 1976	5 pCi/l	9 pCi/l	Water from Well Hole #14.
External Radiation	-	Dose Limits To Public Individuals	NCRP, 1971	500 mrem/yr**	660 mR/yr	2000 hr/yr at maximum Observed External Gamma Rate of 330 μR/hr.
		Decontamination Guidelines for Facilities and Equipment	USNRC, 1976	0.2 mrad/hr	4.6 mrad/hr	Peak Observed Beta-Gamma Radiation Level On Site.
		EPA Guidelines for Decontamination of Uranium Mill Sites	USEPA, 1978	10 μR/hr	330 μR/hr	Peak Observed Gamma Radiation Levels.
		Clean-up Criteria For Uranium Mill Sites	USNRC, 1978	140 mrem/yr	660 mR/yr	2000 hr/yr at Maximum Observed External Gamma Rate of 330 μR/hr.
Radon in Air	Rn-222 & Daughters	10 CFR 712 Remedial Action Guide for Radon Daughter Concentration	USDOE, 1976	0.03 WL+	0.00001 WL	Max Concentration Predicted On Site - Outdoors
					0.29 WL	Max Concentration Predicted For Worst Case - Indoors
		10 CFR 20 Maximum Permissible Concentration In Air In Restricted Areas	USNRC, 1960	3 pCi/l	0.13 pCi/l	Max Concentration Predicted On Site - Outdoors
					41 pCi/l	Max. Concentration for Worst Case Building - Indoors
Particulates In Air (resuspension)	U-238	10 CFR 20 Maximum Permissible Concentration In Air Unrestricted Areas	USNRC, 1960	3 pCi/m^3	0.02 pCi/m^3	Max Concentration Predicted On Site - Outdoors
	Ra-226			3 pCi/m^3	0.07 pCi/m^3	
	Pb-210			4 pCi/m^3	0.07 pCi/m^3	For Mechanical Resuspension of The Surface++
	Ac-227			0.08 pCi/m^3	0.02 pCi/m^3	
	Th-230			0.08 pCi/m^3	0.07 pCi/m^3	

*MPC would apply to surface water - no contamination was found in surface water.
**This limit also imposed by the State of Missouri (1964).
+This limit is for structures other than dwellings and schoolrooms.
++Assumes a 5 percent disturbance of the site surface.

ditch south of Brown Road contained quantities of U-238 greater than 0.05 percent by weight. Source material is defined by 10 CFR 40 as any material, other than fissionable material, which contains 0.05 percent by weight (500 ppm) uranium and/or thorium (1961). Coldwater Creek sediment was contaminated but at much lower levels. The contamination in the ditch is outside the fence and can therefore be considered off-site. It was most likely deposited by surface run-off. The external exposures resulting from this run-off were calculated for the most probable and worst case basis. Since the contamination is off-site, the Quit-Claim Deed, as presently enforced, has not controlled exposures through this pathway. The most probable case assumes the exposure to an individual performing road maintenance along the ditch. The exposure period was assumed to be one work week per year (40 hours) at the most highly contaminated portion of the ditch (330 μR/hr at 1m). The resulting individual dose would be 13 mR/yr, well within applicable guidelines. The worst case basis assumes the same exposure rate but for an exposure period of 2000 hours per year (standard work year). Due to the nature of the ditch, it is highly unlikely that an individual will occupy this area for this amount of time. The annual exposure on this worst case basis would be 660 mR/yr, above the applicable standards shown in Table 4-1.

The only significant group of individuals which could be exposed through this pathway is users of Brown Road. Due to the distance from the road to the ditch, the air attenuation of the radiation, the shielding provided by the vehicles, and the short exposure periods involved, the population exposure to this group is expected to be minimal. The average exposure rate on Brown Road will probably not exceed 5 μR/hr above background. This is strictly a rough estimate based upon average exposure rate in the ditch which is then reduced by a conservative average distance from the ditch to the road. Assuming an individual makes two trips per day at 40 mph past the site the annual incremental exposure would be 0.04 mrad/yr. About 17,000 individuals could receive this annual exposure which would result in a population exposure of 0.7 person-rad/yr.

Other exposures could result from the uncontrolled use of the contaminated material in the ditches. The only circumstance limiting exposures from the ditch is the improbability of long exposure periods in the ditch. Future use of the ditch land and material could result in unacceptable exposures. Since this contamination is beyond direct control it could be used for fill-in yards, gardens, etc. and result in unacceptable public exposure. Further, run-off from the site is expected to continue which could increase contamination levels even further.

It is doubtful that concentrations of radioactive materials in surface run-off or resulting sediments will increase significantly. However, the total area of contamination outside of the fence could increase significantly. Even the insignificant migration (when compared to permissible exposures and concentrations) can and should be prevented under ALARA concepts. Determination of the migration of material to these ditches during deed enforcement depends upon radiological descriptions of the site at the time the deed went into affect.

Groundwater Leaching - Groundwater samples from test wells on and off-site were contaminated. The contamination found did not exceed the maximum permissible concentrations for effluents from NRC licensed facilities as given in Appendix B, Table II, column 2 of 10 CFR 20 (1975). However the Ra-226 content in one on-site hole exceeded EPA's guidelines for combined Ra-226 and Ra-228 in drinking water of 5 pCi/l. The impact of this pathway can be considered minimal based on the probable usage of groundwater. The Quit-Claim Deed requires that the NRC be notified prior to any drilling on-site. The NRC could either prohibit drilling for drinking water or require the user to meet current drinking water standards. The closest existing well is almost two miles from the site. Any future off-site use of this water is unlikely due to low quality and low quantity of the water, and the easy access to surface water through municipal supplies. In addition, most of the water leaching through the site flows into Coldwater Creek and becomes a fraction of the site surface water which is discussed in Section 3.3.

Radon Emanation - As stated in Section 3-8 measurements of Rn-222 in air showed no detectable activity above background levels off-site. Further estimates of on- and off-site concentrations resulting from the site were made as part of the follow-up survey and are shown in Table 4-2. On-site the maximum contribution would be 0.13 pCi/l which is only 26 percent of typical background concentrations. Off-site the maximum contribution would be 0.03 pCi/l which is only 6 percent of typical background concentrations. These theoretical estimates confirm the results of the measurements shown in Table 3-16. For conversion of Rn-222 concentrations to Working Levels (WL) of radon daughters, Healy's (1978) empirical formula was used. As shown in Table 4-2 a peak level of 1E-5 WL is achieved at a distance of 0.05 miles from the center of the site. As shown in Table 4-1 these levels are well within the standards shown. On this basis, outdoor Rn222 and its daughters will probably result in no significant impacts.

Utilizing the highest emanation rates measured by ORNL (Table 3-17) expected concentrations of Rn-222 in a theoretical worst case building were made using the method presented by Healy (1978). Assuming the worst case building had no floor, was eight feet tall and had 0.5 air changes per hour, the concentration of Rn-222 would be about 41 pCi/l. Using Fitzgerald's (1976) conversion (100 pCi/l = 0.7 WL) for a building of this type, the radon daughter concentration would be 0.29 WL. These values are well in excess of the standards given in Table 4-1. Therefore, if a building was built under these worst case assumptions, the Rn-222 and daughter buildup in the building could result in exposures which exceed guideline values. Typical building practices such as using a concrete slab base and/or forced ventilation could reduce these levels by an order of magnitude.

Resuspension of Particulates - Particulates from the site can be resuspended either by wind or by mechanical disturbances. An evaluation was made of the potential for resuspension of particulates resulting from

Table 4-2

Radon-222 Concentrations Resulting From the Airport Storage Site
(pCi/liter x 10^{-3})

Direction from Center of Site (mi)	Compass Direction															
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
0.25	8.8	8.4	9.1	12.0	22.5	10.7	6.5	5.5	6.0	8.1	12.9	22.3	34.5	22.0	15.3	11.0
0.50	3.0	2.1	2.4	3.0	5.3	2.5	1.7	1.4	1.7	2.5	3.7	2.5	4.3	5.2	3.2	3.4
0.75	1.7	0.9	1.2	1.5	2.5	1.2	0.8	0.6	0.9	1.3	1.9	1.0	1.8	2.5	1.5	1.5
1.00	1.2	0.5	0.7	0.9	1.5	0.7	0.5	0.4	0.6	0.8	1.1	0.6	1.0	1.4	0.9	0.9
1.25	0.8	0.3	0.5	0.6	1.0	0.5	0.3	0.2	0.4	0.5	0.8	0.4	0.7	1.0	0.6	0.6
1.50	0.6	0.3	0.4	0.5	0.8	0.4	0.3	0.2	0.3	0.4	0.6	0.3	0.5	0.7	0.4	0.4
1.75	0.5	0.2	0.3	0.4	0.6	0.3	0.2	0.1	0.2	0.3	0.4	0.2	0.4	0.6	0.3	0.3
2.00	0.4	0.2	0.2	0.3	0.5	0.2	0.2	0.1	0.2	0.3	0.4	0.2	0.3	0.5	0.3	0.3
2.25	0.3	0.1	0.2	0.2	0.4	0.2	0.1	0.1	0.2	0.2	0.3	0.1	0.3	0.4	0.2	0.2
2.50	0.3	0.1	0.2	0.2	0.4	0.2	0.1	0.1	0.1	0.2	0.3	0.1	0.2	0.3	0.2	0.2

On-Site and Near-Site Locations in the North Sector

Distance (mi)	0.01	0.02	0.03	0.04	0.05	0.07	0.10	0.13
Concentration	130	130	120	110	90	70	40	30
Travel Time (sec)*	7	14	22	29	36	50	72	94
Working Levels	3E-6	6E-6	8E-6	1E-5	1E-5	1E-5	9E-6	8E-6

* Assumes average wind speed of 5 mph.
** Based on Healy's empirical formula (1978).

future disturbance to the airport storage site surface (see Table 4-1). This evaluation was based on conservative assumptions -2,000 hr/yr activity level over 22 percent of the site providing an average yearly disturbance of five percent. Since anticipated time requirements and areal disturbance required for site stabilization and/or potential development (a police academy driver training facility) under this proposed action are minimal, resuspension of particulates should be inconsequential. Wind resuspension was ignored since it would be orders of magnitude less important than mechanical resuspension under these circumstances. The calculated values are well within maximum permissible concentrations. The maximum off-site values would be one fourth of those given in Table 4-1. Even under the worst conditions then, resuspension of particulates should not result in significant impacts.

External Doses - Surface contamination was found on many areas on-site at levels greater than 0.05 percent by weight of U-238. As with surface run-off and the resulting sedimentation, external doses result from this contamination. Unlike off-site doses, external doses from contamination on-site may be controlled by the deed which states:

> ". . .future use of such tract shall be dependent upon the effectiveness of the cover and fill material in reducing external radiation to acceptable levels."

The deed's term "acceptable" is vague and can be interpreted in many ways. The most widely used value of "acceptable" radiation level is the NCRP guideline of 500 mR/yr (NCRP, 1971). EPA has suggested a level of 10 μR/hr above background for the release of similar sites following decontamination (EPA, 1974). The NRC (1976) guidelines for decontamination of facilities and equipment suggest a limit of 0.2 mrad/hr for beta-gamma emitters averaged over 1 square meter. Although the term "acceptable" as used in the Quit-Claim Deed is not well established, present levels of external radiation are probably unacceptable. Therefore, the proposed action must include the addition and maintenance of clean fill to many areas of the site. The addition and maintenance of this amount of fill would be consistent with the philosophy that doses be kept "as low as reasonably achievable (ALARA)." This fill could range from none to a foot depending upon what is termed "acceptable" and the level of contamination. Maintenance of the fill is important since substantial quantities of fill added in 1971 for just this purpose has since eroded away. Failure to maintain adequate fill has violated the terms of the Quit-Claim Deed. Future violations, leading to environmental impacts of unknown magnitude from external doses, must be considered as highly probable unless future enforcement of the deed is assured.

Mechanical Redistribution - The activities of man and animals on the site could cause redistribution of contaminated material. The Quit-Claim Deed limits man's excavation on-site. Animals have been observed to burrow into the contaminated material. This burrowing has brought some subsurface contamination to the surface. The magnitude of this contamination is expected to be minimal compared to present contamination levels.

Off-site transport of contamination by animals is expected to be insignificant.

4.1.2 Non-Radiological Impacts

Non-radiological impacts resulting from use of the Quit-Claim Deed to control present radiation exposure from the site are primarily associated with fill activities required to reduce external radiation to acceptable levels, with off-site cleanup activities, and with past on-site activities.

Air Quality Impacts - During deposition of fill material and off-site clean up activities there is a possibility of fugitive dust generation. Airborne dust may migrate off-site; however, anticipated levels should not be significant. No other impacts to air quality are anticipated.

Geologic Impacts - Continued use of the site will not affect the general geologic framework of the site and its surroundings. The seismicity of the area should not affect the site substantially more than surrounding areas.

The lack of compaction of on-site fill material makes the site less suitable for foundations than sites with natural soils or properly compacted fill. Specifically, differential fill compaction may result in locally severe erosion problems as voids develop. Standard engineering practices will be required to control erosion.

Although natural compaction of the fill will tend to decrease permeability, the subsequent increase in surface runoff from this site is not expected to be discernable because of the limited areal extent of the site.

Groundwater Contamination - The fill material is non-organic and contains no industrial waste. Leachate should, therefore, contain insignificant concentrations of toxic chemicals. Based on the elemental composition of the residues once stored on the airport storage site (Appendix H), leachate from the contaminated soils may contain heavy metals and other toxic elements. However, the heavy clay Nevin and Menfro soils and underlying lacustrine deposits (see Section 3.2) should be effective in naturally attenuating these contaminants and preventing their reaching the underlying limestone formations. Some iron is likely to enter the groundwater from the building rubble, barrels, steel piling, and other materials buried on-site. However, the volume of this waste is low and should not significantly alter groundwater quality. Groundwater in this area is not generally used. Its quality is poor, and since deed covenants prohibit excavating and drilling on-site, there is no expected impact on subsurface water supplies. Furthermore, since most of the groundwater generated on-site or moving through the site discharges primarily into Coldwater Creek, contamination of the local groundwater system is highly unlikely. The seepage of groundwater to Coldwater

Creek is considered insignificant compared to average stream flow (see Section 3.3). The extent of downstream effects of this seepage should also be insignificant given the dilutional effects of background flow. As such, it is anticipated that no significant adverse effects on downstream water use will result from seepage of groundwater from the site.

Surface Water Contamination - The potential impacts to Coldwater Creek as a result of this proposed action are minimal. The Quit-Claim Deed requires that fill be placed on the site to adequately dampen radiation levels to acceptable limits, and that all Federal and State laws be adhered to.

The major regulation that will control surface water contamination is the St. Louis County Department of Public Works "Stormwater Detention Design Criteria and Guidelines", that became effective September 1, 1975. All projects that would fall under the inspection, licensing or plan review jurisdiction of the Department of Public Works, on items related to stormwater management, sanitary sewers, and site development are subject to the guidelines, criteria, and requirements mentioned above. The requirements specify that stormwater retention requirements for all development of any land are subject to licensing and review by the Department of Public Works. Given that these requirements are followed, no significant increase in stormwater runoff will occur from the site for this proposed action. Sediment erosion will depend on the final conditions of the site (slope, grade, vegetative cover, etc.). Increased sedimentation during construction, filling, or any other activities at the site will have to be controlled by erosion and sedimentation control measures. In addition to this, if stormwater detention ponds are required to control runoff quantity, runoff quality will also be improved through settling of pollutants. Any stormwater runoff control measures that are employed on site will have to be properly maintained to ensure their continued effectiveness.

Biological Impacts - Deposition of clean fill on the site to cover surface "hot spots" may require clearing or burial of existing vegetation. Since no rare or endangered plants have been identified on the site, and since the site flora is comprised of species which are common to disturbed areas, no impact can be identified. Loss of vegetation would not constitute a significant decrease of wildlife habitat over most of the site. Trees and shrubs along the west end of the site, however, are more valuable as wildlife habitat due to their closeness to the creek where they serve to aid bank stability and control runoff. The wooded fenceline extending along Brown Road from the creek is also of value both as an established hedgerow important as habitat and as an aesthetic highway screen. These areas should be conserved, if possible.

The suitability of unselected fill material for satisfactory establishment of vegetation is questionable. As can be seen on the existing site, the growth of sufficient ground cover to prevent recurrent erosion of new fill may not be obtained on conglomerate unselected fill material.

A suitable layer of fill material sufficiently maintained by vegetative cover and runoff catchments would allow for the development of permanent vegetation and wildlife habitat. The area would have to be managed to ensure that wildlife utilization is compatible with airport activities. The primary purpose of establishing and maintaining vegetation on site is to minimize surface erosion.

The potential impacts on aquatic biology resources from this proposed action are negligible. Since Coldwater Creek is at present highly stressed by low water quality and highly variable storm-water flows, there is little in the way of aquatic biota to be adversely impacted. Construction and grading activities on the site may cause some erosional material to enter the stream; however, the stream's high intermittent flow tends to minimize the residence time of deposited material. Coldwater Creek is not part of any wetlands area nor does it describe a significant open space or natural (biological) area. Development of the site according to DNR guidelines should not cause an increase in storm-water runoff to the stream, nor cause any additional stress to the few numbers of species which reside there. No endangered aquatic species have been recorded in Coldwater Creek or its tributaries.

Land Use and Population Impacts - The site can be used only for uses permitted through the deed, and its use must conform with aircraft navigation activities or associated uses within the guidelines under the Air Navigation Space Regulations of the Zoning Ordinance and regulations of the FAA. The primary impact on land use due to the proposed action is that no structures other than those required for air navigation needs or specifically exempted by the Federal Aviation Administration may be erected or remain on site.

Since there is no population residing within one quarter of a mile, and only 75 to 100 persons within half a mile of the site, the proposed action will not have any direct impact on existing residential population. Furthermore, there are no anticipated impacts to the existing employment centers, nor on the local economy from the proposed action. The proposed action will not affect the traffic pattern along Brown Road or the use of nearby parking lots, nor will it have any effect on the use of the Berkeley Khoury League recreational facilities. Similarly, there will be no impact on the cultural and aesthetic setting of the general area from the proposed action.

Cultural Resource Impacts - Since no sites or structures of historical, archaeological or cultural importance are either on-site or within a reasonable distance from the site, no impact to cultural resources is anticipated from this proposed action.

Noise Impacts - No significant noise impacts are anticipated from this proposed action. Construction activities during site clean up and adding fill material to the site will require the use of earth-moving equipment and heavy trucks. Noise levels from the heavy equipment which might be used are given below (EPA, 1971):

Equipment	Noise Level (dBA) at Fifty Feet
Trucks	91
Bulldozers	80
Scrapers	88
Graders	85
Paving Machines	89
Power Shovels	116
Compactors	116

As indicated by noise/land use guidelines (Table 4-3), a level of 75 dBA is acceptable for developed lands. Higher dBA ratings are acceptable for undeveloped and open land as well as some industrial uses. Since no homes, schools, or other structures are within 500 feet of the site, noise generated by these activities will be sufficiently attenuated so as not to cause annoyance. Noise levels may interfere with recreational activities within the adjacent park, but not to any greater extent than noise from the airport. Furthermore, since use of this park is primarily during the weekends and evenings these impacts should be minimal.

Table 4-3

Land Use and Design Noise Levels

Land Use Category	Design Noise Level - L10	Description of Land Use Category
A	60 dBA (Exterior)	Tracts of lands in which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheathers, particular parks or portions of parks, or open spaces which are dedicated or recognized by appropriate local officals for activities requiring special qualities of serenity and quiet.

Table 4-3
(continued)

Land Use Category	Design Noise Level - L10	Description of Land Use Category
B	70 dBA (Exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, recreation areas, playgrounds, active sports areas, and parks.
C	75 dBA (Exterior)	Developed lands, properties or activities not included in categories A and B above.
D	-	Requirements for undeveloped lands are dependent upon the potential and existing land use of adjacent parcels. For example, land in an area to be developed for industry may be exposed to 75 dBA.
E	55 dBA (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

Source: U.S. Department of Transportation, Federal Highway Administration PPM 90-2, Noise Standards and Procedures, February 1973.

Potential Accidents or Mishaps - Severe weather, such as intense precipitation or surface winds over a period of time, (see Section 3.1) could result in significant erosion despite controls and could contribute to off-site migration of fill or residual radioactive material.

4.2 USE OF THE QUIT-CLAIM DEED TO CONTROL ANTICIPATED RADIATION EXPOSURE FROM THE SITE AFTER BURIAL OF CONTAMINATED MATERIAL FROM THE LATTY AVENUE SITE

The second proposed action differs from the first as discussed in Section 4.1 in that approximately 18,300 to 50,000 cubic yards of contaminated material from 9200 Latty Avenue would be deposited on the airport storage site. This proposed action could result in short term and long term impacts. The short term impacts would result from the construction of a burial pit and the burial of the material from the Latty Avenue site. Long term impacts would result from future uses of the site and migration of contamination off-site as discussed for the first proposed action.

4.2.1 Radiological Impacts

Short Term Impacts - The only short term radiological impacts considered are those relating to the on-site construction and filling of the deposition area with material from the Latty Avenue site. Potential impacts of Latty Avenue clean-up and transport are beyond the scope of this assessment and are addressed in the remedial action plan and EIA for Latty Avenue site clean-up in the Draft Environmental Impact appraisal related to the further decontamination action of the Latty Avenue contaminated site at Hazelwood, Missouri and Plan 1, Phase 1 Decontamination Plan for Latty Avenue site, NRC, 1978 and the conceptual engineering study (Appendix I). The Latty Avenue material will be distributed, graded and compacted for possible use under the proposed Police Academy Driver Training Track area, but not within the 500 year floodplain. Contaminated material which cannot be buried under the asphalt track will be covered by 2 to 4 feet of suitable soil. Those pathways presented in Figure 4-1 were considered for individuals involved in the construction activities and for individuals off-site.

The individuals involved in construction and transport operations could be exposed to resuspended particulates, external radiation and radon from emanation. The decontamination plan calls for comprehensive dust control which along with present soil moisture will minimize the resuspension of particulates. External gamma radiation levels during construction will probably be similar to those at present. An individual working 8 hours per day for the 55 day working period at the maximum observed dose rate of 300 μR/hr would receive about 132 mrem of external whole body radiation. This estimate is extremely conservative since the individuals involved will be highly shielded by the earth-handling equipment in which they are working.

Assumptions made for the radon emanation calculations for this proposed action are as conservative as those made for the preceding proposed action. The additional Rn-222 emanating from the Latty Avenue material will probably not result in air concentrations exceeding the limits specified in Table 4-1. Healy (1978) indicated that concentrations of Ra-226 in soil as high as 2100 pCi/g will not result in outdoor radon daughter concentrations in excess of 0.03 WL. This is based on a circular source 250 meters in radius, an emanation fraction of 0.2, and contamination to an infinite depth. The Ra-226 concentration observed in the Latty Avenue material averaged less than 150 pCi/g, considerably less than Healy's limit.

Long Term Impacts - Those significant impacts from radon emanation and surface run-off discussed for the first proposed action will also be present in this proposed action. No reduction in exposure will be afforded by the disposal. The deposition of the Latty Avenue material would possibly add to the contamination of the exposure pathways.

As discussed in Subsection 4.1.1, surface run-off could result in significant exposures off-site through external radiation. The other pathways resulting from surface run-off will remain inconsequential. Construction of an impermeable asphalt covering with highway runoff controls, as in the proposed mitigating action of the Police Driver Training Track (Appendix I and Section 5), should adequately control surface runoff. Without this mitigation, disposal of the Latty Avenue material will probably increase contamination off-site because (1) much of the site area would be covered with clean fill, and (2) surface runoff has been significant in the past. Furthermore, the Quit-Claim Deed would not restrict future excavation or access to the Latty Avenue material because most of it will be buried above the 1971 topographical elevation. Excavation in this area could increase run-off and direct radiation exposures.

Although the disposal of the Latty Avenue material could add to the contamination of groundwater, the impact of such additions are expected to be minimal. Based on the reasons presented in Section 3.3 no use is expected to be made of groundwater on or near the site for drinking purposes. A program has been developed for long-term groundwater monitoring (Section 3.8).

External doses from the Latty Avenue material are expected to be minimal. When the material is first deposited it will be covered with 2 to 4 feet of fill which will reduce such exposures to acceptable levels. Some erosion of the cover material will occur in the future. However, the Quit-Claim Deed requires that external doses be maintained at acceptable levels.

Radon emanation could contribute to on-site exposures. As stated in the first proposed action, radon accumulation in future building on-site could be significant. Ra-226 concentrations in the Latty Avenue material are higher than those observed at the airport storage site. Also concentrations of Th-230 are expected to be high in the material from the Latty Avenue site. Ra-226 will continue to be produced, as will Rn-222 and radon daughters, from this Th-230. As such, during the next 50-100 years radon emanation will increase. Since excavation in the Latty Avenue material would not be controlled by the Quit-Claim Deed, possible impacts from Rn-222 buildup in a building built directly on or with the Latty Avenue material could be greater than those calculated for the first proposed action. Rn-222 concentrations outdoors will probably not exceed limits as a result of the deposition of the Latty Avenue material.

As stated earlier, the Quit-Claim Deed will not control excavation of the Latty Avenue material. The concentrations of particulates in air due to resuspension could conceivably exceed limits if such excavation were to occur. Therefore, resuspension of particulates could have a significant impact under this proposed action if attempts were made to excavate the Latty Avenue material after it is buried.

4.2.2 Non-Radiological Impacts

Short term non-radiological impacts considered below include those impacts relating to on-site disposal of the Latty Avenue material plus those described for the preceding proposed action associated with site maintenance, off-site cleanup, and addition of clean fill required to meet deed restrictions. Potential impacts of Latty Avenue cleanup and transport to the airport site are beyond the scope of this assessment. (See NRC 1978). The evaluation assumes that the Airport Authority will comply fully with all applicable regulatory requirements (both of a radiological and non-radiological nature). As such, long-term non-radiological impacts should be precluded.

Air Quality Impacts - In addition to deposition of fill material and off-site cleanup activities excavation for, and deposition and covering of material from Latty Avenue most likely will result in the generation of fugitive dust. Off-site airborne transport of fugitive dust may be significant.

On-site air quality may also be influenced by hydrocarbon emissions from hauling and excavating equipment; however, this impact would be of short duration and should contribute only slightly to the air quality problem surrounding the airport (see Section 3.1).

Geologic Impacts - Use of the site under this proposed action will not affect the general geologic framework of the site and its surroundings. The seismicity of the area should not affect the site substantially more than the surrounding areas or to any greater extent than the preceding proposed action.

During the excavation and disposal activities a greater hazard for surface erosion and stream sedimentation will exist. In addition, the placement of up to four feet of clean fill over the buried Latty Avenue material will alter surface runoff and should be integrated with site runoff controls.

Groundwater Contamination - Based on the elemental composition of the residues stored on-site and later transferred to Latty Avenue (Appendix H), both the on-site soils and 18,300 to 50,000 cubic yards of material NRC (1978) (Appendix I) proposes to bury at the site probably contain slightly higher concentrations of metals and other soluble chemical species than unexposed soils and fill material. If the Latty Avenue material is buried on-site, slightly larger concentrations of these chemicals may be leached into the groundwater than the preceding proposed action. However, the Nevin and Menfro soils and underlying lacustrine deposits (see Section 3.2) should effectively attenuate these contaminants prior to their reaching the limestone formations. In addition, since groundwater flows are directed into Coldwater Creek, the potential for contamination of the limestone formation and off-site subsurface water supplies is remote. The impact of seepage of this leachate into Coldwater Creek

on surface water quality is minimal and only slightly greater than anticipated for the preceding proposed action because the groundwater entering the creek from the site will be diluted by at least a ratio of 4,400:1 under normal conditions (see Section 3.3).

Surface Water Contamination - The potential for surface water contamination of Coldwater Creek as a result of this proposed action is minimal and only slightly greater than the preceding proposed action. The Quit-Claim Deed requires that fill be placed on the site to adequately dampen radiation levels to acceptable limits, and that all Federal and State laws be adhered to. Compliance with County guidelines for storm-water detention should result in no significant increase in runoff from the proposed action.

The primary non-radiological impact to surface water quality that will result from this action is sedimentation of Coldwater Creek. Construction activities will result in the disturbance of the surface of the site for the deposition of contaminated material from Latty Avenue. Adequate measures to control erosion and sedimentation will have to be taken to avoid unnecessary deposition of soil material (possibly with radiological contamination) in the creek.

The extent of downstream effects of any erosion into Coldwater Creek will not be significant given the dilutional effects of background flow in Coldwater Creek (see Section 3.3). It is therefore anticipated that no significant adverse effects (non-radiological) on downstream water use will result from this proposed action.

Biological Impacts - Deposition and burial of Latty Avenue material at the airport site would result in disturbing a larger area of the site for a longer period than incurred in just maintaining existing site standards. As such, this proposed action may result in a greater loss of vegetation and wildlife habitat. Since no rare or endangered plants have been identified on-site and since the site flora is comprised of species which are common to disturbed areas, these losses are considered insignificant. If compatible with airport operations, the trees along the creek within the site should be preserved (see Section 3.4.2).

Potential sediment loss to the creek would also be greater than anticipated thereby affecting bank and downstream habitats to a greater extent. Since the site area has not been judged as valuable vegetation or wildlife habitat, the noise and activity of construction equipment is also not a significant impact. It should be noted that wildlife existing on the site seem well accustomed to the noise of aircraft and local traffic. The final condition of the site for biological communities and human use would remain the same.

The potential impacts on aquatic biology resources from this proposed action are negligible and are no greater than the preceding proposed action. Since Coldwater Creek is at present highly stressed by low water quality and highly variable storm-water flows, there is little in the way of aquatic biota to be adversely impacted. Construction and

grading activities on the site may cause some erosional material to enter the stream. However, the stream's high intermittent flows tend to minimize the residence time of deposited material. Coldwater Creek is not part of any wetlands area nor is it currently designated as a significant open space or natural (biological) area. A pilot project is currently underway to develop the lower portions of the stream as linear parkland. This parkland plan recommends only visual use of the creek from walking and bicycling trails along the banks. No water base recreation is proposed or expected due to the poor water quality of Coldwater Creek. At this time, no impact of the airport site on the proposed park is foreseen. Development of the site according to DNR guidelines should not cause an increase in stormwater runoff to the stream, nor cause any additional stress to the few numbers of species which reside there. No endangered aquatic species have been recorded in Coldwater Creek or its tributaries.

Land Use and Population Impacts - Any excavation as proposed by NRC (1978) or in Appendix I is not in conformance with deed restrictions on land use (Appendix A). Assuming that the deed will be modified to allow disposal of Latty Avenue material and to protect this material from excavation (it will be above the 1971 topographic elevation), no adverse impacts to existing population and employment centers in the immediate surroundings of the site are anticipated. Conformance with deed restrictions on radiation exposure to on-site individuals will necessitate sufficient fill activity to insure desired land use. Furthermore, since the surrounding land uses are mostly industrial, excavation and other activities associated with the proposed action may not be perceivable to people working, residing, or playing in adjacent areas. As with the preceding proposed action, the deed does not allow structures other than those required for air navigation aids or specifically exempted by the Federal Aviation Administration to be erected or remain on site. The decontamination measures at Latty Avenue will benefit the Latty Avenue vicinity. However, decontamination is not contingent upon selection of this proposed action. Furthermore, since the movement and placement of 18,300 to 50,000 cubic yards of contaminated material by truck from Latty Avenue to the airport storage site can be accomplished in 55 to 150 working days (NRC, 1978 and Appendix I), these activities will provide only limited work opportunities for local hauling and earth moving firms and should not significantly contribute to the local economy. The slight increase in truck traffic volume on Brown Road may pose an increased hazard to children playing in the adjacent park. Otherwise, park activities should not be affected by the proposed action.

Cultural Resource Impacts - Since no sites or structures of historical, archaeological, or cultural importance are either on site or within reasonable distance from the site, no impact to cultural resources is anticipated from this proposed action.

Noise Impacts - No significant noise impacts should result from this proposed action. Construction activities related to covering the site or burying contaminated material from the Latty Avenue site and then ad-

ding cover material will involve the use of bulldozers and heavy trucks. Noise levels from the heavy equipment which might be used for these activities are given in Section 4.1.2. Anticipated noise levels from this proposed action may be slightly higher and of longer duration than those anticipated for the preceding proposed action in that an additional 55 to 150 days work will be required to complete the deposition and covering of the Latty Avenue material.

As indicated by noise/land use guidelines (Table 4-3), a level of 75 dBA is acceptable for developed lands. Higher dBA ratings are acceptable for undeveloped and open lands as well as some industrial uses. Since no homes, schools, or other structures are within 500 feet of the site, noise generated by these activities will be sufficiently attenuated so as not to cause an annoyance. Noise levels may interfere with recreational activities within the adjacent park, but not to any greater extent than noise from the airport. Furthermore, since use of this park is primarily during the weekends and evenings these impacts should be minimal.

Potential Accidents or Mishaps - The most significant potential mishaps would result from severe weather. Localized rainfall of great intensity and duration, as may happen in thundershowers or occluded systems, could exceed runoff controls and contaminate Coldwater Creek if they occurred during the burial. Severe wind storms or tornadoes (see Section 3.1) could also transport significant quantities of dust and material from the site. A grassfire could also cause local dispersal of contaminated dust from convection and combustion of plant materials. The probability of these events occurring is extremely low.

Improper placement or spillage of Latty Avenue material within the site should be easily corrected through excavation and use of clean fill for cover. Accidents during the handling and transport of material from Latty Avenue are addressed in NRC (1978). Due to the low number of truck trips anticipated to transport the 18,300 to 50,000 cubic yards of Latty Avenue material the probability that traffic accidents en route will increase is considered low. However, as stated earlier, this increase may pose an increased hazard to children playing in the adjacent park.

SECTION 5

MITIGATING MEASURES TO THE PROPOSED ACTIONS

The mitigating measures discussed here are actions which could feasibly be taken to mitigate radiological and non-radiological impacts resulting from implementation of either of the proposed actions. Mitigating measures, which would be expected to reduce those exposures or impacts deemed significant in Section 4, are presented below. The measures are categorized as off-site measures, on-site measures, and Latty Avenue disposal measures. The use of the site as a Police Academy driver training facility is also considered as a mitigating measure.

Off-Site Measures - Although off-site population exposures are inconsequential, individual exposures could result through external radiation from surface run-off of contamination. The ditches along Brown Road are of concern because without further action the run-off of contamination will continue. As a mitigating measure the following actions could be taken to reduce these exposures and/or non-radiological impacts:

1. Decontaminate the ditches to levels consistent with as low as reasonably achievable (ALARA) objectives.

2. Stabilize the site to prevent future erosion.

3. Provide maintenance of the stabilized site.

Items 2 and 3 are logical extensions to the proposed actions which must include the addition of clean fill to reduce external exposures to acceptable levels. Without these measures any fill added under the proposed action could erode away, again making radiation exposures from the site unacceptable under the Quit-Claim Deed and possibly recontaminating off-site ditches. These measures would also serve to reduce radon emanation and resuspension of particles.

On-Site Measures - The addition of fill and site stabilization will reduce on-site exposures by radon emanation, resuspension of particles and direct exposures as discussed above. The only other potential on-site radiological impact is through radon concentration in any future building on-site. The addition of fill as called for in the proposed action should mitigate this pathway. However, depending on the type of building and effectiveness of the fill, this pathway could become significant. The mitigating measure would be to reduce radon concentrations in any on-site building by altering the deed to include one or more of the following:

1. Prohibit buildings on-site.

2. Require any building construction to include measures necessary to ensure compliance with the provisions of 10 CFR 712.

Depending on the extent of the site that has to be filled to reduce exposures, the resulting vegetation and habitat loss may or may not be significant. Reestablishment of vegetation as quickly as possible will insure control of fugitive dust and reduce erosion from surface water runoff, thereby limiting migration of sediments off-site. However, since most of the site lies within the approach and takeoff zones of two runways, it is not desirable to utilize plant species that will enhance the wildlife value of the site to an extent that will interfere with airport operations.

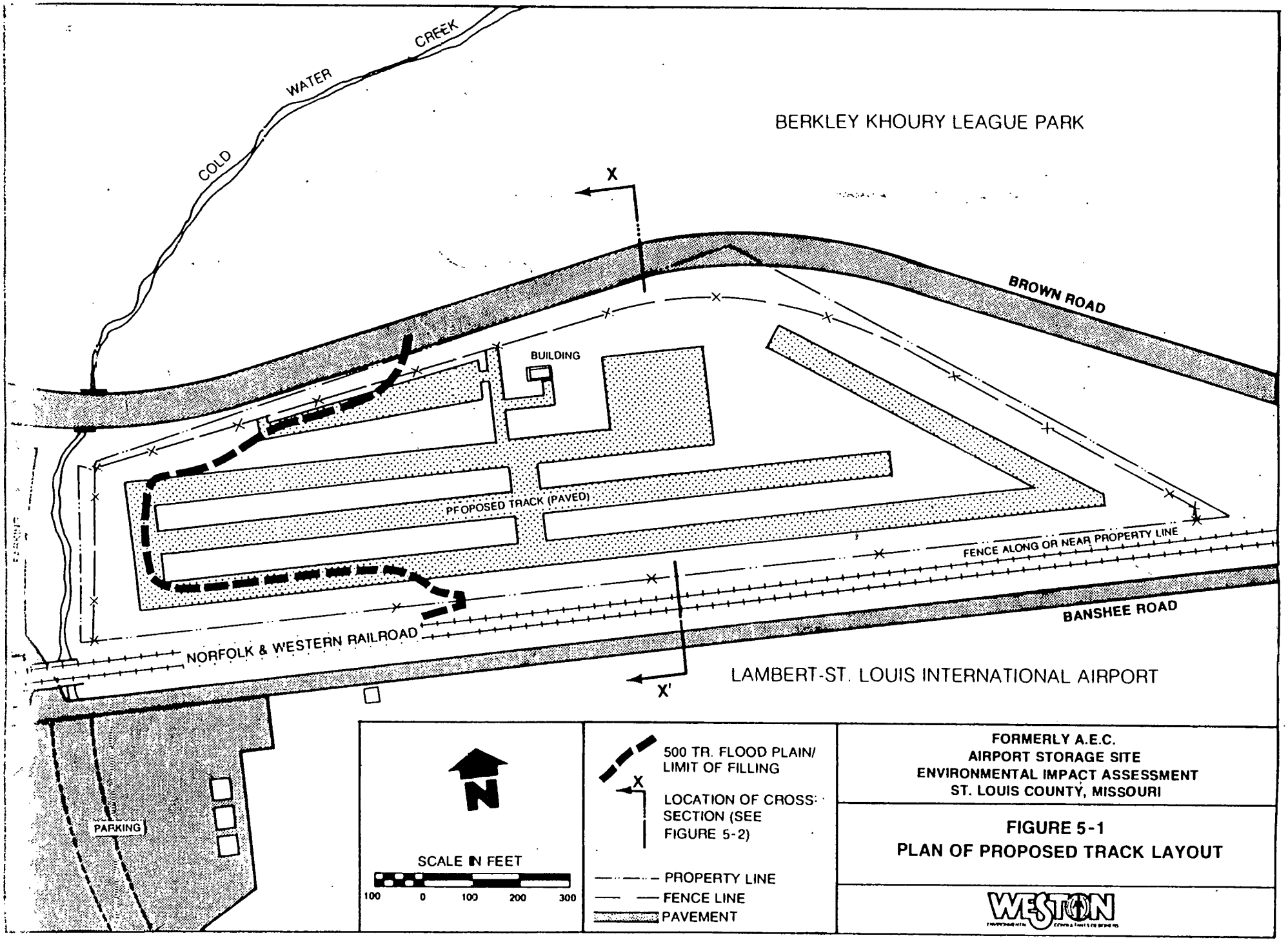
Other measures which would further stabilize the site from erosional losses include covering with a veneer of top soil those portions of the site that are presently sparsely vegetated, and seeding or sprigging these areas with turf grasses. In addition, areas near Coldwater Creek that are gullied could also be repaired and, if necessary, riprap or other erosion control measures employed as needed according to EPA (1976). Past erosional problems of the site should be corrected to the extent possible.

Latty Avenue Disposal Measures - The Latty Avenue material could result in exposures in excess of guideline values because the Quit-Claim Deed would not control access to the material. Excavation is only controlled below the 1971 topographical elevation. To mitigate these impacts the deed should be altered to prohibit on-site excavation without prior written approval by the NRC. Other exposures from the Latty Avenue material could result if the cover material is not maintained. The mitigating measure of site stabilization and maintenance discussed under off-site measures would maintain this cover material.

Police Academy Driver Training Facility - The use of the site as a police academy driver training facility as presented by Graves (1978) would significantly reduce radiation exposure rates on- and off-site. A conceptual engineering study is presented in Appendix I. The margin of safety provided by the NRC (1978) disposal plan for the Latty Avenue material will be increased by burying this material under the test track. This modification will reduce groundwater seepage through this material and will move the material further from Coldwater Creek allowing greater potential for attenuation of groundwater contamination prior to its seepage into the creek.

The compaction and road surface (about 40 percent) will reduce groundwater infiltration, external dose rates and radon emanation and increase surface runoff, which would be controlled by a highway type drainage system. The pavement would not only reduce on-site radiation exposure, but would also tend to minimize the amount of groundwater seepage through the site and into the creek.

The proposed plan layout of the driver training track is shown in Figure 5-1. (Source: St. Louis Police Academy.) Typical highway construction standards and the June 1977 Survey were used for estimating purposes.



FORMERLY A.E.C.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI

FIGURE 5-1
PLAN OF PROPOSED TRACK LAYOUT

WESTON

The Latty Avenue material (approximately 50,000 cubic yards) will be distributed above 500 year floodplain elevations, graded, and compacted under the track area. Waste material that may be removed from the drainage ditch along Brown Road (approximately 6,000 cubic yards) will be handled with the Latty Avenue material. Contaminated material which cannot be buried under the asphalt track will be covered by 2 to 4 feet of suitable soil. Clayey soils (or other suitable low permeability soils) will be used to cover waste materials which cannot be buried beneath the track. Suitable soils must restrict water infiltration, promote vegetation growth, and control radiation exposure. The base soils should have a high clay content while surface measures include temporary and permanent erosion and drainage controls. It will be advantageous, to complete disposal activities within a reasonable condensed time frame so that permanent site stabilization can be completed. A phased coordination of site completion with disposal activities may be practical. All of the above actions would significantly reduce the erosion problems which have been present in the past. Slopes along the length of the track will be roughly 1/2 percent toward Cold Water Creek. Grades along the perimeter of the track and site will be no greater than 6:1.

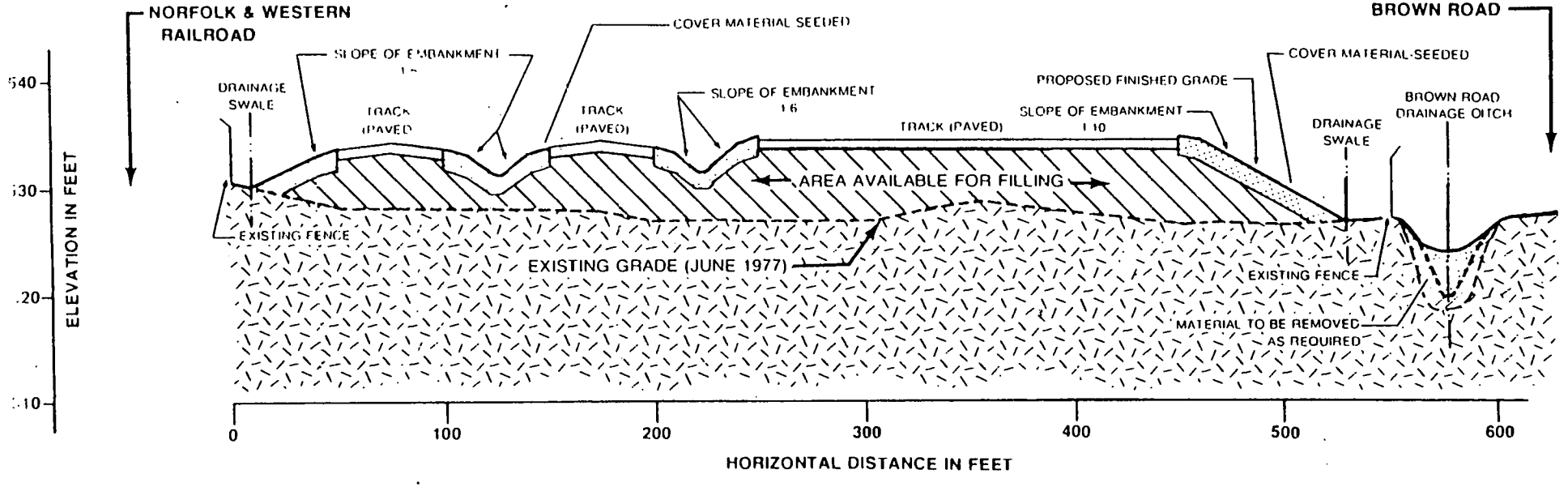
Figure 5-2 depicts a total cross-sectional view through the site. The available capacity between the existing (June 1977) ground surface and the track elevation as shown in Figure 5-2 is roughly 70,000+ cubic yards. This is sufficient to handle the 56,000 cubic yards of contaminated soil material from Latty Avenue and Brown Road.

A current topographical site survey is being prepared for the final site closure/development plan. The construction/demolition debris that has been dumped since June 1977 may have to be bulldozed and relocated on the site to facilitate track construction.

The exact plans for any buildings associated with the facility should be evaluated to minimize the potential for exposure from inhalation of radon daughters. Measurements of radon daughter concentrations, as recommended by 10 CFR 712 (1976), may be necessary to assure that the buildings, as constructed, meet radiation protection criteria. The Police Academy's proposed plan (Graves, 1978) would result in the loss and exclusion of natural vegetation over most of the site. However, the mowed grass areas of the facility would act to stabilize unpaved areas that are presently sparsely covered with vegetation and would have some value to indigenous wildlife.

Development of the Police Training Facility according to this plan will provide for long-term stabilization of the material, ensuring that further contamination of off-site ditches and Coldwater as occurred in the past, will not reoccur.

A local requirement that will affect the control of surface water runoff is the St. Louis County Department of Public Works "Stormwater Detention Design Criteria and Guidelines." (Section 3.3) which may require the use



FORMERLY AEC.
AIRPORT STORAGE SITE
ENVIRONMENTAL IMPACT ASSESSMENT
ST. LOUIS COUNTY, MISSOURI

FIGURE 5 - 2
CROSS-SECTION XX' (TYPICAL)
OF PROPOSED TRACK LAYOUT

WESTON

SEE FIGURE 5-1 FOR LOCATION OF CROSS-SECTION

of stormwater retention basin(s). Due to the fact that a basic design objective for the development of this site is to minimize infiltration, the use of stormwater retention basin(s) is not consistent with this objective. Depending upon the details of the final design plan, it may be necessary to request a variance or partial variance from these guidelines due to the special nature of the site. Use of portions of the training track surface for stormwater retention or use of another impermeable basin are possible.

Interpretation of deed restrictions (Appendix A) suggest that use of the site as a policy training facility may not be within the original intent of the covenants agreed to by the Airport Authority. It may be necessary, for the deed to be modified by the Federal Government so as to allow this particular use, assuming that it meets with FAA approval.

SECTION 6

UNAVOIDABLE ENVIRONMENTAL IMPACTS

The majority of environmental impacts of either of the proposed actions will be avoided through the implementation of mitigation measures (see Section 5). Those impacts created by the mitigating measures and the residual exposures or impacts remaining after implementation of the mitigating measures are considered unavoidable. For instance, construction workers could receive some exposure while decontaminating the off-site ditches or while constructing the driver training facility. The development of detailed plans for the mitigating measures should include the control of this type of exposure. It is believed that these plans could reduce such exposures to levels consistent with ALARA objectives. Examples of residual impacts would be: small amounts of radioactive material will continue to be released from the site through runoff; small quantities of contaminated groundwater would continue to seep into Coldwater Creek and the underlying sediments; fugitive dusts, and gaseous emissions and noise from heavy equipment would be generated below nuisance levels; temporary vegetation and habitat loss will occur; and use of the site will remain "restricted" through the covenants of the deed. With implementation of either of the proposed actions and the mitigating measures presented in Section 5, the contamination and exposures related to the site should be within guidelines and standards.

SECTION 7

ENVIRONMENTAL IMPACTS OF ALTERNATIVES

The alternatives to the proposed actions are listed in Section 2.4. Each alternative alters the potential impacts from the site in its present condition and can create additional impacts.

Alternative 1 - Complete Site Decontamination With Removal Of Radioactive Contaminated Material To An Unidentified Location - calls for excavating contaminated soil located on-site and within off-site drainage ditches and contaminated scrap and building rubble previously stored on-site. This alternative would minimize the long term radiological impacts of future site usage. However, the short term radiological and non-radiological impacts from site clean-up most likely would be considerable. Excavation and removal of a very large volume of contaminated sediment and debris (an estimated 200,000 cubic yards) would constitute a moderate construction project and take a significant period of time (depending on equipment, as much as one year). During excavation, the potential for off-site migration of fugitive dust and storm runoff sediment beyond control measures are naturally increased. The longer time period and direct exposure to buried materials having higher radiological levels also greatly increases the dose exposures to construction workers. Depending upon the location of the unidentified disposal site, removal of material would mean heavy truck traffic or loading to railroad tenders. Transport of the material, particularly by truck, has a significant potential for material loss enroute. The large volume of clean fill required to return the site to its present topographic elevation would most likely have to be excavated and hauled to the site and, therefore, constitutes additional off-site impacts upon traffic and local resources. More than any other alternative this action would result in the complete removal of existing wildlife habitat on the site. As a moderate construction project, removal of all contaminated material from the site will result in significant consumption of energy and labor resources.

The major advantage of this alternative is that the site could be released for unrestricted use from a radiological viewpoint. However, due to limitations on land use resulting from its proximity to the airport, the land will still be "restricted". Above ground structures are severely limited by height, and the site is within currently proposed airport expansion plans. The disadvantages are: the short term impacts (both on-site and off-site) from clean-up activities could be considerable; possible radiological impacts could result at the unidentified disposal site; and site clean-up would be extremely expensive. This expense is probably not warranted since the value of the property is limited due to the airport zoning restrictions.

Alternative 2 - Release Of The Site For "Unrestricted Use" With No Further Action - calls for removal of restrictions in the Quit-Claim Deed pertaining to radiological concerns. Under this alternative, NO control of the material would then be in effect concerning radiation exposures on-site or concerning off-site migration of contaminated material. As an example, the Airport Authority (or transferee) would no longer be required to maintain a layer of clean fill adequate to control radiation levels to "acceptable" levels for the designated land use. Current uncontrolled surface runoff would continue to move radioactive sediments off-site into Coldwater Creek and the ditch along Brown Road. Continued surface erosion of the fill would also allow greater exposure of contaminated sediments from fugitive dust dispersing to the airport and Khoury Park. Excavation and drilling would no longer be restricted which could result in unacceptable exposures through radon accumulation in structures, increased external dose, and increases in surface run-off. The contaminated material could also be transported and dispersed in any manner possibly resulting in adverse health effects (i.e., use of material in building construction). External radiation for continuous occupancy on the existing site could be well in excess of current guidelines. The advantage of this alternative is that no further action or cost would be required. The disadvantage is the extremely large increase in the potential impacts concerning increased exposure to and/or migration of radioactive material. However, reconsideration and a clean up of the site sometime in the future is not precluded.

Alternative 3 - Release Of The Site For "Unrestricted Use" After Burial of Contaminated Material From the Latty Avenue Site - similar to Alternative 2 but with the burial of the contaminated material from the Latty Avenue site. Short term radiological and non-radiological impacts resulting from this burial in accordance with the NRC (1978) plan would be the same as anticipated for the second proposed action. In addition, the long term impacts discussed above for Alternative 2 would be present in Alternative 3 at an enhanced level due to the addition of this material. The advantages of this alternative would be that this contaminated material would be disposed of with no further action required. The disadvantages would be those impacts described for Alternative 2, magnified by the addition of this contaminated material. As with the preceding alternative, reconsideration and/or a site cleanup sometime in the future is not precluded.

Alternative 4 - Continued Restriction Of The Site With No Development Of The Site Permitted - would require repossession of the site by the government and converting it to a government storage facility. Total control of the site landuse can only be achieved by the landowner, which necessitates government ownership. Under this alternative only casual exposures would be received by individuals visiting or monitoring the site. Those pathways resulting in off-site migration of contamination would result in exposures as discussed for the first proposed action. By implementing off-site mitigating measures discussed for the first proposed action, all off-site impacts would be within current guidelines. The advantage of this alternative is the elimination of possible on-site doses from "unrestricted use" of the land. Furthermore, by having the Federal

Government directly responsible for site maintenance and radiological surveillance of the site, the potential for loss of material through surface erosion and runoff would be minimized. Under this alternative the site could still be maintained as a clear zone for the take-off and landing of aircraft, and the existing wildlife habitat would be protected from development. The major disadvantage of this alternative is that the land could not be directly used or developed. However, reconsideration and a clean up of the site sometime in the future is not precluded by this alternative.

SECTION 8

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

8.1 USE OF THE QUIT-CLAIM DEED TO CONTROL PRESENT RADIATION EXPOSURE FROM THE SITE

The addition and maintenance of clean fill to reduce direct radiation to acceptable levels to comply with deed restrictions and decontamination of off-site ditches does not constitute significantly large; or in any anticipated way detrimental consumption of energy, labor, natural materials, or other resources. This action also poses no real long term effect upon public health, water quality, or local biological or social communities. Enforcement of the Quit-Claim Deed convenants provides control of land use to a greater extent than local zoning ordinances and FAA regulations. These ordinances and regulations concern primarily above ground structures or obstructions, thereby effectively precluding noncompatible land use. Maintenance of the site as brushland, grassland, or a police driver training facility would constitute a suitable use of the site in an area of continued urban development.

8.2 USE OF THE QUIT-CLAIM DEED TO CONTROL ANTICIPATED RADIATION EXPOSURE FROM THE SITE AFTER BURIAL OF CONTAMINATED MATERIAL FROM LATTY AVENUE

The commitment of resources under this proposed action does not differ significantly from the preceding proposed action. The additional consumption of energy, material, and labor required for the burial of the Latty Avenue material should only equal that expended in any minor industrial construction project and deserves no special consideration. Burial of this material at the airport site in no way precludes future relocations of the material to another site or recovery of the mineral resource (source material). If additional deed covenants are agreed to by the Airport Authority (or transferee) and erosion controls are maintained properly, burial as prescribed by NRC (1978) should adequately contain this material on site.

SECTION 9

RELATIONSHIP OF LAND USE PLANS, POLICIES, AND CONTROLS

The St. Louis County General Plan - History Element refers to the Lambert-St. Louis 2000 Plan. The Plan proposes to extend Runway 24 by an additional 1,000 feet, bringing the end of this runway to within 250 feet of the site boundary. However, the elevation of the Norfolk and Western Railroad track will interfere with minimum clearance requirements specified by the Federal Aviation Administration (FAA). Assuming that this limitation can be resolved and the plan executed, the approach zone of this runway would include most of the eastern sector of the site. The Lambert-St. Louis Airport 1975-1995 Master Plan (1975) does not include the extension of this runway, but does include using the adjacent park for a short take off and landing aircraft port, further limiting use of the site. No other land use plans for the area interact with the proposed plans.

The site is under two zoning district regulations. The western one-third of the property is within the Coldwater Creek flood plain and is designated a flood plain district, while the entire site is zoned an industrial district. Zoning regulations allow the site to be used for any permitted use under industrial district limitations provided that adequate flood protection measures are suggested in advance and approved by the County Planning Commission.

Under the Air Navigational Space Regulations of the St. Louis County Zoning Ordinance, the air navigation space above the site "shall be maintained free and clear of all stationary structures or trees above an imaginary surface of a plane beginning at a point 200 feet beyond the end of each runway, and rising one foot for each 50 feet for a distance of 10,000 feet outward from the point of beginning and further outward rising one foot height in each forty feet in horizontal distance to a point 50,000 feet from the point of beginning. The 'instrument runway' has a width of 1,000 feet at a point 200 feet beyond the end of the runway, and widens uniformly, thereafter, to a width of 16,000 feet at a distance of 50,200 feet beyond the runway end."

According to the Airport Master Plan, the eastern one-third of the site is within the instrument runway path of Runway No. 24, while the central one-third of the site is within the instrument runway path of Runway No. 17. Hence, the runway path restrictions apply to two-thirds of the site (Figure 3-7).

FAA regulations further restrict the construction, erection, alteration, or growth of any structure, tree or other object in the approach area of the runways of the airport. In addition, the erection of any permanent structure or facility in any portion of a runway approach area which would interfere with the use, operation, or future development of the

airport is prohibited. The Airport Authority may not permit any structure, other than those required and permitted by FAA, to be erected or remain on the property, nor permit any use to be made of the property which would result in or create interference with air navigational aids, aeronautical communication systems, or otherwise impair the vision of pilots; render it difficult to distinguish airport lights; endanger or be hazardous to aircraft maneuvering in the vicinity of the airport; or permit any object of natural growth on the property within 200 feet of an approach light system component to extend above the plane of the light path.

Deed restrictions further limit the use of this land (see Section 2.2). The property was conveyed to the Airport Authority specifically for aeronautical use, and for the development, improvement, operation or maintenance of the Airport. The Quit-Claim Deed specifies that the property may not be leased, sold, salvaged or disposed of by the Airport Authority and used for other than Airport purposes without the written consent of the Administrator of the FAA. The deed also stipulates that unless authorized by the Administrator, the Airport Authority cannot grant or permit any person, firm or corporation the exclusive right to conduct any aeronautical activity on the property. It further stipulates that no structure, other than those required for air navigation aids or specifically excepted by the FAA may be erected or remain on the property. As such, erection of any structure on the site or use of the site is limited and controlled by zoning ordinances, FAA regulations, and the deed.

The key provisions of NRC regulations - Licensing of Source Material (in 10 CFR Part 40) requires a specific license for the possession, use, transfer, etc. of certain source materials (which includes any material, except fissionable material, containing by weight 0.05 percent or more of uranium, thorium, or any combination thereof) unless exempted. If the material at the site is above the defined threshold and not otherwise exempt, the Authority would seem to be required to secure a specific license to maintain at, transfer from, or accept at the site source material.

SECTION 10

RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Productivity of the site must be defined in terms of potential land use with its given location and restrictions. The existing soil and biota resources have been greatly disturbed in the past, offering marginal resource value for preservation. Deed, zoning and FAA restrictions greatly narrow the range of site land uses (Section 9) almost to a maintenance as open space (except the western end of the site). Although all of these restrictions may be changed in the future, at this point FAA and zoning restrictions should be considered part of the long-term environment. Productivity, in this situation, can only be conceived in terms of: 1) a limited open space use, such as parkland, road or parking surface or surface storage area; or 2) low industry, such as shops or warehouses. Neither of the two preferred actions significantly add to the existing long term restrictions for site land use.

The stabilization of contaminated material of both the existing airport site and that from Latty Avenue provided by the preferred actions should be considered a major long-term benefit. Surface sediment stabilization, by the maintenance of site vegetation and other permanent erosion measures necessary to prevent off-site migration of the protective surface fill or subsequent disposed material, will also enhance the marginal aesthetic and habitat value of the site.

The minimal short-term adverse impacts of addition of new fill and burial of Latty Avenue material are far outweighed by the anticipated stable disposal of this contaminated material. This is also true of off-site clean-up actions.

In summary, maintenance of the existing contaminated material and/or the Latty Avenue material, if buried on-site, will not significantly affect the long-term productivity of the airport site.

SECTION 11

ENVIRONMENTAL TRADE OFF ANALYSIS OF THE PROPOSED ACTIONS AND ALTERNATIVES

Potential impacts of the proposed actions and alternatives are summarized in Table 11-1. Comparison of the actions and alternatives primarily regard control of stored radiological contaminated material, external radiological doses, costs and impacts of construction and the extent of land use restrictions.

The major issue of adequately controlled, long term storage of the radiological contaminated material would be achieved in both proposed actions with deed enforcement -- in Alternative 4 with Federal government maintenance and in Alternative 1 where the airport site material is adequately stored elsewhere. Although the proposed actions should provide adequate control of the material, Alternatives 1 and 4 imply slightly greater control through total removal and more stringent maintenance, respectively. Proposed Action 2 and Alternative 4 provide adequate control of the Latty Avenue material in addition to existing airport site material. Once again, Alternative 4 implies slightly greater control than proposed Action 2.

External radiological exposure and that from radon gas should be controlled to insignificant levels in all actions and alternatives, except Alternatives 2 and 3. Although Federal and State regulations are still applicable, the release of restrictions in Alternatives 2 and 3 could result in unacceptable doses.

Unrestricted construction allowed in Alternatives 2 and 3 could result in on-site radiological impacts, such as unacceptable on-site exposures or off-site material migration and exposures. Construction required for movement of the Latty Avenue material or the airport site material may potentially result in significant impacts from worker exposure, fugitive dust, severe weather or accident. However, with proper controls and mitigations these minimal impacts or risk of impacts should be acceptable within the objectives of the remedial action program. This is, likewise, true for costs required for transport and storage of the Latty Avenue contaminated material. The high costs anticipated for removal of existing contaminated material on the airport site, as discussed, allow for very little benefit in future site land use due to remaining FAA and zoning land use restrictions.

The proposed actions continue existing land use restrictions regarding radiological material through the Quit-Claim Deed, while only Federal and State regulations regarding this material would apply in Alternatives 2 and 3. Alternative 4 permits no developed use of the site, while only FAA and zoning restrictions apply in Alternative 1.

Table 11-1

Potential Impacts of
Proposed Actions and Alternatives*

	Proposed Actions		Alternatives			
	1	2	1	2	3	4
IMPACT						
Adverse						
On-site external dose (Long-term radiological)				●	●	
Off-site external dose (Long-term radiological)				●	●	
Radon in on-site buildings				●	●	
Radiological impacts from on-site construction		o	o	●	●	o
Land use restrictions (radiological)	o	o		o	o	●
Biological disturbance (long-term)	(no effects or impacts)					
Construction costs (maximum)		o	●		o	o
Beneficial						
Control of on-site contaminated material	●	●	●			●
Storage of Latty Avenue contaminated material		●			●	●
Allowance for restricted land use	●	●	●	●	●	●
Construction costs (minimal)	●			●		

* ● Major Unavoidable Impact
o Significant Potential Impact

Alternatives 2 and 3 could likely result in unacceptable environmental impacts and are, basically, inconsistent with remedial program objectives. Alternative 1, although feasible and consistent with objectives, provides little benefit in land use given the long term FAA and zoning restrictions.

Selection of either of the proposed actions over Alternatives 1 or 4 has to be evaluated within the objectives of the Department of Energy Formerly Utilized Sites Remedial Action Program, to develop remedial action protocols for the management of contaminated sites in a manner that not only is cost effective in protecting public health and environmental quality, but also permits further use of these sites and resources.

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Appendix A

Deed Opinion-Legal Council

APPENDIX A

SUMMARY OF IMPLICATIONS OF LEGAL FRAMEWORK ON THE PROPOSED ALTERNATIVES

Land uses available for the St. Louis Airport Site are determined by various legal mechanisms, including: the Quit-Claim Deed (see attachment A-1) between the General Services Administration (on behalf of the various Federal agencies and interests); and, zoning, health and other such State and local regulations and ordinances. For purposes of this environmental legal analysis the potential effect of the second category is not considered to be a factor at this time. An analysis of the legal framework depends therefore on the direct legal effect of the Quit-Claim Deed and the indirect effect of the applicable Federal regulations (whether or not specifically referenced in the Deed). It should be noted that this summary is not intended to be a substitute for advice of legal counsel to any of the parties who may have legal rights affected by use or non-use of the site. Because of the complex legal issues involved, it is recommended that the parties (i.e. the Authority, the G.S.A., the F.A.A., etc.) seek advice of their own legal counsel.

EFFECT OF THE QUIT-CLAIM DEED

In his letter of September 18, 1978, Jack Peace, Esq. (see attachment A-2), advises in general that: the Quit-Claim Deed is a legally binding restriction on use of the site, as to the Authority and any subsequent transferree; the Deed probably does restrict land uses to aeronautical- or aviation-related uses; the Federal Government, through the General Services Administration, has the right to re-entry of the site for breach by the Authority of the Deed's conditions/covenants; that the disposition of additional radioactive materials not for the purposes of aeronautics or aviation is likely prohibited by the Deed; and, disturbance of the soil twelve inches below the surface contour shown on the 1971 topographical survey is not permitted without the consent of the AEC (NRC). The GSA, by unilateral release, may lessen or delete any or all such restrictions, and, the GSA and Authority, by bilateral release agreement, may delete, lessen or add additional restrictions under the Quit-Claim Deed. It should be noted also that the obligations of the Authority include maintenance of the site in accordance with present and future regulations, and that (due to the very broad language used) the consent of the AEC (NRC) and FAA is required for almost any possible proposed action. Further, it is assumed that the condemnation of the site in 1947 eliminated any third-party rights to minerals of other interests in the property, and that the Authority has not subsequently granted any such rights to third-parties since becoming grantee under the Deed. (Further investigation of this aspect is now under way.)

EFFECT OF FEDERAL REGULATIONS

Due to either a specific reference in the Deed or to the pervasive effect of statutory authority, certain Federal regulations restrict or limit available uses of the site.

Referenced specifically by the Deed are regulations of the AEC (NRC) at Paragraphs 7.P, 7.P.(1), and 7.P.(2) and the FAA at Paragraphs 7.A and 7.L. These references clearly render applicable the regulations of these agencies. Also applicable, but to a lesser extent, are the regulations promulgated pursuant to the Occupational Safety and Health Act (OSHA) and future regulations pursuant to the Resource Conservation and Recovery Act (under purview of the EPA).

It can be assumed that the OSHA regulations, applicable only to the employer-employee relationship, will be complied with in two ways: first, workers involved in construction activities by appropriate protective mechanisms supplied by their respective employers; second, ultimate users of the site by compliance with the AEC (NRC) regulations by the Authority and its transferrees.

The AEC (NRC) regulations are contained primarily in 10 CFR Part 20 Standards for Protection Against Radiation and 10 CFR Part 40 Licensing of Source Material. The most pertinent parts of Part 20 regulations provide as follows: that exposure to any individuals in restricted areas is limited, thereby affecting construction activities and final uses; that certain levels of exposure are prohibited in unrestricted areas; that disposal of covered wastes is prohibited except to authorized recipients; that no disposal by burial in soil is allowed except if less than a certain radiation level and at a minimum depth of four feet.

The key provisions of Part 40 requires a specific license for the possession, use, transfer, etc. of certain source materials (which includes any material, except fissionable material, containing by weight 0.05 percent or more of uranium, thorium, or any combination thereof) unless exempted. If the material at the site is above the defined threshold and not otherwise exempt, the Authority would seem to be required to secure a specific license to maintain at, transfer from, or accept at the site source material.

PROPOSED ACTIONS

The first proposed action is to maintain the site without additional material from the Latty Avenue site, in accordance with the requirements of the Quit-Claim Deed. Maintenance for conformance to applicable AEC (NRC) regulations will probably require the addition of fill material for cover to a depth of four feet. FAA approval is apparently required before any such maintenance activities are undertaken. It is assumed that consent of the AEC (NRC) for site maintenance both above existing topographical levels and below the twelve-inch line will be granted,

and that the Authority will be granted a specific license or exemption. It may be preferable to request a blanket consent from the GSA/FAA for certain types of normal site maintenance, or the GSA/FAA may wish to unilaterally release the Authority from the Deed restriction requiring consent for site maintenance which requires earth-moving "disturbance".

The second proposed action, addition of the Latty Avenue site material, creates additional questions. More germane at this point is the specific license requirement to receive the Latty Avenue material, which is presumed will be granted or found to be subject to exemption. Again specific consent from AEC (NRC) and FAA are required because of the revision of the existing topography. In addition, this second proposed action would seem to require a release from the GSA for this non-aeronautic use of the site, whereas site maintenance to the 1971 levels under the first proposed action would not require such a release. Maintenance to conform with present regulations (i.e. four foot of cover) under the first proposed action would however seem to require a GSA release, but since AEC (NRC) regulations require such maintenance the release would not seem to be a factor at this point.

ALTERNATIVES TO THE PROPOSED ACTION

Alternative 1 - Implementation of this action, once complete, would have the effect of removing the AEC (NRC) as a limiting authority from the Deed. Once the site was designated "unrestricted use" by AEC (NRC) all restrictions relating to AEC and radiation exposure would be released from the Deed by the GSA. This would have the effect of requiring only GSA/FAA consent for uses which, as with other actions, could be specifically defined in the form of a release.

Alternative 2 - Under this alternative, designation and release by the AEC (NRC) for "unrestricted use" assumes that the Authority would properly maintain the site. The ACE (NRC) could release its right of reversion under the Deed for failure by the Authority to conform to AEC (NRC) requirements, and instead rely on other statutory and regulatory sanctions to insure maintenance by the Authority. This approach would seem to require that the Authority be granted a specific license.

Alternative 3 - The same framework applicable to Alternative 2 applies to this alternative as well.

Alternative 4 - The GSA, by virtue of the Deed conditions/covenants has the right of reversion to regain title to the site, upon breach of one of the conditions and sixty day notice to the Authority. Failure to maintain the site or attempted development of the site without securing the necessary approval from GSA, FAA or NRC according to current regulations could be cause for the GSA's exercising of its right of reversion.

ATTACHMENT 1

MAC Airport Storage Site
Lambert-St. Louis Municipal Airport
St. Louis, Missouri - [illegible]
Contract No. [illegible]

QUITCLAIM DEED

1. THIS INDENTURE, made this 8th day of March, 1972, between the UNITED STATES OF AMERICA, acting by and through the Administrator of General Services, under and pursuant to the powers and authority contained in Section 13 (g) of the Surplus Property Act of 1944, (58 Stat. 765) as amended, (50 U.S.C. App. 1622 (g)), and the Federal Property and Administrative Services Act of 1949, approved June 30, 1949, (63 Stat. 377), as amended, and regulations and orders promulgated thereunder, party of the first part, as grantor, and the St. Louis Airport Authority, a body politic, created, operating and existing under and by virtue of the laws of the State of Missouri, party of the second part as grantee.

2. WITNESSETH, that the said grantor, for and in consideration of the assumption by the grantee of all the obligations and its taking subject to certain reservations, restrictions and conditions and its covenant to abide by, and its agreement to, certain other reservations, restrictions and conditions, all as set out hereinafter, has remised, released and forever quitclaimed and by the presents does remise, release and forever quitclaim to the grantee, its successors and assigns, without warranty expressed or implied, under and subject to the reservations, restrictions, conditions and exceptions, all as hereinafter expressed and set out, all right, title, interest, claim and demand which the grantor has in and to that certain property situate, lying and being in the County of St. Louis, in the State of Missouri, and described as follows, to wit:

3. A tract of land in U. S. Survey 7, Maria Des Liards Common Fields and in U. S. Survey 3096, as described: Beginning at an old stone set at the intersection of the northeast line of U. S. Survey 3096 with the north line of the right of way of Wabash Railroad, 100 feet wide; thence along the northeast line of U. S. Survey 3096, north 51 degrees 15 minutes west, 1112.08 feet to a stone in the south line of property conveyed to Catherine Graham, et al, by deed recorded in Book 358, page 411, of the records of the City (former County) of St. Louis; thence along the south line of said tract so conveyed to Catherine Graham, et al, south 82 degrees 14 minutes west, 1312.77 feet to a stone in the northwest line of said U. S. Survey 3096; thence along said survey line, South 39 degrees 7 minutes west 20.46 feet to an iron pipe in the northeast line of said U. S. Survey 7; thence along said northeast line of Survey 7, north 51 degrees 41 minutes west 28.90 feet to a point in the center line of the present ditch of the Cold Water Creek; thence along said center line, south 13 degrees 54 minutes west, 103.72 feet to a point of curve; thence southwardly along a curve to the left having a radius of 1536 feet, a distance of 199.72 feet to a point; thence south 6 degrees 27 minutes west, 40.48 feet to the northern line of the right of way of the Wabash Railroad Company, 100 feet wide; thence along said right of way line, south 85 degrees 23 minutes east 2274.48 feet to the beginning (excepting therefrom that part lying within Brown Road, as now established), all in St. Louis County, Missouri, containing 21.74 acres, more or less.

The property transferred hereby is transferred subject to all taxes lawfully accrued and unpaid and all special taxes and assessments, which grantee further assumes and agrees to pay, and subject to all, if any, existing easements, licenses, permits, and grants for roads, streets, highways, rights of way, drainage districts, public utilities, pipe lines, water lines, sewers, ditches, transmission lines, coal or mineral rights, reserved to or outstanding in third parties, in, on, over or across said property.

THE FOREGOING is conveyed as aeronautical use property, which has been determined essential, suitable, desirable or reasonably necessary to fulfill the immediate and foreseeable requirements of the grantee for the development, improvement, operation or maintenance of the airport.

4. WHEREAS, all the property hereby conveyed has heretofore been declared surplus to the needs of the United States of America, is presently under the jurisdiction of the General Services Administration, is available for disposal and its disposal by it is authorized by the Administrator of General Services, acting pursuant to the above referred to laws, regulations and orders.

5. TO HAVE AND TO HOLD the same, together with all and singular the appurtenances thereunto belonging or in anywise appertaining, and all the estate, right, title, interest or claim whatsoever of the grantor, either in law or in equity and subject to the reservations, restrictions and conditions set forth in this instrument, to the only proper use, benefit and behalf of the grantee, its successors and assigns forever.

6. NOW THEREFORE, by the acceptance of this Deed or any rights hereunder, the grantee, for itself, its successors and assigns, agrees that the transfer of all the property transferred by this instrument, is accepted subject to the following restrictions set forth in subparagraphs (a) and (b) of this paragraph, which shall run with the land:

(a) That, except as provided in subparagraph A of numbered paragraph 7, the property transferred by this instrument shall be used for public airport purposes for the use and benefit of the public, on reasonable terms and without unjust discrimination and without grant or exercise of any exclusive right for use of the airport within the meaning of the term "exclusive right" as used in subparagraph C of the numbered paragraph 7. As used in this instrument, the term "airport" shall be deemed to include all land, buildings, structures, improvements and equipment used for public airport purposes.

(b) That, except as provided in subparagraph A of the numbered paragraph 7, the entire landing area, as defined in Section 101 of the Federal Aviation Act of 1958, as amended, and Federal Aviation Regulations pertaining thereto and all structures, improvements, facilities and equipment in which this instrument transfers any interest shall be maintained for the use and benefit of the public at all times in safe and serviceable condition to assure its efficient operation and use, provided, however, that such maintenance shall be required as to structures, improvements, facilities and equipment only during the useful life thereof, as determined by the Administrator of the Federal Aviation Agency (FAA) or his successor in function. In the event materials are required to rehabilitate or repair certain of the aforementioned structures, improvements, facilities or equipment, they may be procured by demolition of other structures, improvements, facilities or equipment transferred hereby and located on the above land which have outlived their use as airport property in the opinion of the Administrator of the FAA or his successor in function.

7. FURTHER, by the acceptance of this Deed or any rights hereunder, the grantee for itself, its successors and assigns, also assumes the obligation of, covenants to abide by and agree to, and this transfer is made subject to, the following reservations and restrictions set forth in subparagraphs A to P, inclusive, of this paragraph, which shall run with the land: Provided that the property transferred hereby may be successively transferred only with the proviso that any such subsequent transferee assumes all the obligations imposed upon the grantee by the provisions of this instrument.

A. That no property transferred by this instrument shall be used, leased, sold, salvaged, or disposed of by the grantee for other than the airport purposes without the written consent of the Administrator of the FAA. The term "property" as used herein is deemed to include revenues or proceeds derived therefrom.

B. Property transferred for the development, improvement, operation or maintenance of airport shall be used and maintained for the use and benefit of the public on fair and reasonable terms without unjust discrimination. In furtherance of this covenant (but without limiting its general applicability and effect) the grantee specifically agrees (1) that it will keep the air-

agree to all types, kinds, and classes of aeronautical use without discrimination between such types, kinds and classes. Provided, that the grantee may establish such fair, equal, and not unjustly discriminatory conditions to be met by all users of the airport as may be necessary for the safe and efficient operation of the airport; and provided, further, that the grantee may prohibit or limit any given type, kind or class of aeronautical use of the airport if such action is necessary for the safe operation of the airport or necessary to serve the civil aviation needs of the public. (2) That in its operation and the operation of facilities on the airport, neither it nor any person or organization occupying space or facilities thereupon will discriminate against any person or class of persons by reason of race, color, creed, or national origin in the use of any of the facilities provided for the public on the airport. (3) That in any agreement, contract, lease, or other arrangement under which a right or privilege at the airport is granted to any person, firm or corporation to conduct or engage in any aeronautical activity for furnishing services to the public at the airport, the grantee will insert and enforce provisions requiring the contractor: (a) to furnish said service on a fair, equal and not unjustly discriminatory basis to all users thereof, and (b) to charge fair, reasonable and not unjustly discriminatory prices for each unit of service, provided, that the contractor may be allowed to make reasonable and nondiscriminatory discounts, rebates, or other similar types of price reductions to volume purchasers. (4) That the grantee will not exercise or grant any right or privilege which would operate to prevent any person, firm, or corporation operating aircraft on the airport from performing any services on its own aircraft with its own employees (including, but not limited to maintenance and repair) that it may choose to perform. (5) That in the event the grantee itself exercises any of the rights and privileges referred to in subsection (3) above the services involved will be provided on the same conditions as would apply to the furnishing of such services by contractors or concessionaires of the grantee under the provisions of such subsection (3) of this paragraph 7 D.

C. The grantee will not grant or permit any exclusive right for the use of the airport at which the property described herein is located which is forbidden by Section 308 of the Federal Aviation Act of 1958, as amended, by any person or persons to the exclusion of others in the same class and will otherwise comply with all applicable laws. In furtherance of this covenant (but without limiting its general applicability and effect), the grantee, specifically agrees that, unless authorized by the Administrator, it will not either directly or indirectly, grant or permit any person, firm or corporation the exclusive right to conduct any aeronautical activity on the airport including but not limited to, charter flights, pilot training, aircraft rental and sightseeing, aerial photography, crop dusting, aerial advertising and surveying, air carrier operations, aircraft sales, and services, sale of aviation petroleum products whether or not conducted in conjunction with other aeronautical activity, repair and maintenance of aircraft, sale of aircraft parts, and any other activities which because of their direct relationship to the operation of aircraft can be regarded as an aeronautical activity. The grantee further agrees that it will terminate as soon as possible and no later than the earliest renewal, cancellation, or expiration date applicable thereto, any exclusive right existing at any airport owned or controlled by the grantee and that, thereafter, no such right shall be granted. However, nothing contained herein shall be construed to prohibit the granting or exercise of exclusive right for the furnishing of nonaviation products and supplies or any service of a nonaeronautical nature or to obligate the grantee to furnish any particular nonaeronautical service at the airport.

D. The grantee shall, insofar as it is within its powers and to the extent reasonable, adequately clear and protect the aerial approach to the airport. The grantee will, either by the acquisition and retention of easements or other interests in or rights for the use of land airspace or by the adoption and enforcement of zoning regulations, prevent the construction, erection, alteration, or growth of any structure, tree, or other object in the approach areas of the runways of the Airport which would constitute an obstruction to air navigation according to the criteria or standards prescribed in Part 77 of the Federal Aviation Regulations, as applicable, according to the currently approved airport layout plan. In addition, the grantee will not erect or permit the erection of any permanent structure or facility which would interfere materially with the use, operation, or future development of the Airport, in any portion of a runway approach area [illegible] the grantee has acquired, or may hereafter acquire, property interest permitting it to do control and the use of the surface of

land. Insofar as it is within its power and to the extent reasonable the grantee will take action to restrict the use of the land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations including landing and take-off of aircraft.

E. The grantee will operate and maintain in a safe and serviceable condition, as deemed reasonably necessary by the Administrator of the FAA, the airport and all facilities thereon and connected therewith which are necessary to service the aeronautical users of the airport other than facilities owned or controlled by the United States and will not permit any activity thereon which would interfere with its use for airport purposes: Provided, that nothing contained herein shall be construed to require that the airport be operated for aeronautical uses during temporary periods when snow, flood, or other climatic conditions interfere with such operation and maintenance, repair, restoration or replacement of any structure or facility which is substantially damaged or destroyed due to an act of God or other condition or circumstance beyond the control of the grantee.

F. That the grantee will make available all facilities of the airport at which the property described herein is located or developed with Federal aid and all those usable for the landing and taking off of aircraft to the United States at all times, without charge, for use by aircraft of any Agency of the United States in common with other aircraft, except that if the use by aircraft of any Agency of the United States in common with other aircraft, is substantial, a reasonable share, proportional to such use, of the cost of operating and maintaining facilities so used, may be charged; and unless otherwise determined by the FAA, or otherwise agreed to by the grantee and the using Federal Agency, substantial use of an airport by United States aircraft will be considered to exist when operations of such aircraft are excess of those which, in the opinion of the FAA, would unduly interfere with use of the landing area by other authorized aircraft or during any calendar month that (1) either five (5) or more aircraft of any Agency of the United States are regularly based at the airport or on land adjacent thereto, or (2) the total number of movements (counting each landing as a movement and each take-off as a movement) of aircraft of any Agency of the United States is 300 or more, or (3) the gross accumulative weight of aircraft of any Agency of the United States using the airport (the total movements of such Federal aircraft multiplied by gross certified weights thereof) is in excess of five million pounds.

G. The grantee will not permit any structure, other than structures required for aids to air navigation and such other structures as may be specifically excepted in writing by the FAA, to be erected or remain on the land herein described and to and in which the grantor's property interest is hereby conveyed nor will it permit any use to be made of the said land which would result in or create electrical or electronic interference with electronic air navigational aids or aeronautical radio communications or smoke, lights or glare or other impairment to the vision of pilots of aircraft using the above-identified airport or which would render it difficult for such pilots to distinguish between airport lights and others, or which would create noisome odors or attract waterfowl or otherwise endanger or be hazardous to aircraft landing at, taking off from or maneuvering in the vicinity of the said airport, or permit any object of natural growth on the said land within 200 feet of an Approach Light System component to extend above the plane of the light path thereof.

H. The grantee does hereby release the Government, and will take whatever action may be required by the Administrator of the FAA to assure the complete release of the Government from any and all liability the Government may be under for restoration or other damage under any lease or other agreement covering the use by the Government of the airport, or part thereof, owned, controlled or operated by the grantee, upon which, adjacent to which, or in connection with which, any property transferred by this instrument was located or used: Provided, that no such release shall be construed as depriving the grantee of any right it may otherwise have to receive reimbursement under Section 17 of the Federal Airport Act of 1946, as amended, for the necessary rehabilitation or repair of public airports heretofore or hereafter substantially damaged by any Federal ag

I. That whenever so requested by the FAA, grantee will furnish without cost to the Federal Government, for construction, operation and maintenance of facilities for air traffic control activities, or weather reporting activities, or communication activities related to air traffic control, such areas of the property described herein or rights in buildings on the airport at which the property described herein is located, as the FAA may consider necessary or desirable for construction at Federal expense of space or facilities for such purposes, and the grantee will make available such areas or any portion thereof for the purposes provided herein within 2 months after receipt of written request from the FAA, if such are or will be available.

J. The grantee will: (1) furnish the FAA with annual or special airport financial and operational reports as may be reasonably requested using either forms furnished by the FAA or in such manner as it elects so long as the essential data are furnished, and (2) upon reasonable request of the FAA; make available for inspection by and duly authorized representative of the FAA the airport, at which the property described herein is located, and all airport records and documents affecting the Airport, including deeds, leases, operation and use agreements, regulations, and other instruments and will furnish to the FAA a true copy of any such document which may be reasonably requested.

K. And, that the grantee will not enter into any transaction which would operate to deprive it of any of the rights and powers necessary to perform or comply with any or all of the covenants and conditions set forth herein unless by such transaction the obligation to perform or comply with all such covenants and conditions is assumed by another public agency found by the FAA to be eligible as a public agency as defined in the Federal Airport Act of 1946, as amended, to assume such obligation and have the power, authority, and financial resources to carry out all such obligations and. if an arrangement is made for management or operation of the Airport by any agency or person other than the party of the second part, it will reserve sufficient rights and authority to insure that such Airport will be operated and maintained in accordance with these covenants and conditions, any applicable Federal Statute, and the Federal Aviation regulations.

L. And, that the grantee will keep up to date at all times an airport layout map of the Airport at which the property described herein is located showing: (a) the boundaries of the Airport and all proposed additions thereto, together with the boundaries of all offsite areas owned or controlled by the grantee for airport purposes and proposed additions thereto; (b) the location and nature of all existing and proposed airport facilities and structures (such as runways, taxiways, aprons, terminal buildings, hangars, and roads), including all proposed extension and reductions of existing airport facilities; (c) the location of all existing and proposed nonaviation areas and of all existing improvements thereon and uses made thereof and such airport layout map and each amendment, revision, or modification thereof, shall be subject to the approval of the FAA, which approval shall be evidenced by the signature of a duly authorized representative of the FAA on the face of the airport layout map, and the grantee will not make or permit the making of any changes or alterations in the Airport or any of its facilities other than in conformity with the airport layout map as so approved by the FAA, if such changes or alterations might adversely affect the safety, utility, or efficiency of the Airport.

M. And, that if at any time it is determined by the FAA that there is any outstanding right or claim of right in or to the Airport property, described herein, the existence of which creates an undue risk of interference with the operation of the Airport or the performance of compliance with covenants and conditions set forth herein, the grantee will acquire, extinguish or modify such right or claim of right in a manner acceptable to the FAA.

N. That in the event that any of the aforesaid terms, conditions, reservations, or restrictions are not met, observed, or complied with by the grantee or any subsequent transferee, whether caused by the legal inability of said grantee or subsequent transferee to perform any of the obligations herein set out, or otherwise, the title, right of possession and all other

rights transferred by this instrument to the grantee, or any portion thereof, shall at the option of the grantor revert to the grantor in its then existing condition sixty (60) days following the date upon which notice to this effect is made in writing by the Administrator of the FAA or his successor in function, unless within said sixty (60) days such default or violation shall have been cured and all such terms, conditions, reservations and restrictions shall have been met, observed, or complied with, in which event said reversion shall not occur and title, right of possession, and all other rights transferred hereby, except such, if any, as shall have previously reverted, shall remain vested in the grantee, its transferees, successors and assigns.

O. That the construction as covenants of any of the foregoing reservations and restrictions recited herein as covenants or the application of the same as covenants in any particular instance is held invalid, the particular reservation or restrictions in question shall be construed instead merely as conditions upon the breach of which the Government may exercise its option to cause the title, interest, right of possession, and all other rights transferred to the grantee, or any portion thereof, to revert to it, and the application of such reservations or restrictions as covenants in any other instance and the construction of the remainder of such reservations and restrictions as covenants shall not be affected thereby.

P. The grantee has inspected and is fully familiar with the physical condition of the tract of land herein conveyed. The Government has made no representation, warranties, or undertakings as to such condition or that the land is free and clear of all contamination and hidden hazards, or as to the fitness or availability of the land for any particular use. The Government has transmitted to the grantee available information on radiation and contamination levels with respect to the lands herein conveyed and the grantee acknowledges the receipt of this information. The grantee recognizes that the subsurface of the tract of land herein conveyed is contaminated with source material as defined in the Atomic Energy Act of 1954, as amended, and in the Atomic Energy Commission regulations, and that future use of such tract shall be dependent upon the effectiveness of the cover and fill material in reducing external radiation to acceptable levels. The grantee hereby covenants for itself, its successors, and assigns that:

(1) There shall be no removal of earth covered by excavation, drilling, or other disturbance without prior notice to the United States Atomic Energy Commission, Washington, D. C., or if the State of Missouri has executed and there is in effect an Agreement with the United States Atomic Energy Commission, pursuant to Section 274b of the Atomic Energy Act of 1954, as amended, to the State of Missouri department or agency responsible for the licensing and regulation of radioactive materials; provided that this restriction shall apply only to any excavation, drilling, or other disturbance affecting the earth more than 12 inches below the site elevations as they existed on October 7, 1971, as shown on topographic survey map prepared by Rowland Surveying Company, Inc., Clayton, Missouri, which map is attached hereto and made a part hereof; and

(2) All applicable regulatory requirements of the Atomic Energy Commission or any State agency having regulatory authority over radioactive material shall be complied with.

8. AND IT IS FURTHER AGREED AND UNDERSTOOD by and between the parties hereto and the grantee, by its acceptance of this Quitclaim Deed, acknowledges its understanding of the agreement, and agrees that, as part of the consideration for this deed, the grantee covenants and agrees for itself, its successors and assigns, that: (1) the program for or in connection with which this Deed is made will be conducted in compliance with, and the grantee, its successors and assigns, will comply with all requirements imposed by or pursuant to the regulations of the FAA as in effect on the date of this Deed (14 CFR Part 15) issued under the provisions of Title VI of the Civil Rights Act of 1964; (2) this covenant shall be subject in all respects to the provisions of said regulations; (3) the grantee, its successors and assigns, will promptly take and continue to take such actions as may be necessary to effectuate this covenant; (4) the United States shall

have the right to seek judicial enforcement of this covenant; (5) the grantee, its successors and assigns, will: (a) obtain from any person (any legal entity) who, through contractual or other arrangements with the grantee, its successors and assigns, is authorized to provide services or benefits under said program, a written agreement pursuant to which such other person shall, with respect to the services or benefits which he is authorized to provide, undertake for himself the same obligations as those imposed upon the grantee, its successors and assigns, by this covenant; (b) furnish the original of such agreement to the Administrator of the FAA, or his successor, upon his request therefor; and that this covenant shall run with the land hereby conveyed, and shall in any event, without regard to technical classification or designation, legal or otherwise, be binding to the fullest extent permitted by law and equity for the benefit of, and in favor of the grantor and enforceable by the grantor against the grantee, its successors, and assigns.

IN WITNESS WHEREOF, the party of the first part has caused this Quitclaim Deed to be executed in its name and on its behalf, the day and year first above written.

UNITED STATES OF AMERICA
Acting by and through
Administrator of General Services

By _____
Chief, Real Property Division
Property Management and Disposal Service
General Services Administration
Region 6
Kansas City, Missouri

WITNESSES:

_____

_____

ACKNOWLEDGMENT

STATE OF MISSOURI)
) SS
COUNTY OF JACKSON)

I, Wilbur F. Fidler, a Notary Public in and for said State and County aforesaid, do certify that on the 24th day of March, 1972, before me appeared Charles W. McKinney, Chief, Real Property Division, who executed the foregoing deed, to me personally known, and known to me to be such Chief, Real Property Division, who being by me duly sworn did say that he is such Chief, Real Property Division, and that he signed his name and caused the seal of the General Services Administration to be affixed to said deed in pursuance of proper authority, and that said deed was signed and sealed by him as such Chief, Real Property Division, on behalf of the UNITED STATES OF AMERICA; and that said Charles W. McKinney acknowledged the execution of said deed to be his free act and deed as such Chief, Real Property Division, and the free act and deed of the UNITED STATES OF AMERICA, by the Administrator of General Services, and the free act and deed of the General Services Administration, acting for the UNITED STATES OF AMERICA, and that the seal affixed to said deed is the official seal of the General Services Administration.

IN WITNESS WHEREOF, I hereunto set my hand in the County and State aforesaid on the date last above written.

_____
Wilbur F. Fidler
Notary Public

My Commission Expires: August 14, 1972.

ACCEPTANCE

The St. Louis Airport Authority does hereby accept this quitclaim deed and by such acceptance agrees to all of the terms and conditions thereof.

Executed this 15th day of May, 1973.

(Official Seal)

By _____
David E. Leigh
Title Acting Director of Airports

Attest: _____
Grace Heneck
Title Register

By _____
John F. Bass, Sr.
Title Comptroller

Certificate of Grantee's Attorney

I, Jack L. Koehr, acting as attorney for the St. Louis Airport Authority herein referred to as the "grantee" do hereby certify: That I have examined the foregoing quitclaim deed and the proceedings taken by the grantee relating thereto and find that the acceptance thereof by the grantee has been duly authorized and that the execution thereof is in all respects due and proper and in accordance with the laws of the State of Missouri, and further that, in my opinion, the Quitclaim Deed constitutes a legal and binding compliance obligation of the grantee in accordance with the terms thereof.

Dated at St. Louis, Missouri the 15th day of May, 1973.

By _____

Title _____

CERTIFICATE

STATE OF MISSOURI)
)
CITY OF ST. LOUIS)

I the undersigned duly appointed and acting Register of the City of St. Louis, State of Missouri, do hereby certify that the foregoing is a true and correct copy of the executed Acceptance of a Quit Claim Deed dated March 8, 1972, between the United States of America, acting by and through the Administrator of General Services, as grantor and the St. Louis Airport Authority as grantee, which is filed in the Office of the Recorder of Deeds of St. Louis County, Missouri, Book 6666 pages 541 through 548, and the Original of which is now on file in this Office, as required by Article IX, Section 1 of the Charter of the City of St. Louis, as Deed No. 1751.

Witness my hand and the Seal of the City of St. Louis this 21st day of June, 1973.

Grace Heneck
Register

(Official Seal)

ratifying and adopting the acceptance of said land and the execution of said agreement by the Director of Airports and the Comptroller of the City of St. Louis.

BE IT ORDAINED BY THE CITY OF ST. LOUIS, AS FOLLOWS:

Section One. The Airport Authority, the Director of Airports and the Comptroller of the City of St. Louis on behalf of said City are hereby authorized to accept title to land offered by the United States of America acting by and through the Administrator of General Services by Quitclaim Deed, being Contract No. GS-06-DR-(S)-9-C085, and to execute said acceptance as set out above.

Section Two. The action of the Director of Airports and the Comptroller in accepting and executing said acceptance on behalf of the City of St. Louis together with all statements, representations, warranties and agreements contained in said Quitclaim Deed is hereby ratified and adopted.

STATE OF MISSOURI }
CITY OF ST. LOUIS } ss:

I, the undersigned Register of said City do hereby certify the foregoing to be a true copy of

ORDINANCE No. 56433

APPROVED: FEBRUARY 13, 1973

the original of which is on file in this office.

Witness my hand and the seal of the City of St. Louis this 29TH day of MARCH 1973.

REGISTER

ATTACHMENT 2

COUNSEL

SEP 21 1978

Roy F. Weston

STOCKARD, ANDERECK, HAUCK, SHARP & EVANS
ATTORNEYS AT LAW
P. O. BOX 549
9TH AND WASHINGTON STREET
TRENTON, MISSOURI 64683
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GREGORY C. STOCKARD
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ERWIN L. MILNE
JACK PEACE
PATRICK A. BAUMHOER

JEFFERSON CITY OFFICE
P. O. BOX 1280
101 WEST McCARTY STREET
JEFFERSON CITY, MISSOURI 65101
314-634-3422

September 18, 1978

Roy F. Weston, Inc.
Weston Way
West Chester, Pennsylvania 19380

Attention: James D. Hobbs, Jr.
General Counsel

Re: Quit-Claim Deed, St. Louis Airport

Dear Jim:

Pursuant to our telephone conversations and your letter of September 8, 1978, I have researched Missouri law on the effectiveness of a Quit-Claim Deed conveying certain property from the United States Government to the St. Louis Airport Authority, which Quit-Claim Deed is recorded in Book 6666, Page 541 in the Recorder of Deeds Office of St. Louis County.

How effective is the Quit-Claim Deed under applicable law in restricting land use? In Missouri, a Quit-Claim Deed is a recognized method of imposing restrictions on land use, even though the Grantee may not have signed any agreement. The mere acceptance of the Deed and the rights under the Deed by the Grantee binds him to perform the covenants recited therein. Mozingo vs. Mozingo, 149 S.W.2d 897 (1941).

Do the Deed restrictions restrict land use to aeronautical or aviation purposes only or can the site be used for police academy driving school? It appears from an examination of the Quit-Claim Deed that the intent of the United States Government (through the General Services Administration), was that this land be used for aviation purposes only. The general rule is that the Grantor of land may restrict the use of land in any particular way, as long as the restriction does not violate public policy. Noel vs. Hill, 138 S.W. 364 (1911). It is doubtful that a Missouri Court would hold this restriction to aeronautical use only to be against public policy.

It is likewise my opinion that these restrictions do not violate the rule forbidding restraints on alienation of land since the Grantee may convey the property at his pleasure, subject, of course, to the same conditions and covenants. Nor are the restrictions violative of the rule against perpetuities since the Grantor can release the restrictions at any time. Swain vs. Maxwell, 196 S.W.2d 780 (1946).

In short, although restrictive covenants such as found in this Deed are looked upon with a jaundiced eye, if the terms of the Deed imposing the restrictions are clear and unambiguous, the restrictions or covenants will be enforced.

Whether or not the restrictions are considered to be covenants or conditions could have some effect on the type of remedy available to the Government. The remedy for breached covenant is usually simply one at law. In other words, there is no reversion; the Grantor must allege and prove money damage. The remedy for a breached condition, on the other hand, is usually the power in the Grantor to terminate the Grantee's interest in the property; to re-enter the property. The Quit-Claim Deed here in question appears to impose restrictive covenants rather than conditions. Therefore, the remedy would be limited to a suit at law for monetary damages, if any. But, the Deed also contains a specific provision for re-entry by the Grantor in sixty days if the covenants are breached. As in any contractural agreement, the intention of the parties as shown by the agreement governs and, if the intent of the St. Louis Airport Authority was that the U. S. Government have this right of re-entry, then the right will likely be enforced even though the right is not normally associated with the breach of a covenant. In short, the reversionary right in this Deed is very likely enforceable as written. The Government may not, of course, enforce this right, in which event, there would be a waiver, but I would not recommend assuming the Government would not act.

Also, be aware that in the proper circumstance, Missouri Courts will grant injunctive relief to prevent an anticipated violation of the covenant. Duncan vs. Academy of the Sister of the Sacred Heart, 350 S.W.2d 814 (1961).

What is the effect of the reversion right in the Quit-Claim Deed? This has essentially been answered in the discussion above but to summarize:

a. Usually, for the breach of a covenant, monetary damages is the remedy.

b. However, when there is a specific agreement for the right of re-entry, then the Court will likely enforce that remedy. Consequently, it appears that this reversionary interest is clearly set forth, not ambiguous, and could be enforced.

Can additional nuclear-contaminated material be brought to the site? To answer this, I think we must agree that the restrictive covenants conditions in the Deed are effective and valid and that generally these restrictions require that the property be used for aeronautical purposes only. If the nuclear material is brought to the area for aviation purposes, then we are within the terms of the restrictive covenants and no violation occurs. On the other hand, if the nuclear material has no relation to aeronautical or aviation purposes, then it would likely be deemed a violation of the specific covenants of this Deed.

Can the upper soil cover be removed along with the existing contaminated soil to another site? On page 6 of the Quit-Claim Deed there appears the restriction in pertinent part "There shall be no removal of earth ... without prior notice to the United States Atomic Energy Commission ... provided that this restriction shall apply only to any excavation ... effecting the earth more than twelve inches below the site elevations as they existed on October 7, 1971 ..." What we are talking about then is simply an intrepretation of this covenant to determine whether or not a particular disturbance of the soil will result in a violation thereof. Essentially, anything can be done to the top twelve inches of the soil even to the extent of having it removed. If the contaminated soil is below the top twelve inches, in other words thirteen or fourteen inches below the surface, then it appears that notice must be given to the AEC.

What methods might be available to avoid these restrictions? A Petition seeking a Declaratory Judgment would seem to be out of the question. I think the law is clear that a Deed is a proper method to impose restrictions and that these restrictions as imposed in this Deed would be considered valid and enforceable by a Missouri Court. In other words, a Declaratory Judgment would simply be an uphill battle with little hope of having these restrictions declared void. The answer seems to lie in simply the fact that any Grantor

may release the restrictions that he has imposed on his property. Likewise, a Grantor may release some restrictions he has previously imposed and not others. I would simply suggest that the Grantor of this property, namely the United States Government acting through the General Services Administration, be contacted and negotiate the release or expungement of those restrictions deemed necessary to effectuate and permit the expected use of this property. Any such agreement should, of course, be filed of record with the St. Louis County Recorder of Deeds office and should specifically refer to this particular Quit-Claim Deed.

Yours very truly,

Jack Peace

JP:fm

ATTACHMENT 3

inter-office memorandum

TO: F. Benenati

DATE: 11 October 1978

cc: D. Phoenix

FROM: J. Hobbs

SUBJECT: St. Louis Airport - Third Party Rights W. O. No.:

Because of the questions raised about the existence of third party rights and interests in the St. Louis Airport Site, I requested local legal counsel, Jack Peace, Esq., to prepare a title search to investigate that matter. In the interests of time, it was decided to have the title researched beginning with the 1947 Condemnation Order, assuming that the Order had condemned all interests in the property at that time.

Attached is a copy of this limited title opinion prepared by Mr. Peace. Briefly, it concludes: There is a reasonable certainty that the Condemnation Order condemned all interest in the property, with exception of "existing easements for public roads and highways, for public utilities, for railroads and for pipelines, and, to right of way condemned by drainage district Number 2-A for channel of Cold Water Creek across West part of property"; there may be some leasehold interest in the property under lease to McDonnell Aircraft Corporation; the State Highway Commission and Drainage District Number 2-A claim some interest in the property; the Laclede Gas Company is holder of an easement to install and construct an 8" gas main (see further discussion below); the McDonnell Aircraft Corporation is holder of an easement for the construction of a sanitary sewer pipeline; an aerial easement granted in favor of the City of St. Louis includes a provision restricting the Federal Government (until October 1987) from erecting any building or structure higher than 550 feet above sea level; the Metropolitan St. Louis Sewer District is holder of an easement for a sanitary sewer pipeline; the McDonnell Douglas Corporation is holder of an easement for installation of sewer pipeline; The City of St. Louis, by ordinance, has restricted construction of buildings or other structures in the floodplain of Cold Water Creek; there are other restrictions by virtue of the Quit-Claim Deed to the St. Louis Airport Authority; there appear to be no thirty party interests in minerals.

The practical effect of these third party rights is that before a proposed action is initiated, the consent of the holders of these easements (to the extent of their easement) will be required. No action is allowed which will have the effect of impairing of making burdensome the use of an easement. Any action, therefore, will have to be carried out with due consideration for their prior third party rights.

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October 9, 1978

Roy F. Weston, Inc.
Weston Way
West Chester, Pennsylvania 19380

Attention: James D. Hobbs, Jr.

Dear Jim:

Enclosed please find the material provided me by the St. Paul Title Insurance Corporation of Clayton, Missouri, on the 21.74 acres conveyed by the United States to the St. Louis Airport Authority. Also, for your information, please find a copy of my letter to St. Paul Title requesting this information.

Your problem presented to me was to attempt to determine whether or not there were any third party rights affecting this land. It appears that there are. I will point out here that because of the time element involved, I did not check the legal descriptions of the property on each of the documents enclosed. I have merely assumed that because the documents were included by St. Paul Title that they do affect, in one way or another, the 21.74 acres herein involved. If time later on permits, you may want to examine these documents more closely, especially in regard to the legal descriptions to insure that each deals with the property of which we are concerned.

First off, let us examine the Condemnation Order which was entered in the United States District Court for the Eastern District of Missouri, Docket Number 4899, which is recorded in Book 2209, Page 352. I can say with reasonable certainty that all interest in the property were condemned by this Order, except as those hereinafter noted. Please note that I used the phrase "reasonable certainty" because, as you know, without an abstract showing all interest prior to 1947 and prior to the entry of this Condemnation Order, absolute certainty cannot be obtained.

The reason that I feel that all interest were condemned is two-fold. First, the Condemnation Order indicates that the property was condemned in "Fee Simple Absolute". Generally, when fee simple absolute

is condemned, all interests are condemned. Secondly, the right to just compensation for the property taken is vested in the persons entitled thereto. In other words, a sum of money was paid into the registry of the Court. The Condemnation Order provides this sum of money is to be distributed to the people who may have an interest in the property. For example, if a person owns the mineral interest, he would be entitled to a portion of the Condemnation proceeds. The surface owner would be entitled to a portion of the proceeds, et cetera. In short, the "just compensation" is to be distributed to the title owners as shown and if they receive money, then their interest would be extinguished.

However, the Condemnation Order does specifically except and subject the Order to "existing easements for public roads and highways, for public utilities, for railroads and for pipelines, and, to right of way condemned by drainage district number 2-A for channel of Cold Water Creek across West part of property." Thus, this Condemnation Order would not condemn property that would be deemed to be a public road or highway or be deemed as being used for public utilities or railroads or pipeline or to the area of land used by the drainage district.

Also, the Condemnation Order states that there is a declaration of taking containing a statement of the estate and interest in the said land taken for said public use. If time had permitted, we should obtain a copy of this "declaration of taking" to see the exact estate or interest being condemned. However, as indicated above, it appears that fee simple absolute was the nature of the estate or interest condemned.

The next entry is a Quit-Claim Deed recorded in Book 2408, Page 332 wherein the United States War Assets Administration conveys certain buildings and property to the City of St.Louis. This document also surrenders and assigns a lease hold interest to the City of St. Louis and further grants the City of St. Louis the right to use a cooling tower and other equipment. If any of these buildings are on the 21.74 acres, then the City of St. Louis will have an interest since I find no subsequent entries where the City of St. Louis has extinguished its right and title to the property.

The next entry is a Quit-Claim Deed, recorded in Book 2479, Page 387, wherein the Reconstruction Finance Corporation quit-claims a parcel of property to the United States of America. The property conveyed is commonly known as that portion of the McDonald Aircraft Corporation facility lying north of the Wabash Railroad Company track.

The next entry is a lease recorded in Book 2565, Page 445, which is a lease from the United States to McDonnell Aircraft Corporation. This is a summary of a lease only and therefore the actual terms of the lease are unknown. It is likely that this property herein leased is the same as that previously conveyed by the Reconstruction Finance Corporation to the United States of America, above mentioned. However, if any of this leasehold property is included within the 21.74 acres, then McDonnell Aircraft Corporation would have an interest as Lessee.

The next entry is an easement recorded in Book 2853, Page 421. This is an easement from Drainage District Number 2-A of St. Louis County to the State Highway Commission for State Highway purposes. From the Condemnation Order above discussed and from this document, the Drainage District is definitely claiming some interest in the property. Also, the State Highway Commission would have some interest in those areas where their highways are located.

The next entry is a conveyance recorded in Book 2895, Page 47. This is a conveyance by McDonnell Aircraft Corporation to the State Highway Commission. This is again a conveyance for State Highway purposes.

The next entry is a conveyance recorded in Book 3178, Page 456. This is a grant of easement from the United States to the Laclede Gas Company for purposes of installing and constructing an 8 inch gas main to service McDonnell Aircraft Corporation. Consequently, Laclede Gas Company would have some interest in the 21.74 acres as holders of this easement. Please note condition number 11 of that easement wherein the United States reserves all uranium, thorium, and all other materials determined pursuant to Section 5(b)(1) of the Atomic Energy Act to be essential to the production of fissionable material. That condition states that any such material in quantities which may not be transferred without a license under the Atomic Energy Act shall be the property of the United State Atomic Energy Commission. Presumably, any such material of a quantity not requiring a license would not be reserved. I mention this condition only for its possible application to our situation. For example, would small quantities of fissionable material be deemed to be the St. Louis Airport Authorities' property? Conversely, are larger quantities deemed to be the property of the United States Atomic Energy Commission? The Atomic Energy Commission rules and regulations should certainly be perused.

The next entry is simply identified as number 5, 10-18-56. This is a grant of easement from the United States to the McDonnell Aircraft Corporation. This is an easement for the construction of a sanitary sewer pipeline. Consequently, McDonnell Aircraft may have an interest in the acreage to the extent of this easement.

The next entry is a Quit-Claim Deed recorded in Book 4765, Page 44. This is a conveyance by the United States of America to the McDonnell Aircraft Corporation. This is a conveyance of approximately 7.332 acres and I doubt that this acreage falls within the boundaries of our 21.74 acres.

The next entry is an easement recorded in Book 4970, Page 593. This is an easement for a period of 25 years running from the United States of America to the City of St. Louis. This easement specifically obligates the United States of America to refrain from erecting or building any building or structure in excess of an elevation higher than 550 feet above sea level. If this property conveyed by this easement falls within the 21.74 acres, then this building height restriction would apply.

The next entry is an easement recorded in Book 5119, Page 118. This is an easement from the United States of America to the Metropolitan St. Louis Sewer District. It is a conveyance for sanitary sewer pipeline. Again, if this sewer easement is on the 21.74 acres, then the Metropolitan St. Louis Sewer District would have an interest to the extent of the rights granted in the easement.

The next entry is an easement recorded in Book 6329, Page 1467. This is an easement from the United States to McDonnell Douglas Corporation. This is a conveyance for purposes of installation of sewer pipeline. Again, if this is located on the 21.74 acres, which I assume that it does, as mentioned above, since St. Paul Title included it in the chain of title, then McDonnell Douglas would have an interest in the property to the extent of the rights granted in this easement.

The next entry is an ordinance of the City of St. Louis recorded in Book 6502, Page 2287. This ordinance establishes building or floodway reservation lines along Cold Water Creek. In other words, buildings or other structures could not be built within certain areas because of the hazards of flooding. Again, since St. Paul Title included this document I assume that it affects a portion of our property and consequently buildings may not be erected in certain areas as therein described because of the possibility of flooding and property damage.

The last entry is then the Quit-Claim Deed whereby the United States of America conveys the property to the St. Louis Airport Authority, which Deed is recorded in Book 6666, Page 541. This Quit-Claim Deed has been discussed in some detail in previous correspondence. In conclusion, there are some property interests that appear to affect this land. First off, there are several sewer easements and highway

conveyances that touch the property. The actual effect on the use of the property would probably be minimal since these sewer lines could be located and avoided.

There may also be some leasehold interest that may effect the property. I am specifically referring to the lease to McDonnell Aircraft recorded in Book 2565, Page 445.

Drainage District Number 2-A also claims some interest to the extent of providing drainage for Cold Water Creek. Along these same lines, the ordinance prohibits the erection of buildings within a designated flood hazards zones. There is also a restriction on the height of buildings under the terms of the aerial easement recorded in Book 4970, Page 593.

As you can see, most of these items are ones that could well be anticipated. As far as any actual adverse interest, such as third party interest in mineral rights, are concerned, there appear to be none. In other words, except for the interests as above shown, I would conclude that the St. Louis Airport Authority owns the property subject to the terms and conditions of the Deed recorded in Book 6666, Page 541.

I hope that this satisfactorily answers any questions that you might have. If not, please do not hesitate to advise. Enclosed is our bill for legal services rendered, not including the costs for sprint mail service to Philadelphia, which bill shall be forthcoming at a later date. Also enclosed is St. Paul Title's bill for title search. Please pay this bill directly to St. Paul Title.

I will be looking forward to hearing from you.

Yours very truly,

Jack Peace

JP:fm
Enclosures

Table B-1

Recorded Seismic Events Between 1795 and 1975

In a 30 Mile Radius From St. Louis, Missouri

Maximum Intensity	Distance from Point (Km)	Earthquake Source			
		Year	Month	N Lat.	W Long
III	18	1934	08	36.95	89.20
III	18	1937	03	40.40	84.20
IV	11	1939	11	38.22	90.06
IV	11	1953	09	38.60	90.10
IV	3	1954	02		
V	18	1955	04	38.12	89.80
VI	18	1956	11	37.10	90.60
V	18	1958	11	38.40	87.90
V	18	1962	02	36.47	89.59
III	18	1962	06	37.70	88.50
IV	18	1963	03	36.70	90.10
VI	18	1965	10	37.85	91.08
IV	18	1967	07	37.50	90.40
VII	18	1968	11	38.00	88.50
III	42	1970	11	35.90	89.90
VI	17	1902	01	38.60	90.30
VI	28	1838	06	38.50	90.30
IV	28	1843	02	38.50	90.30
VI	28	1857	10	38.50	90.30
VI	28	1903	02	38.50	90.30
VII	38	1903	11	38.50	90.30
III	28	1974	03	38.55	90.13
	30	1930	12	38.50	90.20
V	32	1920	05	38.50	90.50

Table B-1 (Cont'd)

Recorded Seismic Events Between 1795 and 1975

In a 30 Mile Radius From St. Louis, Missouri

Maximum Intensity	Distance from Point (Km)	Year	Month	Earthquake Source N Lat.	Earthquake Source W Long
	33	1973	04	38.46	90.20
V	37	1974	06	38.62	89.94
VI	40	1882	09	39.00	90.00
V	40	1882	10	39.00	90.00
VI	41	1947	06	38.40	90.20
V	46	1795	01	39.00	89.90
V	46	1938	11	38.50	89.90

Sources: Earthquake Data File Summary U.S. Department of Commerce

Appendix C

Water Quality-Coldwater Creek

Table C-1

Water Quality Sampling Results for Coldwater Creek

RANGE IN MEASURED WATER QUALITY FOR THE GIVEN PARAMETERS

Sampling Location	Carbon Dioxide (mg/l)	Alkalinity (mg/l)	pH	Total Acidity (mg/l)	Ortho-Phosphates (mg/l)	Total Phosphates (mg/l)	Turbidity (JTU)
(1.6 miles upstream)	5-25	85.6 - 222.3	7.0 - 8.5	5.6 - 28.4	0.0 - 4.5	0.0 - 13.0	0 - 45
(3.3 miles downstream)	5-25	85.6 - 273.0	7.0 - 9.5	5.6 - 28.4	0.1 - 2.2	1.0 - 3.8	0 - 50

RANGE IN MEASURED WATER QUALITY FOR THE GIVEN PARAMETERS

Sampling Location	Suspended Solids (mg/l)	Volatile Suspended Solids (mg/l)	Copper (mg/l)	Iron (mg/l)	Chromium (mg/l)	Total Solids (mg/l)	Ammonia Nitrogen (mg/l)	Chloride (mg/l)	Total Coliforms Coliform/100 ml
(1.6 miles upstream)	8-69	6-35	0.0 - 0.2	0.25 - 1.00	0.0	436 - 1316	0.20 - 1.20	37.8 - 258.0	6.0×10^{1} - 8.8×10^{4}
(3.3 miles downstream)	6-135	6-130	0.0 - 0.4	0.50 - 1.75	0.0-0.3	420 - 1094	0.28 - 1.20	37.8 - 310.6	0.4×10^{1} - 4.0×10^{3}

Source: Coleman, 1971.

WESTON

Appendix D

Erosion - Sedimentation Volumes

From the St. Louis Airport Site

Appendix D

Erosion - Sedimentation Volumes

From the St. Louis Airport Site

The sediment loading function that was used to determine the amount of soil material that is eroded and transported into Coldwater Creek is based on the concepts of the mechanisms of gross erosion and sediment delivery. The Universal Soil Loss Equation has the form.

$$Y(S)_E = \sum_{i=1}^{n} [A_i \times (R \times K \times L \times S \times C \times P \times S_d)_i]$$

Where:

$Y(S)_E$ = sediment loading from surface erosion, tons/year (or tons per storm event if an R factor is used for a specific design storm occurrence).

A_i = acreage of those portions of the site with similar land uses or surface erosion characteristics.

R = rainfall factor, expressing the erosion potential of average annual rainfall at the site (or the erosion potential for specific design storm events).

K = Soil - erodibility factor

L = Slope - length factor

S = Slope - steepness factor

C = Ground cover factor

P = Erosion control practice factor

S_d = Sediment delivery ratio

The values for the above factors were selected for the St. Louis Airport Site on the basis of:

1) prior experience in the use of the USLE

2) site investigations by WESTON which included:

   - soils sampling and analysis

3) available information relating the USLE factors to the specific soil, ground cover, and land use characteristics of the St. Louis Airport site.

The factors in Table D-1 were used to analyze the erosion/sedimentation characteristics of the St. Louis Airport Site. The results of this analysis are presented in Table 3.8.

Table D-1

Universal Soil Loss Equation Parameters

For The Existing St. Louis Airport Site

USLE Parameter	St. Louis Airport Site Value
Rainfall Factor (R)	
- Annual,	230
- 20 year storm event	107
- 10 year storm event	93
- 5 year storm event	77
- 2 year storm	58
- 1 year storm event	43
Soil Erodibility Factor (K)	0.43
Slope Length/Slope Steepness Factor(LS)	0.35
Ground Cover Factor (C)	
• 50% of Area	0.011
- 100% coverage	
- 75% canopy	
• 50% of Area	0.130
- 40% coverage	
- 25% canopy	
Erosion Control Practice Factor (P)	1.0
Sediment Delivery Ratio (S_d)	0.6

Appendix E

Dominant On-Site Vegetation

31 August 1978

Table E-1

Plant Species
Airport Site - 30 August 1978

Common Name	Scientific Name
Herbaceous	
Goldenrod	Solidago spp.
Ragweed	Ambrosia artemisiifolia
Giant ragweed	Ambrosia trifida
Nodding foxtail	Setaria faberi
Goosefoot	Chenopodium album
American ampelopsis	Ampelopsis cordata
Ladys-thumb	Polygonum persicaria
Canada thistle	Cirsium arvense
Indian grass	Sorghastrum nutans
Sedge	Carex sp.
Woody	
Cottonwood	Populus deltoides
Red mulberry	Morus rubra
Black willow	Salix nigra
Box elder	Acer negundo
Black cherry	Prunnus serotina
Slippery elm	Ulmus rubra
Tree-of-heaven	Ailanthus altissiina

Appendix F

Rare and Endangered Plants

And Animals of St. Louis County

Table F-1

Endangered Plant Species of
St. Louis County

Fragrant milkweed	Asctepias meadii	*End •
White prairie aster	Aster commatatus	Rare •
Aster	Botonia asteroides var.decurrens	**Rare •
Cut-leaved grape fern	Botrychium dissectum var.dissectum	Rare
Douglas sedge	Carex douglasii	End •
Graceful sedge	Carex gracillima	Unk.
Slender sedge	Carex praegracilis	Rare •
Schweinitz's sedge	Carex schweinitzii	End
Inland salt grass	Distichlis stricta	Rare •
Moss	Fontinalis disticha	End
Praire whited fringed orchid	Habenoria leucophaea	**Rare
Puccoon, Gromwell	Lithospermum latifolium	Rare
Shining clubmoss	Lycopodium lucidulum var.lucidulm	Rare
Green Adder's mouth	Malaxis unifolia fiunifolia	Rare
Climbing milkweed	Matelea obliqua	Rare
Aster	Matricaria maritima var.agrestis	Unk.
Broom-rape	Orobanche ludoviciana	End.
Arrow arum	Peltandra virginica	Rare
Smartweed	Polygonum bicorne	Rare
Aster	Prenanthes racemosa	End.
Orchid	Spiranthes ovalis	Rare
Hedge nettle	Stachys hyssopifolia	Unk. •

* Nationally endangered species (listed or proposed, 1976).

** Nationally threatned species (listed or proposed, 1976).

• Potentially occuring in site habitats.

Table F-2

Endangered Animal Species of

St. Louis County

Invertebrates			
Milliped	*Zosteractis interminata*	Rare	
Western fan shell	*Cyprogenia aberti*	Rare	
Mussel	*Fusconaia ebena*	End.	
Elephants ear mussel	*Elliptio crassidens*	End.	
Fishes			
Lake sturgeon	*Acipenser fulvescens*	End.	
Pallid sturgeon	*Scaphiryhnchus albus*	End.	
Alligator gar	*Lepisosteus spatula*	Rare	
Alabama shad	*Alosa alabamae*	Rare	
Sturgeon chub	*Hybopsis gelida*	Rare	
Sicklefin chub	*Hybopsis meeki*	Rare	
Pallid shiner	*Notropis amnis*	Pos.Ex.	●
Amphibians and Reptiles			
Four-toed salamander	*Hemidactylium scutatum*	Rare	●
Wood frog	*Rana sylvatica*	End.	●
Birds			
Red-shouldered hawk	*Buteo lineatus*	+End.	●
Barn owl	*Tyto alba*	+End.	●
Double-crested cormorant	*Phalacrocorax auritus*	+End.	
Mississippi kite	*Ictinia misisippiensis*	Rare	

Table F-2 (Continued)

Endangered Animal Species of

St. Louis County

	Birds (Continued)		
Sharp-shinned hawk	Accipiter striatus	+End.	•
Cooper's hawk	Accipiter cooperii	+End.	•
King rail	Rallus elegans	+Rare	
Upland sandpiper	Bartramia longicauda	+Rare	•
Least tern	Sterna albifrons	+End.	
Henslow's sparrow	Ammodramus henslowii	+Rare	•
Bachman's sparrow	Aimophila aestivalis	+Rare	•
Northern bald eagle	Haliaeetus leucocephalus alascensis	Rare	
Osprey	Pandion haliaetus	+End.	
Peregrine falcon	Falco peregrinus	⁂End.	•
	Mammals		
Long-tailed weasel	Mustela frenata	Rare	•

⁂ Nationally endangered species (listed or proposed, 1977).

\+ Audubon Society's "Early Warning" Blue List for 1977.

• Potentially occuring on the site.

Appendix G

Cultural Resources of the Site

And Its Vicinity

MISSOURI DEPARTMENT OF NATURAL RESOURCES
P.O. Box 176 Jefferson City, Missouri 65101 (314) 751-4422

September 12, 1978

Mr. Korah T. Mani
Senior Planner
Roy F. Weston, Inc.
Weston Way
West Chester, Pennsylvania 19380

Re: AEC Storage Area, Adjacent to Lambert-St. Louis Airport, St. Louis, Missouri

Dear Mr. Mani:

In response to your letter dated 5 September 1978, the Office of Historic Preservation has reviewed available information and has determined that no known cultural resources are located within the project area. Furthermore, since the area has been subject to previous ground disruption, an in-field cultural resource assessment will not be necessary; therefore, we have no objection to this project.

If I can be of further assistance, please call or write.

Sincerely,

OFFICE OF HISTORIC PRESERVATION

Michael S. Weichman
Senior Archaeologist

MSW:js

Appendix H

Elemental Composition

Of Residues Stored On-Site

Composition of On-Site Residues

The following information was taken from a description of residues located on the site for sale and removal (AEC, 1960).

Table H-1

Pitchblende Raffinate Composition

	1 (a)	2 (b)	3 (c)
Al	0.22%	0.26%	1.8%
Ca	11.0	11.9	2.7
Co	2.8	3.3	1.8
CO_2	1.4	1.9	--
Cr	--	--	0.02
Cu	0.9	1.95	0.9
Fe	1.2	1.4	0.7
Mg	5.0	1.9	0.04
Mn	0.12	0.16	0.04
Mo	0.33	0.23	0.03
Ni	4.1	3.5	3.1
NO_3	27.1	25.2	8.3
P_2O_5	0.96	1.1	--
Pb	Tr	Tr	1.8
R.E.	--	--	0.22
S total	0.8	1.47	--
Sc	--	--	0.015
Se	1.5	0.73	--
Si	5.56	4.69	0.82
Sr	--	--	0.02
Th	--	--	0.0038 (e)
Ti	--	--	0.007
U	0.13	0.13	0.14
V	Nil	Nil	0.3
Y	--	--	0.04
Solids	50.3	50.7	--
L.O.I @ 500°C	--	--	49.7
Soluble Matter	46.2	43.1	--

(a) 30-gallon sample from 3 locations using 4-inch auger, taken in February 1953. Reported on solids basis.

(b) 30-gallon shovel sample from surface of piles in 35 different locations, taken in February 1953. Reported on solids basis.

(c) Sample taken in the Spring of 1955 from an area containing raffinate produced during a period in which primarily pitchblende was processed. Reported on ignited basis.

(d) Sample contained 0.00039% ionium.

Table H-2

Colorado Raffinate Composition

	%		%
Al_2O_3	2.1	P_2O_5	1.2
CaO	41.8	PbO	0.05
Co	0.13	SO_3	15.8
Fe_2O_3	8.7	SiO_2	5.4
Halides	0.2	Th	0.1 - 1.0
MgO	21.2	TiO_2	0.2
MnO_2	0.8	U	0.62
MoO_3	0.05	V_2O_5	1.1
Na	0.5 - 5.0	Loss on	
Ni	0.10	Ignition	76.17

Ag, As, B, Ba, Be, Bi, Cd, Cr, Cu, Ga, In, K, Nb, Sb, Sn, Sr, W, Y, Zn and Zr - all less than 0.1% each.

The nitrate content of the Colorado raffiante is similar to that of the pitchblende raffinate.

Table H-3

Barium Sulfate Cake (Unleached) Composition

Barium Salfate	60-80%
H_2O	15-35%
Uranium	1-2 %
Misc. Pb, Cu, Ni, Fe, etc.	1-2 %
Solids - rock, gravel, sand, etc.	1-2 %

Table H-4

Barium Cake (Leached) Composition

Barium Sulfate	60-80%
H_2O	15-35%
Uranium	0.05-0.15%
Miscellaneous Metals	1-2 %
Solids - rock, gravel, sand, etc.	1-2 %

Appendix I

Conceptual Engineering Study for the Storage of Latty Avenue Material and Construction of a Police Academy Driver Training Facility

Table J-1
Radiological Survey - Coldwater Creek
April 1979

Sample Location	Water (pCi/l) ^{238}U	^{226}Ra	^{210}Ph	^{230}Th	^{227}Ac	Sediment (pCi/g) ^{238}U	^{226}Ra	^{227}Ac
Approximately 1.6 mi. upstream of S0+00	0.4	< 0.5	< 3.0	< 0.5	< 0.5			
Approximately 60 ft. upstream of S0+00	1.0	< 0.5	4.0	< 0.5	< 0.5	0.69	0.72	< 0.04
S0+00	3.0	< 0.5	3.0	< 0.9	< 0.9	0.69	0.71	< 0.04
S0+95 (Downstream)	3.0	< 0.5	3.0	< 0.5	< 0.5	0.73	1.06	< 0.04
S2+00 (Downstream)	3.0	< 0.5	1.0	< 0.9	< 0.9	0.73	1.08	< 0.04
S3+10	9.0	< 0.5	5.0	< 4.0	< 4.0	1.13	1.05	< 0.07
S4+00						1.08	1.24	< 0.03
S5+00	4.0	< 0.9	1.0	< 14	< 14	1.21	1.33	< 0.04
S6+00	11	< 0.5	2.0	< 0.9	< 0.9	1.57	1.18	< 0.04
Approximately S0+30 (South outfall)	500	0.9	3.0	5	< 5	9.8	2.02	< 0.06
Brown Road Ditch (South side - North outfall)	3500	1.8	11	< 0.5	< 0.5	15.7	3.09	0.54
Brown Road Ditch (North Side)	230	0.9	8.0	< 5	< 5	8.2	2.29	0.87

*Source: Health and Safety Research Division, ORNL.