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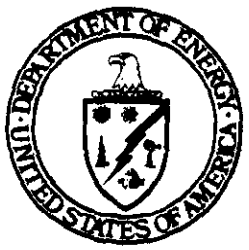
DOE/EA-0381

Environmental Assessment

Gas Reburning-Sorbent Injection Project at Springfield City Water Light and Power Lakeside Station

A Project Proposed By
Energy and Environmental Research Corporation



1989

U.S. Department of Energy
Assistant Secretary for Fossil Energy

ENVIRONMENTAL ASSESSMENT
FOR ENHANCING THE USE OF EASTERN AND MIDWESTERN COALS
BY GAS REBURNING-SORBENT INJECTION
AT CWLP LAKESIDE STATION, BOILER NO. 7

September 1989

Prepared for
PITTSBURGH ENERGY TECHNOLOGY CENTER

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LIST OF ACRONYMS AND ABBREVIATIONS

CCT	Clean Coal Technology
CFR	Code of Federal Regulations
CILCO	Central Illinois Light Company
CWLP	City Water Light & Power
DOE	(U.S.) Department of Energy
EER	Energy and Environmental Research Corporation
EHSS	Environmental, Health, Safety, and Socioeconomic
ENR	Illinois Department of Energy and Natural Resources
EPA	(U.S.) Environmental Protection Agency
EPRI	Electric Power Research Institute
ESP	Electrostatic Precipitator
FR	Federal Register
g/l	grams/liter
GR-SI	Gas Reburning with Sorbent Injection
IEPA	Illinois Environmental Protection Agency
MBtu	Million British thermal units
MGD	Million Gallons per Day
mg/l	Milligrams per liter
MGY	Million Gallons per Year
MWe	Mega Watts of energy
NEPA	National Environmental Policy Act (1970)
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NTIS	National Technical Information Service
OSHA	Occupational Safety and Health Administration
PON	Program Opportunity Notice
psig	Pounds per square inch gauge
RCRA	Resource Conservation and Recovery Act (1976)
scfm	Standard cubic feet per minute
SO_2	Sulfur dioxide
SO_x	Sulfur oxides
tpy	Tons per year
TSP	Total Suspended Particulates
TSS	Total Suspended Solids

1. INTRODUCTION

In December 1985, Congress made funds available for a Clean Coal Technology (CCT) Program in Public Law No. 99-190, An Act Making Appropriations for the Department of Interior and Related Agencies for the Fiscal Year Ending September 30, 1986, and for Other Purposes. This Act provided funds..."for the purpose of conducting cost-shared Clean Coal Technology projects for the construction and operation of facilities to demonstrate the feasibility for future commercial applications of such technology...", and authorized DOE to conduct the CCT program. DOE issued a Program Opportunity Notice (PON) on February 17, 1986, to solicit proposals for conducting cost-shared CCT demonstrations.

An overall strategy for compliance with the National Environmental Policy Act (NEPA) was developed for the CCT Program consistent with the Council on Environmental Quality NEPA regulations (40 CFR 1500-1508) and the DOE guidelines for compliance with NEPA (52 FR 47662, December 15, 1987). This strategy includes both programmatic and project-specific environmental impact considerations, during and subsequent to the selection process. This strategy has three major elements. The first involves preparation of a comparative programmatic environmental impact analysis, based on information provided by the offerors and supplemented by DOE, as necessary. This environmental analysis ensures that relevant environmental consequences of the CCT Program and reasonable programmatic alternatives are evaluated in the selection process.

The second element involves preparation of a pre-selection project-specific environmental review based on project-specific environmental data and analyses that offerors supplied as a part of their proposal. This analysis contained a discussion of the site-specific environmental, health, safety, and socioeconomics issues associated with the demonstration project. It included, to the maximum extent possible, a discussion of alternative sites and/or processes reasonably available to the offeror, a discussion of the environmental impacts of the proposed project and practical mitigating measures, and a list of permits, to the extent known, that must be obtained to

implement the proposal. It also contained the strengths and weaknesses of each proposal relative to the demonstration project environmental and site-related criterion.

The third element provides for preparation by DOE of site-specific documents for each project selected for financial assistance under the PON. This Environmental Assessment describes the actions to be taken at one of the CCT project sites.

After considering the evaluation criteria, the program policy factors, and the NEPA strategy, the proposal submitted by Energy and Environmental Research Corporation (EER), Irvine, California, was one of the proposals selected for award.

EER proposes to demonstrate that Gas Reburning and Sorbent Injection (GR-SI), a control technology for the acid rain precursors, SO_2 and NO_x, is suitable for retrofit applications, particularly in utility plants constructed before New Source Performance Standards went into effect. The goal of this program is to prove the technical and economical feasibility of the GR-SI technology. If successful, it will achieve up to 60% NO_x and 50% or more SO_2 reduction at about the same cost as wet flue gas desulfurization processes which capture only SO_2.

Gas Reburning-Sorbent Injection is a two part process in which gas reburning is used to control NO_x while sorbent injection is used to control SO_2. Nitrogen oxides, or NO_x, are formed when nitrogen included in the fuel oxidizes or when nitrogen contained in the combustion air is oxidized. Special combustion techniques are required to reduce NO_x formation and emissions and one that has been developed is gas reburning (GR), part of the GR-SI process. This process is applicable to all types of combustors currently used for firing pulverized coal. In gas reburning, NO_x is reduced to molecular nitrogen (N_2).

The primary fuel is coal and the reburning fuel is natural gas. The use of natural gas instead of a coal or oil as the reburning fuel avoids introduction of additional fuel bound nitrogen into the process. Additional air is injected above the reburning zone to burn the fuel fragments and this produces water vapor and carbon dioxide.

The net effect of this combustion technique is up to a 60% reduction in NO_x formation without increases in the emission of other undesirable chemical compounds or a waste of fuel. In addition, since natural gas contains no sulfur, there is a reduction in SO_2 emissions commensurate with the fraction of gas fired.

Sulfur oxides, predominantly SO_2, are formed from the oxidation of sulfur compounds in the coal and its ash. The SO_2, if not controlled, is discharged to the atmosphere with the balance of the flue gas. One method of removing the SO_2 is by dry sorbent (lime) injection as used in this process. In the GR-SI process, sorbent is injected into the flue gas in the upper part of the boiler combustion zone. After absorbing the SO_2, the spent sorbent is removed in an electrostatic precipitator (ESP).

The technology demonstration program to be conducted by EER will focus on three Illinois utility boilers representing an appropriate the range of boiler technology in existing electric utility plants:

- Illinois Power Company (IP), Hennepin Station, Unit 1; 71 MWe (net) Tangentially-Fired

- Central Illinois Light Company (CILCO), Edwards Station, Unit 1; 117 MWe (net) Front Wall-Fired

- City Water Light & Power (CWLP), Lakeside Station Unit 7; 33 MWe (net) Cyclone-Fired

For all three test sites, the nominal test design basis is for 15 percent of the heat input obtained by gas firing and 85 percent by coal firing. Due to the lower coal consumption, the quantity of bottom ash is reduced and, due to sorbent injection, the amount of precipitator solid waste is increased. The net impact is an increase in solid waste.

This Environmental Assessment describes the actions to be taken at Lakeside Station and the environmental impacts of these actions.

2. PROPOSED ACTION AND ALTERNATIVES

This section describes the existing facility at Lakeside Station, presents a brief technical description of the GR-SI technology demonstration project, describes anticipated project activities, and defines project resource requirements and discharges.

2.1 PROPOSED ACTION

2.1.1 Site Description

Lakeside Station and the adjacent Dallman Station occupy a 75-acre site on the northwest shore of Lake Springfield, in the southeast section of the city of Springfield in Sangamon County, Illinois. Figure 2-1 shows the location of Springfield and Sangamon County (shaded) in Illinois. Figure 2-2 provides additional detail regarding the CWLP plant location with respect to the city and other regional features. Both stations are owned and operated by CWLP. Since the GR-SI project will be conducted in Unit 7 of Lakeside Station, the discussion in this volume is focused toward Lakeside Station. However, the proximity to Dallman Station and the use of some of the same facilities (e.g., ash disposal ponds) necessitates inclusion of some relevant background information for Dallman Station. In this volume, "CWLP plant" refers to both stations combined. The individual stations are referred to by name.

The layout of the CWLP plant is illustrated in the aerial view of Figure 2-3. The building in the upper right (northeast) portion of the photograph houses the Lakeside Station boilers and generators. Dallman Station is located slightly below center on the right side of the photo. Lake Springfield borders the plant on the east, south and southwest. U.S. Interstate Highway 55 and Adlai Stevenson Drive comprise the plant boundaries on the west and north, respectively. The CWLP plant also contains a water treatment plant, shown just above the center of Figure 2-3. A second aerial photograph, included as Figure 2-4, shows the ash disposal area located due north of Lake Springfield, separated by the Spaulding Dam. Ash from Lakeside

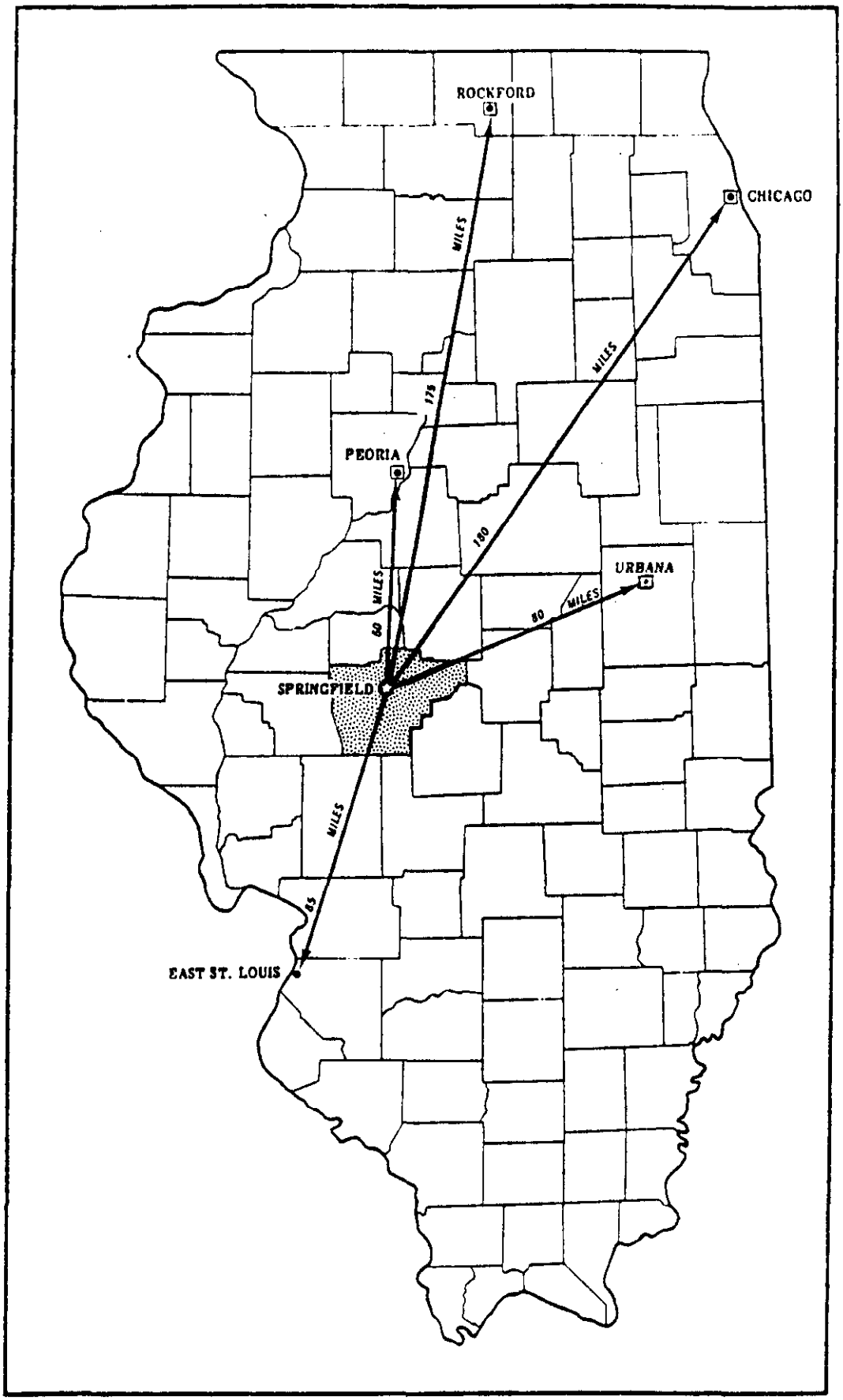


Figure 2-1. Location of Springfield and Sangamon County in Illinois

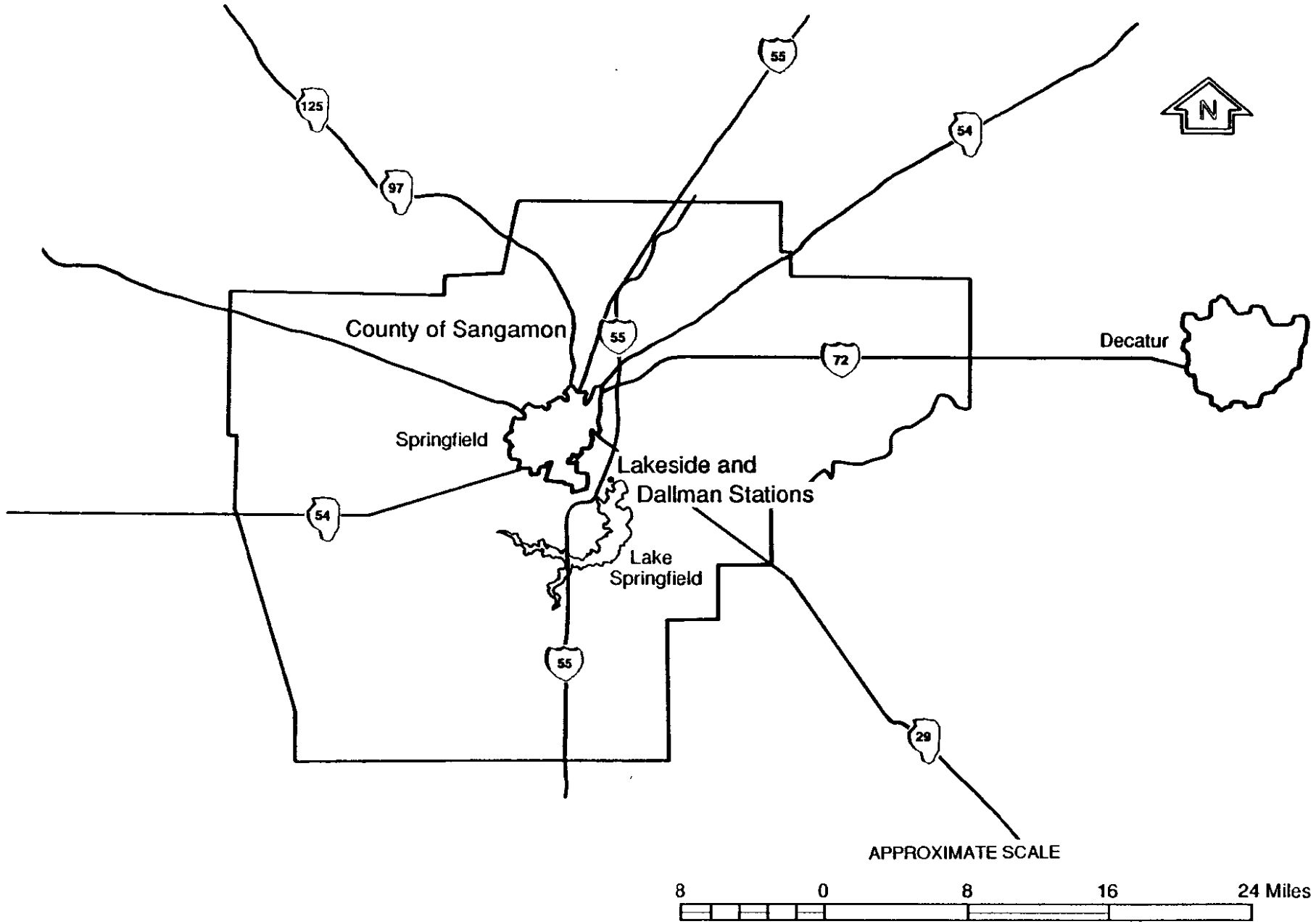


Figure 2-2. Map of Sangamon County

Figure 2-3. Aerial View of CWLP Lakeside and Dallman Stations

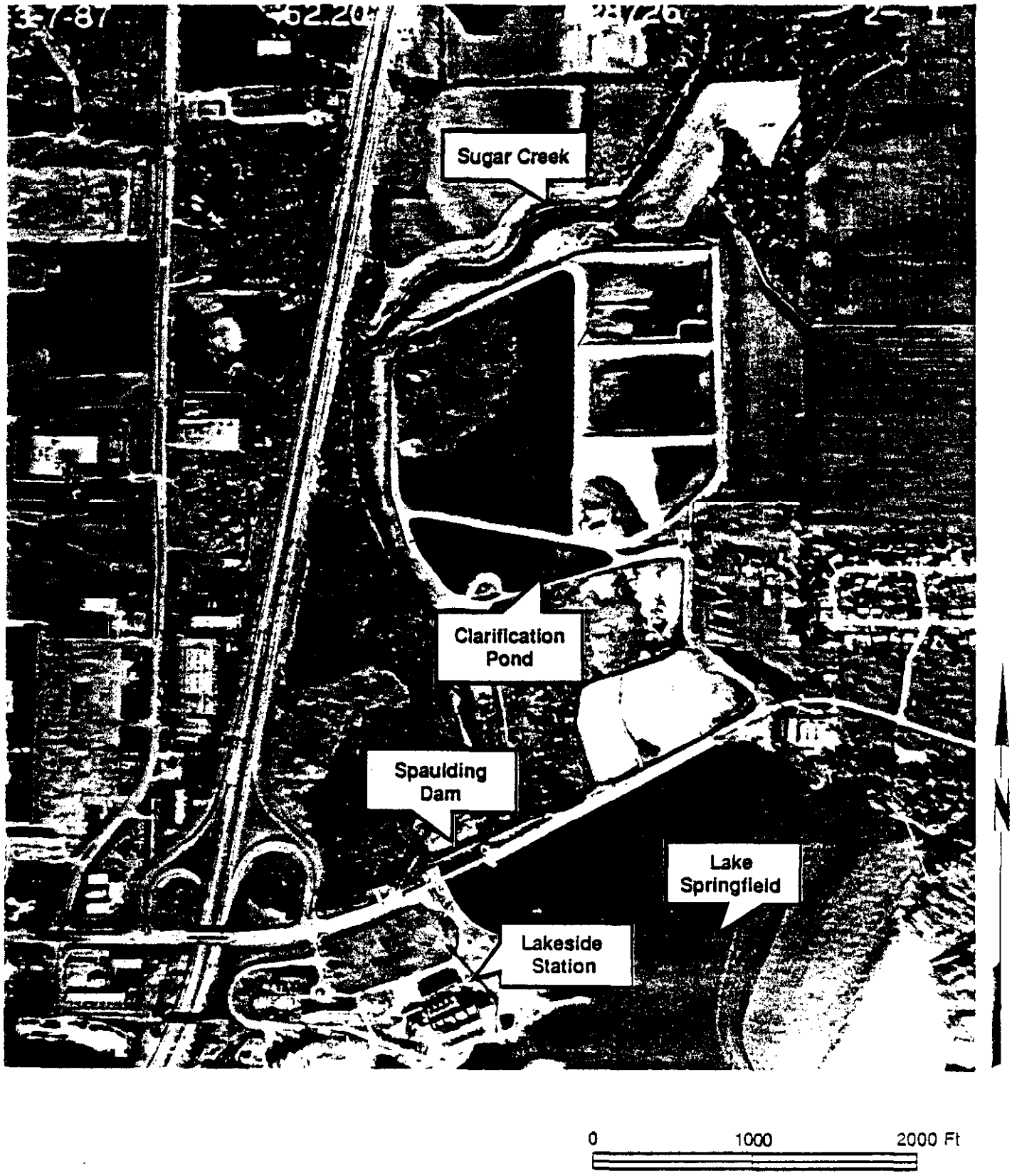


Figure 2-4. Aerial View of Lakeside/Dallman Ash Disposal Area

Station is currently sluiced to the large quadrilateral pond located just above the center of the photo. The smaller triangular pond directly below the Lakeside ash pond is used as a secondary clarification pond. The discharge structure to Sugar Creek can be seen on the left side of the clarification pond. Sugar Creek begins at the Spaulding Dam spillway (left end of the dam) and traverses the west and north boundaries of the ash disposal site. Beyond the photograph, Sugar Creek continues in a meandering path until it empties into the Sangamon River, about 5 miles northeast of the CWLP plant. The three impoundments located to the right of the Lakeside ash pond are the dry landfill cells that are currently used for disposal of dewatered scrubber sludge from Dallman Station. Additional Lakeside Station site features are identified on the station plot plan presented in Figure 2-5.

Lakeside Station is accessible by rail and truck. The Illinois Terminal, Gulf Mobile and Ohio, Illinois Central, Norfolk and Western, and Baltimore and Ohio Railroads all have traffic lines running within 3 miles of the plant site. An Illinois Terminal Railroad spur line is in place and operational though not used. Interstate Highway 55 runs adjacent to the plant site. Water supplies for Lakeside Station are taken from Lake Springfield. CWLP also operates a water treatment plant on the site which supplies potable water to the Lakeside Station and to the entire city of Springfield. A major gas pipeline currently provides natural gas to the Dallman Station on the south end of the site.

Lakeside Station has three operational electrical generating units. The GR-SI technology demonstration will be conducted in Unit 7. All of the boilers at Lakeside and Dallman stations burn bituminous coal from Logan County, located about 15 miles northeast of Springfield. This coal (as received) contains 9.1 percent ash and 2.7 percent sulfur, and has a heating value of 10,400 Btu/lb. Coal is delivered to Lakeside Station by truck and unloaded into a storage pile in which a minimal reserve capacity is maintained. Lakeside coal pile runoff is intermittent (i.e., runoff occurs only during and after precipitation) and has an annualized average flow rate of 0.019 million gallons per day (MGD), based on measurements made by CWLP

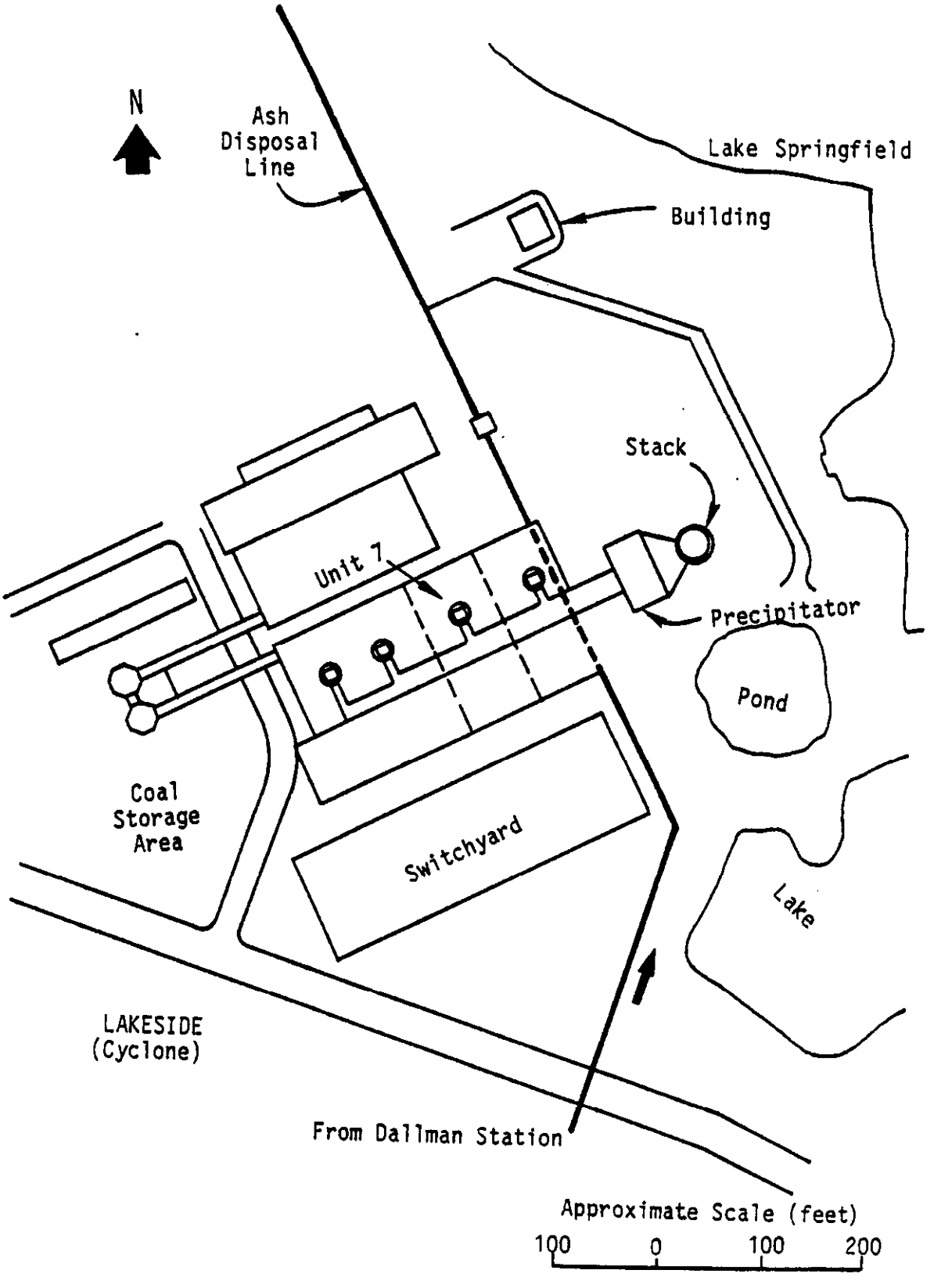


Figure 2-5. Existing Lakeside Station Plot Plan

personnel. Runoff is collected in a pond, and pond water is discharged into Lake Springfield under the plant NPDES permit.

2.1.2 Existing Plant Operation

Lakeside Station currently operates two coal-fired steam electric generating units with a total net generating capacity of 66 MW_e. Two additional 20 MW_e units are licensed but have not been used in the past five years. The project will be conducted in Unit 7, a 33 MW_e cyclone-fired boiler. Based on the Unit 7 peak net generating capacity of 39.8 MW_e, the full load coal firing capacity of Unit 7 is approximately 39,700 lb/hr. Plant records indicate that in 1986 Unit 7 fired 41,700 tons of coal, and the two generating stations on the CWLP site fired 815,000 tons of coal. Therefore, in 1986, Unit 7 accounted for about 5.1 percent of the coal usage for Lakeside and Dallman stations. The Lakeside Unit 7 capacity factor for 1986 was 24.0 percent.

An electrostatic precipitator (ESP) is used to control particulate emissions. The ESP is a cold side unit, i.e. it operates downstream of the air preheater. The ESP, which serves all three units in Lakeside Station, has a specific collection area (SCA) ranging from 333-1000 $ft^2/(1000\ ft^3/min)$, depending on the number of units in operation at a given time.

Solid waste streams from the boiler include the fly ash collected by the plant ESP and the furnace bottom ash. These waste streams are exempted from RCRA Subtitle C Hazardous Waste regulations by 40 CFR Part 261.4(b)(4). Based on 1) the full load coal firing rate (39,700 lb/hr), 2) the coal ash content (9.10 percent), 3) CWLP data indicating that 75 percent of the ash leaves the furnace as bottom ash while the remaining 25 percent goes to fly ash, and 4) the measured (1987) full load particulate emission rate (6 lb/hr), the approximate rate of production of fly ash from Unit 7 during full load operation is 897 lb/hr. On the same basis, the approximate full load flow rate of bottom ash to the ash pond is 2710 lb/hr. These flow rates are presented in the form of a process flow diagram in Figure 2-6, representing the baseline conditions for Unit 7 at full load. Based on the 1986 Unit 7

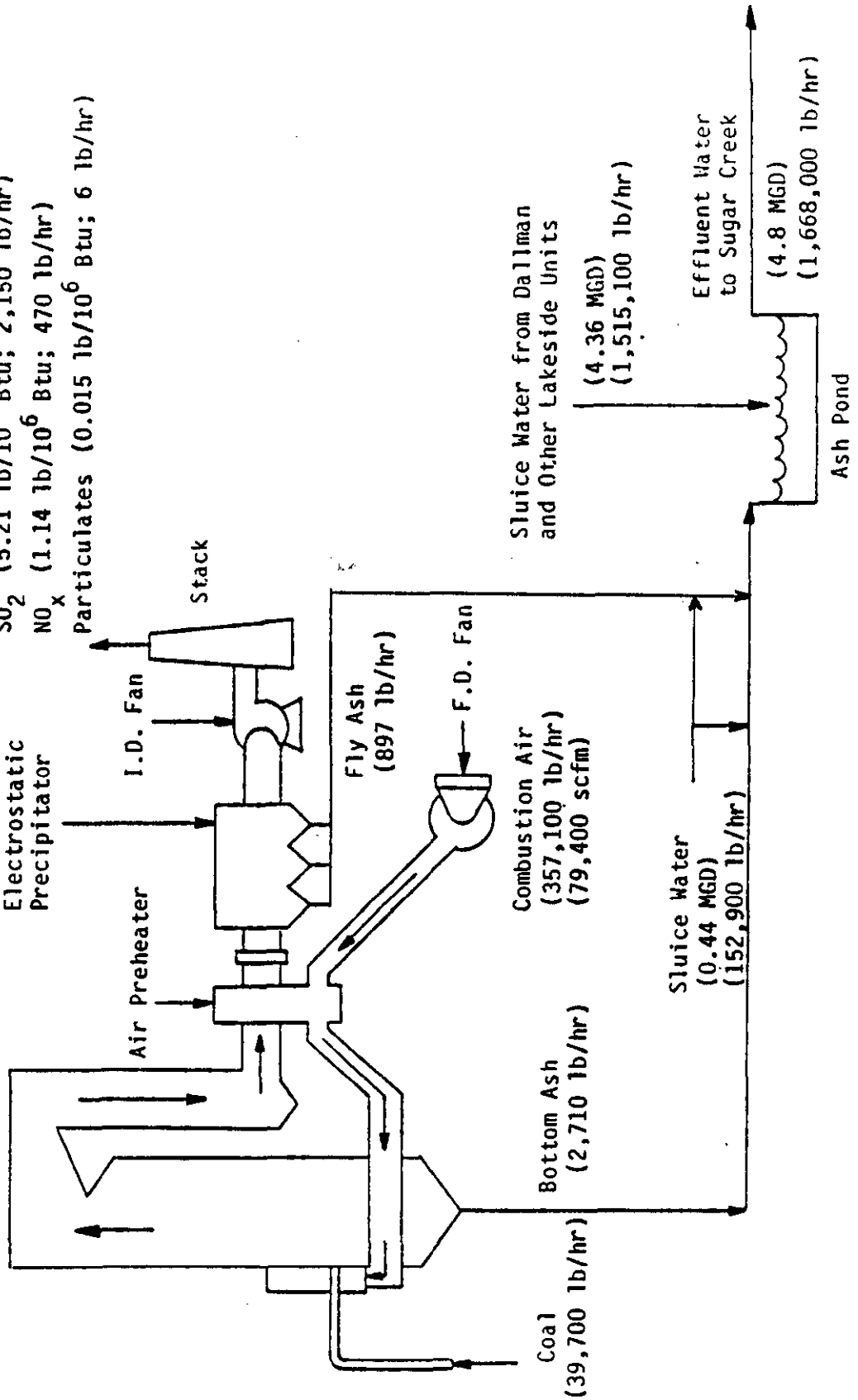


Figure 2-6. Process Flows for Baseline Operation at Peak Output

coal consumption reported by the plant (41,700 tons) and the coal ash content (9.10 percent), Unit 7 generated approximately 3795 tons of ash in 1986. Assuming that ESP emissions are a constant 0.015 lb/MBtu (based on precipitator evaluation tests conducted in June, 1987) the approximate distribution of the ash generated by Unit 7 in 1986 was:

bottom ash	- to pond	2846 tons/year (tpy)
fly ash	- to pond	943 tpy
fly ash	- stack emissions	6.3 tpy

These ash generation data are presented in the form of a process flow diagram in Figure 2-7, representing annual process flows based on Lakeside Station 1986 operating data. The British Petroleum Coal Handbook indicates that typical furnace bottom ash dry densities range from 40 to 53 lb/ft^3 while typical dry fly ash ranges from 42 to 65 lb/ft^3. Thus, ash volumes for Lakeside Unit 7 were calculated using the high end of the dry density range as a conservative best estimate, i.e. bottom ash and fly ash densities of 53 lb/ft^3 and 65 lb/ft^3, respectively. Based on these densities, the gravimetric ash data presented above represent 107,400 ft^3/yr (2.47 acre-ft/yr) of bottom ash and 29,000 ft^3/yr (0.67 acre-ft/yr) of fly ash. Based on CWLP 1986 operating data, the total bottom and fly ash quantities sluiced to the ash pond from all units at Lakeside and Dallman Stations were calculated. These data, presented in Table 2-1, indicate that Lakeside Unit 7 accounted for approximately 9.0 percent of the total ash sluiced to the pond in 1986. The fly ash from Dallman Unit 33 was not included in the Table since this unit is equipped with a wet scrubber to collect the fly ash. The scrubber sludge is disposed dry into separate landfill cells at the ash disposal site. It should be noted that Dallman Unit 33 is wall-fired, while Units 31 and 32 are cyclone-fired.

The waste disposal site is located immediately to the north of Lake Springfield. The disposal site includes three ash ponds for wet disposal of bottom ash from the two stations, and three clay-lined dry landfill cells used for disposal of dewatered flue gas desulfurization sludge from Dallman Station. The ash pond receiving waste from Lakeside Unit 7 is shown in Figure 2-4. The pond covers approximately 40 acres and is reported by CWLP to have a remaining life of six years. The discharge from the pond is routed through a

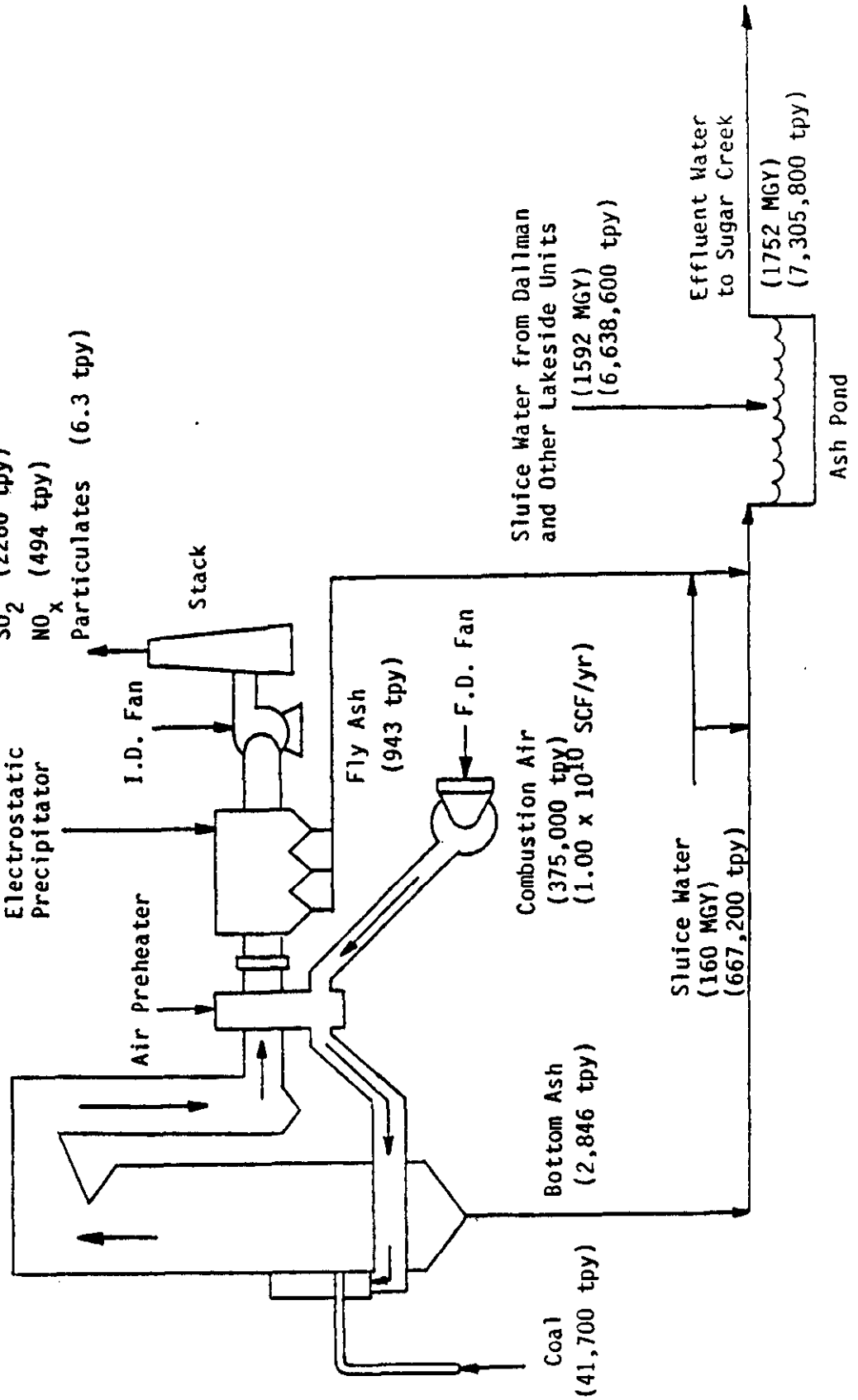


Figure 2-7. Process Flows for Baseline Operation - 1986 Annual Data

TABLE 2-1. Annual Baseline Ash Disposal

	Bottom Ash		Fly Ash		Total Ash	
	ft^3/yr	acre-ft/yr	ft^3/yr	acre-ft/yr	$ft/^3yr$	acre-ft/yr
Lakeside Unit 7	107,400	2.47	29,000	0.67	136,400	3.13
Lakeside Unit 8	26,075	0.60	7,075	0.16	33,150	0.76
Dallman Unit 31	290,910	6.68	77,475	1.78	368,385	8.46
Dallman Unit 32	444,225	10.20	118,340	2.72	562,565	12.91
Dallman Unit 33	410,150	9.42	--	--	410,150	9.42
Total of Lakeside and Dallman Stations	1,278,760	29.36	231,890	5.32	1,510,650	34.68

triangular shaped clarification pond of nine acres before being discharged to Sugar Creek. The three waste landfill cells, to the east of the ash pond encompass a total area of 33 acres. Two are currently empty, and the third is filled to approximately one-third capacity with dewatered scrubber sludge from Dallman Station.

Process water from Lake Springfield is currently used for cooling applications and for transporting fly ash and bottom ash. Cooling water is pumped once through condenser tubes which cool the steam from the turbines back to water. The cooling water does not come into direct contact with the boiler water. Process water flow rates as measured by the utility are summarized in Table 2-2. The Lakeside coal pile runoff pond has approximately 600,000 gallon capacity, and catches runoff from three areas: a parking area, a site access road, and the Lakeside coal handling/storage area. Discharge from the pond is intermittent and controlled; current procedure calls for a 24-48 hour settling time after a major precipitation event. The pond is then drained and sampled according to NPDES permit provisions. Based on measurements made by CWLP personnel, the annualized average flow rate for 1987 was 0.019 MGD, with actual discharges occurring during five months. The average flow for these five months was 0.046 MGD. Documentation from CWLP supporting these data are included in Appendix B. The Unit 7 sluice water requirement averages 0.44 MGD. Effluent water from the ash pond is discharged under an NPDES permit into Sugar Creek, which runs from Lake Springfield to the Sangamon River. The NPDES permit for the combined Dallman and Lakeside discharge requires the plant to file monthly effluent water quality monitoring reports detailing flow rate, pH, total suspended solids, and amounts of oil and grease in the effluent from all Lakeside and Dallman units. Average values of these parameters for 1986, as determined from monthly reports, are presented in Table 2-3. Current ash pond sulfate concentration is about 0.32 g/l.

Based on the full load coal firing rate and the coal elemental analysis, the stoichiometric combustion air requirement for Unit 7 is approximately 310,500 lb/hr, or about 69,000 standard cubic feet per minute (scfm). Lakeside Unit 7 typically operates at 15 percent excess air; thus, typical full load air consumption is approximately 357,100 lb/hr (79,400 Table

TABLE 2-2. Process Water Flow Rates

Source	Flow Rate (MGD - million gallons per day)
Lakeside Circulating Boiler Water	0.92
Lakeside Cooling Water	290.0
Unit 7 Sluice Water	0.44
Lakeside Coal Pile Runoff	0.019 (intermittent)

TABLE 2-3. Average Ash Pond Effluent Water Parameters in 1986*

Parameter	High	Low	Average	Permit Limit
Flow Rate (MGD)	7.05	2.88	4.80	--
pH	9.06	8.40	8.77	6.0-9.0
TSS (mg/l)	14.88	6.20	9.88	15.0
Oils/grease (mg/l)	3.30	0.05	1.10	15.0

*from all Lakeside and Dallman Units

scfm), as indicated in Figure 2-6. Air emissions of potential concern for the GR-SI project include SO_2, NO_x, and particulates. Based on the full load coal firing rate for Unit 7 (39,700 lb/hr) and the as-fired coal sulfur content (2.7 percent), and assuming 100 percent conversion of coal sulfur to SO_2, the full load SO_2 emission rate is approximately 2150 lb/hr (5.21 lb/MBtu). Preliminary baseline emissions tests conducted by Clean Air Engineering at Unit 7 in April, 1988 indicated that Unit 7 NO_x emissions average about 470 lb/hr (1.14 lb/MBtu). Based on ESP performance tests conducted in June, 1987 by Clean Air Engineering, the full load particulate emission rate for Unit 7 is approximately 6 lb/hr (0.015 lb/MBtu).

2.1.3 Engineering Description of the Proposed Action

The objectives of the project are to provide a comprehensive data base of full-scale experience demonstrating the performance of GR-SI in pre-NSPS utility boiler applications and to promote commercialization of this combination of technologies. Figure 2-8 illustrates the application of GR-SI to a cyclone fired boiler. Natural gas is injected above the main heat release zone to reburn NO that is produced in that zone. NO is reduced by a hydrocarbon radical (CH) producing HCN which allows the formation of NH via NCO. Molecular nitrogen is produced by the reaction of NO with N at high temperature and with NH_2 at lower temperatures (<2200°F). The GR-SI system will provide 60 percent NO_x control, which can be attributed to reductions during the reburning process as well as from reductions due to lower coal usage. The pre-NSPS Lakeside unit does not have an NO_x emission regulatory constraint. Thus, this NO_x emission reduction could be useful to the plant in response to potential future NO_x regulations.

The sorbent will be injected into the upper furnace. For the cyclone fired Unit 7 boiler, the SO_2 strategy will be to reduce SO_2 emissions by 50 percent while firing the existing Illinois coal. This emission reduction is not required by existing regulations but could be used for compliance with any future SO_2 regulations. Sorbent injection will increase the amount of solid material in the flue gas; thus, the amount of solid waste being generated will increase.

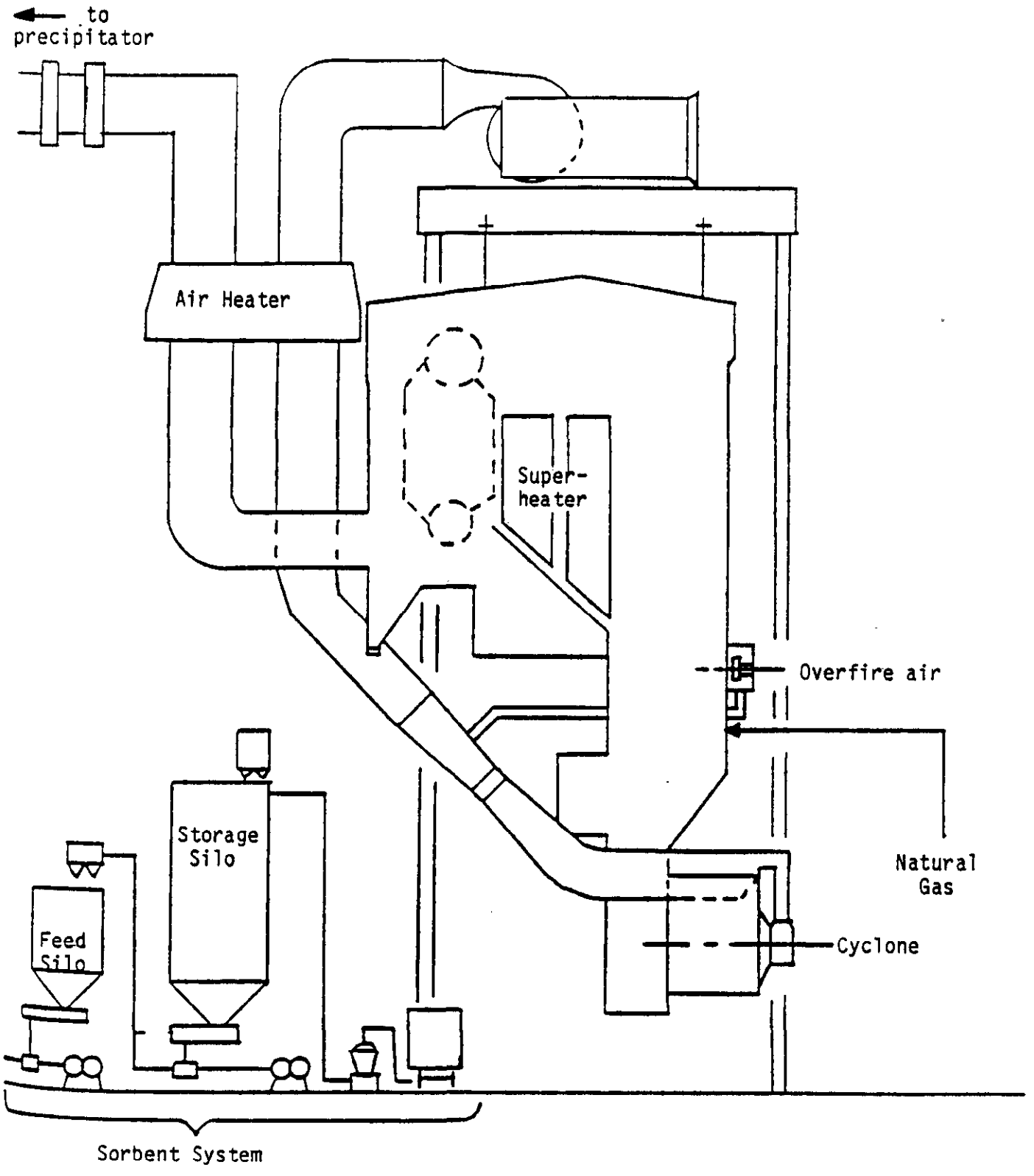


Figure 2-8. Application of Gas Reburning-Sorbent Injection for NO_x/SO_2 Control

The solid waste from GR-SI is a blend of spent and unreacted calcium-based sorbent with fly ash which, due to the presence of unreacted lime, has similar characteristics to lime/fly ash/scrubber sludge prepared for sludge disposal or the solid product from lime-based spray dryer systems. The fly ash will be managed by using dry transport to a permitted off-site landfill. Bottom ash will continue to be sluiced approximately 0.25 miles to the existing on-site ash pond.

The on-site installation work will be divided into two steps: an initial installation step where all work is conducted during normal unit operation and the final installation step which requires a unit outage. The following equipment will be installed during normal unit operation:

1. Sorbent unloading and storage equipment
2. Sorbent feeding and transport equipment
3. Sorbent piping and injection equipment assembly
4. Sorbent injection control assembly
5. Gas piping and controls assembly
6. Gas injector assembly
7. Instrumentation installation except for final connections

A plot plan of Lakeside Station showing the location of the sorbent storage silo is shown in Figure 2-9.

The intent is to complete the initial installation in time to provide flexibility on completing the final installation during a scheduled outage. The following equipment must be installed during an outage:

1. Windbox modifications
2. Furnace or duct penetrations for gas injectors, overfire air ports or sorbent injectors
3. Final connections for control equipment
4. Final gas plumbing
5. Final instrumentation connections
6. ESP upgrades, if required

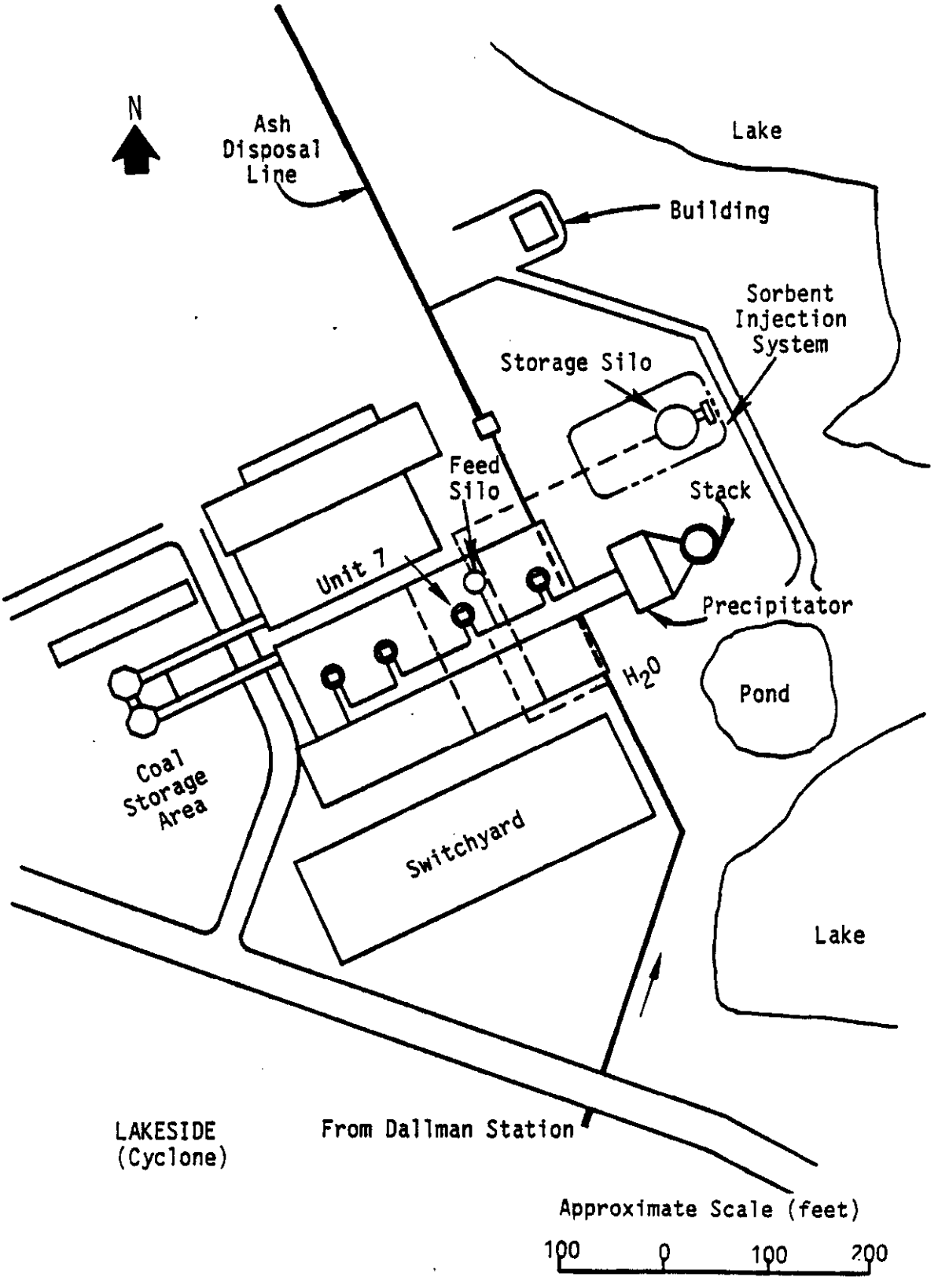


Figure 2-9. Proposed Plot Plan of Lakeside Station

Boiler tubes are lined with asbestos to minimize heat loss, and some asbestos handling will be required. All boiler modification work will be conducted by a contractor qualified to work with asbestos materials. EER will include in the contractor's specifications a requirement that all applicable OSHA and EPA regulations be satisfied, including asbestos removal guidelines, air monitoring requirements, and proper disposal considerations.

A feeder pipeline, 1400 feet long, will be constructed connecting Unit 7 to the existing natural gas pipeline at the west boundary of the site. Construction of the natural gas pipeline at Lakeside Station will include the following steps:

- o Final route selection
- o Materials and equipment procurement
- o Excavation
- o Pipefitting

Each of these steps will be coordinated by CILCO, owner of the trunk pipeline and will occur during Phase 2 of the demonstration project. The tentative route selected for installation of the Lakeside Station natural gas pipeline is shown in Figure 2-10. This route lies entirely within the boundaries of the CWLP plant. The pipeline installation will be conducted by the Gas Division of CILCO. The materials and equipment required for the pipeline construction include piping, fittings, welding supplies, excavation equipment, and material handling equipment. All materials will meet applicable codes and common industrial practices will be matched. Pipeline construction will require excavation of a trench approximately two feet wide and four feet deep. A clearance path, 33 feet wide, is required for equipment access. The pipeline will be routed to convenient termination adjacent to Unit 7.

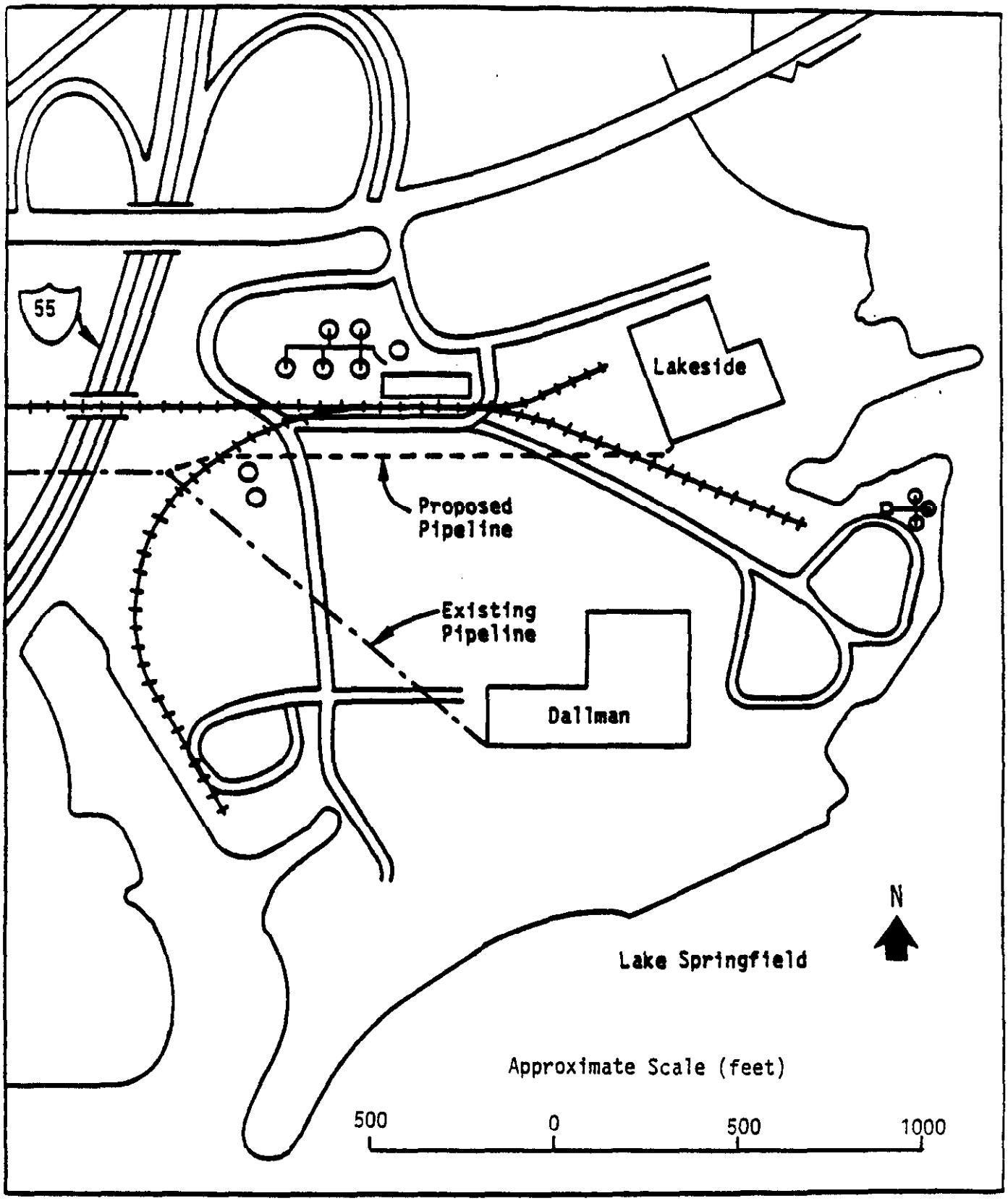


Figure 2-10. Tentative Route of Natural Gas Pipeline to Lakeside Station

2.1.4 Project Source Terms

This section characterizes all of the source terms of the GR-SI technology demonstration project. Source terms can be divided into the categories of resource requirements and project discharges.

2.1.4.1 Project Resource Requirements

Effected project resource requirements include energy, land, water, labor, materials, and transportation. Figures 2-11 and 2-12 detail important GR-SI process flow rates for full load and annualized operation, respectively. The resource requirements associated with the GR-SI technology demonstration project are identified below.

Energy Requirements. Additional energy requirements associated with the GR-SI technology demonstration include electrical power to run sorbent equipment and natural gas required as reburning fuel. The estimated increase in electrical power consumption for the Lakeside Station is about 400 kW-hr/hr. This increased electrical load will occur whenever the GR-SI system is in operation. Based on CWLP's projection of the Unit 7 capacity factor for the year in which the GR-SI testing will be conducted (25 percent), the total operating time of the GR-SI system will be between 876 and 2190 hours. The lower end of the operating range (876 hours) was calculated assuming the GR-SI system operates 40 percent of the time that Unit 7 is in operation, and Unit 7 operates at full load for 25 percent of the available hours in a 365-day year. The upper end of the range (2190 hours) was determined assuming the GR-SI system operates 100 percent of the time that Unit 7 is in operation, and Unit 7 operates at 25 percent of full load for 100 percent of the available hours in a 365-day year. Based on these estimated boundary conditions, the total increase in electrical consumption over the course of the one-year GR-SI demonstration will be between 350 and 876 MW-hr. The upper boundary condition, which has a very low probability of occurrence, represents less than five percent of the projected electrical output of Lakeside Unit 7 and less than 0.5 percent of the projected electrical output of the CWLP plant.

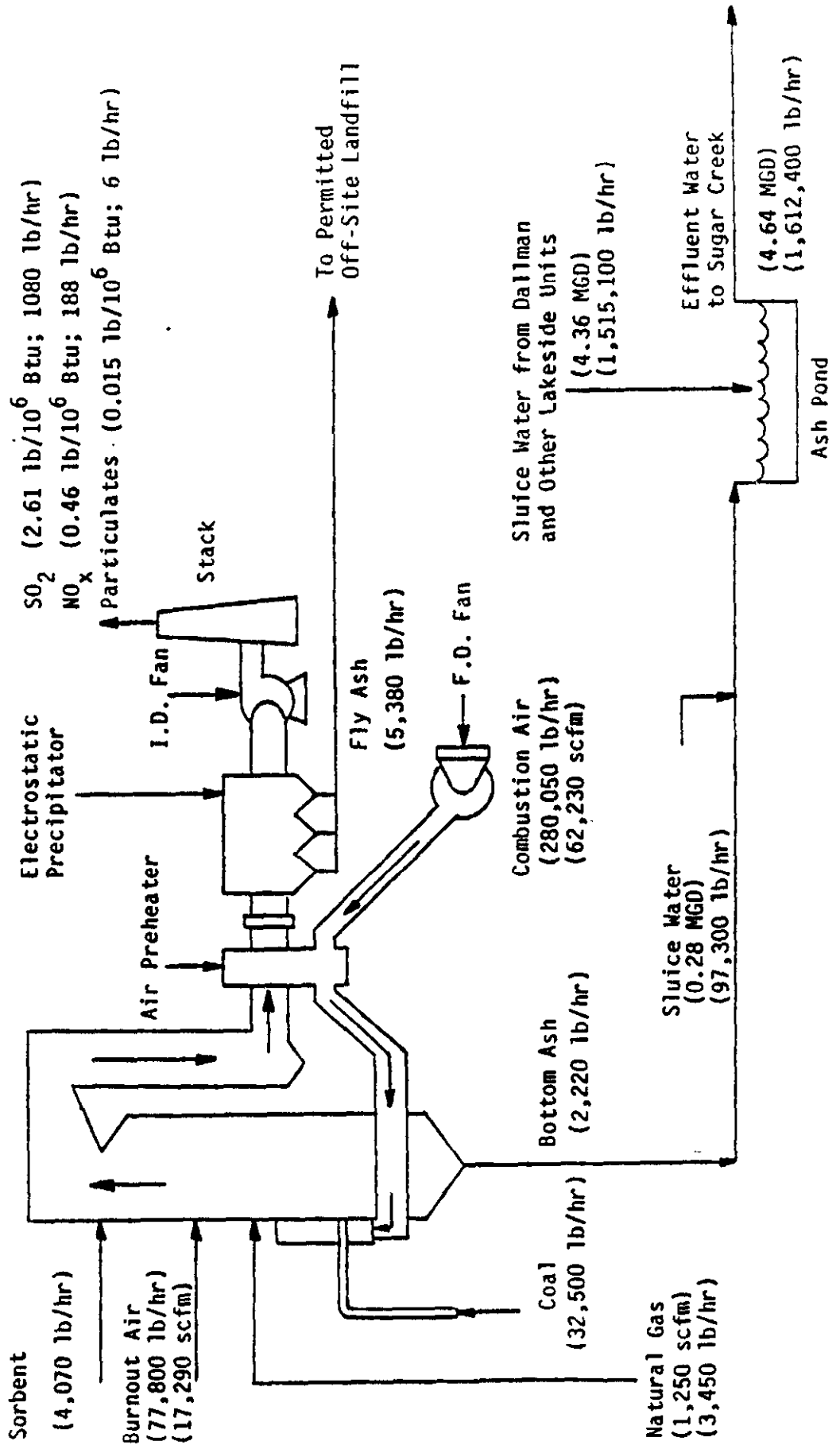


Figure 2-11. Process Flows for GR-SI Operation During Peak Output

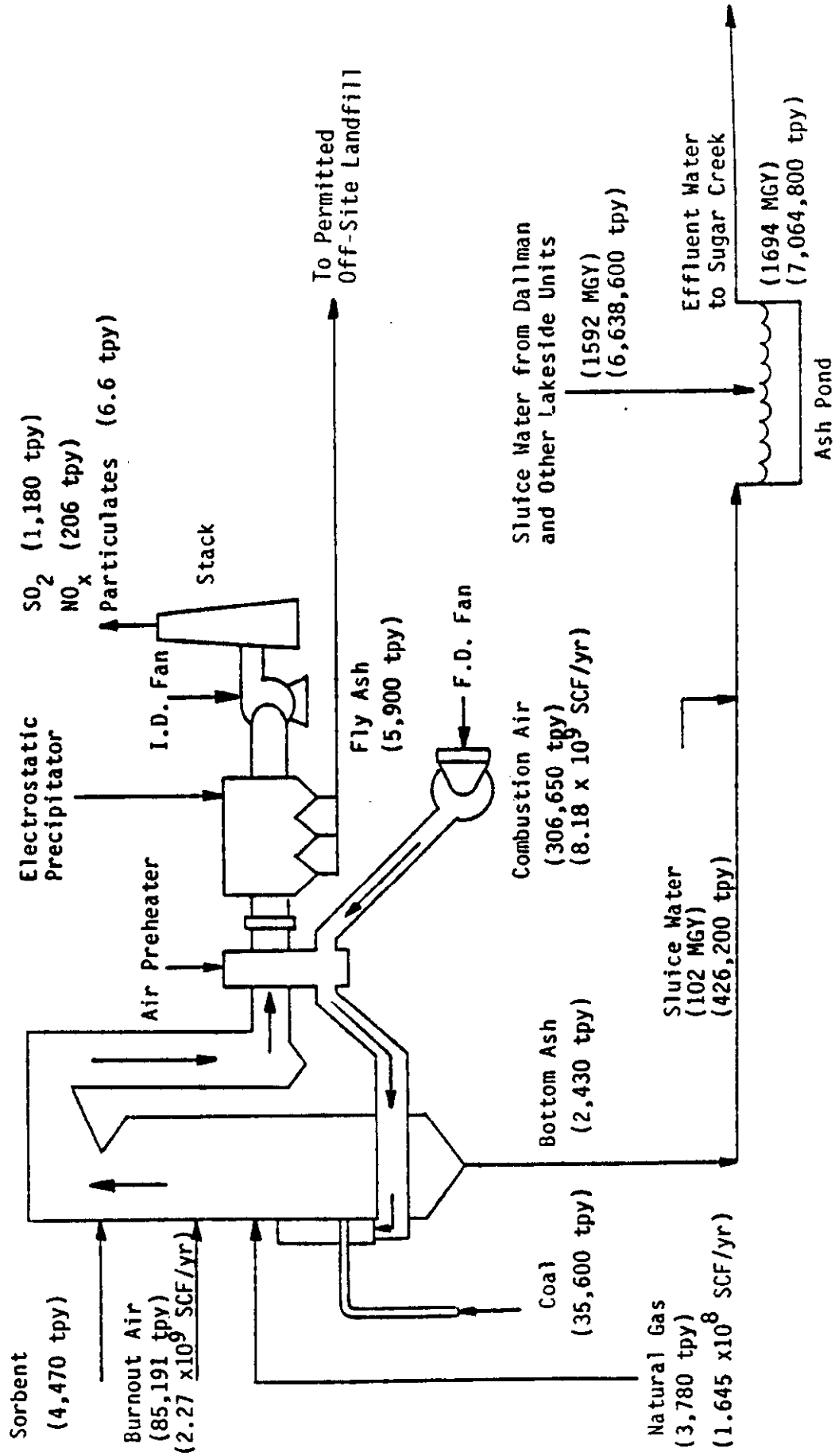


Figure 2-12. Process Flows for GR-SI Operation - Projected Annual Data

It is estimated that the natural gas consumption rate for the host site at full operating capacity will be 1250 scfm. This value is calculated by assuming that the Unit 7 peak generation rating will remain at its present level of 39.8 MW_e net, and that the stoichiometric oxygen ratios in the combustion, reburn, and burnout zones will be 1.1, 0.9, and 1.15 respectively. These ratios were found to be optimal in previous gas reburning studies (Greene et al. 1985). Records from the Gas Division of CILCO indicate that the natural gas will have a heating value of 21,650 Btu/lb and a density of 0.046 lb/ft^3. The Illinois coal that is currently used will continue to be used during the GR-SI demonstration. Coal usage will decrease due to the additional heat input associated with the natural gas. Full load coal feed rate will decrease by approximately 18 percent to 32,500 lb/hr. Projections made by CWLP personnel indicate that the Unit 7 capacity factor will increase slightly from its present value of 24 percent to 25 percent for the year in which GR-SI testing will be done. This corresponds to an annual consumption of about 35,600 tons of coal. Assuming that coal usage at other Lakeside units and all Dallman units will remain at present levels, the total annual CWLP plant coal usage will be approximately 808,900 tons, and Lakeside Unit 7 will account for about 4.4 percent of CWLP plant coal use.

Land Requirements. There is no anticipated requirement for additional land outside the existing plant boundaries. The GR-SI technology demonstration involves the retrofit of two emission control procedures on an existing utility boiler with no change in the expected service life of the boiler. The natural gas pipeline will be constructed entirely within CWLP plant boundaries. The GR-SI technology itself is implemented within the existing boiler structure. The ancillary systems associated with GR-SI are relatively compact. The host site has been examined to ensure that adequate space is available on site for the pipeline and installation of the sorbent storage and feeding equipment. Sufficient space is available for convenient location of all required hardware.

Fly ash captured by the particulate control equipment will be transported dry to a permitted off-site landfill for disposal. During the year-long GR-SI demonstration, it is estimated that 181,500 ft^3 (4.17 acre-ft) of

fly ash from Unit 7 will be placed in the landfill. CWLP has already contacted one permitted landfill (Christian County Landfill) which has expressed interest in accepting the GR-SI waste.

Bottom ash will continue to be sluiced to the on-site ash pond. Plant personnel estimate that, at the present usage rate, the 40-acre pond has a remaining usable life of six years. As discussed in Section 2.1.2, approximately 136,400 ft^3 (3.13 acre-ft) of ash from Unit 7 enter the ash pond annually. During the one-year GR-SI demonstration, approximately 91,700 ft^3 (2.11 acre-ft) of waste from Unit 7 will be sluiced to the pond. Therefore, the ash pond will fill more slowly as a result of the GR-SI project.

Water Requirements. The GR-SI process does not require the utilization of water, per se. Less sluice water will be required because fly ash will be transported dry to an off-site landfill during GR-SI operation. As discussed in Section 2.1.2, Unit 7 currently generates about 3795 tons of ash per year and has a sluice water requirement of approximately 0.44 MGD. During GR-SI operation, bottom ash will continue to be sluiced to the pond and will be generated at the rate of approximately 2430 tons per year. Assuming that the relative ratio of sluice water to ash loading will remain constant, approximately 0.28 MGD of sluice water will be required during GR-SI operation. Assuming that sluice water requirements for the other Lakeside and Dallman units will remain constant, the total CWLP plant sluice water requirement will decrease from its present level of about 4.80 MGD to approximately 4.64 MGD.

Labor Requirements. Labor will be required for installation of the GR-SI equipment, operation and maintenance of the hardware, and verification of system performance. Although the equipment installation represents the largest labor requirement, it is still a relatively small effort which can be managed by EER using locally available labor to provide both general and specialized skills. A breakdown of labor requirements is presented in Table 2-4.

TABLE 2-4. Construction Labor Requirements

Task		Duration (months)	Community Supplied Labor (hrs)
Phase 1:	Baseline Testing	1	240
Phase 2:	Construction	16	3,360
Phase 3:	GR-SI Testing	12	2,000
Total		29	5,600

Operation and maintenance of the GR-SI systems requires very little additional labor; it is anticipated that these tasks may be conducted by the existing Lakeside Station operations staff upon completion of a brief training program. During test periods, EER test crew personnel will also be available to oversee operation and maintenance procedures.

Performance verification tasks will be conducted by EER test crews. No additional labor will be required for these tests.

Materials Requirements. The primary material requirement for the GR-SI technology demonstration is a calcium-based sorbent. During operation, approximately 4070 lb/hr of $Ca(OH)_2$ sorbent will be required. Over the course of the one-year demonstration, approximately 4460 tons of sorbent are expected to be used at the site. Approximately 150 tons of sorbent will be stored in the site's sorbent silo. The raw material for sorbent is limestone for which the state of Illinois is a major producer. The sorbent to be tested will be selected as part of the demonstration process.

Construction materials will be purchased from local distributors. Construction materials include sorbent silo and handling equipment, piping and small hardware items.

Transportation Requirements. The main factors impacting transportation will be a decrease in coal usage and an increase in sorbent usage. Coal is currently delivered to Lakeside by 20-ton trucks; six truck loads per day are needed to supply the Unit 7 coal requirements, assuming coal is delivered 365 days per year. Because total coal usage will decrease, only five trucks per day will be required for coal delivery after GR-SI is implemented. The sorbent will be trucked in and will require approximately one truck per day for delivery. Also, one truck load per day of GR-SI fly ash will require transport to a local permitted landfill. Therefore, the total truck traffic for Unit 7 will increase to seven trucks per day. Overall, 112 trucks per day are required to supply the current coal requirements of Lakeside and Dallman Stations, and about eight trucks per day are required to transport the Dallman Station scrubber sludge to the ash disposal area.

2.1.4.2 Project Discharges

Significant waste discharge streams from the boilers employing the GR-SI technology include stack emissions and a solid waste consisting of fly ash and spent sorbent. Emission reduction targets of 60 and 50 percent for NO_x and SO_2, respectively, have been established for the GR-SI demonstration in Lakeside Unit 7. The NO_x emission rate from Unit 7 is expected to decrease to about 188 lb/hr (0.46 lb/MBtu). The SO_2 emission rate is expected to decrease to about 1080 lb/hr (2.61 lb/MBtu). Annual emissions of NO_x and SO_2 during the GR-SI demonstration will be about 206 and 1180 tpy, respectively, based on expected emission rates and projected capacity factor.

No changes in CO, unburned hydrocarbons, or particulate emission rates are anticipated as a result of the GR-SI project. Although annual particulate emissions will increase from the 1986 level of approximately 6.3 tons to about 6.6 tons during the one-year GR-SI demonstration, this change is due to the increase in capacity factor and does not reflect any change in instantaneous particulate emission rate. The increase in projected capacity factor is not related to the GR-SI program, but is based on CWLP electricity demand projections.

During initial GR-SI equipment testing, some variation in SO_2 control efficiency is expected. However, no permit limits for SO_2 will be exceeded since the coal currently fired in Lakeside Unit 7 (which will also be fired during the GR-SI demonstration) complies with the SO_2 permit level without controls.

Solid waste will change in both composition and flow rate due to the change in coal firing rate and the addition of sorbent. Projected annual solid waste production for Lakeside Unit 7 and the entire CWLP plant is summarized in Table 2-5, which assumes that all Dallman and Lakeside Station units other than Lakeside Unit 7 will continue to generate ash at their present rates. Based on the decreased coal feed rate and the sorbent injection rate, the flow rate of fly ash collected by the ESP during full load

TABLE 2-5. Expected Annual GR-SI Solid Waste Generation

	Bottom Ash		Fly Ash		Total Ash	
	ft^3/yr	acre-ft/yr	ft^3/yr	acre-ft/yr	ft^3/yr	acre-ft/yr
Lakeside Unit 7	91,700	2.11	181,500	4.17	273,200	6.27
Total of Lakeside & Dallman Stations	1,263,060	29.00	384,390	8.82	1,647,450	37.82

operation is expected to increase to about 5380 lb/hr (compare Figures 2-6 and 2-11). The GR-SI fly ash composition will be approximately 14 percent coal ash, 27 percent $CaSO_4$, and 59 percent $Ca(OH)_2$. Based on the projected capacity factor (25 percent), the annual fly ash generation rate will increase to about 5900 tpy (compare Figures 2-7 and 2-12). Assuming that fly ash density will remain at 65 lb/ft^3, the annual fly ash volume will increase to approximately 181,500 ft^3/yr (4.17 acre-ft/yr).

Bottom ash flow rate will decrease to about 2220 lb/hr during full load operation due to reduced coal consumption. Annual bottom ash flow rate will decrease to approximately 2430 tpy. Assuming that bottom ash density will remain at 53 lb/ft^3, the annual bottom ash volume will decrease to approximately 91,700 ft^3/yr (2.11 acre-ft/yr). Note that these figures, including the data in Table 2-5, do not include dewatered scrubber sludge from Dallman Station.

Bottom ash will continue to be sluiced to the existing ash pond. Because less ash will be sluiced to the pond, sluice water requirement and effluent water discharge to Sugar Creek will decrease. Pond discharge is expected to decrease from its present value of 4.80 MGD to 4.64 MGD. Composition of the waste being sluiced and ratio of sluice water to ash are expected to remain at their present values. Bottom ash composition from Lakeside Unit 7 is not expected to change since 1) the same coal will be fired during the GR-SI demonstration as is currently fired, and 2) sorbent injection will occur near the top of the furnace at the inlet to the convective section. Thus, all of the sorbent is expected to enter the convective section, where it will react with gas phase SO_2 and, ultimately, be captured in the ESP. Therefore, no changes are anticipated in ash pond pH, total suspended solids, or oil and grease concentrations. Because a slight decrease is expected in pond discharge rate, a slight decrease is also expected in annual loading of pollutants to Sugar Creek. Coal pile size is not expected to change and thus coal pile runoff will not change.

The GR-SI fly ash will be transported off-site by truck to a landfill permitted by IEPA to accept this type of waste. CWLP personnel have visited

the Christian County Landfill to discuss the potential for disposal of the GR-SI ash there. Christian County Landfill operators are experienced in the handling of AFBC ash, which has many similar characteristics, and expressed an interest in handling the GR-SI ash. The permitted landfill is also equipped with liner and leachate collection systems to minimize impact to groundwater.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

This subsection identifies and characterizes three alternatives to the proposed action: no action, use of alternative technologies, and use of alternative sites.

2.2.1 The No Action Alternative

Under the No Action alternative, DOE would not provide funds to place GR-SI technologies at Lakeside Station. Under this alternative, testing of these technologies would be undertaken only at the Hennepin and Edwards sites, as discussed in Section 1.0. The existing plant engineering design and station configuration would remain as described in Section 2.1.2. Conditions at the Lakeside site would remain unmodified. Excluding Lakeside Station as a test site would eliminate the cyclone fired boiler from the types of boilers being tested in this demonstration project.

2.2.2 Alternative Technologies

The proposed action is to install GR-SI technologies at the Lakeside site to provide a demonstration of the effectiveness of these combined technologies in reducing SO_2 and NO_x emissions. Other technologies could be installed at this location to achieve similar environmental objectives.

Two competing methods for SO_2 control are presently in commercial operation on coal-fired power plants: wet limestone flue gas desulfurization and spray dryers. Both of these are high in capital cost and require a significant amount of space for installation, and both produce waste streams

that require disposal considerations similar to those for GR-SI. GR-SI has the advantage of relatively low capital cost and minimal installation space.

Combustion modifications which inhibit the formation of NO_x in the furnace as it burns include low NO_x burners, multi-stage combustion, reburning and overfire air. Gas reburning is the only near term NO_x control option available in cyclone furnaces where combustion takes place in a horizontal cylinder attached to the outside of the furnace. Other furnaces using pulverized coal employ circular or cell type burners in wall-fired or tangentially-fired arrangements and can take advantage of low NO_x burner technology. Post-combustion treatments such as selective catalytic reduction which removes flue gas down-steam of the boiler are plagued by complex operational issues and higher costs than in-furnace NO_x reduction.

The limitations associated with these existing emissions control technologies emphasize the need for exploring additional options and do not provide a reasonable alternative to GR-SI.

2.2.3 Alternative Sites

The available population of coal-fired electric utility plants having the appropriate characteristics and boiler configuration to be suitable for retrofit with GR-SI technology were surveyed using MEGABASE, a commercially available computerized database of all fossil fuel-fired utility boilers east of the Mississippi River. Only those sites currently available for demonstration purposes were considered as acceptable alternatives. Results of the survey indicated that 67 coal-fired utility boilers were operating in Illinois as of January 1980. To minimize environmental impact, only those alternative sites were evaluated that had been previously disturbed, were previously allocated to electric power production, and for which the necessary permits had already been obtained. The alternative sites meeting these criteria and having net generating capacities below 100 MWe (the maximum feasible size with which to conduct the demonstration within the designated level of funding) were Hennepin Station, Edwards Station, and the proposed site at Lakeside Station.

The boiler at Hennepin Station is tangentially-fired and, because the goal of this project is to demonstrate GR-SI in a cyclone-fired boiler, Hennepin could not be used. The boiler at Edwards Station is front wall-fired, so could also not be used for this project. The proposed GR-SI demonstration project at Edwards Station is described in an environmental assessment (DOE/EA-0382), and that at Hennepin Station in a Memorandum-to-File dated May 9, 1988. Since no sites other than Lakeside were available that offer the minimal environmental impact to be expected from these previously allocated sites, no further alternative sites were evaluated.

3. EXISTING ENVIRONMENT

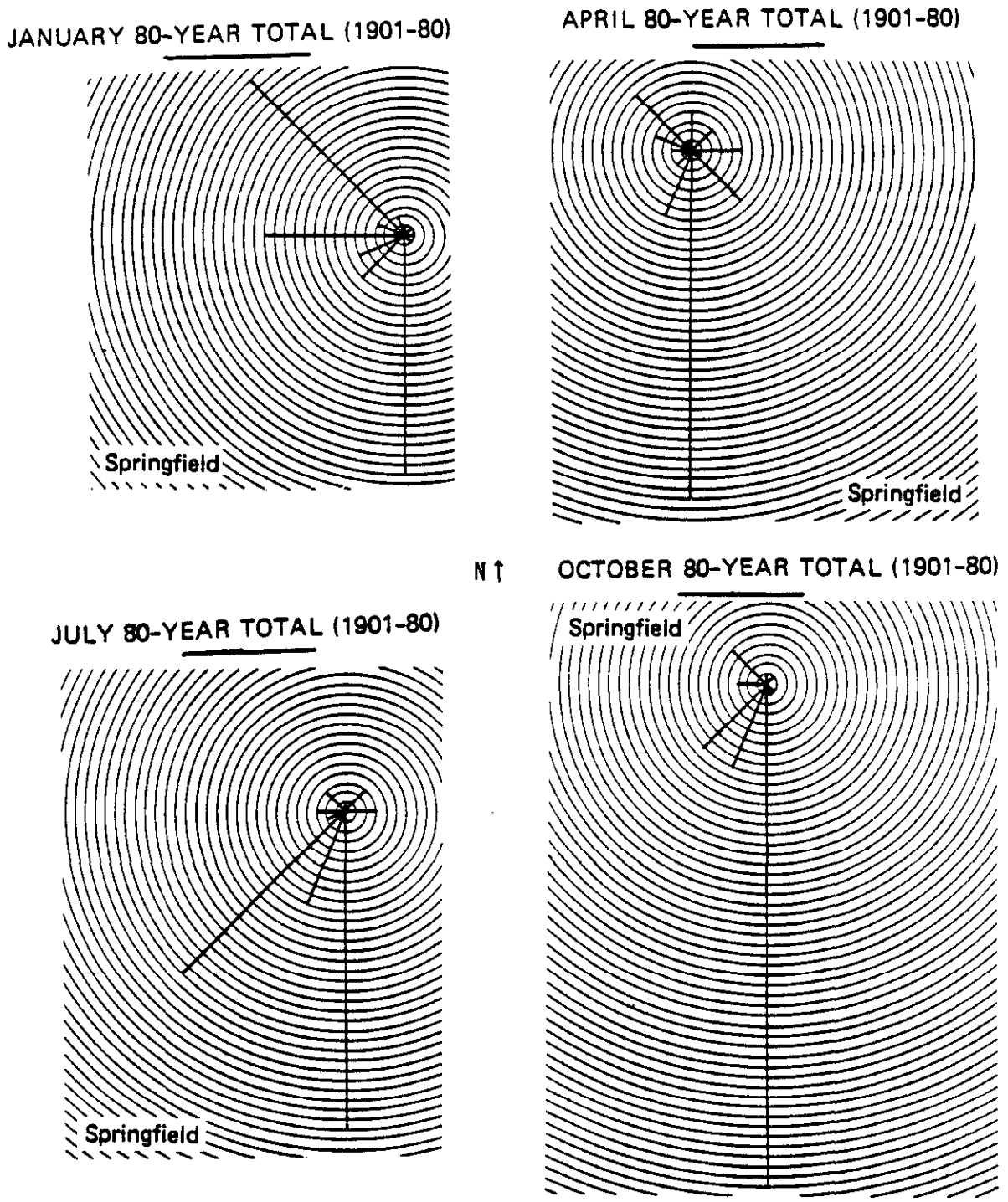
This section describes the environmental setting at Lakeside Station, focusing on environmental features that might be impacted by the proposed action. The environment is divided into the six categories that are characterized individually in this section.

3.1 ATMOSPHERIC RESOURCES

The area of central Illinois in which the demonstration site is located provides a typical continental climate with warm summers and fairly cold winters. Figure 3-1 shows wind roses for Springfield for four months representing the four seasons. For most of the year, prevailing winds tend to be from the south. According to the Illinois State Climatologist, who is an agent of the Illinois State Water Survey, average annual precipitation for Springfield is 33.8 inches. The climate is typical of the entire midwestern states area and not representative of a local specialized environment.

The air quality in the area of Lakeside Station is generally good. Sangamon County is in Federal Air Quality Control Region 75 (West Central Illinois Intrastate), and is a primary attainment area for the U.S. EPA criteria pollutants SO_2, NO_x, and total suspended particulates (Illinois EPA 1985). The region is a secondary non-attainment area for total suspended particulates. A survey of Illinois EPA's Air Emissions Inventory revealed that in Sangamon County, 145 businesses and industrial plants emit air pollutants, of which 86 emit particulates, 18 emit SO_2, and 24 emit NO_x.

Lakeside Station is in close proximity to the city of Springfield, as well as to several railroads, highways, and other industrial plants. Current noise levels at Lakeside Station are attributable to normal plant operation (e.g., coal pile shaping and coal feeding) and coal delivery trucks for both Lakeside and Dallman Stations.



Key: For each concentric circle, the wind blows 1 percent of the time from the direction of the line. Thus a line directed vertically downward from the city that passed through 10 circles would indicate that the wind blew from the south 10 percent of the time.

Figure 3-1. Wind Roses for Springfield, Illinois

3.2 LAND RESOURCES

Lakeside Station is situated adjacent to Lake Springfield in the Springfield Plain of the Central Lowlands Physiographic Province. The Plain is characterized by broad upland divides with mature valleys. No large hills exist in the vicinity, but rolling terrain is found near the Sangamon River. Approximately 10 feet of loess covers the Illinoisan age glacial drift which is itself underlain by pre-Illinoisan glacial drift and Pennsylvania age bedrock. The floodplain map of the Lakeside Station area given in Figure 3-2 shows that the plant itself is in a Zone C area, while the ash ponds are in a Zone A6 area. Zone C areas experience minimal flooding, while Zone A6 represents the 100-year floodplain, i.e., areas with a one percent probability of being flooded in any one year.

Although much of the land surrounding Lakeside Station is urbanized, some farmlands are found in the area. According to the Sangamon County Soil and Water Conservation District, a branch of the U.S. Department of Agriculture, the soil in this area is classified as Fayette silt loam, and is not considered prime or unique farmland. Floodplain and wetland areas and the impact of the GR-SI project upon these areas are described more completely in the Floodplain/Wetlands Assessment attached to this volume as Appendix A.

3.3 WATER RESOURCES

Effluent water from the Lakeside and Dallman ash ponds is discharged to Sugar Creek. Ambient water quality data for Sugar Creek near Lakeside Station are summarized in Table 3-1, including flow rates and concentrations of contaminants. Also included are the Illinois General Use Water Quality Standards for various parameters, which must be met in waters of the state for which there is no specific designation. Table 3-1 indicates that dissolved oxygen, boron, and iron occasionally fail to meet Illinois general use water quality standards. Creek flow rate depends on a number of factors, including rainfall and amount of water spilling over the Spaulding Dam from Lake

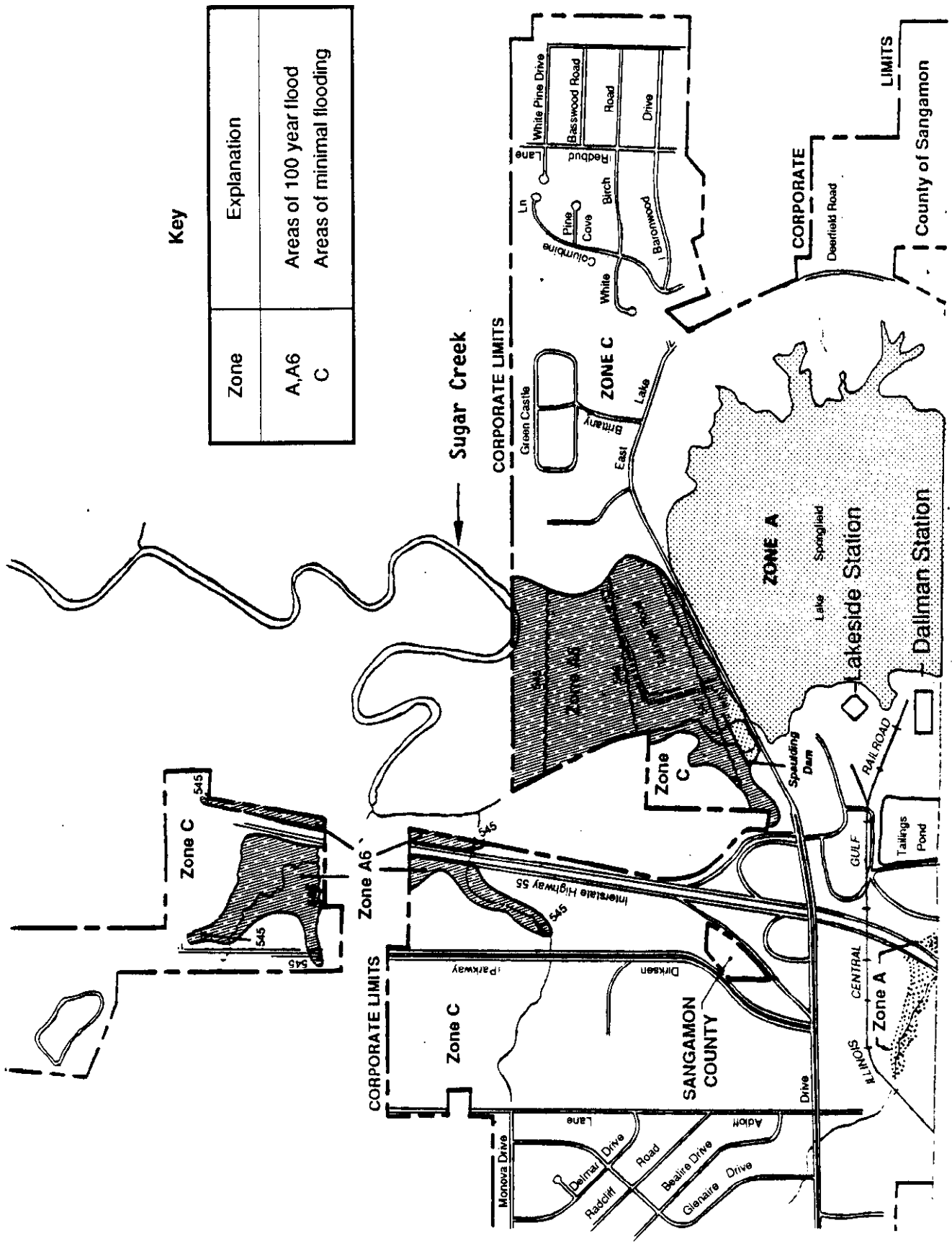


Figure 3-2. Flood Zones Near Lakeside Station

TABLE 3-1. Water Quality Data for Sugar Creek Near Springfield for 1985[a]

Parameter	High	Low	Average	Illinois General Use Water Quality Standard
pH	8.0	7.1	7.7	6.9
Flow Rate (ft^3/s)	159.0	4.6	60.0	
Dissolved Oxygen (mg/l)	13.0	5.2*	8.8	>6.0
Barium (mg/l)	0.071	0.045	0.059	<5.0
Boron (mg/l)	3.6*	0.1	1.73*	<1.0
Cadmium (mg/l)	<0.003		<0.003	<0.05
Chloride (mg/l)	0.052	0.019	0.033	<500.0
Chromium (mg/l)	0.008	<0.005	0.005	<1.0
Copper (mg/l)	<0.005		<0.005	<0.02
Iron (mg/l)	2.7*	0.26	0.87	<1.0
Lead (mg/l)	<0.05		<0.05	<0.1
Manganese (mg/l)	0.25	0.047	0.113	<1.0
Nickel (mg/l)	0.011	<0.005	0.005	<1.0
Silver (mg/l)	<0.003		<0.003	<0.005
Sulfate (mg/l)	210.0	40.0	114.0	<500.0
Zinc (mg/l)	<0.05		<0.05	<1.0

*Value not meeting water quality standard.

[a](U.S. Geological Survey 1986)

Springfield. Creek flow rate generally does not fall below 3 MGD (4.6 ft^3/sec)due to dam spillage and pond discharge. There are no other industrial plants discharging into Sugar Creek.

3.4 ECOLOGICAL RESOURCES

The region of Lakeside Station is part of the Prairie Peninsula Section of the Oak-Hickory Forest Region (Braun 1950). Forests of the area are predominantly oak-hickory and, although widely distributed, are generally limited to slopes of shallow and ill-defined ravines or of low morainal ridges. Historically, prairie occupied the gently rolling to flat intervening areas (Braun 1950) but former prairie areas are now extensively used for agricultural crops, industrial sites, and residential areas. The area in the immediate vicinity of the plant site is a mosaic of industrial properties, highways, residential and farmland with some woodlands interspersed north of the power station (see Figure 2-4). Lakeside Station is bordered on its east and south boundaries by the open waters of Lake Springfield.

A search of the Illinois Natural Areas Inventory data base in 1988 yielded nine natural area sites within a 25-mile radius of Lakeside Station. Table 3-2 lists these natural areas. Their locations are mapped in Figure 3.3. According to the U.S. Fish and Wildlife Service, there are no federally designated critical habitats near Lakeside Station (Bade. Personal communication, 1988).

The Illinois Natural History Survey has also identified approximately 1310 plant species within 25 miles of Lakeside Station. According to the Great Lakes Area Regional Office of the U.S. Fish and Wildlife Service, no species of flora in Sangamon County are federally listed as endangered or threatened (Refsnider. Personal communication, 1988).

The Illinois Natural History Survey also identified 476 bird, fish, mollusk, amphibian, and reptile species within 25 miles of Lakeside Station. According to the U.S. Fish and Wildlife Service, two of these species, the Indiana bat (Myotis sodalis) and the bald eagle (Haliaetus leucocephalus), are

TABLE 3-2. Natural Areas in the Lakeside Station Regional Environment

Reference Number	Area Name	Acreage
279	Porta School Natural Area	25.0
178	Elkhart Hill	157.0
44*	Carpenter Park	237.0
842	Norfolk & Western Railroad Prairie	1.1
245	Sangamon State University Natural Area	40.0
801	Abraham Lincoln Memorial Garden	77.0
85	Long Point Slough (West)	89.0
84	Long Point Slough (East)	73.0
13	Berry's Woods	23.0

*Dedicated Nature Preserve

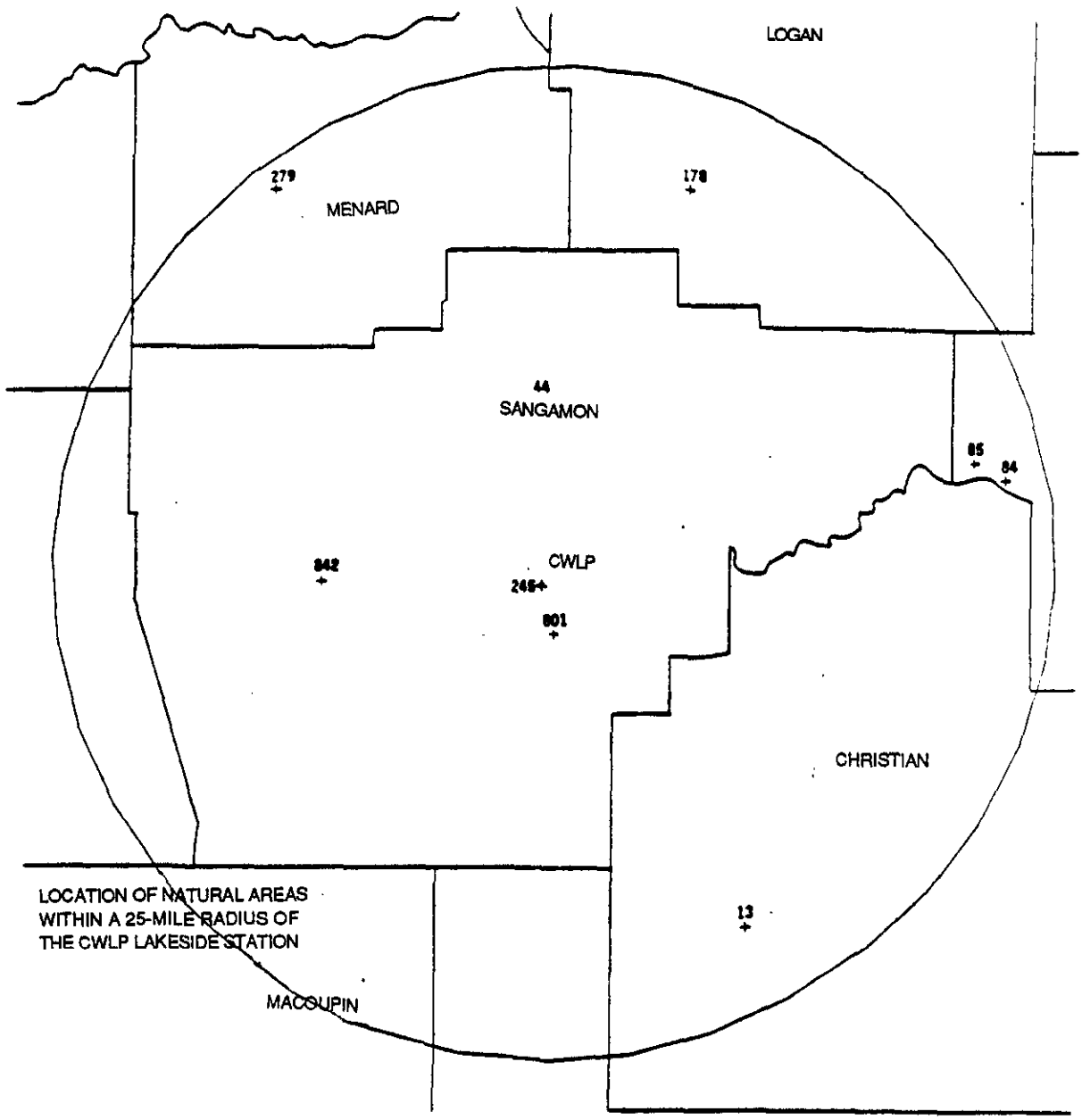


Figure 3-3. Natural Areas in the Lakeside Station Regional Environment (numbers refer to Natural Areas listed in Table 3-2)

endangered. Both species have a statewide distribution, but have no critical habitat in the vicinity of Lakeside Station.

Lake Springfield, located to the east and south of the station, is one of 2900 lakes in Illinois (Bhowmik, et al. 1987). Some 258 square miles of land comprise the watershed draining into Lake Springfield (Stall and Lee 1980). Even though Lake Springfield receives approximately a ton of sediment per acre per year through soil erosion in the watershed, bottom-dwelling species such as mollusks have remained fairly stable. Of the nine mollusk species surveyed in a 1953 study, all nine plus four previously unrecorded species were found at these identical locations in 1978 (Klippel and Parmalee 1979). No specific data are available to characterize the fauna of Sugar Creek near the Lakeside Station but the creek is known to support permanent fish populations (Roseboom, et al. 1986).

3.5 SOCIOECONOMIC RESOURCES

The Lakeside site is located immediately adjacent to the city of Springfield in Sangamon County. Springfield has a population of approximately 100,000 (U.S. Department of Commerce, 1983), while a total of 176,000 people reside in the county. The local area provides an economic base of labor and materials to the Lakeside plant.

Means of transportation of materials and manpower to the plant are provided by nearby railroads and Interstate Highway 55.

3.6 ENERGY AND MATERIALS RESOURCES

The main material resources of interest for this project are limestone, coal, and natural gas. Limestone is in abundant supply, with a capacity to deliver over 17 million tons per year to the U.S. market (Gutschick 1987, p. 2). There are over 160 limestone quarries in Illinois and Missouri (Boynton 1980, p. 14). Coal is trucked in from Logan County in central Illinois. Lakeside has a contract running through 2005 with its coal supplier; thus, no problem is expected with coal availability. A natural gas

pipeline will be constructed at the site. Natural gas is also in abundant supply, with capacity existing to deliver an additional 6.5×10^6 scfm beyond current consumption to the U.S. market (American Gas Association 1985).

4. ENVIRONMENTAL CONSEQUENCES

4.1 IMPACTS OF THE PROPOSED ACTION

Demonstration of GR-SI technologies in a pre-NSPS utility boiler has the potential to impact the environment in several ways. The discussion that follows considers the consequences of both construction and operation. Plans for mitigating possible detrimental impacts are also discussed. In this way, it will be shown that this project will have no significant EHSS impacts. Although Hennepin Station, Edwards Station, and Lakeside Station are all located near the Illinois River, they are at a substantial distance from one another; therefore, cumulative impacts from development at all three locations is not expected.

4.1.1 Atmospheric Impacts

During construction, the only air emissions at the Lakeside Station are expected to be fugitive emissions from equipment installation and minor landscaping. The area affected by installation of the sorbent silo and natural gas pipeline will be less than one-tenth of an acre. Therefore, fugitive emissions resulting from construction are expected to have a negligible impact upon air quality. Transportation requirements for the CWLP plant will increase from 120 to 121 trucks per day. This negligible change should have no impact upon air quality.

Several air quality impacts are anticipated during project operations. Emission rates of NO_x and SO_2 are expected to decrease by 60 percent and 50 percent, respectively. In addition to the potential public health benefits of these emission reductions, the utility plant could also benefit if stricter air pollution laws were passed. It is anticipated that the electrostatic precipitator will have sufficient specific collection area to counteract the increase in particulate loading. Thus, the particulate emission rate from Unit 7 is expected to remain at 6 lb/hr (0.015 lb/MBtu). Total annual particulate emissions from Unit 7 will increase from 6.3 to 6.6 tons/year, but this increase is due to the higher projected capacity factor,

which is independent of the GR-SI project. Fugitive emissions may decrease slightly due to the smaller quantity of coal that will be loaded to Unit 7. Dust control measures will be used to prevent fugitive emissions of fly ash during transportation to the landfill cells.

The handling and use of dry, calcium-based sorbents presents several unique problems. Sorbent handling requires special care to prevent inhalation of the dust or contact with the eyes, since the sorbent is not only abrasive, but somewhat alkaline. Also, the potential exists for fugitive dust emissions during the transportation and storage of sorbents. To minimize fugitive emissions, a dustless pneumatic handling system will be used. Sorbent will be transported to the site in fully enclosed tanker trucks, and will be transferred pneumatically to the sorbent storage tank. The only exposure of limestone to the atmosphere will be through vents in the storage silo; these vents will be equipped with bag filters. If a need arises for workers to handle limestone, mitigating measures to minimize risks to workers will include mandatory use of protective apparatus such as enclosed safety goggles and inhalation dust filters.

Noise from the addition of the GR-SI process will be generated mainly by construction activities. The State of Illinois Noise Pollution Regulations (35 Ill. Adm. Code 901.107 part d) state that equipment used for construction is exempt from general regulations governing allowable noise levels. Therefore, construction activities will not violate Illinois noise regulations. Construction will be short-term and will not have a lasting effect on noise levels. Construction will also occur against a background of the ambient operational noise from other power plant activities. Incremental operational noise from the GR-SI project will be negligible compared to current plant noise. Because few residences are in close proximity to the plant, no significant noise impact is expected.

4.1.2 Land Impacts

All construction activities will occur on-site. Thus, no land impacts beyond plant boundaries are expected. The natural gas pipeline will be installed entirely on-site and is not expected to impact any land values.

Fly ash will be transported dry to a permitted off-site landfill. Only about 4.17 acre-ft of GR-SI fly ash will be transported to an off-site landfill if this option is selected. Assuming a disposal depth of 10 feet, only about 0.42 acres of land already allocated for waste disposal would be consumed during this project. Studies have shown that coal fly ash/spent sorbent mixtures have good landfill characteristics due to their pozzolanic properties, which allow the solid waste to harden into a cement-like substance after drying (Electric Power Research Institute 1988). Bottom ash will continue to be sluiced to the ash pond. As discussed in Section 2.1.3.3, the amount of waste from Unit 7 entering the pond will decrease from its present value of 136,400 ft^3 (3.13 acre-ft) to 91,700 ft^3 (2.11 acre-ft) during the year-long GR-SI demonstration. Thus, the ash pond will fill more slowly as a result of the GR-SI project.

The project is not expected to have any land impacts beyond plant boundaries. Therefore, there should be no archaeological, cultural, or historical impacts of the project.

4.1.3 Water Quality Impacts

Bottom ash, is expected to have the same composition as the baseline bottom ash, and will be sluiced to the ash pond for disposal, in keeping with current practice. The Unit 7 sluice water requirement will decrease from its present value of 0.44 MGD to 0.28 MGD. The GR-SI project will not affect any other plant water flow rates. While the decrease mentioned above represents a reduction of approximately 36 percent in the Unit 7 sluice water requirement, this process water use is insignificant when compared with the Lakeside Station cooling water requirement of 290 MGD. Thus, the project will have a negligible impact on water usage.

The decrease in Unit 7 sluice water will cause a reduction in the ash pond effluent water discharge rate from the present value of 4.80 MGD to 4.64 MGD. The GR-SI project is not expected to have any effect on ash pond pH, total suspended solids, or oil and grease concentrations. Annual loadings will decrease slightly due to the decrease in effluent water flow rate. Thus, the project is expected to have a negligible impact on Sugar Creek water quality.

The GR-SI fly ash will be disposed of in a permitted off-site landfill. The waste will be transported to a landfill permitted by IEPA to accept this waste type. IEPA requires permitted landfills to have liners and leachate collection systems to prevent groundwater contamination.

4.1.4 Ecological Impacts

Construction of the 1400-foot gas feeder pipeline will temporarily disturb approximately one acre of roads and grass-covered property entirely within plant site boundaries. Soil loss in the Lake Springfield Watershed from 1930 to 1978 is estimated to have averaged 3.96 tons per acre per year with 24% deposited in Lake Springfield (Stall and Lee 1980). Given the low topographic relief of the pipeline route, and assuming good erosion control practices are followed during pipeline construction, soil erosion is expected to be minimal and corresponding impacts to Lake Springfield biota would also be minimal. After pipeline installation, the disturbed area will be contoured and reseeded, and habitat recovery will be rapid.

Construction activities will contribute some noise and fugitive dust emissions to the environment. However, noise and dust emissions from these activities will have a negligible impact upon area biota because construction will be short-term and is similar to other ongoing minor construction activities characteristic of this industrial site.

Transportation requirements will increase slightly (1 truck per day) but insignificantly compared to the 120 trucks per day currently servicing

Lakeside and Dallman Stations. This small increase in noise and diesel engine emissions would result in a negligible adverse impact to area biota.

The GR-SI project is expected to substantially improve air quality by reducing NO_x and SO_2 emissions by 60 and 50 per cent, respectively. These reductions would have a minor beneficial impact on area biota.

Coal pile runoff will remain unchanged and no changes are anticipated in ash pond pH, total suspended solids, or oil and grease. A slight decrease in annual loadings of pollutants to Sugar Creek will likely have a minor beneficial effect to stream organisms.

The proposed action is not expected to affect any of the nine natural areas listed in Section 3.4 either directly or indirectly. The GR-SI project will not impact any federally listed threatened or endangered species, and no ecologically sensitive areas will be disrupted.

4.1.5 Socioeconomic Impacts

The labor requirements for the GR-SI project were detailed in Section 2.1.4.1. The total labor required from the local community is expected to be about 5600 man-hours for construction, to be spread over an eight-month period. This requirement will involve less than 20 new personnel. Pipeline construction will be coordinated by CILCO using CILCO personnel, and will have a minimal impact upon the area's economy. Operational manpower requirements should remain at current levels. Due to the availability of an ample labor force within commuting distance and the small labor requirement of the project, the GR-SI project will have a minimal positive impact on local employment. The four construction supervisors will be non-local EER personnel; therefore, no adverse impact on housing and support facilities is anticipated, especially since the host site is within commuting distance of metropolitan areas. In addition, miscellaneous, small pieces of equipment and pH adjustment materials may be purchased locally. Thus, the GR-SI project should have a small positive impact upon the Lakeside area economy.

As described in Section 2.1.4.1, the project will result in a decrease in coal use at Unit 7 from 41,700 tpy (1986 data) to approximately 35,600 tpy. This represents a decrease of 6,100 tons of Illinois coal during the life of the project (one year), which would produce a negligible adverse impact on the Illinois coal economy.

The GR-SI project will require one truck per day for sorbent delivery, five trucks per day for coal delivery, and one truck per day for fly ash removal, a total of seven trucks per day. Since the current traffic volume is six trucks per day for coal delivery to Lakeside Unit 7, an increase of one truck per day is expected. Contrasted with the current requirement of about 120 trucks per day for the entire CWLP plant, the GR-SI project will have only a minimal impact on transportation requirements.

4.1.6 Energy and Materials Impacts

The estimated increase in electrical power consumption rate due to GR-SI is about 400 Kw-hr/hr. Although this rate of electrical consumption is not negligible, it represents only 1.1 percent of the total net generating capacity of Unit 7, 0.4 percent of the Lakeside Station capacity, and 0.09 percent of the CWLP plant capacity. This additional energy requirement, then, will have minimal impact on the availability of electrical power beyond the plant boundaries.

The possible areas of materials impact are coal usage, natural gas usage, and sorbent usage. Implementation of GR-SI technology will result in direct replacement of approximately 18 percent of the baseline coal input with natural gas. Full-load coal usage will decrease from approximately 39,700 lb/hr to about 32,500 lb/hr. Because Unit 7 accounts for only 5.1 percent of the total CWLP plant coal usage, an 18 percent reduction in Unit 7 coal usage will have a minimal impact upon CWLP plant coal consumption.

During full-load GR-SI operation, Unit 7 will consume approximately 1250 scfm of natural gas. General availability of natural gas resources is not expected to present any problem; capacity exists to deliver an additional

6.5×10^6 scfm beyond current consumption to the U.S. market. This surplus represents 20 percent of the current U.S. consumption, and the increased consumption for Lakeside Station amounts to less than 0.02 percent of the current excess capacity.

The year-long test phase of the project will require about 4,470 tons of limestone-based sorbent. Capacity exists to deliver 17 million tons per year of limestone to the U.S. market. Therefore, the project will require only 0.03 percent of the U.S. limestone supply. Limestone availability is not a problem because over 160 quarries exist in Illinois and Missouri.

4.1.7 Impact Summary

In summary, no significant EHSS impacts are anticipated during the construction and operation phases of the GR-SI technology demonstration, other than the beneficial impact of the reduction in NO_x and SO_2 emissions. Disposal of the GR-SI systems at the end of the demonstrations (if required by the host utilities) would incur the same types of impacts and levels of risk associated with the on-site construction activities; i.e., minimal to negligible EHSS impacts are anticipated for any disposition activities, if required.

4.2 IMPACTS OF THE ALTERNATIVES

This subsection addresses three alternatives to the proposed action: no action, the use of alternative technologies, and the use of alternative sites.

4.2.1 No Action

Under this alternative, the GR-SI technologies would not be installed at Lakeside Station. As a result, environmental conditions at the site would be no different than under existing conditions. In particular, NO_x and SO_2 emissions would remain unchanged from current operating conditions. The benefits gained from reducing these emissions by using the GR-SI process would not be realized.

4.2.2 Alternative Technologies

Installation of alternative emission control technologies at Lakeside Station would not provide DOE with information on the effectiveness of GR-SI. In particular, information would be lacking on the effect of GR-SI with a cyclone-fired boiler. Thus, installing alternative technologies is not a practical option and requires no further impact analysis.

4.2.3 Alternative Sites

Two alternative sites, Edwards and Hennepin, are considered by the applicant (EER) to be suitable for installation of GR-SI technologies. The environmental impacts of installing the GR-SI process at these alternative sites are evaluated in independent NEPA compliance actions. Hennepin Station is evaluated in U.S. Department of Energy, Memo-to-File dated May 9, 1988, and the Edwards site is evaluated in a U.S. Department of Energy Environmental Assessment (DOE/EA-0382).

5. REGULATORY COMPLIANCE

This section describes current permit requirements and regulations governing plant operation, and outlines the anticipated permit modifications and the process by which they will be obtained.

5.1 REGULATIONS AND PERMIT REQUIREMENTS

Demonstration of the GR-SI technologies will be on a retrofit basis for the Lakeside boiler; therefore, the host site currently has all necessary permits for air emissions, land use, water use, and water discharges.

The Division of Air Pollution Control of the Illinois Environmental Protection Agency (IEPA) has issued a permit to CWLP for operation of Unit 7 at Lakeside Station. Particulate emissions are limited to 0.1 lb/MBtu and there is a limit of 30 percent for opacity measurements. An SO_2 emissions limit of 6.0 lb/MBtu also exists. The utility is required to submit quarterly operating reports that describe all excess opacity incidents including date, length of occurrence, and reason for occurrence.

Bottom ash wastes from the boiler will be handled by wet transport to a settling pond. The ash pond discharges to surface waters are regulated by the National Pollutant Discharge Elimination System (NPDES). The Illinois EPA Division of Water Pollution Control has issued an NPDES permit to CWLP to regulate ash pond discharge to Sugar Creek. The existing permit contains concentration limits for various parameters as well as monitoring requirements. The monitoring requirements and the limits imposed are described in Table 5-1.

5.2 ANTICIPATED PERMIT MODIFICATIONS

5.2.1 Air Permit Modifications

Lakeside Station is located in Sangamon County which is designated as an attainment area for NO_2, SO_2, O_3, and CO, but is a secondary non-

TABLE 5-1. Effluent from Ash Pond At Lakeside Station - Measurement Plan and Permit Limits

Parameter	Measurement Method	Measurement Frequency	Permit Limit	
			30-Day Avg.	Daily max.
Flow Rate	Single Reading	Once/Week	-	-
pH	Grab Sample	Twice/Week	6-9	6-9
Total Suspended Solids	24-hour Composite	Twice/Week	15.0 mg/l	15.0 mg/l
Oil and Grease	Grab Sample	Twice/Week	15.0 mg/l	20.0 mg/l

attainment area for total suspended particulates (TSP). After reviewing the nature of the GR-SI technologies demonstration, the Illinois EPA (IEPA) indicated that modifications to existing air permits, rather than new permits, will be required (Patrick Dennis, IEPA. Personal communication, September 1987). Emissions limits in the permits will not change, but the permit must be written to describe the full operation of the facility and all attendant equipment. Specifically, required information will include descriptions of boiler modifications, sorbent storage and injection equipment, projected coal input, ESP modifications and estimated efficiency, trucking changes, and fugitive dust control measures.

It may also be necessary to obtain approval for emissions resulting from initial startup and testing of the GR-SI process. Since startup and testing will be relatively short-term, IEPA has indicated that there should be no difficulty in obtaining such a variance. In applying for a variance, it will be necessary to submit a schedule of construction and testing activities.

All preparation, including engineering calculations and design work, will be done so that permit modification applications will be ready for submittal at the end of Phase 1 of the project. Permit applications will then be submitted early in Phase 2. IEPA is required to respond to permit applications within 90 days. In the experience of the utility, 60 to 90 days are usually required for permit approval. Sufficient lead time will be allocated for permit applications to allow Phase 2 construction and startup activities to begin as scheduled.

5.2.2 Solid Waste/Water Permit Modifications

Management of the fly ash/sorbent waste generated during this program will be conducted in accordance with all applicable federal, state, and local regulatory requirements. Solid waste streams from coal firing and flue gas emission control procedures are exempt from classification as hazardous wastes under both federal (40 CFR 261.4) and Illinois (35 Ill. Adm. Code 721.104) regulations.

The current method of ash disposal by wet transport to a settling pond will be used for disposal of the GR-SI system bottom ash. Therefore, the NPDES limits on ash pond discharge will be applicable to the waste generated. The IEPA Division of Water Pollution Control has indicated that a new NPDES permit will not be required, and that modifications to the existing permit will be sufficient (Gary Cima, IEPA. Personal communication, September 1987). In applying for NPDES permit modifications, it will be necessary to describe to IEPA all projected changes in the water and solid waste entering the ash pond, and in the effluent water leaving the ash pond. Permit modifications applications will be prepared at the end of Phase 1 and submitted early in Phase 2. In the experience of the utility, 60 to 90 days is usually required for permit approval.

The IEPA Land Pollution Division has regulatory authority for the dry disposal of wastes. Disposal of the GR-SI fly ash in an off-site landfill will require procurement of a supplemental permit by the landfill operator. The permit application must identify the waste generator and disposal facility operator, and must provide a detailed characterization of the waste.

5.2.3 Other Required Permits

All of the GR-SI equipment will be installed within the boundaries of the plant; thus, zoning and land use issues do not apply. Construction permits for installation of the equipment will be obtained from the state and local authorities. In general, it is anticipated that demonstration of GR-SI technologies can be conducted in an environmentally sound manner in complete compliance with all applicable environmental regulations without the imposition of extraordinary control measures.

6. REFERENCES

American Gas Association. 1985. Natural Gas Production Capability - 1986. Arlington, Virginia: American Gas Association.

Bade, Gerry, U.S. Fish and Wildlife Service, Rock Island Field Office. Telephone conversation with Susan Agrawal, Energy and Environmental Research Corporation, September 28, 1988.

Bhowmik, N.G., W.C. Bogner and W.P. Fitzpatrick. 1987. "Sedimentation of Lakes and Reservoirs in Illinois." In: Ragan, Robert N.,ed. Proceedings of the 1987 National Conference on Hydraulic Engineering. New York: American Society of Civil Engineers.

Boynton, R.S. 1980. Chemistry and Technology of Lime and Limestone. New York: Wiley.

Braun, E.L. 1950. Deciduous Forests of Eastern North America. New York:The Free Press.

Cameron, D. and J.A. Arnott. 1986. "Design and Testing of a Retrofit Dry Sorbent Injection System on a 300 MW Pulverized Fuel Boiler." Proceedings, 1986 Joint Symposium on Dry SO_2 and Simultaneous SO_2/NO_x Control Technologies. EPRI CS-4966, Vol. 2.

Cima, G., IEPA. Personal communication. September 1987.

Dennis, P. IEPA. Personal communication. September 1987.

Electric Power Research Institute. 1988. Laboratory Characterization of Advanced SO_2 Control By-Products. CS-5783. Palo Alto, California: EPRI.

Feindel, R.G. and D. Gass. 1986. "Demonstration of Front End Alkali Injection and Combustion Modification Techniques at Boundary Dam G.S. Unit 4 -Progress Report." Proceedings, 1986 Joint Symposium on Dry SO_2 and Simultaneous SO_2/NO_x Control Technologies. EPRI CS-4966, Vol. 2.

Gartrell, F.E. 1973. "Full Scale Desulfurization of Stack Gas by Dry Limestone Injection: Volume I." EPA-650/2-73-019a, (NTIS No. PB228447).

Greene, S.B., S.L. Chen, W.D. Clark, M.P. Heap, D. W. Pershing, and W.R. Seeker. 1985. "Bench Scale Process Evaluation of Reburning and Sorbent Injection for In-Furnace NO_x/SO_x Reduction." EPA-600/7-85-021.

Gutschick, K.A. 1987. Lime for Environmental Uses. Philadelphia, Pennsylvania: American Society for Testing and Materials (ASTM).

Hendriks, R.V., P.S. Nolan and M.L. Kunkle. 1986. "Wall-Fired LIMB Demonstration Design for Ohio Edison's Edgewater Unit 4." Proceedings, 1986 Joint Symposium on Dry SO_2 and Simultaneous SO_2/NO_x Control Technologies. EPRI CS-4966, Vol. 2.

Illinois Environmental Protection Agency. 1985. Geographic Designations of Attainment Status of Criteria Pollutants.

Klippel, W.E and Parmalee, P.W. 1979. "The varied fauna of Lake Springfield, Illinois: An Assessment After Two Decades." Nautilus 93 (4): 189-197.

Reese, J. and K. Durucz. 1985. "Sulfur Dioxide Emission Control by Furnace Injection of a Dry Sorbent." DOE/FC/10616-1965.

Refsnider, Ron, U.S. Fish and Wildlife Service, Great Lakes Regional Office. Telephone conversation with Susan Agrawal, Energy and Environmental Research Corporation, September 28, 1988.

Roseboom, D., et al. 1986. "Influences of Land Uses and Stream Modifications on Water Quality in the Streams of the Court Creek Watershed." Illinois State Water Survey Report. IL/ENR/RE/WR-86/16.

Stall, J.B. and M.T. Lee. 1980. "Reservoir Sedimentation and Its Causes in Illinois." Water Resources Bulletin. Vol.16, No.5.

Takahashi, Y., et al. 1981. "Development of Mitsubishi 'MACT' In-Furnace NO_x Removal Process." Mitsubishi Heavy Industries, Ltd. Technical Review. Vol. 18, No. 2.

U.S. Department of Commerce. 1983. Population Census.

U.S. Geological Survey. 1986. "Water Resources Data - Illinois 1986." U.S. Geological Survey Water Data. Report IL-86-2.

Wendt, J.O.L., C.V. Sternling and M.A. Matovich. 1973. "Reduction of Sulfur Trioxide and Nitrogen Oxides by Secondary Fuel Injection." Fourteenth Symposium (International) on Combustion. Pittsburgh, Pennsylvania: The Combustion Institute.

APPENDIX A
FLOODPLAIN/WETLANDS ASSESSMENT

A.1 Project Description

The proposed project is a field evaluation of the effectiveness of gas reburning-sorbent injection technologies in controlling NO_x and SO_2 emissions from a coal fired boiler equipped with a cyclone combustor. The evaluation will be conducted at City Water Light and Power (CWLP) Lakeside Station. Lakeside Station consists of two coal-fired steam generating electrical units with a total net generating capacity of 66 MW_e. The project will be conducted in Unit 7, a 33 MW_e cyclone fired boiler. Lakeside Station and the adjacent Dallman Station occupy a 75 acre site on the northwest shore of Lake Springfield in Sangamon County, Illinois. Coal combustion and flue gas cleaning wastes are currently transported to an on-site waste disposal area located immediately north of Lake Springfield. This disposal area includes three ash ponds for wet disposal of fly ash and bottom ash from the two stations, and three dry landfill cells for disposal of dewatered flue gas desulfurization sludge from Dallman Station. The Federal Emergency Management Agency flood zone map of the Lakeside Station area shown in Figure A-1 indicates that the power station itself is not within the floodplain, but that the waste disposal area is within the 100 year floodplain, i.e. an area with a one percent chance of being flooded in any one year. The natural gas pipeline to be constructed during the project will be entirely within plant boundaries and will not traverse the floodplain.

The U.S. Fish and Wildlife Service map shown in Figure A-2 displays wetlands near Lakeside Station, and Table A-1 describes the wetland classification codes used on the wetlands map. The power station area does not contain wetlands, but the ash pond and dry landfill cells contain wetland areas. The ash pond contains wetlands having the classification codes L2USCh and L1UBHh, which stand for lacustrine littoral unconsolidated shore seasonal diked/impounded wetlands and lacustrine limnetic unconsolidated bottom permanent diked/impounded wetlands, respectively. The dry landfill cells contain wetlands having the classification code PUBGh, which stands for palustrine unconsolidated bottom intermittently exposed diked/impounded

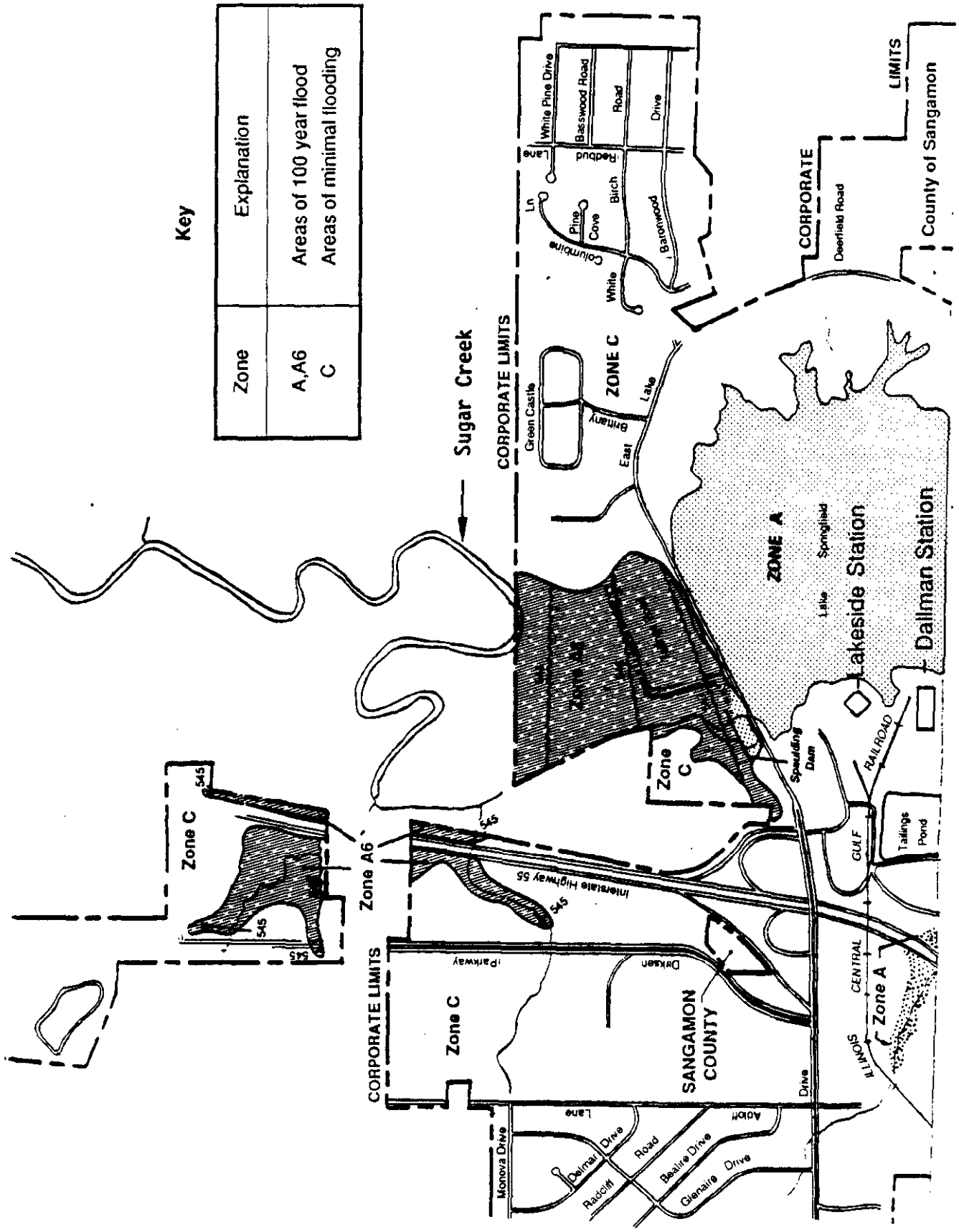


Figure A-1. Flood Zones Near Lakeside Station

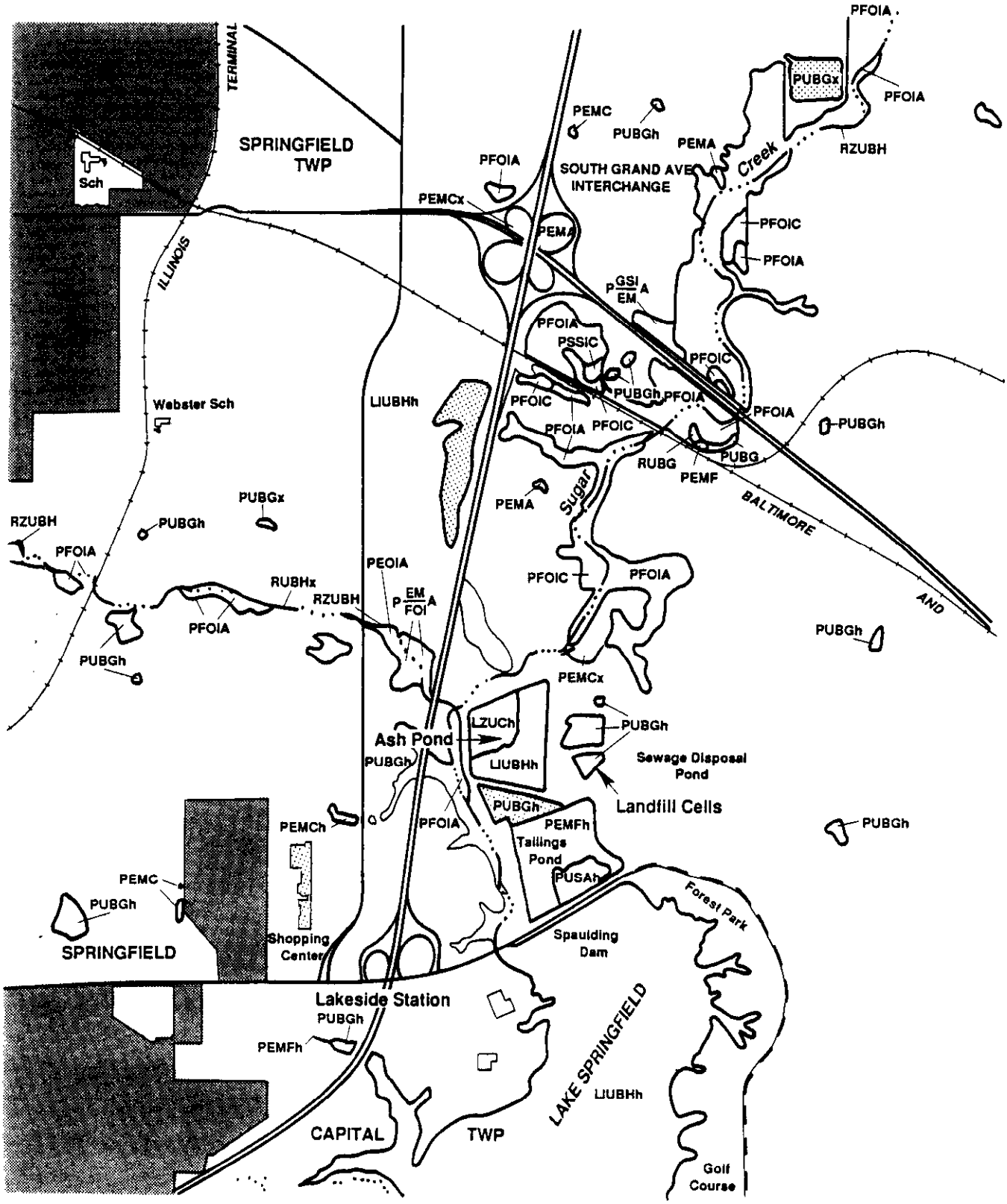


Figure A-2. Wetlands Near Lakeside Station

TABLE A-1. Key to Wetlands Classification Codes

Category	Code	Description
System	P	Palustrine
	L	Lacustrine
Subsystem	1	Limnetic
	2	Littoral
Class	US	Unconsolidated shore
	UB	Unconsolidated bottom
	EM	Emergent
	FO	Forested
Subclass	1	Broad leaf deciduous
Modifying terms	A	Temporary
	C	Seasonal
	F	Semipermanent
	G	Intermittantly exposed
	H	Permanent
	h	Diked/impounded
	x	Excavated

wetlands. The Illinois Department of Conservation, which compiled the wetlands map for the U.S. Fish and Wildlife Service, has indicated that the ash pond and landfill wetlands are labelled as such solely because they contain standing water, and not because they support aquatic life. The ponds and landfill cells were excavated for the purpose of waste disposal, and did not contain standing water or support aquatic life prior to excavation.

The project is intended to demonstrate that gas reburning-sorbent injection (GR-SI) technologies can provide a cost effective approach for the control of NO_x and SO_2 emissions from coal-fired boilers. GR-SI involves the introduction of natural gas above the main heat release zone in the boiler to reduce the formation of NO_x. Downstream of this point, burnout air and limestone based sorbent are injected into the flue gas stream and the sorbent reacts with SO_2 to form calcium sulfate. The calcium sulfate is subsequently removed along with the fly ash by the plant particulate control equipment and transported to a disposal location. During the GR-SI demonstration, the calcium sulfate along with the fly ash will be transported to an off-site landfill. Lakeside Station waste streams are currently sluiced to an on-site ash pond for disposal. The goals of the GR-SI system are to reduce NO_x and SO_2 emissions by 60 percent and 50 percent, respectively.

Project construction will involve retrofit to the existing power plant. All construction will take place in the immediate vicinity of the boiler except pipeline installation, which will involve on-site construction of a 1400 foot natural gas pipeline. Once equipment has been installed, the GR-SI demonstration will operate for a period of 12 months.

To demonstrate the potential for retrofitting existing coal-fired power plants to reduce air emissions, it was necessary to select an appropriate plant for the GR-SI demonstration. After analysis of the alternatives, as described in Section A.3, Lakeside Station was selected. Because power plants require large amounts of cooling water, many plants such as Lakeside were constructed near bodies of water and consequently are located near or within floodplains.

A.2 Floodplain/Wetlands Effects

Effects Resulting from Construction

Construction of the GR-SI equipment itself will involve internal structure retrofit and will not impact floodplain or wetland values. The natural gas pipeline will be constructed entirely within the boundaries of the site and will not traverse any floodplains or wetlands.

Effects Resulting from Operation

The GR-SI equipment will occupy existing structures and will not block any floodways or otherwise impact the floodplain. The underground natural gas pipeline will not impact the floodplain or wetlands. The only other aspect of the project that could potentially impact the floodplain or wetlands is activity in the ash pond and dry landfill cells.

Gas reburning is not expected to change the properties of either the fly ash or bottom ash. Sorbent injection will not affect bottom ash, but the fly ash will be altered in that it will contain appreciable amounts of calcium sulfate and unreacted sorbent.

All ash from Unit 7 is currently sluiced to the on-site ash pond. Ash from other Lakeside and Dallman units is sluiced to the same area. In addition, dewatered scrubber sludge from Dallman Station is transported by truck to the dry landfill cells in the waste disposal area. At present operating conditions, Lakeside Unit 7 generates approximately 136,400 ft^3 (3.13 acre-ft) of fly ash and bottom ash per year, while the total annual waste generation rate for the CWLP plant is approximately 1,510,650 ft^3/yr (34.68 acre-ft/yr) of fly ash and bottom ash (sluiced to ponds) and 1,620,000 ft^3/yr (37.19 acre-ft/yr) of dewatered scrubber sludge. During the GR-SI demonstration, fly ash from Unit 7 will be collected dry and transported off-site for disposal in a permitted landfill. Bottom ash will continue to be sluiced to the ash pond. Lakeside Unit 7 will produce approximately 181,500

ft^3 (4.17 acre-ft) of sorbent-modified fly ash and 91,700 ft^3 (2.11 acre-ft) of bottom ash during the one year field evaluation.

The project has been designed to minimize potential harm within the floodplain and wetlands by limiting the amount of construction. Pipeline construction will not occur in floodplains or wetlands. GR-SI project operation will have no effect on above-ground land features and will have no long-term impacts on the floodplain or wetlands. No lives or property will be disrupted. Therefore, the project is expected to have negligible short- and long-term effects on floodplain and wetland values.

A.3 Alternatives

The goal of this clean coal technology project is to demonstrate the effectiveness of GR-SI technology for controlling NO_x and SO_2 emissions from three different types of coal-fired boilers that represent the existing boiler population. The no action alternative, i.e. not demonstrating GR-SI, limits the options for controlling emissions from existing boilers. Two technologies are currently used for SO_2 control in coal-fired power plants: wet limestone flue gas desulfurization and spray dryers. Both of these require significantly more space for installation and are more costly to implement than GR-SI, and both produce waste streams that require disposal considerations similar to those for GR-SI. Current technology for NO_x emissions control involves control of local fuel/air stoichiometry to minimize NO_x formation. This technology has limited effectiveness and may reduce boiler efficiency and boiler life if improperly applied. These limitations associated with existing emissions control technologies emphasize the need for additional options, such as GR-SI.

Site selection was performed using MEGABASE, a commercially available computerized database of all fossil fuel fired utility boilers east of the Mississippi River. MEGABASE indicated that there were 67 operational coal

fired utility boilers in Illinois as of January, 1980. Only seven of these were cyclone fired boilers with net generating capacities below 100 MW_e net. These seven boilers included:

- CWLP Lakeside Units 7 and 8
- CWLP Dallman Units 31 and 32
- Marion Station Units 1, 2 and 3

Analysis of CWLP Lakeside Station indicated that the plant was not within the floodplain and that any activities within the floodplain would result in negligible impact. Neither the Marion nor the Dallman units offered any advantage with respect to floodplain issues. The Marion units were used as alternate boilers for the cyclone fired GR-SI demonstration.

APPENDIX B
DOCUMENTATION OF CONTACTS

This appendix contains source data supporting information in the Lakeside EA. Records of conversations with the U.S. Fish and Wildlife Service verifying the presence of threatened and endangered species are reproduced. The letter documenting the description CWLP provided regarding the Lakeside coal pile runoff pond is included. Soil survey information supplied by the Soil Conservation Service is also included.

Energy and
Environmental
Research Corporation

CONTACT REPORT

DATE: 9/28/88 ORIGINATOR: SUSAN AGRAWAL

CONTACT BY: ✓ TELEPHONE ____ MEETING OTHER: ____

NAME, TITLE AND ORGANIZATION	Rock Island Field Office
Gerry Bade	U.S. Fish and Wildlife
ADDRESS AND TELEPHONE NUMBER	
(309) 793-5800	
PURPOSE OR SUBJECT (Give project number if appropriate)	
Lakeside EIV - Information about endangered species	

SUMMARY:

- The only federally listed endangered species for Sangamon County are the Indiana Bat and the Bald Eagle, which is listed as wintering in Sangamon County.
- The project will have no effect on these species, since no habitat for the species is being affected by the project.

ACTION:

DISTRIBUTION:

3622 Lyckan Parkway, Suite 5006 • Durham, NC 27707 • (919) 489-1726

Energy and
Environmental
Research Corporation

CONTACT REPORT

DATE: 9/28/88 ORIGINATOR: Susan Agrawal

CONTACT BY: ✓ TELEPHONE ____ MEETING OTHER: ____

NAME, TITLE AND ORGANIZATION	
Ron Refsnider	Great Lakes Regional Office U.S. Fish and Wildlife Service
ADDRESS AND TELEPHONE NUMBER	
(612) 725-3276	
PURPOSE OR SUBJECT (Give project number if appropriate)	
Lakeside EIV - Information about endangered plant species	

SUMMARY:

There are no federally listed endangered plant species in Sangamon County Illinois

ACTION:

DISTRIBUTION:

3622 Lyckan Parkway, Suite 5006 • Durham, NC 27707 • (919) 489-1726

FRANK G. MADONIA, COMMISSIONER
MUNICIPAL BUILDING, SPRINGFIELD, ILLINOIS 62757
(217) 789-2060

CWLP: Small Enough To Care

October 13, 1987

Mr. Pete Maly
Energy & Environmental Research Corp.
18 Mason
Irvine, California 92718

Dear Mr. Maly:

Please find enclosed responses to your August 14, 1987 request for information.

Request 1 - Copies of NPDES and air permits

Response:

Previously submitted.

Request 2a - List of compliance monitoring requirements...

Response 2a:

See permits.

Request 2b - ... and a set of data values obtained during recent monitoring

Response 2b:

NPDES data (already submitted)
Air emission data (see attachment

Request 3a - Flyash discharge rate/schedule

Response 3a:

On average 800 TPY (1986) or 500 #/hr (1986)

Request 3b - Bottom ash discharge rate/schedule

Response 3b:

On average 3200 TPY (1986) or 2000 #/hr (1986)

Request 3c - Sluice water flow rates with flyash and bottom ash

Response 3c:

Flyash is being pulled from the precipitator hoppers (and sluiced to the ash ponds), on average, approximately 1 hour per 8 hour shift.

Bottom ash is sluiced to the ash ponds approximately 2 hours per 8 hour shift.

The flow rate for bottom ash and flyash remains approximately the same during each phase. The sluice pump utilized is rated at 1850 GPM.

Request 3d - Pond discharge

Response 3d:

Already provided.

Request 4a - Coal pile runoff description of runoff collection scheme

Response 4a: [See redrawn Figure B-1]

The Lakeside Coal Pile Runoff Pond (LCPRP) is a pond dug out of native materials. The pond holds approximately 600,000 gallons. The pond level is controlled by a flexible discharge hose attached to an adjustable cable on a gib.

The pond drains three distinctive areas. Two of these areas will become or are, parking and road areas. The third area will remain a coal handling area contributing a small amount of coal to the pond. The runoff from these areas flow overground until it is collected via ditches or underground pipes. Please see the attached drawing.

The discharge from the pond is intermittent. Current procedure regarding the pond calls for a 24-48 hour settling time after a major precipitation event. After the solids have settled, the pond is drained and sampled according to the NPDES permit provisions.

Request 4b - Seasonal average runoff flow rate.

Response 4b:

The average flow for the last year has been .019 MGD with flow occurring in 5 months. The average flow of the 5 months was .046 MGD.

Request 4c - Quantity of coal carried off by runoff

Response 4c:

Unknown.

Request 4d - Flow rate of discharge water if separate settling pond is used

Response 4d:

The maximum daily amount of flow measured was .36 MGD. The unit discharge rate of the pond has been estimated to be 30,000 GPH.

Request 5 - Potential change in sluice water flow rate. GR/SI is expected to significantly increase the amount of flyash produced. How much additional sluice water would be required if the amount of flyash increased by approximately 50%?

Response 5:

CWLP, not having had any prior experience with GR/SI technology, believes this question would be better answered by EER technical/engineering personnel.

I believe submittal of these data answers all of your questions. If, however, you need additional information, please do not hesitate to contact me at (217) 786-4052.

Sincerely,

Louis Skibicki

Louis Skibicki
Environmental Coordinator

LS/gj

cc: Jim Rechner
Tom Bee
Tom Booker

Table 1
Summary of Results
Particulate Emissions
EPA Method 5
Stack

Run No.	2	3	5
Date (1987)	June 2	June 2	June 3
Start Time (approx.)	12:40 pm	3:20 pm	10:55 am
Stop Time (approx.)	1:45 pm	5:50 pm	12:10 pm
Process Conditions			
UNIT 7			
Btu/lb Coal	10,410	10,560	10,310
Coal Feed Rate (lb/hr)	43,200	36,200	37,300
Heat Input (MBtu)	450	382	385
UNIT 8			
Btu/lb Coal	10,510	10,460	10,480
Coal Feed Rate (lb/hr)	41,600	38,000	40,700
Heat Input (MBtu)	437	397	427
TOTAL			
Heat Input (MBtu)	887	779	812
Gas Conditions			
Temperature (°F)	320	322	316
Moisture (volume %)	10.4	10.3	10.2
O_2 (dry volume %)	7.0	7.1	7.6
CO_2 (dry volume %)	12.3	12.2	11.6
Volumetric Flow Rate			
acfm	365,500	339,500	341,200
dscfm	217,500	201,800	205,500
Particulate Concentration			
gr/dscf	0.0121	0.0056	0.0030
lb/hr	22.5	9.8	5.3
lb/MBtu*	0.0254	0.0126	0.0065

*As calculated by the heat input method

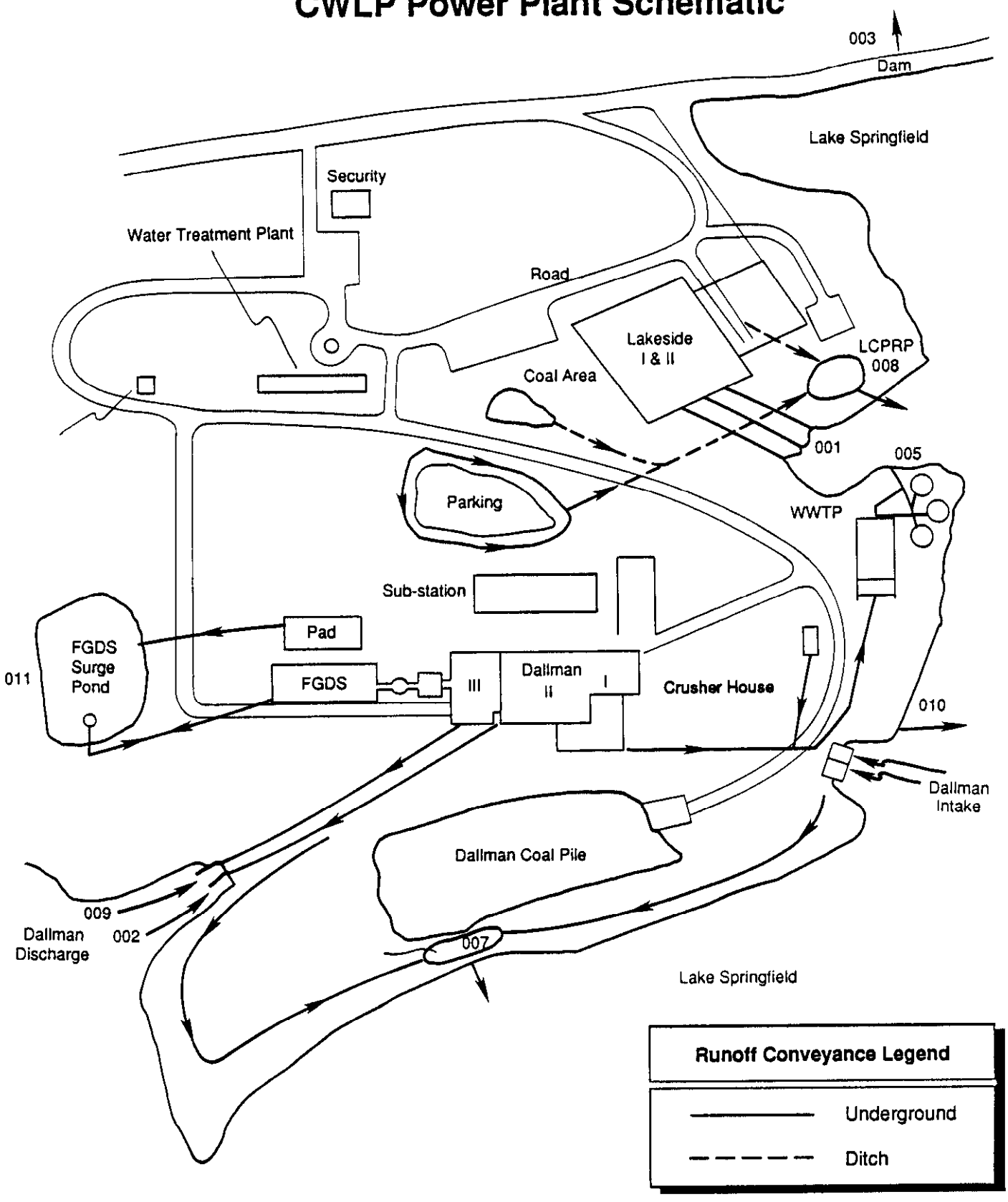


Figure B-1 Lakeside Coal Pile Runoff Pond

United States Department of Agriculture
Soil Conservation Service
40 Adloff Lane, Suite #4
Springfield, Illinois 62703

September 29, 1987

Peter Maly
EER Corporation
18 Mason
Irvine, California 92718

Dear Peter:

As per our phone conversation today, I am enclosing the following:

1. Soil Survey of Sangamon Co.
2. Sangamon Co. Prime Farmland Map Units
3. Aerial Photo of the Power Plant (Omitted)
4. Photocopy of the location in our Plat Book (Redrawn Page B-18)
5. Composite of 4 Soil Survey Maps (Redrawn Page B-19)
   (Because 4 maps come together, we went ahead and photocopied them in that manner for you.

I hope this information will be of some help to you.

Sincerely,

Dan Towery

Dan Towery
District Conservationist

DT/cmk

Enclosure

Soil Survey of

Sangamon County, Illinois

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Illinois Agricultural Experiment Station

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period April 1968 through June 1976. Soil names and descriptions were approved in January 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the Illinois Agricultural Experiment Station. It is part of the technical assistance furnished to the Sangamon County Soil and Water Conservation District. This survey was financed in part by the County Board of Sangamon County, Illinois.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

This soil survey is Illinois Agricultural Experiment Station Soil Report No. 111.

Contents

Issued May 1980

SOIL LEGEND

The map symbols are made up of numbers alone or of numbers succeeded by a capital letter. The capital letter indicates the slope. Symbols without a slope letter are for level or nearly level soils or for miscellaneous areas. A final number of 2 or 3 after the capital letter indicates that the soil is eroded or severely eroded.

SYMBOL	NAME
8D3	Hickory clay loam, 7 to 12 percent slopes, severely eroded
8E	Hickory silt loam, 12 to 18 percent slopes
8E3	Hickory clay loam, 12 to 18 percent slopes, severely eroded
8F	Hickory silt loam, 18 to 50 percent slopes
17	Keomah silt loam
19C2	Sylvan silt loam, 4 to 7 percent slopes, eroded
19D	Sylvan silt loam, 7 to 12 percent slopes
19D3	Sylvan silty clay loam, 7 to 12 percent slopes, severely eroded
19E3	Sylvan silty clay loam, 12 to 18 percent slopes, severely eroded
36A	Tama silt loam, 0 to 2 percent slopes
36B	Tama silt loam, 2 to 4 percent slopes
36C2	Tama silt loam, 4 to 7 percent slopes, eroded
36D2	Tama silt loam, 7 to 12 percent slopes, eroded
43	Ipava silt loam
45	Denny silt loam
50	Virden silty clay loam
67	Harpster silty clay loam
68	Sable silty clay loam
73	Ross loam
74	Radford silt loam
77	Huntsville silt loam
107	Sawmill silty clay loam
112	Cowden silt loam
119D	Elco silt loam, 7 to 15 percent slopes
119D3	Elco silty clay loam, 7 to 12 percent slopes, severely eroded
119E3	Elco silty clay loam, 12 to 18 percent slopes, severely eroded
131C	Alvin loamy sand, 4 to 7 percent slopes
131D	Alvin loamy sand, 7 to 12 percent slopes
131E2	Alvin loamy sand, 12 to 20 percent slopes, eroded
134A	Camden silt loam, 0 to 2 percent slopes
134B	Camden silt loam, 2 to 4 percent slopes
134C2	Camden silt loam, 4 to 7 percent slopes, eroded
134D3	Camden silty clay loam, 7 to 12 percent slopes, severely eroded
138	Shiloh silty clay loam
198	Elburn silt loam
199A	Plano silt loam, 0 to 2 percent slopes
199B	Plano silt loam, 2 to 7 percent slopes
208	Sexton silt loam
212D3	Thebes silty clay loam, 7 to 15 percent slopes, severely eroded
242	Kendall silt loam
244	Hartsburg silty clay loam
249	Edinburg silty clay loam
259C	Assumption silt loam, 4 to 7 percent slopes
259D2	Assumption silt loam, 7 to 15 percent slopes, eroded
280B	Fayette silt loam, 2 to 4 percent slopes
280C2	Fayette silt loam, 4 to 7 percent slopes, eroded
280D2	Fayette silt loam, 7 to 15 percent slopes, eroded
280D3	Fayette silty clay loam, 7 to 15 percent slopes, severely eroded
284	Tice silty clay loam
451	Lawson silt loam
533	Urban land
551F	Gosport silt loam, 18 to 50 percent slopes
567C	Elkhart silt loam, 4 to 7 percent slopes
567D2	Elkhart silt loam, 7 to 15 percent slopes, eroded
684B	Broadwell silt loam, 2 to 4 percent slopes
684C2	Broadwell silt loam, 4 to 7 percent slopes, eroded
685B	Middletown silt loam, 1 to 4 percent slopes
685C2	Middletown silt loam, 4 to 7 percent slopes, eroded
801	Orthents, silty
862	Pits, sand
864	Quarry
2036B	Urban land-Tama complex, 1 to 5 percent slopes
2043	Urban land-Ipava complex
2068	Urban land-Sable complex
2119D	Urban land-Elco complex, 7 to 15 percent slopes

BOUN

AD HC

POWE

DAMS

SANGAMON COUNTY PRIME FARMLAND MAP UNITS

	17	Keomah silt loam
	36A	Tama silt loam, 0 to 2 percent slopes
√	36B	Tama silt loam, 2 to 4 percent slopes
	36C2	Tama silt loam, 4 to 7 percent slopes, eroded
	43	Ipava silt loam
	45	Denny silt loam
	50	Virden silt loam and silty clay loam
	67	Harpster silty clay loam
	68	Sable silty clay loam
	73	Ross loam
1/	74	Radford silt loam
	77	Huntsville silt loam
1/	107	Sawmill silty clay loam
	112	Cowden silt loam
	131C	Alvin fine sandy loam, 4 to 7 percent slopes
	134A	Camden silt loam, 0 to 2 percent slopes
	134B	Camden silt loam, 1 to 4 percent slopes
1/	138	Shiloh silty clay loam
	198	Elburn silt loam
	199A	Plano silt loam, 0 to 2 percent slopes
	199B	Plano silt loam, 1 to 4 percent slopes
	208	Sexton silt loam
	242	Kendall silt loam
	244	Hartsburg silty clay loam
	249	Edinburg silty clay loam
	259C	Assumption silt loam, 4 to 7 percent slopes
√	280B	Fayette silt loam, 2 to 4 percent slopes

1/	284	Tice silty clay loam
1/	451	Lawson silt loam
	567C	Elkhart silt loam, 4 to 7 percent slopes
	684B	Broadwell silt loam, 2 to 4 percent slopes
	684C2	Broadwell silt loam, 4 to 7 percent slopes, eroded
	685B	Middletown silt loam, 1 to 4 percent slopes

1/ Evaluate locally. Qualifies as prime farmland if flooding is less frequent than once in two years during the growing season and the soil is drained.

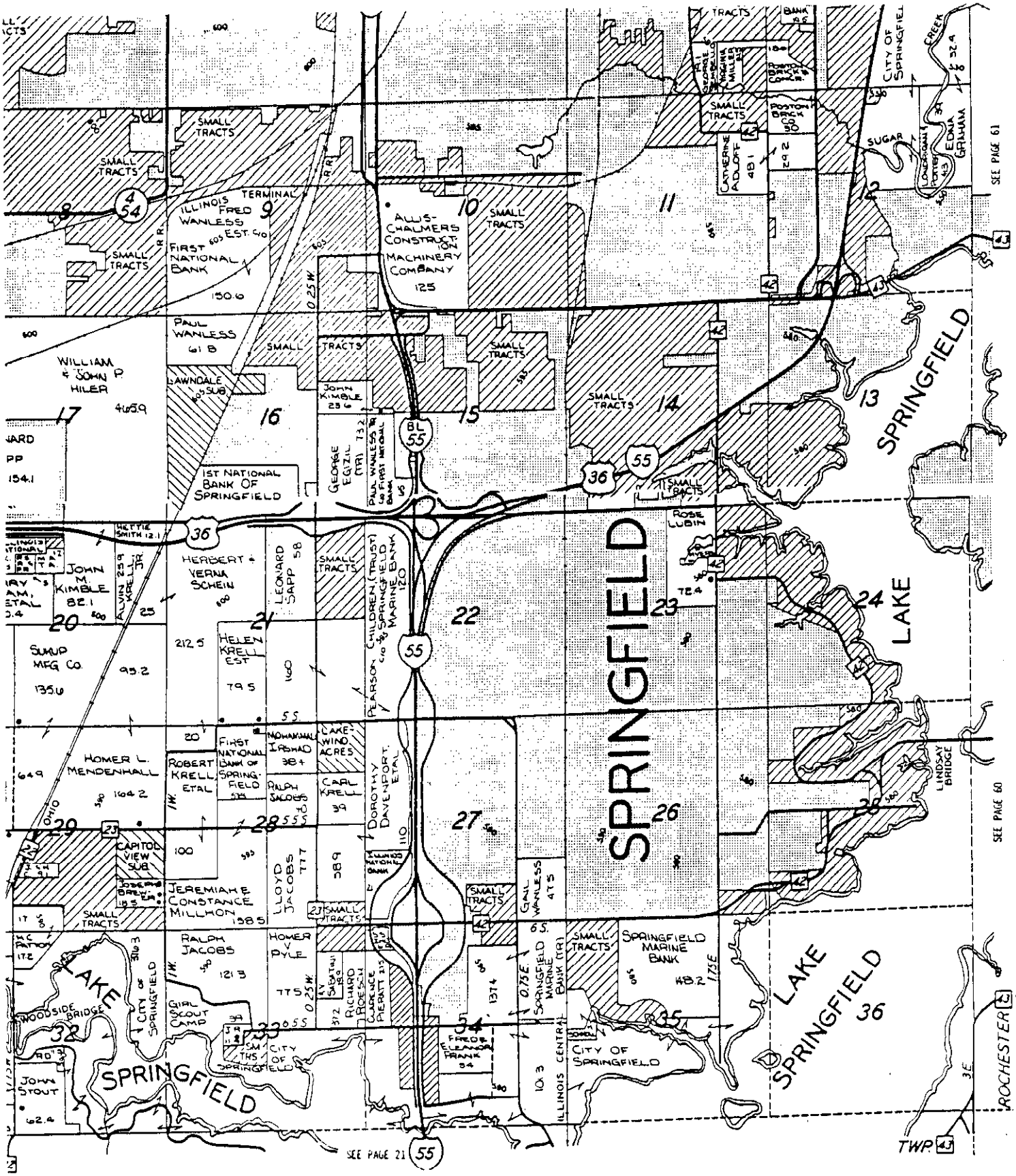


Figure B-2. Photocopy of SCS Plat Book

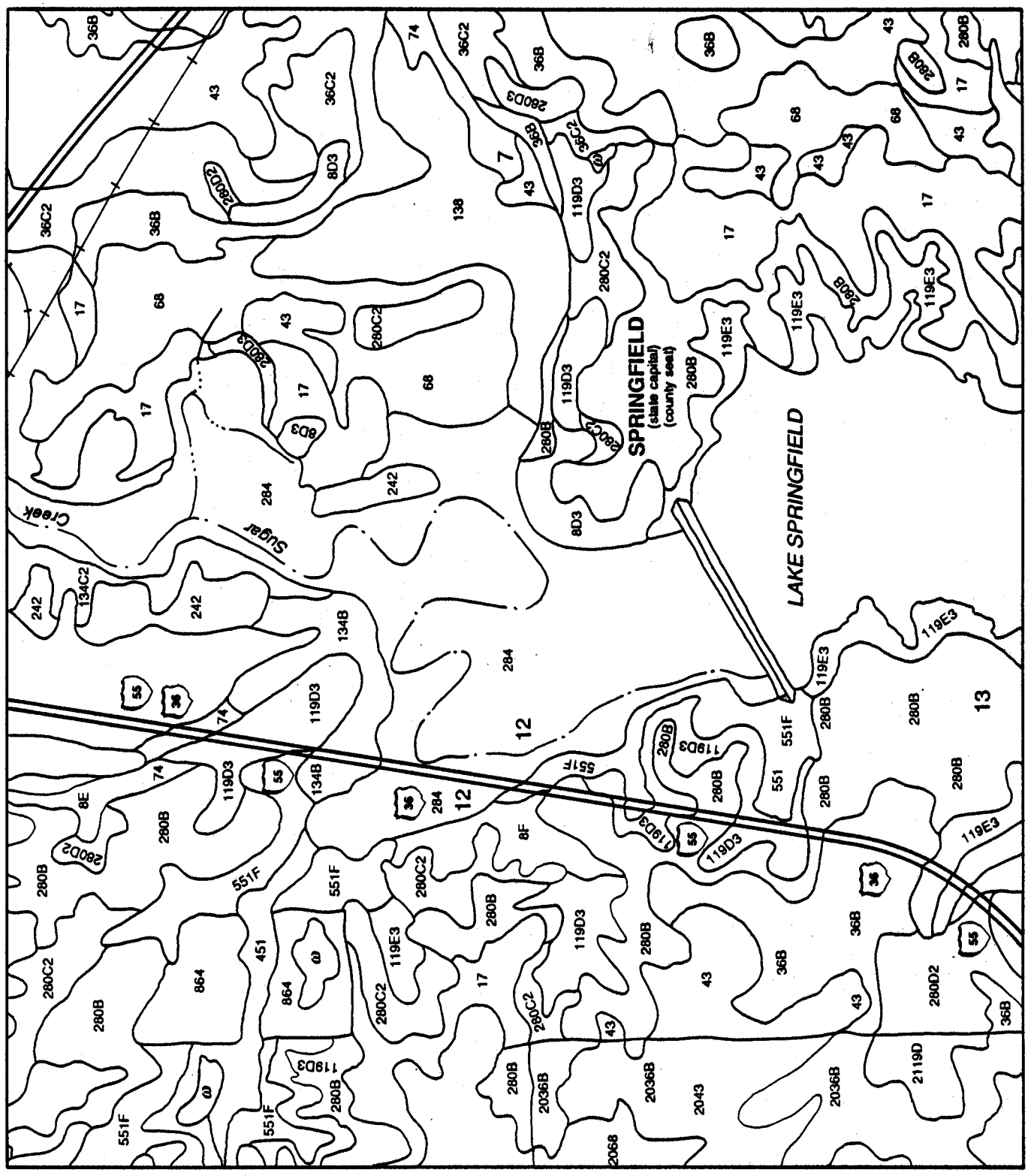


Figure B-3. Soil Survey Map (Redrawn)