NUREG-0470
Supp. No. 2

Draft Supplement to **Final Environmental Statement** related to the construction of Allens Creek Nuclear Generating Station Unit No. 1

Docket No. 50-466

Houston Lighting & Power Company

U.S. Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

December 1980

SUMMARY AND CONCLUSIONS

This draft second Supplement to the Final Environmental Statement (FES) was prepared by the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation. The Supplement addresses site alternatives to the proposed Allens Creek Nuclear Generating Station (ACNGS) and a proposed means a of transporting the reactor pressure vessel to the site.

1. This action is administrative.

2. The proposed action is the issuance of a construction permit to the Houston Lighting & Power Company for the construction of ACNGS Unit No. 1, located near the Brazos River in Austin County, Texas, and scheduled for commercial operation in 1986.

   The facility will employ a boiling-water reactor producing 3579 MWt (the maximum expected thermal power level is 3758 MWt). A single steam turbine generator will use the generated heat to provide net electrical output capacity of 1146 MWe. The exhaust steam will be cooled by the flow of water pumped from and discharged to a newly constructed lake having a surface area of about 2072 ha (5120 acres). The Brazos River will serve as the primary source of cooling-lake makeup water and as the receiving body for the cooling-lake discharges.

3. Principal matters considered:

   a. Alternative sites, and

   b. Reactor pressure vessel transportation.

4. Summary of alternative site analysis:

   In its alternative site review, the staff reviewed the applicant's alternative site methodology, selected and analyzed alternative sites that were representative of those resource areas capable of supporting a nuclear-powered generating station, and compared these alternative sites with the Allens Creek site. Having made this comparison, the staff did not find any of the alternative sites environmentally preferable to Allens Creek. Thus, the staff concluded that none of the alternative sites can be shown to be obviously superior to the Allens Creek site. The Allens Creek site remains an acceptable choice for location of the proposed nuclear station.

5. Summary of proposed reactor pressure vessel transportation:

   The staff has reviewed a proposed method of transporting the reactor pressure vessel from the Texas coastline to the Allens Creek site. In this review the staff considered the impacts of barge transportation up the San Bernard River, construction of a barge unloading facility, and overland transportation of the reactor pressure vessel from the unloading facility to the Allens Creek site. The staff concluded that this means of transportation would have no major adverse impacts.

6. The following Federal, State, and local agencies were asked to comment on this draft supplement:

Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army, Corps of Engineers
Department of Commerce
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Department of Energy
Environmental Protection Agency
Office of the Governor, State of Texas
County Judge, Austin County, Texas
Houston-Galveston Area Council
Mayor, City of Wallis
Sierra Club

7. The staff's FES and the first Supplement to the FES were made available to the CEQ and to the other specified agencies in November, 1974, and August, 1978, respectively. This draft second Supplement to the FES was made available to the public and to the other specified agencies in December 1980.

8. On the basis of the analysis and evaluation set forth in this Supplement, the first FES Supplement, and in the FES; after weighing the environmental, economic, technical, and other benefits of ACNGS Unit No. 1 against environmental and other costs; and after considering available alternatives, it is concluded that the action called for under the National Environmental Policy Act of 1969 (NEPA) and 10 CFR Part 51 is the issuance of a construction permit for the station.

9. Since the first FES Supplement was issued in August 1978 two decisions of the Atomic Safety and Licensing Appeal Board have resulted in a need to modify the conclusions and proposed conditions contained in the first FES Supplement. In Tennessee Valley Authority (Yellow Creek Nuclear Plant, Units 1 and 2), ALAB-515, 8 NRC 702 (1978), the Appeal Board held that the NRC may not incorporate in permits to build power plants conditions which in actuality, call for a "review" of the adequacy of water quality requirements previously established by EPA. In Carolina Power and Light Company (H. B. Robinson, Unit No. 2), ALAB-569, 10 NRC 557 (1979), the decision of the Appeal Board was that NRC is bound to take EPA's considered decisions regarding water quality matters under the Federal Water Pollution Control Act Amendments of 1972 at face value, and simply to factor them into its NEPA cost-benefit balance. In accordance with these decisions, the draft NPDES Permit included in the first FES Supplement as Appendix "S.F." is now recognized as being determinant with respect to effluent limitations and monitoring programs affecting water quality. Thus, any proposed effluent limits and water quality monitoring requirements that were recommended in the first FES Supplement by the staff that differ from the limits and monitoring requirements of the draft NPDES should be withdrawn. The staff has used the results of its own analysis of the impacts of the limits of the NPDES on the aquatic environment. The staff's analysis in the first FES Supplement concluded that the effect of

discharges at the levels permitted by the NPDES Permit "could alter the biotic productivity of the cooling reservoir" (FSFES Section 5.3.2.2, Chlorine effects on biota through long-term exposure). Given this uncertainty regarding the ACNGS as a viable fishery, the staff in its alternative site review only assumed that the " . . . impoundment will support some form of a recreational fishery and associated recreational water uses." (Section 2.3.1.2, Aquatic ecology and water use). The staff also reconsidered its assessment of alternative cooling systems after de-emphasizing the benefit of a recreational fishery at the site (due to uncertainties in maintaining a viable fishery in the lake) and relying on the assessment of the other recreational benefits associated with the cooling lake and planned adjacent state parks (Section 2.3.1.2, Socioeconomics)

Since staff conditions recommended in the first FES Supplement can be modified during a subsequent operating license review to remove or modify any conditions excluded by ALAB-515 and ALAB-569, and since the staff has already accounted for the changed impacts on the aquatic environment, the staff has concluded that a detailed revision of the first FES Supplement conditions and corresponding discussions in the text of the report is not warranted at this time. In summary the principal changes are:

Condition 7.a.* The benefits equivalent to the fishery benefits given in the FES (Section 5.6.4) are no longer recommended as a requirement, and staff approval of the revised lake management program as it relates to aquatic matters is no longer required.

Condition 7.b. Since the NPDES requires a chlorine minimization study, all proposed NRC conditions with respect to this study, including a requirement to include a level at least as low as 0.1 mg/liter Total Residual Chlorine at the point of discharge to the lake, are withdrawn.

Condition 7.c. The condition that chlorine not be discharged upstream of the traveling screens for the circulating - water intake structure is more restrictive than the NPDES conditions and is withdrawn as a condition.

Condition 7.f. All proposed conditions for preoperational monitoring programs related to water quality, including those described in the Environmental Report Supplement and in Section 5.6 of the first FES Supplement are withdrawn.

*Final Supplement to the Final Environmental Statement, NUREG-0470, August 1978.

CONTENTS

CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

FOREWORD

Recent Atomic Safety and Licensing Appeal Board decisions regarding alternative sites have placed greater emphasis on the staff's procedures for alternative site review and analysis. On reconsideration of these procedures as employed by the staff in the FES and first FES Supplement, the staff has found that the presentation of additional information with respect to (1) the identification and analysis of specific alternative sites, and (2) the comparison of these sites with the Allens Creek site, is warranted. This second Supplement to the FES presents the results of the staff's analysis and comparison of alternative sites.

This Supplement also contains the staff analysis of environmental impacts associated with transportation of the reactor pressure vessel from the confluence of the San Bernard River with the Gulf Intracoastal Waterway to an unloading point along that river and thence overland to the Allens Creek site. This transportation method was proposed by the applicant subsequent to issuance of the staff's first FES Supplement.

Copies of this Draft Supplement and the applicant's Environmental Report Supplement and supporting documents are available for public inspection at the Commission's Public Document Room, 1717 H Street N.W., Washington, D.C.; and at the Sealy Public Library, Atchison Street, Sealy, Texas 77474. Single copies of this Supplement may be obtained by writing to the:

Director, Division of Technical Information and Document Control
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Richard W. Froelich and Calvin W. Moon are the NRC Project Managers for this Supplement. Should there be questions regarding the contents of this Supplement, Mr. Moon may be contacted by calling 301-492-7704 or writing to the following address:

Division of Licensing
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, D.C. 20555

1. INTRODUCTION

1.1 BACKGROUND

Pursuant to the Atomic Energy Act of 1954, as amended, and the Nuclear Regulatory Commission's (NRC) regulations in Title 10, Code of Federal Regulations (CFR), an application was filed by Houston Lighting & Power Company (hereafter HL&P or the applicant) for construction permits for two generating units designated as the Allens Creek Nuclear Generating Station (ACNGS) Units 1 and 2 (Docket Nos. 50-466 and 50-467). The application was accepted for docketing on August 24, 1973. If approval of the applicant's request had been given in accord with their schedule, construction of Units 1 and 2 would have proceeded so that Unit 1 would begin commercial operation in 1980 and Unit 2 would begin commercial operation in 1982. Each of the proposed nuclear units was to use a boiling-water reactor (BWR) designed for initial operation at approximately 3579 MWt. Condenser cooling was to be accomplished by the flow of water pumped from and discharged to a newly constructed 3339-ha (8250-acre) cooling lake utilizing makeup water from the Brazos River. Effluents from the cooling lake were to be discharged into the Brazos River. The proposed facility was to be located on the utility-owned site of 4513 ha (11,152 acres) located in Austin County, Texas, approximately 6.4 km (4 miles) northwest of Wallis, 11.3 km (7 miles) south-southeast of Sealy, and approximately 72.4 km (45 miles) west of the center of Houston.

Following an environmental review by the NRC staff for compliance with the provisions of the National Environmental Policy Act (NEPA), a Final Environmental Statement (FES) for the ACNGS was issued in November 1974, and public hearings on environmental and site suitability matters were held in Wallis, Texas, on March 11 and 12, 1975, before an Atomic Safety and Licensing Board (hereafter ASLB or Board). On September 25, 1975, HL&P delayed construction of the two-unit station indefinitely but requested the Board to make certain findings regarding environmental and site suitability matters not likely to change. On November 12, 1975, the Board issued a Partial Initial Decision which constituted a portion of the Initial Decision that was to be issued upon completion of the remaining environmental and site suitability matters and the radiological health and safety phase of the proceeding. On December 21, 1976, HL&P announced plans to reactivate the construction permit application for a one-unit station at the Allens Creek site. On August 1, 1977 the applicant submitted a Supplement to the original Environmental Report (ER) consisting of updated information reflecting changes in the ER which resulted from the deferral and subsequent rescheduling of Unit 1 and the cancellation of Unit 2. Following an environmental review largely based on the ER Supplement, the staff issued draft and final first Supplements to the original FES in February and August 1978.

1.2 SCOPE OF ALTERNATIVE SITE ANALYSIS

The FES and first FES Supplement included analyses of alternatives to the Allens Creek site and reached the same conclusions as to preferability of the Allens Creek site. However, as a result of decisions in Public Service Company of New Hampshire et al. (Seabrook Station, Units 1 and 2), ALAB-471, 7 NRC 477 (1978) and Boston Edison Company et al. (Pilgrim Nuclear Generating Station,

Unit 2), ALAB-479, 7 NRC 774 (1978), the staff has, in cases in which the record is still open, undertaken to reexamine the findings originally made regarding comparisons of alternative sites. For the Allens Creek alternative site analysis, this reexamination led the staff to conclude that additional analyses were required. The staff's principal concern was to identify specific sites for those resource areas previously rejected on general bases and to compare these sites with the Allens Creek site.

In the staff's original assessment of alternative sites for Allens Creek (FES, Sect. 9.1.2.1), consideration was given to HL&P's site evaluation methodology, region of interest, candidate (resource) areas, and candidate sites. Eight resource areas were identified and analyzed, and for various reasons, six of the areas were eliminated without consideration of specific sites. The staff's analysis of the other two resource areas identified sites which were concluded to be acceptable alternatives to the Allens Creek site. However, none of the sites were found preferable to Allens Creek.

In the FES Supplement (Sect. S.9.2, p. S.9-10), the staff reappraised the applicant's site selection methodology in view of (1) the reduction in project scope from a two-unit to a one-unit station and (2) changes in project schedule. Additionally, the alternative of adding a third unit at the South Texas Project (STP) instead of constructing the ACNGS was considered. The staff found: (1) no subregions or sites were rejected because the size of the initially proposed station (2400 MWe) made them unsuitable; (2) reduction in generating capacity and cooling-lake size in no way modified the suitability of the Allens Creek site; and (3) when considered collectively, the environmental advantages and disadvantages of constructing and operating a third unit at STP compared with constructing and operating the ACNGS tended to be comparable. Thus the staff concluded that the Allens Creek site remains an acceptable choice for the location of the proposed nuclear station.

The site analysis presented herein supplements the staff's original assessment by including a site for each viable resource area (except for the Brazos River basin, for which a sufficient number of candidate sites were considered) for comparison with the Allens Creek site. The staff's intent is to ensure that each viable resource area is properly considered in determining whether there are alternative sites that are obviously superior to the proposed site. For this assessment, the staff relied on reconnaissance-level data, which consists of information that is available from the open literature, published or unpublished reports, existing records, authoritative sources, and brief field surveys. Such data does not include information that can only be obtained by detailed onsite monitoring programs or studies.

Houston Lighting & Power Company was notified of the staff's intention to conduct this study in December 1978, and a meeting with HL&P was held in January 1979 to discuss potential site locations in those resource areas for which no specific sites had been identified. At this meeting HL&P provided the staff with a siting study dated December 1975 that identified potentially licensable sites for two- and four-unit nuclear power plants to serve the applicant's system. This study had not been disclosed to the staff in earlier discussions. Based on review of this siting study and on information received by the staff at that meeting, specific sites were identified for further study. These sites were visited by the staff during February 1979.

Major documents used in preparation of the alternative site analysis are the applicant's Environmental Report,[1] Environmental Report Supplement[2] and supplements thereto, the Final Environmental Statement,[3] the Final First Supplement to the Final Environmental Statement,[4] the transcript of the ASLB hearings,[5] and the applicant's 1975 power-plant siting study[6] and supplements thereto.[7] Independent staff calculations and other sources of information (e.g., National Marine Fisheries Service, Texas Parks and Wildlife Department) have also been used as a basis for the assessment of environmental impacts of site alternatives to Allens Creek. In addition, information was gained from a visit by the staff to each of the sites and contiguous areas in February 1979 and by correspondence with the applicant.[8,9]

1.3 SCOPE OF REACTOR PRESSURE VESSEL TRANSPORTATION ANALYSIS

The staff analysis of potential impacts of transporting construction materials to the Allens Creek site, as given in the November 1974 FES, was based on use of rail facility transport when practical. The plant site is adjacent to the AT&SF railway, and HL&P plans to construct a short (less than one mile) railroad spur from this railway to the site. It is the staff's experience that use of rail facilities for transport of construction materials is an acceptable and relatively impact-free method of transportation. Accordingly, no impacts were predicted for rail delivery of construction materials to the site. Impacts of truck transportation of the remaining construction materials were reviewed, and the staff concluded that the measures committed to by the applicant were adequate to ensure that adverse environmental effects would be at the minimum practical level.

In March, 1979, HL&P announced that they plan to transport the reactor pressure vessel to the site via a combination of barge transport, for approximately 42 km (26 miles) up the San Bernard River, followed by overland transport from that point to the Allens Creek site. This means of transport would require construction of a barge slip on the San Bernard River to accommodate transfer of the reactor pressure vessel from the barge to the overland transporter.

On March 30, 1979, the ASLB issued an Order bearing on the potential impacts of HL&P's proposed transportation of the reactor pressure vessel. The Order states in part:

> "We will hear evidence on whether the barging of the reactor pressure vessel and other items on the San Bernard River will require any dredging or channeling of that waterway and what would be the environmental effects thereof. Further, we will hear evidence on what will be the environmental impacts of (a) the movement of the reactor pressure vessel (and of other items to be so transported) on a barge up the San Bernard River, (b) the construction of the barge unloading facility, including any dredging attendant thereto, and (c) the overland transportation of the reactor vessel and of other items from the barge unloading facility to the Wallis site."

The staff analysis in Sect. 3 of this Supplement in response to these requirements of the hearing board is based on its review of HL&P's environmental

assessment submitted on March 26, 1980, brief field observations on November 29, 1979, and on HL&P's responses to staff questions.

REFERENCES FOR SECTION 1

1. Houston Lighting and Power Company, Environmental Report, Allens Creek Nuclear Generating Station, Units 1 and 2, Docket Nos. 50-466 and 50-467, August 24, 1973.

2. Houston Lighting and Power Company, Supplement to the Environmental Report, Allens Creek Nuclear Generating Station, Unit 1, Docket 50-466, August 1977.

3. Directorate of Licensing, U.S. Atomic Energy Commission, Final Environmental Statement, Allens Creek Nuclear Generating Station, Units 1 and 2, Docket Nos. 50-466 and 50-467, November 1974.

4. Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Final Supplement to the Final Environmental Statement, Allens Creek Nuclear Generating Station Unit 1, NUREG-0470, Docket No. 50-466, August 1978.*

5. U.S. Nuclear Regulatory Commission, In the matter of: Houston Lighting and Power Company, Allens Creek Nuclear Generating Station, Units 1 and 2 – Hearings at Wallis, Texas, March 11-12, 1975, transcript of evidentiary hearings before the Atomic Safety and Licensing Board, Docket Nos. 50-466 and 50-467.

6. Teknekron Energy Resource Analysts, Nuclear Power Plant Siting Study, prepared for Houston Lighting and Power Company, December 1975.

7. Teknekron Energy Resource Analysts, Site Evaluation, Site Bz-1, Follet's Island, prepared for Houston Lighting and Power Company, January 1979.

8. W. F. McGuire, Environmental Planning and Assessment, Houston Lighting and Power Company, letter to R. W. Froelich, Division of Site Safety and Environmental Analysis, U.S. Nuclear Regulatory Commission, February 22, 1979.

9. W. F. McGuire, Environmental Planning and Assessment, Houston Lighting and Power Company, letter to R. W. Froelich, Division of Site Safety and Environmental Analysis, U.S. Nuclear Regulatory Commission, March 9, 1979.

*Available for purchase from the National Technical Information Service, Springfield, VA 22161.

2. ALTERNATIVE SITE ANALYSIS

2.1 METHODOLOGY

As noted in Sect. 1.2, Teknekron Energy Resource Analysts[1] conducted a siting study (the Study) to establish future sites for nuclear generating stations to serve the applicant's system. The Study was designed to assist in selection of sites capable of supporting the operation of either two or four 1300-MWe (gross) light-water reactors. The methodology used in the Study can be briefly summarized as follows:

1. Study region (region of interest) selection,

2. Regional screening to identify candidate areas,

3. Selection of candidate sites, and

4. Site selection (ranking).

The staff finds the methodology expressed in the Study to be reasonable. The staff's methodology for alternative site selection involves one additional step not expressly addressed in the applicant's Study. The staff process involves the following:

1. Region of interest selection,

2. Resource area identification,*

3. Resource area screening to identify candidate sites,

4. Selection of candidate sites, and

5. Selection of proposed alternative sites.

Although resource areas were identified in the course of the applicant's regional screening process, the Study did not consider the boundaries of these areas in selecting candidate sites. The regional screening process identified the overall regional area considered suitable for nuclear power plant siting without superimposing the resource area boundaries on this area. As a result, the regional screening process does not ensure that candidate sites are identified in each resource area. The Study also limited the site selection process to the identification of sites capable of supporting two-unit stations. (The Study included both two-and four-unit sites, but any four-unit site could support a two-unit station.) Since the alternatives sought in this case are for a one-unit site, the staff considered the possibility that one or more steps in the applicant's screening process may have omitted candidate sites that would have been suitable for a one-unit station. Upon review of the screening process

* Resource areas are sub-areas within a region of interest that can be distinguished from each other on the basis of one or more environmental resources or characteristics that are reasonably unique to the sub-area. For this analysis, resource areas were established by the boundaries of river and coastal basins.

used, it was concluded that this possibility did exist for one screening criterion: inland (fresh) water availability. The application of this criterion resulted in the elimination of one inland river basin and all of the coastal basins. The staff has given special consideration to this result and concluded that it has not affected the staff's ability to identify potential sites in the selected resource areas. The details of this conclusion are given in Sect. 2.2.2 of this Supplement. The staff concludes that the methodology employed in the Study has provided the basic information needed for our review within the scope of alternative site analysis described in Section 1.2.

2.2 SELECTION PROCESS

2.2.1 Region of interest

The approximate boundaries of the region of interest selected for the Study are shown in Fig. 2.1. The region, larger than the area served by the applicant, is roughly described as the Houston-Galveston-Freeport Gulf Coast area and covers all or parts of 10 counties. Customers are served under franchises in 67 incorporated municipalities, including the cities of Houston, Galveston, Freeport, Baytown, and Pasadena. (FES, Sect. 8.1).

The applicant's bases for selecting the region of interest boundaries shown in Fig. 2.1 are as follows:[1]

1. The Western boundary was established based on three criteria: power load center location, transmission line distance, and safety. The HL&P load center has been stated as being south of Houston, which establishes an economic western boundary based on transmission losses and load flow. Concentrated student jet pilot training areas are located on Matagorda Island and directly to the north of Matagorda Island. These areas are considered to be excluded based on safety considerations.

2. The northern boundary was established based on three criteria: power load center location, transmission line distance, and land use. The HL&P load center location establishes a northern boundary based on transmission losses and load flow. The Sam Houston National Forest is directly north of Houston and is considered as a land-use exclusion. The area within the forest was excluded from being a candidate area; however, the northern boundary of the study area was extended in order to include previously studied Trinity River sites which lie to the east of the forest.

3. The eastern boundary was established based on the natural geographic delineation formed by the Texas-Louisiana state border on the Gulf Coast and the Neches River.

4. The southern boundary was formed by the Texas state territorial limits into the Gulf of Mexico. These limits extend 3 nautical leagues (16.6 km; 10.3 statute miles) into the Gulf from the coast.

The region of interest selected for the Study is larger than that considered by the staff in the original Allens Creek alternative site analysis (FES, Sect. 9.1.2). The staff had determined that that region was satisfactory and reinforced that conclusion in the FES Supplement (Sect. S.9.2). For the

Fig. 2.1. Region of interest. Source: Texaco Energy Resource Analysts, Nuclear Power Plant Siting Study, prepared for Houston Lighting and Power Company, December 1975 (adapted from Map No. 2).

purposes of this analysis, the staff has also considered the region of interest boundaries as they relate to the principal load distribution facilities of the applicant. Figure 2.2 displays the HL&P 345-kV transmission line grid that provides the principal interconnection of their generating facilities. Since any large base-load generating station would logically be connected to this grid, the location of this grid with respect to the region of interest is as important as the principal load center locations. As shown in Fig. 2.2, the proposed region of interest is reasonably well centered on this grid.

2.2.2 Resources areas

2.2.2.1 Resource area identification

The region of interest selected for the Study contains ten resource areas as identified in Table 2.1. This list includes three resource areas not considered by the staff in the FES or FES Supplement: the Neches River Basin and the Neches-Trinity Coastal Basin in the east, and the Colorado-Lavaca Coastal Basin in the west. These resource areas as well as those considered in the FES are shown in Fig. 2.3. For this analysis, selection of resource areas based on plant cooling-water supply (e.g., inland and coastal drainage basins), is appropriate and provides a reasonable division of the region of interest for identification of potential alternative sites.

2.2.2.2 Screening process

The Study used a process of regional screening (of the overall region of interest) to develop candidate areas for potential power plant sites. The principal factors considered in this screening process were demography, land use, and hydrology. The following criteria were used:[2]

- Demography. Areas were excluded where

  1. Cumulative population densities were in excess of a nominal 155 persons/km^2 (400 persons/sq mile) to a radial distance of 64 km (40 miles) from the site, or

  2. Local population densities were in excess of 85 persons/km^2 (220 persons/sq mile) within a 3.2-km (2-mile) radius of the site.

- Land Use. Areas were excluded if within

  1. Areas of existing public lands;

  2. Areas of aircraft prohibited, restricted, warning, and alert areas; and

  3. Areas of airports.

- Hydrology. Areas were excluded if

  1. There were no natural barriers to prevent downward movement of surface water to a usable aquifer below the site;

  2. The site area was directly upstream of the recharge area for an aquifer;

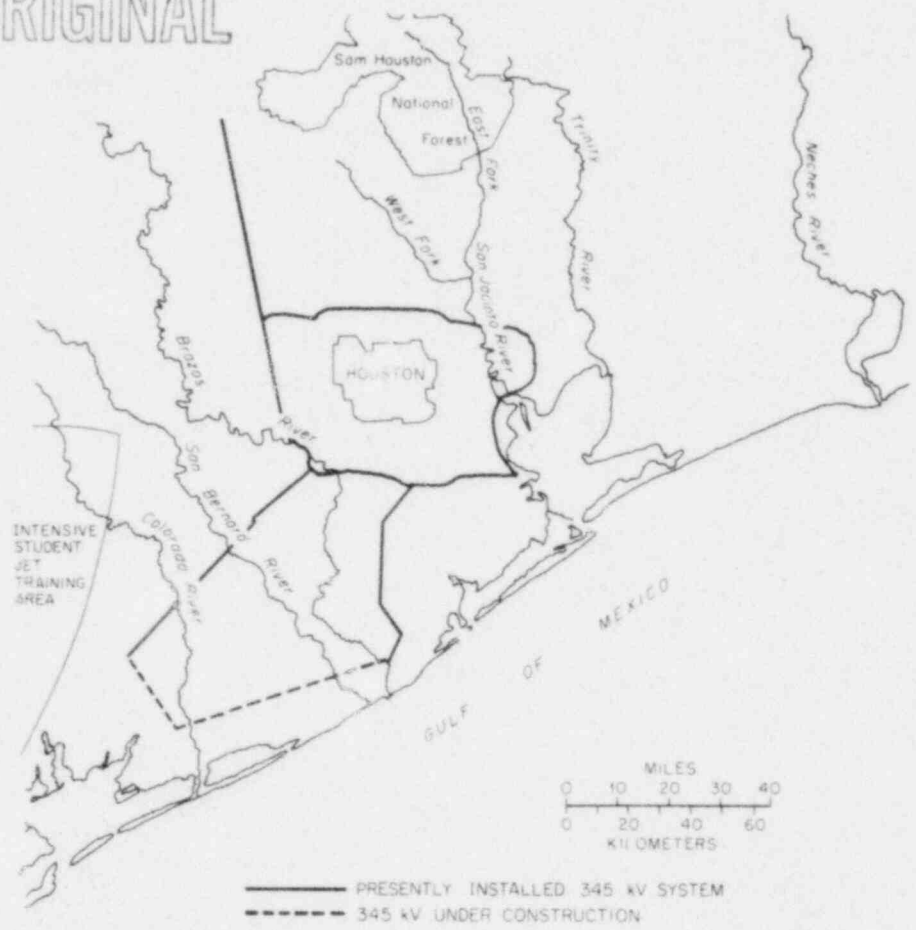


Fig. 2.2. Principal transmission line grid. Source: Teknekron Energy Resource Analysts, Nuclear Power Plant Siting Study, prepared for Houston Lighting and Power Company, December 1975 (adapted from Map No. 21).

Table 2.1. Resource areas considered in the applicant's siting study

River basins	Coastal basins
Neches	Neches-Trinity
Trinity	Trinity-San Jacinto
San Jacinto	San-Jacinto-Brazos
Brazos	Brazos-Colorado
Colorado	Colorado-Lavaca

Source: Teknekron Energy Resource Analysts, *Nuclear Power Plant Siting Study*, prepared for Houston Lighting and Power Company, December 1975.

Table 2.1. Resource areas considered in the applicant's siting study

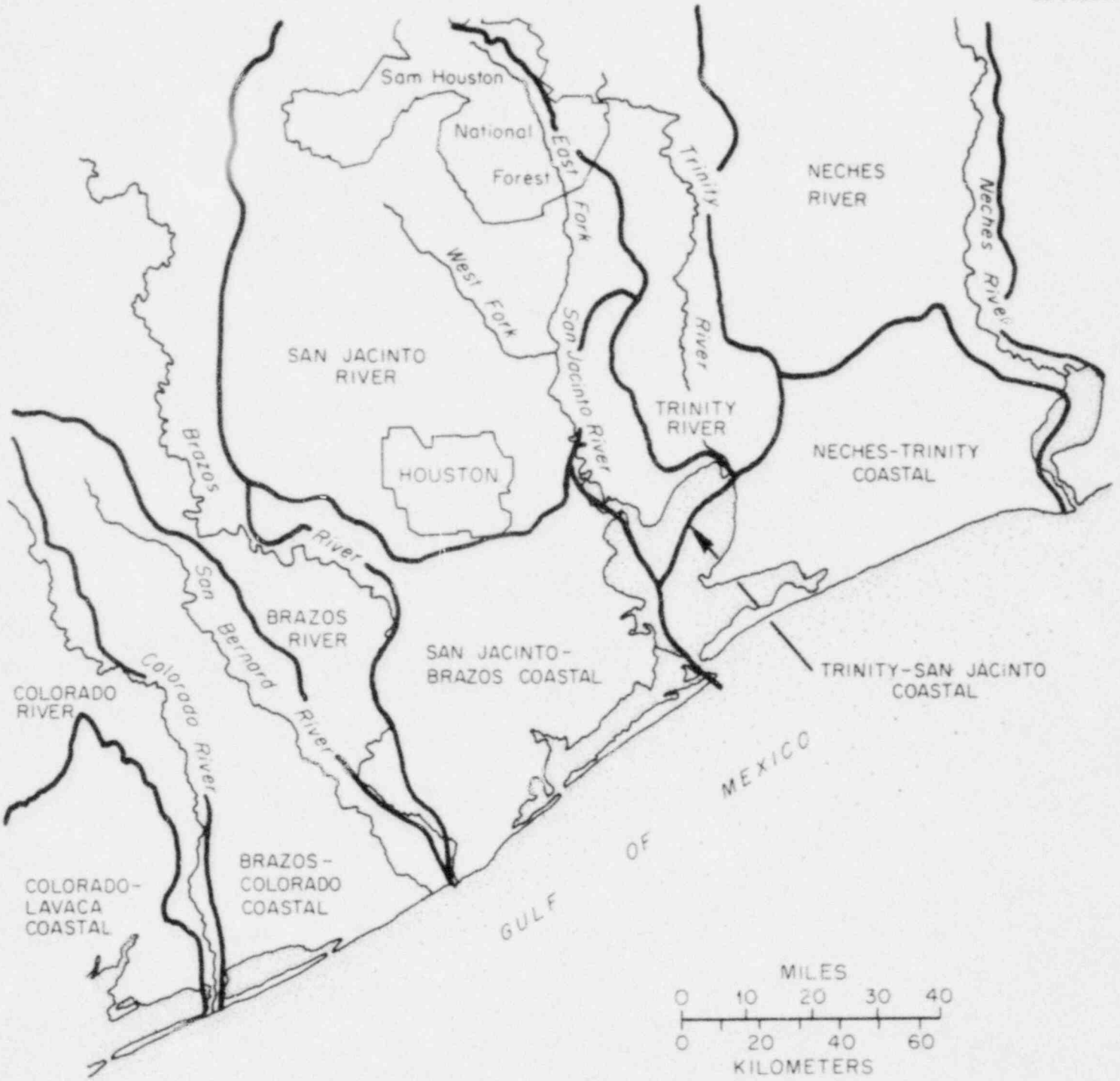


Fig. 2.3. Resource area boundaries - river and coastal basins. Source: Teknekron Energy Resource Analysts, Nuclear Power Plant Siting Study, prepared for Houston Lighting and Power Company, December 1975 (adapted from Map No. 12)

3. The area was subject to flooding and could not be protected by practical means; and

4. Inland (fresh) water availability was less than 72,000 acre-ft per year.

Other screening criteria included geology-seismology, geologic hazards, mineral resources, construction suitability, water quality, environmentally sensitive areas, meteorology, and transportation. The criteria responsible for eliminating major portions of the region of interest were (1) demography and (2) hydrology (water availability).

Figure 2.4 shows the portions of the region of interest eliminated on the basis of demography. The principal screened area (centered on Houston) was excluded on the basis of the 155 persons/km^2 (400 persons/sq mile) criterion. This criterion resulted in the complete exclusion of one resource area - the Trinity-San Jacinto Coastal Basin. Since this resource area was rejected for other reasons (see below), the staff finds that the demography screening process did not improperly eliminate any resource areas from further consideration.

Figure 2.5 presents the Study results of screening the subject resource areas based on inland (fresh) water availability. The Study conclusions were that from the standpoint of inland water availability, the Neches and Trinity river basins had adequate supplies of water, the Brazos and Colorado river basins were "conditionally acceptable" (i.e., marginal with respect to water availability), and that the San Jacinto River Basin and all of the coastal basins had inadequate supplies of fresh water. The staff's analysis of these conclusions can be summarized as follows:

1. The staff concurs that there is an adequate supply of fresh water in the Trinity River and Neches River basins for siting a one-unit nuclear power plant.

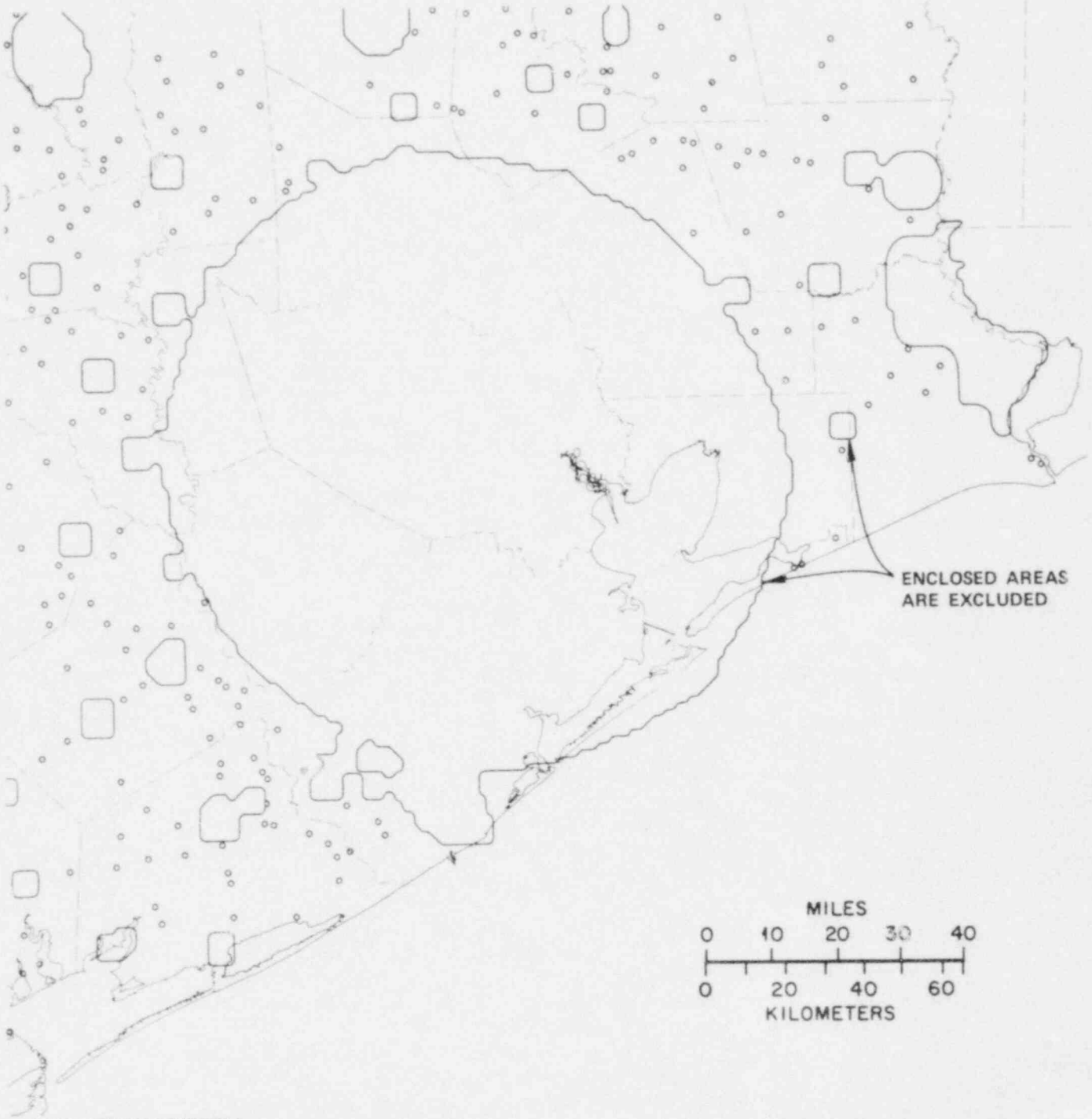
2. The staff concurs that there is an inadequate supply of fresh water in the Trinity-San Jacinto Coastal Basin. Moreover, use of salt water from the Trinity Galveston Bay would be a poor choice, considering the estuarine nature of these water bodies and the potentially severe impacts to aquatic biota from the plant cooling system.

3. The staff did not attempt to reach a decision on the adequacy of fresh water in the Neches-Trinity, San Jacinto-Brazos, and Brazos-Colorado coastal basins because it considered each of these resource areas as appropriate for the siting of nuclear power plants using saltwater cooling rather than fresh water cooling.

4. The staff concluded that inland water could be made available in the Brazos and Colorado river basins.

5. The staff was unable to reach a firm conclusion as to the availability of inland water in the San Jacinto River Basin. (This basin is the principal water source for metropolitan Houston.) The staff was unable to obtain definite statements from the Texas Department of Water Resources about whether rights for industrial consumption of water from this basin could

ES-5107



POPULATION CRITERIA

1. CUMULATIVE POPULATION VERSUS DISTANCE FROM THE REACTOR

   0–5 MILES ≤ 30,000 PERSONS
   0–20 MILES ≤ 500,000 PERSONS
   0–40 MILES ≤ 2,000,000 PERSONS

2. LOCAL POPULATION DENSITIES LESS THAN 220 PERSONS PER SQUARE MILE WITHIN 2 MILES OF THE REACTOR

Fig. 2.4. Regions of interest eliminated on basis of demography. Source: Teknekron Energy Resource Analysts, Nuclear Power Plant Siting Study, prepared for Houston Lighting and Power Company, December 1975 (adapted from Map No. 15).

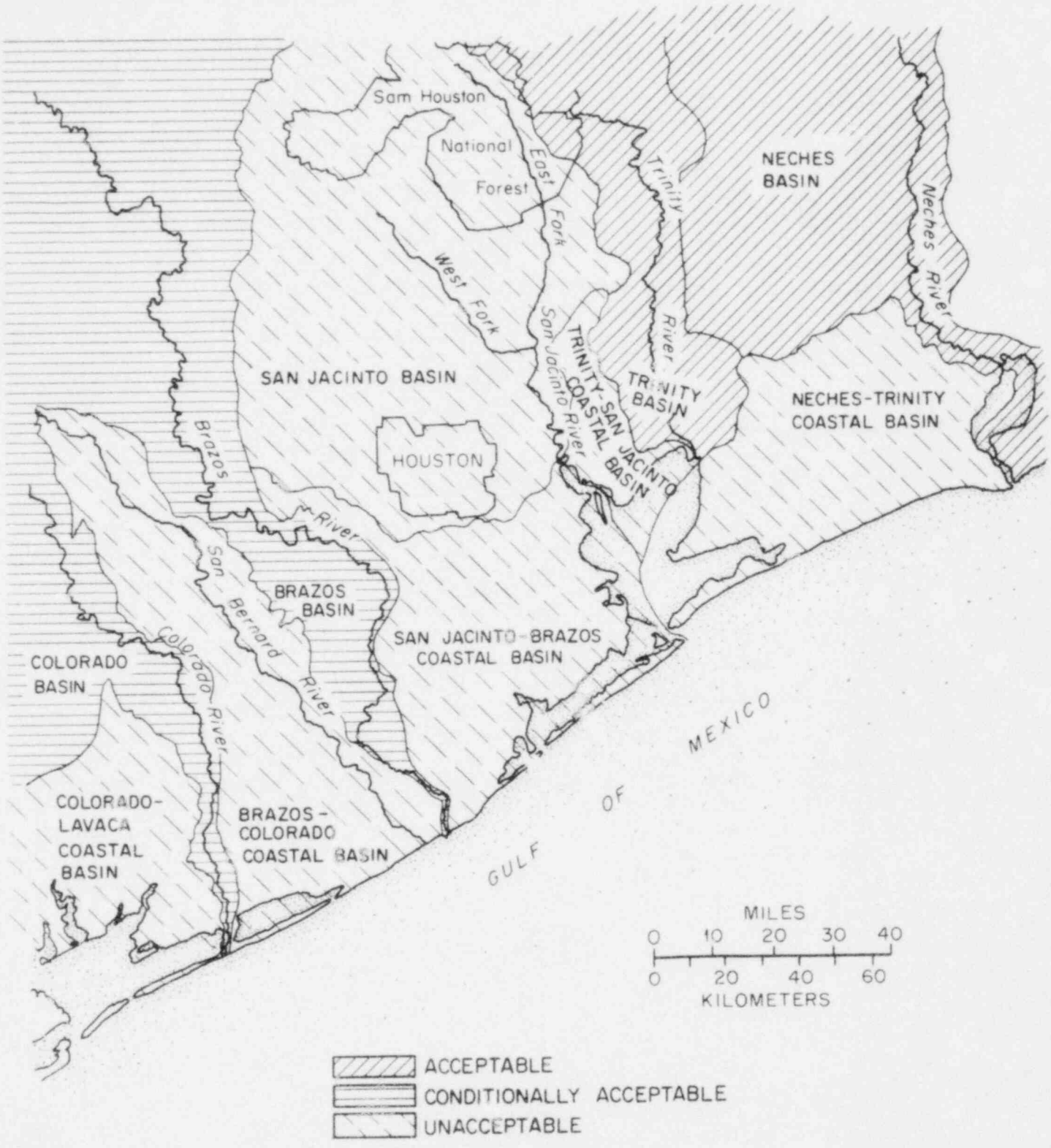


Fig. 2.5. Freshwater availability. Source: Teknekron Energy Resource Analysts, Nuclear Power Plant Siting Study, prepared for Houston Lighting & Power Company, December 1975 (adapted from Map No. 12).

be obtained. This department has informed the staff that the question of availability of water for appropriation can only be addressed in response to a site-specific request for a permit.[3] The staff then considered the probable increases in demands for water from this basin over the next several decades and attempted to balance these demands (based on projected population increases) with the probable water supply from this basin. Although the results of this balancing are subjective, the staff has concluded that the metropolitan Houston area will place a continuing demand on the water supply of this basin. Since the San Jacinto River Basin is the principal source of water for metropolitan Houston, and since the staff was able to identify candidate alternative sites in adjoining resource areas, the staff is of the opinion that the San Jacinto River Basin can be appropriately excluded from further consideration as a potential area for power plant siting.

The staff also considered the disparity between the Study's screening criterion of 72,000 acre-ft per year of available water and the actual amount of water that would be consumed by a one-unit alternative to the Allens Creek plant. This is only a consideration for the San Jacinto River Basin, however, since the other inland river basins had adequate water, and the coastal basins selected by the staff for further study were based on the use of salt water for cooling. The staff believes that a minimum annual water consumption rate for a 1200-MWe nuclear power plant would be on the order of 36,000 acre-ft per year. Even with this reduced quantity of water, the staff remains of the opinion that siting within the San Jacinto River Basin would affect the metropolitan Houston area water supply. The staff has also considered whether reducing the Study screening criterion from 72,000 acre-ft per year to 36,000 acre-ft per year would have identified other sites within the remaining resource areas that should have been considered as potential sites; the staff believes not. Since the coastal basins had been previously identified as net importers of fresh water (FES, Sect. 9.1.2), even the minimum use of 36,000 acre-ft per year of this resource would be considered as adverse, particularly since these resource areas can permit the siting of power plants that could use saltwater cooling. The other inland resource areas were judged to be able to supply the full 72,000 acre-ft per year of water; thus no problems would be anticipated in reducing this quantity of water. While it is true that a one-unit plant would require less land, the staff was not able to identify any cases where this factor could have eliminated otherwise acceptable sites. Although it is probably true that additional one-unit sites could have been identified in one or more of the resource areas, there are no characteristics of these resource areas that would lead the staff to conclude that any of these sites could be shown to be markedly superior to the sites selected for further comparison on the basis of the present Study.

2.2.3 Potential sites

After completing the regional screening process described in Sect. 2.2.2, the Study identified potential sites in the screened areas using the following basic factors: geology and seismology, meteorology, hydrology, demography, land use, aesthetics, and transportation. These were essentially the same parameters used to conduct the regional screening process, but in this case the parameters were applied to specific potential site locations. This process resulted in identification of the sites shown in Fig. 2.6. Sites were identified in all but two resource areas - the San Jacinto River Basin and the

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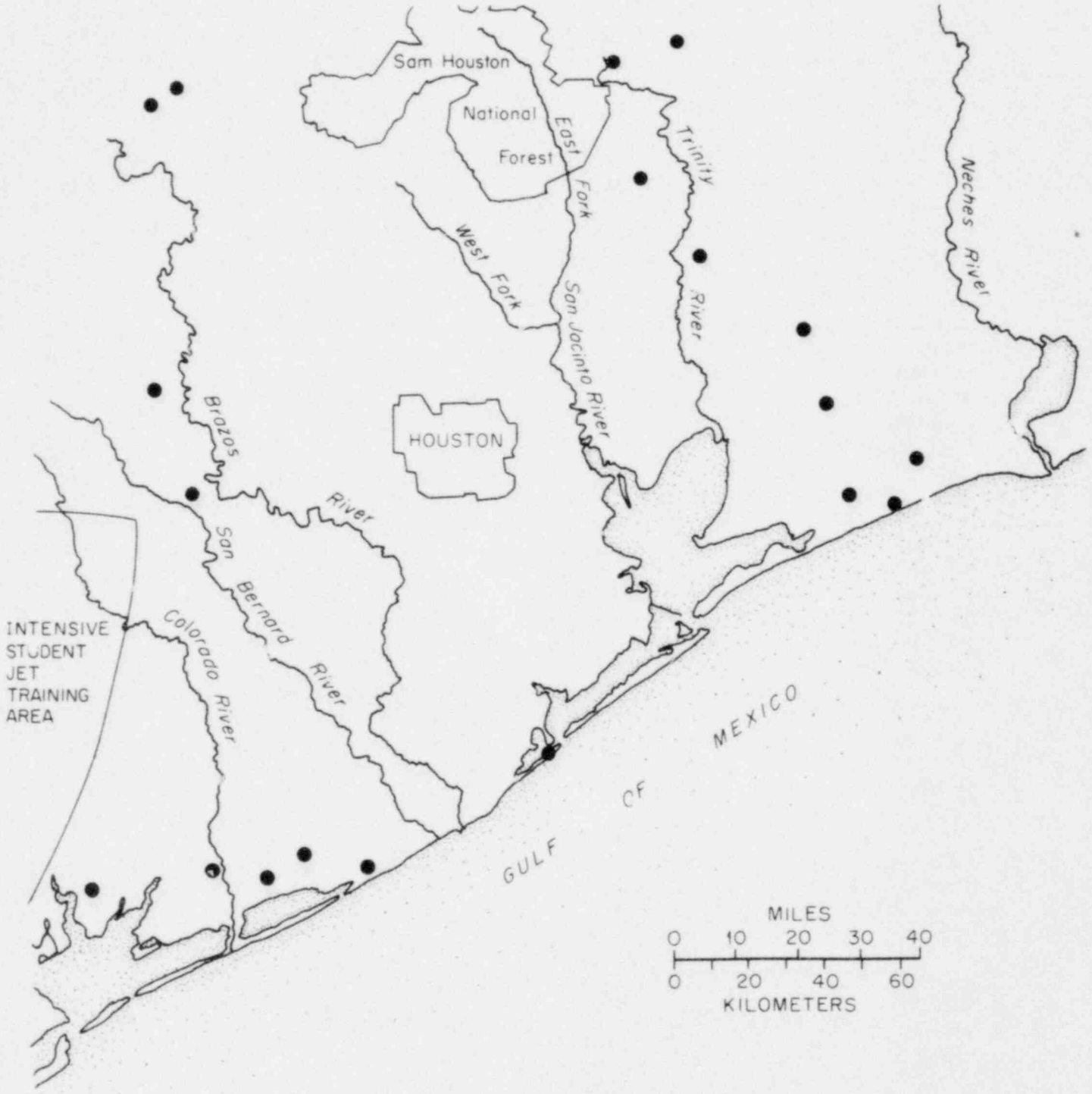

Fig. 2.6. Potential sites. Source: Teknekron Energy Resource Analysts, Nuclear Power Plant Siting Study, prepared for Houston Lighting & Power Company, December 1975 (adapted from Map Nos. 24 and 26).

Trinity-San Jacinto Coastal Basin (Fig. 2.3). Based on previous conclusions (Sect. 2.2.2) with respect to power plant siting in these two resource areas, and the general characteristics of the remaining resource areas, the staff has concluded that the applicant has selected potential sites that are reasonably representative of the resource areas contained within the region of interest. It is the staff's opinion that all these sites are potentially licensable.

2.2.4 Staff's selection of alternative sites

The staff selected five of the applicant's potential sites as candidate sites for comparison with the Allens Creek site. The principal criterion used by the staff in selecting these sites was representation of those resource areas discussed in the FES and FES Supplement that had been dismissed from further consideration without the identification and analysis of specific sites. Other criteria included proximity to the HL&P transmission system grid, land and water use, and sensitive ecological systems. The staff also took into consideration the concern that each selected site was reasonably representative of those sites that could be identified in a particular resource area. The staff did not seek further alternative sites in the Brazos River Basin (the Allens Creek resource area) since specific alternative sites in that basin have been identified and compared with the Allens Creek site (FES, Sect. 9.1.2.1.4). Also, for the reasons given in Sect. 2.2.2, the staff did not seek alternative sites in the San Jacinto River Basin and the Trinity-San Jacinto Coastal Basin. The staff did, however, readdress the South Texas Project (STP) site, located in the Colorado River Basin, to update the comparison of this site with Allens Creek as given in the FES Supplement (Sect. S.9.2). Also, the staff included a site in the Neches-Trinity River Coastal Basin to ensure adequate treatment of coastal basin sites using saltwater cooling.

The candidate sites selected for comparison with the Allens Creek site are shown in Fig. 2.7. Site Je-3 is located in the Neches-Trinity Coastal Basin; site Bz-1 is located in the San Jacinto-Brazos Coastal Basin; and site Ma-3 is located in the Brazos-Colorado Coastal Basin. Salt water from the Gulf is available for each of these sites. Site STP is located in the Colorado River Basin where fresh water is available from the Colorado River via the existing STP cooling pond system. Site Li-3 is located in the Trinity River Basin where cooling water is available from the Trinity River. The ACNGS is the Allens Creek site, located in the Brazos River Basin. The staff did not consider a site in the Colorado-Lavaca Coastal Basin because any site located in this basin would require saltwater cooling and thus would be similar to the Brazos-Colorado Coastal Basin sites. Because of the environmental impacts associated with additional transmission line construction, the staff does not believe that any site in this basin could be shown to be preferable to any sites selected in the Brazos-Colorado Coastal Basin. Sites within the Neches River Basin were not chosen since any such sites, which would be located on or near the Neches River would involve the environmental impacts associated with long transmission corridors.

2.3 SITE DESCRIPTIONS AND IMPACT SUMMARIES

The staff visited the alternative sites (Fig. 2.7) on Feb. 5 through 8, 1979. All sites were inspected by low-level helicopter flight. The STP, ACNGS, Bz-1, and Ma-3 sites were also inspected at ground level. Observations made

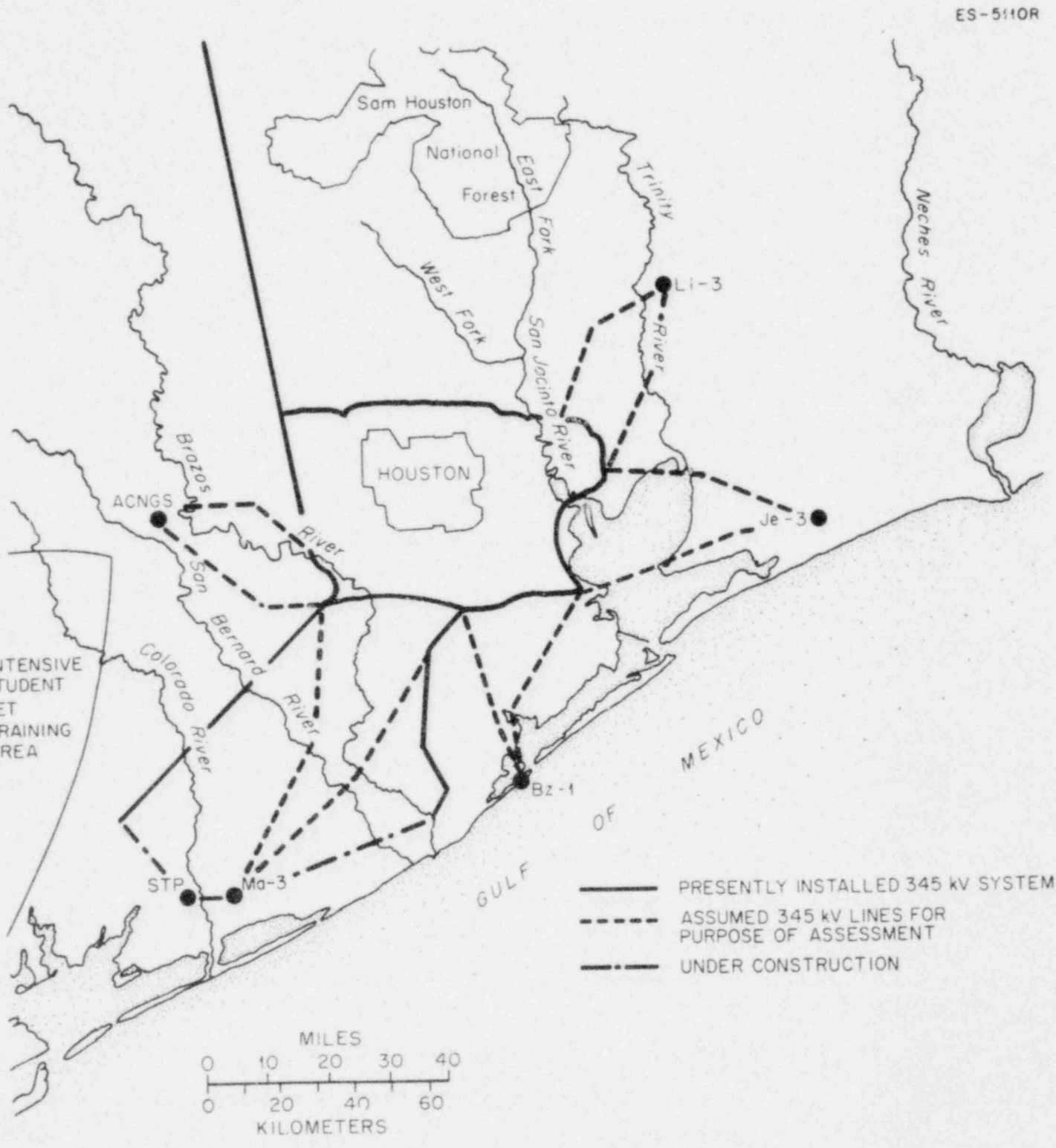

Fig. 2.7. Candidate sites and proposed transmission (345 kV) line grids. Source: Teknekron Energy Resource Analyses, Nuclear Power Plant Siting Study, prepared for Houston Lighting and Power Company, December 1975 (adapted from Map Nos. 21, 24, and 26).

include the following: (1) topographic setting; (2) general land-use patterns; (3) drainage patterns; (4) presence of onsite water bodies; (5) proximity of sites to wetland areas; (6) surrounding communities; (7) commuting road systems; and (8) location of access roads, railroads, and transmission lines. In addition to site-specific observations and inspection of the documents cited in Sect. 1.2, the staff examined U.S. Geological Survey topographic maps and consulted various State officials (e.g., General Land Office, Texas Department of Parks and Wildlife), County officials (e.g., Tax Assessor offices), and Federal agencies (e.g., Corps of Engineers, Department of the Interior). The staff relied on reconnaissance-level data* for the impact analyses. The principal areas of consideration were terrestrial ecology and land use, aquatic ecology and water use, and socioeconomics.

Terrestrial ecology and land use

For each candidate site, an assessment was made of the potential terrestrial ecology and land use impacts associated with construction and operation of the proposed power station and its associated facilities. Since the information on plant design and corridor routing is both limited and tentative, the staff concentrated on identifying major environmental constraints present in the vicinity of the sites and their associated corridors.

Assessment of agricultural impacts is based upon county statistics and a visual assessment by the applicant of current agricultural use. The staff's analyses are limited since no site-specific determinations of production or yield have been made. However, the staff believes that the analysis gives a reasonable approximation of the impacts that might occur.

Assessment of significant ecological features is based primarily on information contained in the Texas Outdoor Recreation Plan[4] and in various documents prepared for the Coastal Zone Management Plan.[5] Although the data in these various documents are several years old, the staff believes that they reflect the most important ecological features of the region.

The staff has not attempted to prepare site-specific assessments of construction and operation impacts on endangered and threatened species since detailed information on each site and corridor would be needed. However, in cases where habitat of an endangered species is known to occur at a particular site or within a particular corridor, the probability of impact has been noted in the analysis.

Aquatic ecology and water use

In order to assess the potential impacts to aquatic communities, the following factors associated with plant construction and operation were considered: (1) onsite aquatic habitat removal or modification, (2) makeup and discharge

* Reconnaissance-level data consists of information that is available from the open literature, published or unpublished reports, existing records, authoritative sources, or information that can be obtained by brief field surveys performed by recognized experts. It does not include information that can only be obtained by detailed onsite monitoring programs or studies.

water pipeline routing through aquatic habitats, (3) changes in freshwater flows, (4) impingement and entrainment impacts from cooling-water intake, and (5) cooling-water discharge impacts, especially discharges of waste heat and biocides. Under each of these categories, general aspects of local and regional aquatic ecology were considered (Table 2.2).

Potential irreversible impacts in any of the aspects listed in Table 2.2 are discussed in the aquatic assessment if they appear to be detrimental to sustaining existing aquatic resources. Potentially minimal or reversible impacts, including many short-term construction impacts, are not discussed. Those aspects of water quality that, if affected, would exacerbate an existing problem in sustaining the quality of an aquatic resource have been emphasized.

Because the analysis of potential impacts from saltwater cooling systems involves considering the general ecology of the nearshore Gulf of Mexico coastal environment, the staff has prepared the following background information and ecological concerns for this area. This analysis considers a land-based facility located between Matagorda Bay and Galveston Bay (e.g., the Bz-1 site, Fig. 2.7), with a cooling-water pipeline system running offshore to a depth of 6 to 7 m (20 to 23 ft). Cooling-water intake and discharge structures would be located approximately 1.6 km (1 mile) offshore. State-of-the-art devices for minimization of impingement/entrainment impacts (e.g., velocity caps) and approved installation/location practices are assumed to be required for any new facility.

Primary aquatic impacts in the Gulf coastal environment could occur from (1) entrainment/impingement impacts on fish and plankton, (2) discharge effects including heated water and biocides, and (3) capture of freshwater surface runoff from site development which would diminish freshwater flows through nearby marshes to their connected estuaries. Each of these aspects is discussed below.

Presently, the ecological data base for the shoreline to the 12-m (39-ft) depth contour in the open Gulf habitat along the Texas coast is limited. The U.S. Bureau of Land Management is currently funding a large-scale biological surveillance program outside of the 12-m (39-ft) contour, but very little has been done inside this depth except for work in isolated areas.[6] Therefore only general ecological descriptions can be made, and comparisons between sites assume a fairly uniform offshore benthic and pelagic habitat except where specifically stated.

Intake entrainment/impingement impacts are associated with cooling-water withdrawal for all heat dissipation systems. In the Gulf coastal area, two primary impacts would be mortalities associated with the impingement of large schools of young-of-the-year forage fish and the entrainment of ichthyoplankton and invertebrate meroplankton, especially those of commercially valuable species such as the penaeid shrimp. Benthic organisms will probably not be markedly affected by cooling-water withdrawal using a mid-water depth placement of the intake port [approximately 3 m (10 ft) off-bottom in 6 to 7 m (20 to 23 ft) of water].

In the Texas Gulf Coast, large schools of young forage fish, such as menhaden, migrate out of estuarine nursery areas, enter the open Gulf environment, and become susceptible to impingement.[7,8] Other small offshore schoolers such as

Table 2.2. Aquatic ecology aspects used in the alternative site analysis

Factor	Consideration
Habitat	Existing physiochemical conditions which provide quality habitats.
	Importance of potentially disturbed habitat as spawning or nursery grounds for important biota.
	Importance of potentially disturbed habitat as feeding areas or migration routes for important biota.
	Sensitivity of potentially disturbed habitat to long-term changes associated with plant operation.
	Uniqueness of aquatic habitat potentially disturbed by plant operation with respect to regional ecology.
Biota	Presence in potentially disturbed areas of recreationally or commercially valuable finfish or shellfish.
	Presence in potentially disturbed areas of important food resources for valuable finfish and shellfish.
	Presence of endangered, threatened, or protected species in potentially disturbed habitat.

anchovy are also present. Large-scale impingement events involving these schooling fish appear to be random or pulsed and nonpredictable.[8] Experience elsewhere has shown that velocity caps on intake structures may not protect against this all-or-none occurrence.[9] Therefore, placement of an intake structure in the open Gulf habitat could potentially result in periodic and large-scale impingement of schooling fish. Such events could be exacerbated by locating the intake structures near tidal passes leading to estuary nursery habitat.[7,8] Review of existing literature does not reveal any knowledge of distinct fish migration routes in the near-shore environment 0 to 7 m (0 to 23 ft).[1] However, locating intake structures near tidal passes would place them in areas of high fish concentrations. Other species of large fish, besides the small schoolers, may also suffer periodic impingement mortalities. However, the impingement of larger fish will probably only involve those individuals attracted to the intake structure as an artificial reef, and their impingements should not result in any significant loss of adults from the Gulf habitat surrounding the intake facility.[7,8]

Entrainment mortality of ichthyoplankton and invertebrate meroplankton may occur. Potential impacts on commercially valuable shrimp are related to their life-cycle stages, which are similar among important shrimp species. The adult shrimp spawn in the open Gulf, the eggs hatch to free-swimming larvae which pass through a series of molts to motile and predominantly planktonic postlarvae, and the postlarvae stages enter the estuaries where they grow to adults in these food-rich environments. White shrimp are of particular importance to entrainment impacts because they move offshore to spawn in up to 15 m (49 ft) of water,[10,11] and they have recently been found to have distinct spawning grounds associated with the schooling behavior of mating adults.[10] Other shrimp species (brown and pink shrimp) do not necessarily exhibit this schooling behavior while spawning. Although the occurrence of white shrimp spawning grounds has only been recently recognized and has not yet been quantified for the Texas coastal region, some concentrations of spawning adults have been found to approach the coast and spawn near tidal inlets.[11] Known spawning sites exist off the mouth of the Brazos River and off Port Aransas.[10] The mass spawning of adult white shrimp in the vicinity of intake structures could result in large-scale entrainment losses of shrimp meroplankton. Therefore specific offshore intake locations cannot be considered environmentally acceptable until a thorough spring-through-fall white shrimp spawning survey has been conducted in the area of the proposed intake.

However, it should be noted that data analysis has shown a poor correlation between the off-shore concentrations of juveniles of important commercial finfish and shellfish species and the eventual recruitment into the adult fishery.[12] It is believed that the limiting factor for the maintenance of the commercial shrimp and other Gulf fisheries is the quality and quantity of the estuarine environment where the young grow and mature.[12] Therefore the effect of large-scale entrainment at a specific site on the eventual status of the Gulf commercial shrimp fishery may actually be low. Apparently the large fecundity of shrimp may preclude anything but geographically large disturbances having significant effects on the regional white shrimp fishery.[12]

Ichthyoplankton of other commercial fish may also be entrained. Although entrainment is not ecologically desirable, the ubiquitous distribution and the large geographic range of most of the Gulf fish species suggest that some additional mortality can be sustained without degrading the basic fishery resource.[7,8]

Cooling-water discharge effects are generally associated with the release of waste heat and biocides. In addition, some nutrient enrichment of the effluent may occur with respect to ambient nutrient levels in the receiving waters. For closed-cycle systems such as cooling ponds and cooling towers, only a relatively small discharge would occur, and any waste heat or biocide would be rapidly mixed into the surrounding water body. It is doubtful that any significant adverse impacts would occur in the offshore Gulf environment from the low-level release of either waste heat or biocides. Once-through cooling systems, however, would have considerable heat released into the receiving system. It has been shown that in this situation the near-field effects will probably be small, but that thermal plume migration across a tidal pass (estuary mouth) could pose an environmental problem.[7] The problem would be especially severe if the thermal plume migrated into an estuary during periods of natural heat stress. Some estuarine organisms then could suffer adverse heat stress effects. The thermal shock potential in the open Texas Gulf Coast environment is probably not of significant concern because of the very small area affected in a geographically large habitat.

The discharge of nutrient-laden heated water into the Gulf may attract and concentrate forage fish which would utilize the stimulated growth of food species. Fish also may be attracted to offshore structures which function as artificial reefs.[7,8] However, there is some controversy over whether such structures actually increase biological productivity in the immediate area; rather, they may serve as attraction sites that differentially concentrate the existing organisms and make them more susceptible to harvesting.[13] The net result should be a locally enhanced fishery with different relative abundances of species present than normally found in the open Gulf habitat.[13]

Construction of large cooling reservoirs and the resulting capture of freshwater surface runoff to estuaries may cause some environmental impacts.[14] It has been shown that there is a positive correlation between freshwater inflows to Texas estuaries (in the area of interest) and the production of white shrimp and other fishery resources[15] and that the productivity of Texas estuaries is generally limited by rainfall and subsequent freshwater inflows.[15,16] In addition to the dilution effect of freshwater on saline conditions in estuaries, inflowing water maintains the marsh habitats (especially in tertiary bays) surrounding the estuaries. The peripheral marshes provide a large input of organic matter to estuaries in the form of detritus that serves as the major food resource for the estuarine-dependent species. The flushing action of freshwater flows carrying this food resource and other nutrients into the estuary is crucial to the ecological functioning of the estuary.[16] Although the effect of reduced inflows depends upon the magnitude and seasonal timing of these events, existing evidence supports the contention that very careful analysis of the effects of reduced freshwater availability to important estuaries should be done before extensive environmental modifications are licensed.[16] Therefore, under conservative assumptions, any site development which captures portions of the drainage of important marshes surrounding estuaries must be considered to have a potential adverse impact on estuarine production.

Socioeconomics

The primary factor in the socioeconomic analysis of alternative sites is the level of in-migration by a construction work force to communities in the site

area. Other concerns or impacts (for example, housing availability, educational capacity, taxes) are largely determined by the extent to which the construction work force resides near the site or commutes to the site from their present residence. In either case there are socioeconomic impacts on the local area, but they may differ in kind and degree. Once the level of in-migration is characterized for each of the sites, the secondary impacts resulting from this in-migration may be estimated.

In-migration estimates are based upon a number of key variables, including peak construction work force estimates, commuting distance to the existing labor supply region, the existing environmental characteristics of the potential host communities, and a number of individual choices that can be made by individual employees. Recent experience in the construction of one-unit nuclear power plants indicates that approximately 3000 workers will be needed during the peak period of construction.[17] The staff has elected to use this figure for all the alternative sites considered in this analysis, including the Allens Creek site. Estimates of in-migration are also dependent upon the proximity of probable labor pools to each site. Areas serving sites located in an isolated rural region usually experience higher levels of in-migration than areas located within a reasonable commuting distance of an adequate supply of labor.

Population effects resulting from construction of a nuclear power plant can be expected to be an expansion of population growth in some areas and a constriction of this growth in others. In an isolated rural area the in-migrating work force and the commuting work force can be expected to indirectly stimulate some temporary and permanent growth. In areas which are developing as suburban communities of metropolitan Houston, it is expected that plant construction and operation might limit population growth in some areas, thereby stimulating growth in other areas. The staff's analysis has considered these diverse population impacts that might be generated by construction of the Allens Creek plant or an alternative. On the one hand, a privately owned, taxable power plant might attract residents who anticipate a favorable property tax scenario; alternatively, a plant might shift residential and commercial development to areas at greater distances from the plant.

Housing availability has been considered as both an independent and a dependent variable in the staff's analysis. It is independent to the extent that it helps to determine limits to in-migration and growth. It is dependent in the sense that in-migrating workers may exhaust the available housing supply, leading to building development and speculation, inflationary prices in the housing market, and related potential adverse impacts.

The staff has also estimated the impacts of plant construction and operation on the educational infrastructure and taxes, and has considered potential impacts to travel and traffic on local road and commuting systems. In addition, the potential impacts to taxing jurisdictions and residential displacement; historical, archaeological, and natural features; recreation resources; and aesthetics are considered.

2.3.1 Allens Creek site

2.3.1.1 Site description

The Allens Creek site has been described in the FES (Sect. 2) and the FES Supplement (Sect. S.2). For convenience in comparing the alternative sites with the Allens Creek site, a brief description is presented below.

The Allens Creek site is located in Austin County, Texas, approximately 72 km (45 miles) west of the center of Houston, 6 km (4 miles) northwest of Wallis, and 11 km (7 miles) south-southeast of Sealy (Fig. 2.8). Access to the site is provided by State Highway 36 and the Atchison, Topeka, and Santa Fe Railroad, both of which run close to the western boundary of the site. The Brazos River lies immediately east of the site.

The site is 4513 ha (11,152 acres) in extent. Present plans call for construction of a 2072 ha (5120 acre) cooling lake and the utilization of an additional 243 ha (600 acres) of land for the nuclear reactor and its ancillary facilities (Fig. 2.9). Two 345-kV transmission line corridors 104 km (65 miles) long and affecting 749 ha (1851 acres) would connect the proposed facility to the W. A. Parish and the Obrien substations of the HL&P power grid (Fig. 2.8).

The Allens Creek site consists of an extensive area of Brazos River floodplain and a smaller uplands area on the western side of the property (Fig. 2.9). The elevation of the floodplain in which the cooling lake and intake/discharge structures will be located is approximately 30 m (100 ft), while the upland area on which the nuclear reactor and other plant facilities will be located ranges from a height of 41 m (135 ft) to 44.5 m (146 ft). The majority of the bottomlands has been cleared for use as cropland and is considered to be prime-1 farmland by the Soil Conservation Service (FES Supplement, Sect. S.4.1.3). The uplands portions of the site are used primarily as rangeland, although some prime and unique farmland is also present. Woodlands are associated with the bluffs, poorly drained areas on the bottomlands, Allens Creek, and portions of the Brazos River. Large numbers of geese and dabbling ducks have been observed feeding on the site croplands.

2.3.1.2 Impact summary

Terrestrial ecology and land use

Construction of the Allens Creek station would result in the permanent loss of 2133 ha (5270 acres) and a temporary loss of 182 ha (450 acres) of terrestrial habitat (FES Supplement, Sect. S.4.3.1). Approximately 88% (2030 ha) of the land to be used is classified as prime or unique farmland (FES Supplement, Sect. S.4.1.3). No plans have been made by the applicant for the use of the remaining 2198 ha (5433 acres) of the site. No federally listed endangered or threatened species is known to use the site, but a State-listed species, the Mississippi kite, has been observed there. Construction of the proposed facility would reduce winter feeding habitat for waterfowl and would reduce the habitat available for an estimated onsite resident population of 33 deer. A unique bluff community of woody species would probably be destroyed by the filling of the cooling lake, but a unique hay meadow would be preserved as part of the proposed state park.

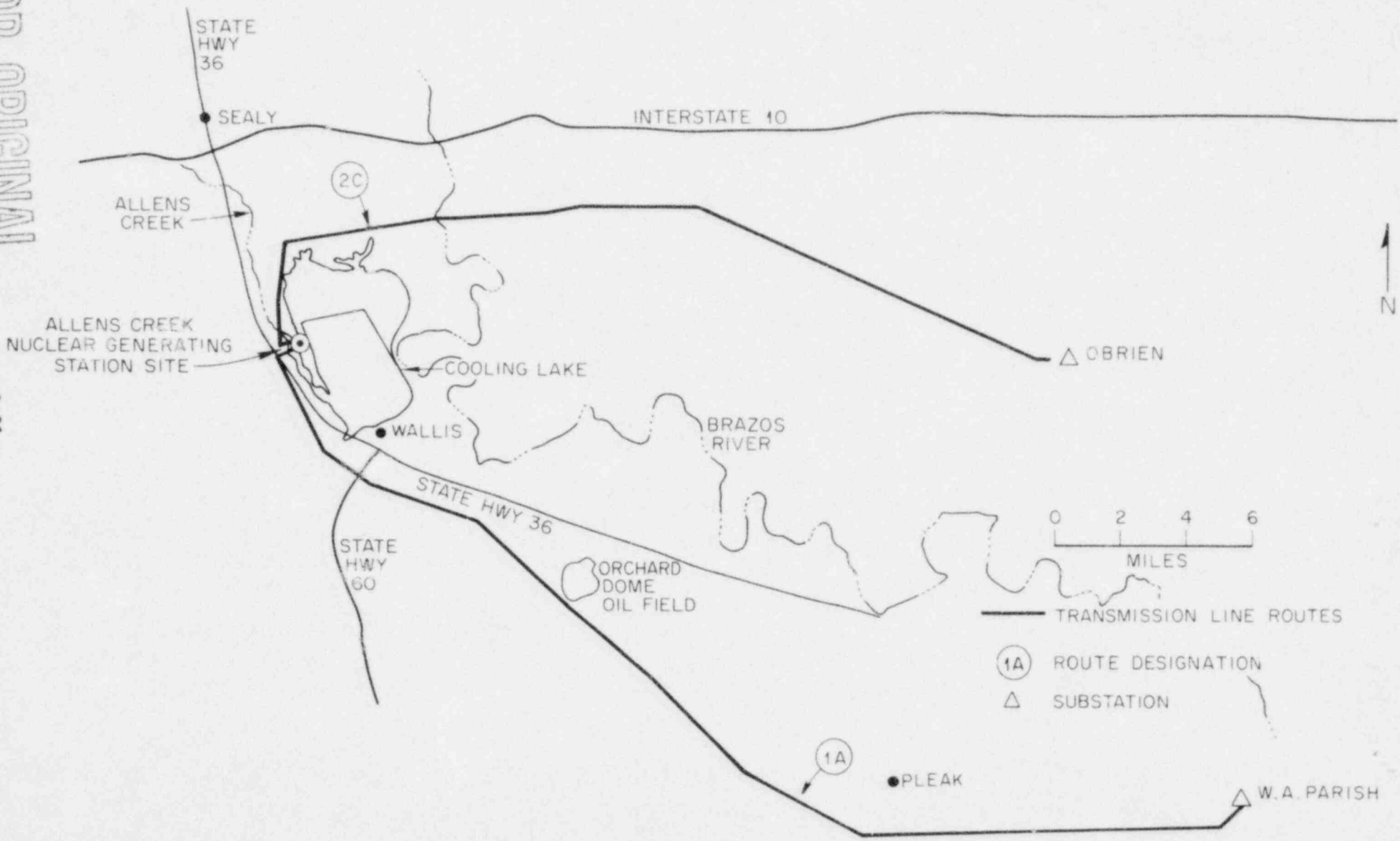

Fig. 2.8. Allens Creek site and transmission line routes. Source: ER, Fig. 3.9-1 (modified) and ER Supplement, Fig. S3.9-1 (modified).

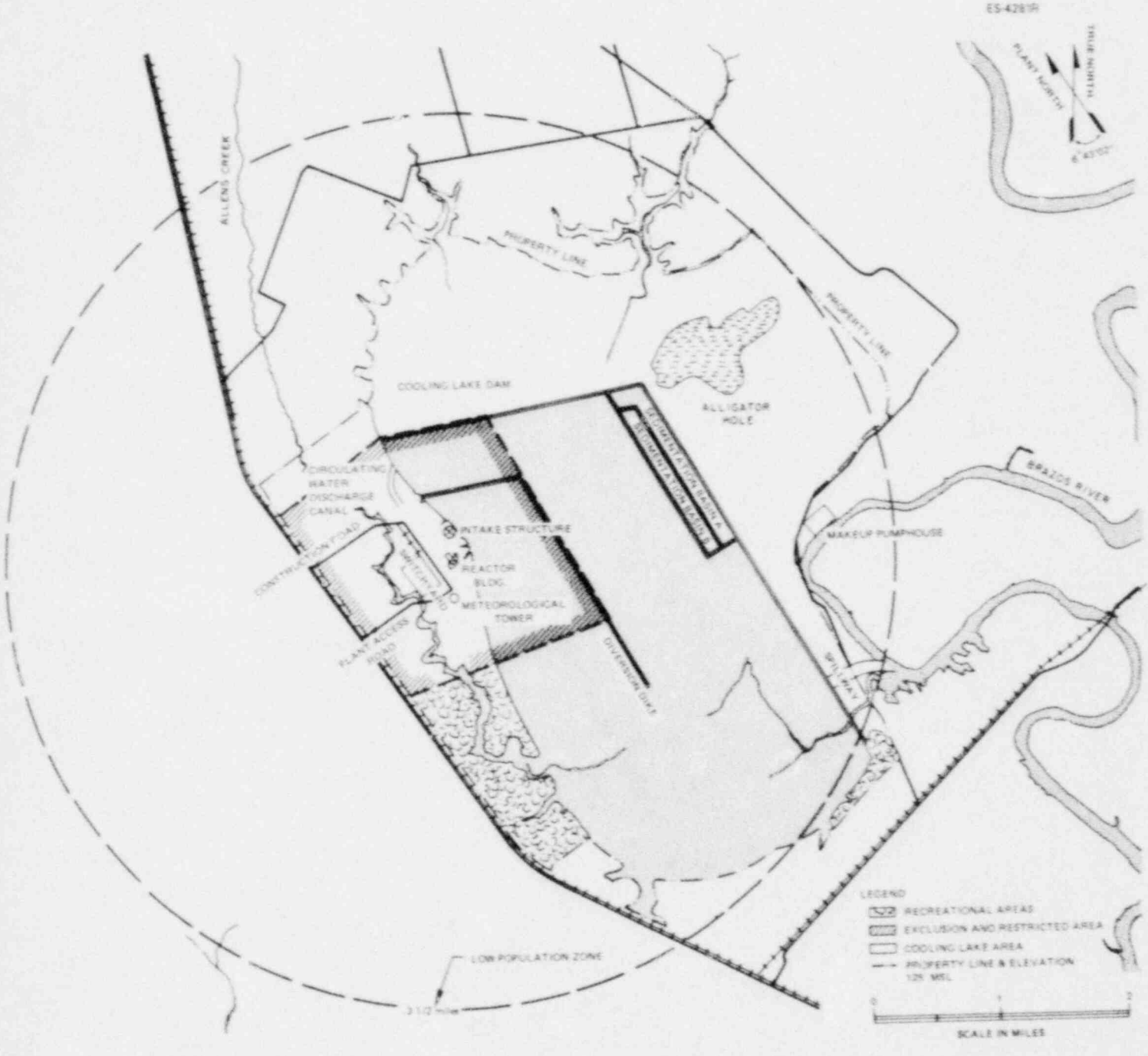

Fig. 2.9. Allens Creek Nuclear Generating Station cooling lake. Source: ER Supplement, S2.1-2 (modified).

The proposed transmission line corridors would affect approximately 749 ha (1851 acres) of land, 68% of which is prime or unique farmland. Construction of the corridors would involve only temporary disruption of agricultural activities along the route, and no permanent change in land use is anticipated. Transmission Route 1A would cross some habitat of the endangered Attwater's prairie chicken. However, the applicant has agreed to mitigation measures acceptable to the U.S. Fish and Wildlife Service to avoid disruption of this habitat and its population (FES Supplement, Sect. S.4.3.1).

The transmission corridors associated with the ACNGS facility would cross extensive areas of ricelands used by wintering waterfowl as feeding areas. In response to a staff question as to potential waterfowl mortality resulting from impacts with transmission facilities, the applicant reported (ER, p. 5.6-2A) that "there are many miles of transmission lines in the HL&P system, some of which have been in existence for several decades. Many of these lines cross water bodies, several of which are used by migratory waterfowl. These lines are regularly inspected (for maintenance purposes) and no instances of significant bird losses have been reported." There is likely to be increased mortality of waterfowl as a result of collisions with the new transmission lines, but there is little evidence to suggest that these losses would have any significant effect on any populations involved.[18]

There should be no terrestrial impacts of significance associated with the makeup and discharge pipelines or spillway that are separate from the overall impacts of constructing the cooling lake since these ancillary facilities would be in close proximity to the lake and adjacent river.

Aquatic ecology and water use

Information on potential impacts to existing aquatic resources and water use associated with construction and operation of the ACNGS are derived from the FES and FES Supplement. Construction at this site will dam a small watershed on the Brazos River and eliminate 12.9 km (8 miles) of an intermittent stream, Allens Creek. It will replace this stream section with a large impoundment using runoff from the Allens Creek watershed and makeup water withdrawn from the Brazos River (Fig. 2.9). This impoundment will support some form of a recreational fishery and associated recreational water uses. Allens Creek currently exists as an ephemeral aquatic habitat with much of its course drying up to isolated pools during low flow periods. It has a high seasonal flow variation and provides permanent aquatic habitat associated with Brazos River biota only in the immediate vicinity of its mouth. It is not unique or considered essential to the functioning of the river ecosystem as it currently exists. The Brazos River contains a mixed freshwater fishery at the Allens Creek location. Although the Texas Parks and Wildlife Department lists this general area of the Brazos River as important fishery habitat,[19] it is important to note that this habitat is not unique and that the river is degraded at this point from agricultural runoff and industrial discharges in comparison to better upstream aquatic habitat located above College Station.[20] Impingement-entrainment impacts on the Brazos River are not considered detrimental to maintenance of the existing river fishery under the proposed pumping schedule and plant design as presented in the FES Supplement (Sect. S.5.3.1.2). The Brazos River supports only a relatively small estuary at its mouth which is not considered prime nursery habitat for finfish and shellfish resources of the Gulf of Mexico, although it does provide this function to some extent.[21]

The Brazos River estuary is considered mainly a waterfowl overwintering area.[5,22,23] Far-field impacts associated with consumptive water use and any aqueous discharges are not considered significant either to existing downstream freshwater fisheries or associated marine and estuarine fisheries near the mouth of the Brazos (FES Supplement, Sect. S.5.3.2.2). No endangered, threatened, or protected aquatic species have been found in the Allens Creek site or in the Brazos River adjacent to the site.

Socioeconomics

The staff estimated (FES Supplement, p. S.4-10) that in-migration of workers at the peak of construction would amount to 15% of the total work force, or a total of 450 workers for a work force of 3000. Assuming 2.85 persons per construction worker family or household (based on STP experience), approximately 1030 persons would be expected to move to communities in the site area. These persons would be expected to be concentrated in the major population centers of Sealy, Wallis, Rosenberg, and Richmond. About 2500 workers would be expected to commute each day to the plant. Most of these would probably come from the Houston metropolitan area. (County population projections are shown in Table 2.3.) The staff believes that this level of in-migration might result in a shortage of housing for construction workers wishing to reside in Austin County. On the other hand, the recent housing growth in Fort Bend County (Table 2.4) should be more than adequate to accommodate in-migrating populations to this county. As shown in Table 2.5, the staff estimates that in-migration would also add some 110 students to the Austin County School District.

The staff projects no particular problems with respect to the probable commuting system. Interstate 10 provides ready access from Houston, particularly since the commuting construction work force would travel in the opposite direction of the metropolitan rush hour commuter traffic. Access roads to the plant from State Road 36 would have to be constructed and would quite likely require traffic signals, but there are no indications that this would impose an unreasonable disruption of normal traffic or endanger the public safety. Access from Interstate 10 to State Road 36 should present no problems, other than perhaps requiring traffic signalization to facilitate turning.

Table 2.3. County population projections

County	1975	1985	% Change from 1975	1990	% Change from 1985	2000	% Change from 1990
Austin	14,600	14,303	−2.0	14,604	+2.1	15,043	+5.5
Fort Bend	74,800	203,993	+177.7	239,859	+17.9	324,004	+33.3
Matagorda	28,000	51,369	+83.5	57,797	+12.5	72,533	+25.5
Brazoria	124,800	196,046	+57.1	215,889	+10.1	259,974	+20.4
Chambers	13,200	23,458	+77.1	26,252	+11.9	32,599	+24.2
Jefferson	262,015[a]	278,248	+6.2[b]	290,182	+4.3	310,318	+6.9
Liberty	37,400	48,943	+30.9	52,484	+7.2	59,915	+14.2

[a] 1978 data.

[b] Percent change from 1978.

Sources: Houston-Galveston Area Council, unpublished information sent to NRC staff, Feb. 3, 1979; South East Texas Regional Planning Commission, mimeographed (July 7, 1978), sent to NRC staff Jan. 17, 1979.

Table 2.4. Housing availability in counties of alternative sites

County	Occupied housing units, 1975	Units vacant for sale or rent, 1970	Vacancy rate: Vacant, 1970 / Occupied units, 1975 (%)	% Substandard housing	Total annual housing growth, 1970–1975: houses and house trailers (%)
Austin	4,840	74	1.5	24.9	2.60
Fort Bend	15,758	347	2.2	19.3	7.65
Matagorda	9,326	505	5.4	15.4	3.04
Brazoria	35,966	1430	4.0	8.5	9.06
Chambers	4,283	104	2.4	15.5	2.90
Jefferson	81,950	3092	3.8	6.4	2.55
Liberty	11,201	364	3.2	19.6	7.50

Sources: Department of Community Affairs, *Texas Housing Needs Analysis,* Austin, March 1977; Texas Highway Department, Motor Vehicle Division, *Table Showing the Number of Registrations for Texas, by Counties,* Austin, 1969, 1974.

Table 2.5. Current enrollment, capacity, planned additional capacity and projected enrollment increases[a] for potentially impacted school districts

Plant/school district	Projected increase	Current enrollment	Capacity	Planned additional capacity
ACNGS	110			
Bellville		1450–1475	1450–1475	None
Sealy		1572	1772	None
Wallis-Orchard		830	930	None
Lamar Consolidated		under capacity	N/A	New High School in August, 1980
Li-3	90			
Liberty		2477	3477	None
Cleveland		2500	3000	None
Dayton		2460	3460	Expanding high school
Baytown		15,559	15,500	4 new schools
Je-3	66			
Beaumont		10,651	12,651	None
Pt. Arthur		11,713	13,913	None
Anahuac		1300	2800	Expanding high school
East Chambers		1143	1643	None
Barbers Hill		1332	1932–2132	1 middle school
Bz-1	180			
Brazosport		11,500	11,700	1 elementary
Angleton		5000	5500	None
Ma-3 and STP	250			
Bay City		4200	4700–4900	None
Matagorda[b]		100	125	None
Palacios		1383	2000	None
Calhoun County		4600–4700	6000	None

[a] Assuming that 60% of inmigrating workers move to these school districts, that 70% have families averaging 2.85 persons per family and that 2/3 of the children are of school age.

[b] One elementary school only.

N/A: Not available.

Sources: Staff communications with offices of school superintendents, December, 1979.

Tax benefits to local jurisdictions, including Austin County, the Sealy and Wallis-Orchard Independent School District, and municipalities, would amount to $5.7 million in 1985, assuming an assessed plant value of $1.0 billion and a reduction in the assessment ratio from 33.3% to 11.1% (ER Supplement, Table S8.1-7). If the assessment ratio does not change, annual payments to these jurisdictions would amount to over $16 million.

The FES Supplement (Sect. S.4.4.6) noted that 16 residences with 48 persons would be displaced by constructing the plant at Allens Creek. The staff has since determined that this displacement has already taken place, and that there are no longer any permanent residents at the Allens Creek site. No historical sites or natural features would be displaced or intruded upon. The cooling lake will provide some recreational benefits* (1619 ha of the lake's 2072 ha would be available for public use), as will a 259 ha park to be developed along a portion of the lake shoreline (FES Supplement, S.5.6.2.3).

Construction of the plant at Allens Creek would be visible from FM 1458 and from the bluff overlooking the cooling-lake area. The plant itself would be visible from State Highway 36, FM 1093, and from parts of the town of Wallis. The plant would be a dominant landscape feature.

2.3.2 Liberty County (Li-3) site

2.3.2.1 Site description

Site Li-3 is located in Liberty County, Texas, approximately 5 km (3 miles) north of Hardin, 5 km (3 miles) south of Moss Hill, and 77 km (48 miles) northeast of the center of Houston. The plant would be located on high ground adjacent to the Trinity River in an area containing no significant onsite water bodies (Fig. 2.10). Access to the site is by Highway 146, which runs between Liberty and Livingston. The nearest railroad is the Missouri Pacific line, which passes through Hardin. At the present time the site is not accessible by barge.

The site would be approximately 260 ha (640 acres) and would be designed to use cooling towers taking water from the Trinity River. (Area for a cooling pond at this site is not available.) A pipeline corridor for the makeup/discharge pipelines would run approximately 7.4 km (4.6 miles) northwest from the site to the Trinity River. This location (Fig. 2.10) is above tidal influence, which ends near river mile 41 near the town of Liberty.[24] It is assumed that the cooling towers would require approximately 4.9×10^7 m^3 (40,000 acre-ft) of makeup water annually and would operate with a concentration factor of 2. (This assumption was patterned after the staff's estimate given in Section 9.2.1.4 of the FES.) In addition, from inspection of the available stream-flow data for the Trinity River,[22] the staff has determined

*Upon reconsideration of previous staff analysis (the FES and the testimony in hearings before the Atomic Safety and Licensing Board in 1975) of the recreational benefits, the staff has concluded that because of uncertainties in maintaining a viable fishery in the lake -- this is due to the high concentration of chlorine in discharges allowed by the NPDES -- earlier estimates of recreational benefits might be somewhat reduced. While the extent of reduction is not amenable to quantification. The staff is of the opinion that the reduced recreational benefits would continue to favor the cooling lakes relative to alternative cooling systems.

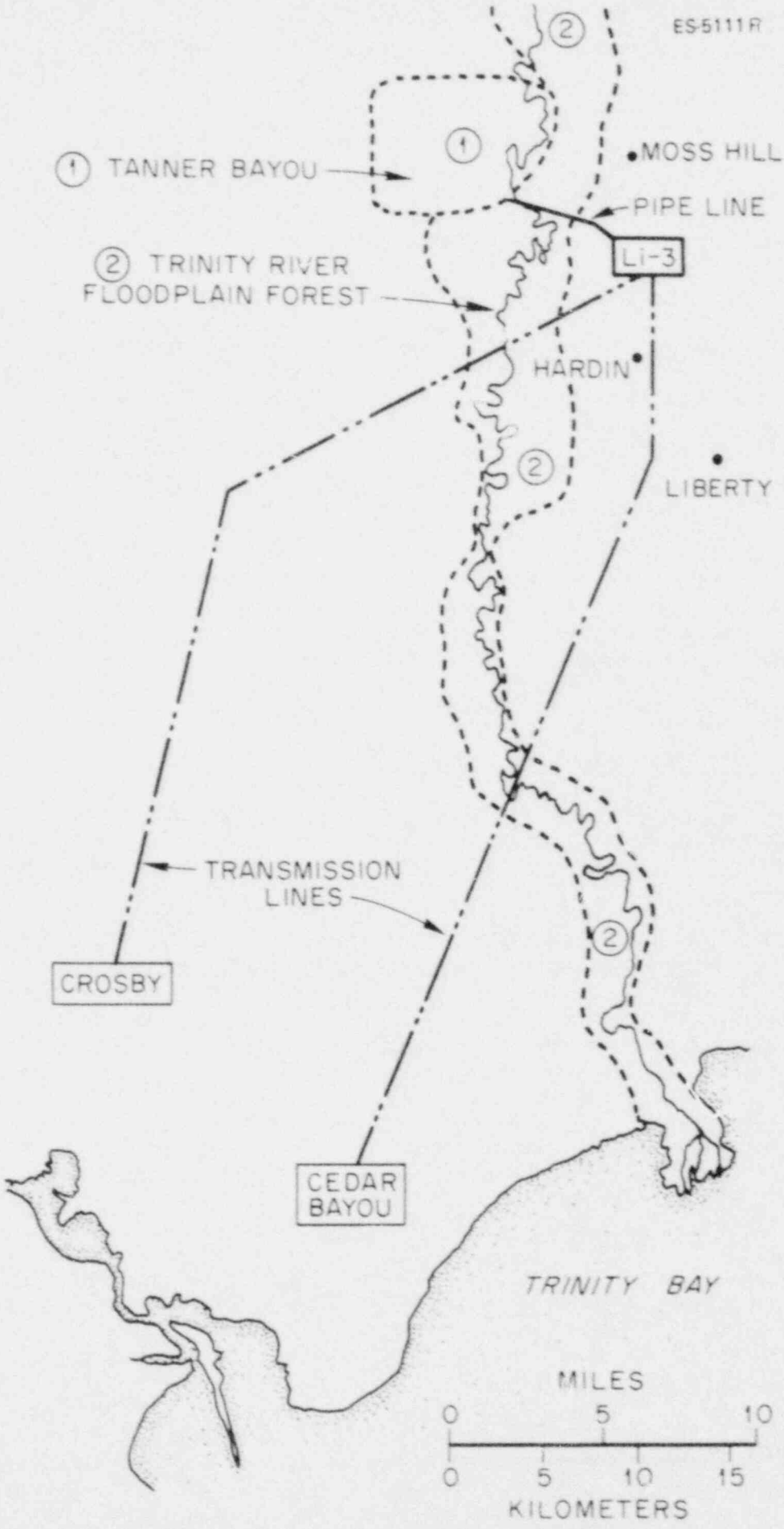

Fig. 2.10. Liberty County (Li-3) site and transmission line routes. Ecological constraints associated with transmission line routes: (1) Tanner Bayou and (2) Trinity River Floodplain Forest.

that a storage reservoir for the cooling-tower system would not be required during low stream-flow conditions. Two transmission line corridors totaling about 101 km (63 miles) would connect the site to the Cedar Bayou and Crosby substations of the existing HL&P transmission system (Fig. 2.10).

The Liberty County site is situated near the boundary of coastal prairie and mixed forest of loblolly pine and hardwoods. The site is relatively flat with elevations ranging from 24 to 27 m (80 to 90 ft). Drainage is to the southeast via Long Island Creek. The applicant's siting study[25] found that 60% of the area was second-growth deciduous forest and the remainder was open grazing land. A visit to the site by the applicant and staff (February 1979) indicated that the majority of the site [233 ha (576 acres)] is presently used as cropland. Since most of the site is cleared, it provides only limited terrestrial habitat. However, the area may serve as a feeding area for wintering flocks of waterflow. Information provided by the Soil Conservation Service indicates that none of the soils in the area are classified as prime or unique at the present time (Appendix B). However, approximately 22% of the soils on the site would be considered prime if drained.

2.3.2.2 Impact summary

Terrestrial ecology and land use

About 45% of the site is used to grow soybeans and an equal acreage to grow rice (Table 2.6). Onsite soybean production is estimated at 252,700 kg (7200 bu), about 0.4% of the county's soybean crop. Rice production is estimated to be 526,000 kg (1.2 million lb), about 0.7% of the county's rice crop. Loss of the site from agricultural production would, therefore, not constitute a major crop loss at either the state or county level.

The ecological value of onsite terrestrial habitat is limited since most of the area has been cleared. Waterfowl wintering in the nearby Trinity River area, and along the Gulf Coast in general, may use the site as a feeding area. The small size of the site relative to much larger ricelands to the south, suggests that loss of this terrestrial habitat would have little effect on waterfowl in the region but may cause a small increase in crop depredation of nearby ricelands.

Only a limited assessment of cooling-tower impacts for the Li-3 site can be made since little information is available on the design of the towers and the meteorology of the site.

Assuming a total dissolved solids concentration of 171 ppm,[24] maximum salt drift deposition rates are estimated by the staff to be 5.6 kg/ha-year (5 lb/acre-year) within 0.8 km (0.5 miles) of the towers. Drift rates beyond 2.4 km (1.5 miles) would be less than 0.35 kg/ha-year (0.32 lb/acre-year). These low rates of deposition are unlikely to cause any type of salt damage to crops or vegetation in the vicinity of the Li-3 site.

The proposed transmission line corridors would be about 101 km (63 miles) long and would require a land area of about 618 ha (1527 acres) (Table 2.7). The applicant estimates that approximately 247 ha (611 acres) of land would be needed for these corridors if a 24-m-wide (80-ft) corridor were used.[26] The staff believes that additional corridor width would be required for 345 kV

Table 2.6. Estimated crop production

Site	Crops	Area planted (ha)	Yield (kg/ha)	Gross production (kg)
ACNGS	Sorghum	1170	3900	4570×10^3
	Corn	121	3500	424×10^3
	Cotton	40	448	18×10^3
	Hay	405	5600	2270×10^3
Li-3	Rice	117	4514	526×10^3
	Soybeans	117	2168	253×10^3
Je-3	Rice	1748	4634	8.1×10^6
Ma-3	Rice	1165	5887	6.9×10^6
STP	N.A.	N.A.	N.A.	N.A.

Sources: FES Supplement, Table S.4.2.; W. F. McGuire, Environmental Planning and Assessment, Houston Lighting and Power Company, letter to R. W. Froelich, Division of Site Safety and Environmental Analysis, U. S. Nuclear Regulatory Commission, March 9, 1979 (response to question No. 3).

Table 2.7. Land use along transmission line corridors

Land use	ACNGS[a]	STP[b]	Li-3[c] (ha)	Je-3[c]	Bz-1[c]	Ma-3[c]
Agricultural	524	233	166	255	389	215
Range/pasture	223	192	194	226	99	407
Woodland timber	2	56				400
Swamp timber			258	68		
Saline marsh					88	
Freshwater marsh		12				5
Residential				10		
Water				157	22	3
Total area	749	493	618	716	598	1030
Length (km)	104	108	101	117	98	169

[a]Corridor areas and length based on FES Supplement, Sect. S.4.1.4.

[b]Corridor length based on W. F. McGuire, Environmental Planning and Assessment, Houston Lighting and Power Company, letter to R. W. Froelich, Division of Site Safety and Environmental Analysis, U. S. Nuclear Regulatory Commission, March 9, 1979 (response to NRC question No. 22); estimates of areas affected assumes an expanded corridor width of 45 m.

[c]Corridor lengths based on W. F. McGuire, Environmental Planning and Assessment, Houston Lighting and Power Company, letter to R. W. Froelich, Division of Site Safety and Environmental Analysis, U. S. Nuclear Regulatory Commission, March 9, 1979 (response to NRC question No. 6); corridor areas based on corridor width of 61 m.

transmission lines, and has used a width of 61 m (200 ft) in evaluating the amount of land that would be needed for the corridors. The staff notes that the transmission lines for the proposed ACNGS use corridor widths ranging from 55 to 80 m (180 to 260 ft).

Land use along these corridors is estimated to be 27% cropland, 31% rangeland, and 42% swamp timber. Both corridors would cross the Trinity River bottomland forest (Fig. 2.10), which is approximately 80 km (50 miles) long and covers 24,000 ha (60,000 acres).[27,5] This forest contains cypress swamp in areas where water stands for most of the year and hardwood forests on lower terraces and riverbanks. These forests contain a wide diversity of plant species and provide important wildlife habitat for waterfowl, furbearers, squirrel, deer, and alligators (classified as endangered in this part of Texas[29]). Ecologically the Trinity River floodplain is part of the Big Thicket[30] but is not a part of the Big Thicket National Preserve. The 80-km (50-mile) stretch of the river and bottomland forest above Trinity Bay has been listed as a proposed natural area.[27] Routing transmission lines through this area would involve considerable disturbance to the forest and its wildlife. Although such disturbance could be reduced by selective routing, use of existing corridors, and other mitigation measures, crossing the area could not be avoided without considerably increasing the length of transmission lines.

The makeup and discharge pipelines for the cooling tower system of the proposed site would occupy a corridor which would run northwest from the site to the Trinity River, a distance of approximately 7 km (4.6 miles). The pipeline corridor would require approximately 22 ha (55 acres) of land, most of which is bottomland hardwood forest. The pipeline crosses Greens and Knight Bayous, and would terminate in the vicinity of Tanner Bayou (Fig. 2.10), which is a proposed natural area containing excellent wildlife habitat, clean white sand bars, and habitat for several endangered species. Possible sightings of an ivory-billed woodpecker have been made in this area.[31]

Aquatic ecology and water use

The Trinity River in the area of the proposed site is characterized by many backwater areas in bayous and oxbow lakes, and good diversity and productivity of aquatic organisms.[31] The river water quality is described as moderately polluted (mainly nutrients added from upstream municipal waste disposal) but with apparently no dissolved-oxygen problems (annual range from 5 to 10 ppm dissolved oxygen).[31,32,5] A mixed river sport fishery exists, and numerous backwater areas provide a unique habitat for centrarchids and other quiet-water species.[31,32] This portion of the Trinity River is rated as a unique fishery by Texas Parks and Wildlife[19] and is a part of the best remaining aquatic habitat on the Trinity River below Dallas-Ft. Worth.[19,31] It is the opinion of Texas Parks and Wildlife that any impact to this fishery cannot be mitigated.[19] There are no endemic, threatened, or endangered species of fish within the Trinity River system.[24] However, the American alligator is common in sloughs along the river.[31]

Impacts to onsite aquatic habitats. None.

Cooling-water pipeline routing impacts. There do not appear to be significant backwater areas which would be permanently disturbed by construction of the

approximate 7-km (4.6-mile) intake and discharge pipeline corridor. Although the pipeline route does cross Knight Bayou and Greens Bayou, construction impacts should be reversible.

Consumptive water-use impacts. Water flow in the Trinity River is highly variable from month to month and from year to year, varying from a few hundred to a few thousand cubic feet per second.[31,33] Average monthly lows during the yearly hydrologic cycle appear to be in the range of 14 to 17 m^3/sec (500 to 600 cfs) with occasional periods of lower flows that may last a month or more. The assumed rate of consumptive water use (55 cfs or 40,000 acre-ft/year) would represent an average worst-case consumption of 5 to 6% of total river flow (assuming 50% loss of cooling-water uptake) with higher consumption rates possible during drought conditions.

Because continuous cooling-water uptake could remove a significant amount of river flows during low water periods, adverse impacts to the existing river fishery could occur unless river flows are augmented by releases from upstream reservoirs during these periods. Consumptive water use also could exacerbate the current problems in maintaining river water quality (dissolved oxygen, nutrients) and the quality of downstream backwater areas, given the existing moderate pollution from upstream municipal sources.[31,32,20]

Consumptive water use could affect the quality of the downstream estuary because the Trinity River is the dominant source of freshwater flows for the highly productive Galveston Bay estuarine complex.[4,32,34] The river discharge represents the principal freshwater inflow component regulating the hydrographic conditions and the corresponding salinity regimes in the associated estuaries. In addition, the Trinity River estuary supports an extensive nursery habitat for finfish and shellfish, and the flushing action of the river sustains the commercial oyster fisheries in the Trinity and Galveston bays.[24,35] Consumptive water-use effects, therefore, are of major concern. Significant impacts could include changes in salinity regimes and a decrease in the amount of detritus entering upper Trinity Bay, which could affect the production of important estuarine-dependent fisheries (e.g., shrimp, oysters, crab, and menhaden).[32]

Impingement and entrainment impacts. Operation of cooling towers would require approximately 1.6 m^3/sec (55 cfs) of makeup water to be continuously withdrawn from the river. During drought conditions or low flow this would represent 9 to 11% of the river flow [using 14 to 17 m^3/sec (500 to 600 cfs) average low-flow conditions]. Although little data is available on the ability of existing fish stocks[31,32] to compensate for entrainment/impingement mortality, impacts on fish production must be assumed to be potentially significant under this water withdrawal scenario. Because of the quality of the mixed species recreation fishery existing in the vicinity of the probable intake locations, the potential impingement and entrainment impacts on these fisheries are undesirable.[19]

Impacts from cooling-water discharge. Thermal and chemical effluents released into the receiving waters could adversely affect river water quality and the quality of downstream aquatic habitats. Thermal discharges combined with consumptive water use would tend to increase existing problems with high nitrogen and phosphorus levels resulting from upstream municipal pollution, and could adversely affect the dissolved-oxygen levels for protection of fisheries in localized areas below the discharge site.[31,32,5]

Socioeconomics

The Li-3 site is approximately 88 km (55 miles) from Houston, 80 km (50 miles) from Beaumont, and 106 km (66 miles) from Port Arthur by way of existing roads. The staff estimates that approximately 1380 persons, including 600 workers, or 20% of the peak construction work force and their families would be expected to migrate to this site. Although the Li-3 site is almost equally close to Houston, Beaumont, and Port Arthur, the commuting systems are not as good, indicating greater in-migration. In-migrants would quite likely move to Hardin, Liberty, Dayton, and other smaller communities in the area.

Housing should present no serious problems at the Li-3 site. Recent housing growth in Liberty County, as indicated in Table 2.4, should be more than adequate to meet any demands by a construction work force. The availability of housing in the county will vary by location; recent information indicates, for instance, that while housing is more available in Liberty than in Cleveland, current high interest rates have depressed home building in both communities.[36]

Since only a relatively small number of workers would probably immigrate to local communities, impacts on local schools should be minimal. This is particularly the case since, as Table 2.5 shows, there is substantial excess capacity in all but one of the potentially impacted school districts to absorb the 90 additional students that location of the plant at the Li-3 site is estimated to produce.

The impacts of plant construction on local roads for the Li-3 site could be quite severe, but mitigation of these impacts should be possible. The most likely commuting route (U.S. Route 90 to Texas State Highway 146) for workers from Houston or Beaumont/Port Authur would take the workers through the middle of downtown Liberty (crossing several railroad tracks, going through the county courthouse square and a series of traffic signals). Continuing north on State Highway 146, one must go through commercial and residential developments on either side of the highway. Travel to Liberty from Beaumont or Houston would not be easy since U.S. Route 90 is not a controlled access highway and has traffic signals in each town.

The adverse impacts related to going through Liberty could probably be mitigated with temporary rerouting of some streets, (e.g., make two-way roads one-way) and modified traffic signals. Impacts related to U.S. Route 90 are also mitigatable but probably are not significant enough to warrant it. Traffic congestion through and north of Hardin is virtually unmitigatable unless the applicant has sophisticated shift and carpool arrangements.

A plant at the Li-3 site would make large payments to local taxation jurisdictions, and these payments would constitute a sizable portion of total property values received in these jurisdictions. In fact, the Li-3 plant county property taxes would account for more than half of the total received in 1985.

Nine residences would be displaced by constructing the plant at the Li-3 site.[25] The staff has identified no historical, archaeological, or natural features, or recreation resources that would be displaced or intruded upon by locating the plant at this site. The plant would be visible from the town of Hardin and Texas Route 146; local vegetation might screen the site to some extent.

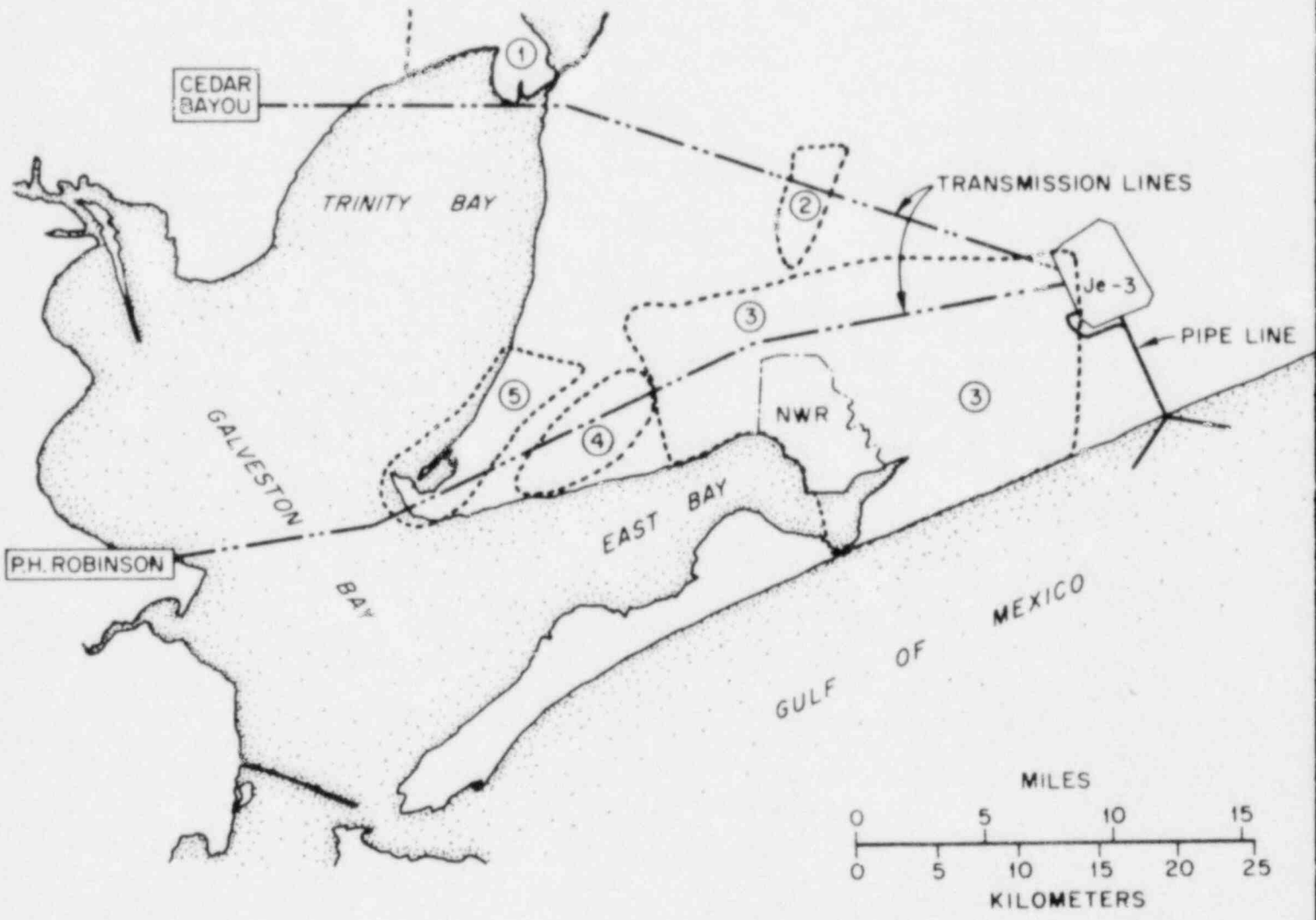

Fig. 2.11. Jefferson County (Je-3) site and transmission line routes. Ecological constraints associated with transmission line routes: (1) Wallisville Reservoir and Trinity River Delta; (2) East and West branches of Oyster Bayou; (3) Black Rail Salt Marsh; (4) Lake Stephenson and Lake Surprise; (5) Smith Point, Lone Oak Bayou, Gordy Marsh, and Vingt-et-un Islands. NWR - Brazoria National Wildlife Refuge.

2.3.3 Jefferson County (Je-3) site

2.3.3.1 Site description

Site Je-3 is located on the county line between Chambers and Jefferson counties, approximately 14 km (9 miles) south of Winnie, and approximately 97 km (60 miles) east of the center of Houston. Access to the site is via Highway 124, which runs from Winnie to High Island. An abandoned railroad parallels Highway 124 and passes within 1 km (0.6 mile) of the site. The Gulf Intracoastal Waterway is approximately 2.4 km (1.5 miles) south of the site (Fig. 2.11).

The applicant reports and the staff agrees that the Je-3 site is suitable for either a cooling-pond or cooling-tower system for dissipation of plant excess heat. Use of a cooling-pond system at the site would require approximately 1940 ha (4800 acres), with the cooling pond occupying about 1540 ha (3800 acres). If a cooling tower were used, the site would require only 260 ha (640 acres). The intake and discharge pipelines would run south-southeast to the Gulf along a corridor approximately 8 km (5 miles) long (Fig. 2.11). It is assumed that each system would require about 4.9×10^7 m^3 (40,000 acre-ft) of makeup water annually and would operate with a concentration factor of 2. Two transmission line corridors would connect the site to the P.H. Robinson and Cedar Bayou substations of the existing HL&P transmission system (Fig. 2.11).

The site is located within the coastal prairie. Brackish to freshwater marshes are found immediately to the south of the site.[5,37] The topography of the site is flat, with elevations ranging from 1.5 to 3.0 m (5 to 10 ft). The area is drained to the south by Barnes Slough and the north prong of Mud Bayou. A system of ditches and dikes associated with the rice fields and a large farm reservoir are present onsite. The applicant estimates that approximately 90% of the site (1748 ha) is presently used for rice farming (Table 2.6). Some grazing also takes place onsite. The Soil Conservation Service has determined that 98% of the site is presently considered to be prime farmland since drainage has been installed, and the land is being used as irrigated farmlands, predominately in rice (Appendix B).

The majority of the site is cleared, and its major ecological value is that it provides a feeding area for wintering waterfowl. The large reservoir onsite provides a source of freshwater and a resting site for these birds. Flood hazard boundary maps provided by the applicant indicate that the site is in an area of special flood hazard[38] (that is, on the 100-year floodplain).

2.3.3.2 Impact summary

Terrestrial ecology and land use

Development of the Je-3 site for a nuclear power plant would have the impact of removing 1900 ha (4700 acres) of prime farmland. This land had an estimated gross production of 8.1×10^6 kg (17.9×10^6 pounds) of rice in 1977 (Table 2.6). In 1977, 26,060 ha (64,400 acres) and 17,800 ha (44,000 acres) of riceland were harvested in Jefferson and Chambers counties, respectively (Table 2.8). Rice yields in these two counties are somewhat lower than for the state as a whole, but gross production ranges from 8 to 11% of the state's total rice production for each county. Assuming all the riceland lost to

Table 2.8. County crop production

County	Year	Area harvested (ha)	Yield (kg/ha)	Gross production (kg X 10^6)
		Rice production		
Brazoria	1976	23,350	4872	114
	1977	23,472	4656	109
Chambers	1976	18,939	4930	93
	1977	17,806	5104	91
Jefferson	1976	25,576	4492	115
	1977	26,062	4630	121
Liberty	1976	14,528	4866	71
	1977	15,176	4510	68
Matagorda	1976	19,506	5872	115
	1977	18,818	5882	111
State totals	1976	205,581	5387	1108
	1977	202,748	5230	1061
		Soybean production		
Liberty	1976	15,176	2595	39.4
	1977	27,802	2168	60.3
State total	1976	140,426	2264	317.9
	1977	307,562	2264	696.3

Source: Texas Crop and Livestock Reporting Service, *1976 and 1977 Texas County Statistics;* U.S. Department of Agriculture, *Agricultural Statistics,* U.S. Government Printing Office, Washington, D.C., 1978.

production was in Jefferson County (since most of the site is in that county), use of the site for the proposed facility would result in a loss of about 7% of the county's rice acreage and gross production. From an ecological perspective, development of the site would remove a relatively large area of land used as a feeding area by wintering flocks of waterfowl. The site is adjacent to important waterfowl areas, and loss of this feeding and resting habitat would cause some shift in behavior patterns of the birds using the site. The construction of the cooling pond would reduce the catchment basin for Barnes Slough and Mud Bayou and would replace the freshwater reservoir with a large saltwater cooling pond. This saltwater habitat would be much less attractive to the waterflow presently using the site although it would undoubtedly attract some bird species. The amount of freshwater entering the marshlands to the south would be reduced to some extent and might favor the development of salt and brackish water marsh over freshwater marsh. An alternative to the cooling lake proposed for the Je-3 site would be saltwater cooling towers. This alternative would reduce the amount of land needed for the site by 87% and thereby reduce the impact on the county's riceland proportionately. Makeup and discharge pipelines would follow essentially the same corridor as that described for the cooling lake, and the impact of pipeline construction would be equivalent.

Only a limited assessment of the cooling-tower alternative can be made since little information is available on the design of the towers and the meteorology of the site. A generic study of saltwater cooling towers[39] indicates that the principal impact on terrestrial ecosystems would be the effects of cooling-tower drift on vegetation and soils of the surrounding landscape. Drift refers to water droplets and dissolved salts which are carried along with the exhaust air leaving the cooling towers. These droplets and airborne salts, formed as the droplets evaporate, are deposited on vegetation and other surfaces at various distances from the towers and may result in foliar damage to plants. Heaviest rates of deposition are generally close to the towers, with rates rapidly decreasing at greater distances. The type and design of the cooling tower, humidity, frequency of precipitation, wind direction and speed, sensitivity of species to salt damage, and natural background levels of airborne salt are all factors to be considered in determining the extent of damage caused by drift.[39]

A recent study of saltwater cooling towers at HL&P's P.H. Robinson power plant north of Galveston[40] showed that drift rates from mechanical-draft cooling towers reached levels as high as 1200 kg/ha-year (1070 lb/acre-year) within 100 m (330 ft) of the towers. Drift rates decreased logarithmically with distance from the towers, to a value of 300 kg/ha-year (270 lb/acre-year) at 432 m (1420 ft). Natural background levels of airborne salt were highly variable, but averaged 250 kg/ha-year (225 lb/acre-year). Slight salt effects on the soils close to the towers were observed. The authors concluded that the potential exists for salinization of poorly drained soils.

The cooling towers which would be used at the Je-3 site are not directly comparable with the towers at P.H. Robinson, since the latter are smaller and only operate during the months of May to September. However, the P.H. Robinson study probably reflects the general problems that might be encountered in the Gulf region.

A cooling-tower design that would be more comparable with the proposed facility located at the Je-3 site is that described in the FES for the Blue Hills Nuclear Generating Station located in Newton County, Texas.[41] The staff has

estimated Je-3 site drift deposition rates for this design based on the following assumptions: (1) three circular mechanical draft towers would be used; (2) makeup water drawn from the Gulf has a total dissolved solids concentration of 35 ppt;[7] (3) the concentration factor in the cooling towers would be two; (4) similar meteorological conditions exist at the two sites; and (5) the drift rate would be 0.002% of the circulating-water flow rate. Using these assumptions, a rough estimate of maximum drift deposition is 1160 kg/ha-year (1030 lb/acre-year) within 2.4 km (1.5 miles) of the three towers. At greater distance, drift rates would decrease to less than 70 kg/ha-year (60 lb/acre-year). For comparison, the maximum predicted drift rates would be almost four times greater than the natural background levels of airborne salt at the Je-3 site.

Effects of salt drift on surrounding vegetation and soils are most likely to occur close to the towers. The vegetation in close proximity to the Je-3 site includes rice farmland, rangeland, and fresh-to-brackish-water marshland. Rice is moderately tolerant to salt[42] and is grown extensively in the coastal prairie region where natural salt levels similar to those observed at P.H. Robinson are present. However, since the Je-3 site is located at the margin of coastal prairie/riceland and coastal marshland, additional inputs of airborne salt from a cooling tower may have a negative impact on plants, such as rice, which may be near their limits of salt tolerance.

The two transmission corridors which would connect the site to the existing HL&P grid at P.H. Robinson and Cedar Bayou (Fig. 2.11) would total 117 km (73 miles) in length and would require approximately 716 ha (1770 acres) of land (Table 2.8). Land use along the proposed corridors has been estimated to be 36% cropland, 31% rangeland, and 22% water (Table 2.7). Impact of the transmission lines on cropland and rangeland would involve temporary disruption of such land use during construction and a minor loss of land, which would be occupied by transmission towers. Once the towers were built and the lines strung, impact on agriculture should be minimal, since the land within the corridor could be returned to agricultural use.

The transmission line corridors would be expected to run through (or very near) a number of proposed or existing natural areas which have high ecological value, and would restrict routing (Fig. 2.11). The corridor to the P.H. Robinson substation would cross the proposed Black Rail Salt Marsh Natural Area (a major habitat for waterfowl, the endangered red wolf, and the threatened alligator) and would cross Lake Surprise, Lake Stevenson, and Smith Point, which provide aquatic habitats and wintering grounds for waterfowl.[27] Smith Point is also a nesting area for the wood stork. The P.H. Robinson corridor is near the northern boundary of the Anahuac National Wildlife Refuge and within 1 km (0.6 mile) of Lone Oak and Gordy Marsh and Vingt-et-un Islands, the last of which is leased by the National Audubon Society as a bird sanctuary for such species as the roseate spoonbill, herons, and egrets. The corridor to Cedar Bayou crosses a proposed 2020-ha (5000-acre) natural area at the forks of the E & W Oyster Bayou. This area provides habitat for the red wolf and a nursery area for marine species. The corridor also crosses a portion of the Wallisville Reservoir area, which has coastal prairie, marshes, and bottomland forest. The abundance of proposed and existing natural areas in the general region between the proposed site and the transmission network of HL&P indicates that extensive mitigation would be necessary to reduce potential ecological impacts.

The pipeline corridor would run south-southeast from the site to the Gulf, a distance of approximately 9.7 km (6 miles). Assuming a corridor width of 30 m (100 ft) approximately 29 ha (73 acres) of land would be used. The applicant estimates that most of this area is rangeland and saline marsh.[43] Aerial inspection of the site and examination of topographic maps by the staff indicate that most of the area affected by pipeline construction is presently disturbed marshland (freshwater, brackish, and saltwater) used extensively for grazing. Although this area provides habitat for waterfowl and alligators, it is highly disturbed compared with marshland south and west of the site. Construction of the pipeline will create temporary disruption, but upon completion, the area could be restored to a condition similar to that before construction.

Aquatic ecology and water use

The Je-3 site is located on agricultural land adjacent to saltwater marshes and sloughs at the eastern edge of the East Bay of the Galveston estuary (Fig. 2.11). East Bay supports extensive nursery habitat for shellfish and finfish, and it is one of three such areas in the Galveston Bay estuarine complex.[32,35] The saltwater marshes and sloughs in the immediate area of the site, however, are not listed as important nursery habitats for finfish or shellfish, although such habitat undoubtedly exists nearby.[4,35]

Impacts to onsite aquatic habitats. A large onsite reservoir would be removed during site development. This reservoir does not appear to be a unique aquatic feature in the general vicinity of the site, nor should its removal present any apparent adverse impact to the freshwater biotic resources of the area.

Cooling-water pipeline routing impacts. Impacts to aquatic habitat along the 9.7-km (6-mile) pipeline route from the site to the Gulf should not be significant because (1) the pipeline corridor (Fig. 2.11) is already heavily disturbed by grazing, (2) the saltwater marshes and sloughs along the route are not listed as an important nursery habitat,[4,35] and (3) the area potentially affected is small in comparison to the area of similar nearby habitat.

Consumptive water-use impacts. Construction of the 1538-ha (3800-acre) industrial reservoir would capture portions of the drainages of Barnes Slough and the north prong of Mud Bayou. Loss of freshwater flow down these water courses, which empty into the Intracoastal Waterway and subsequently into the East Bay of the Galveston estuary, may pose some environmental problems. East Bay apparently has already suffered degradation from saltwater intrusion resulting from construction of Rollover Pass and may suffer additional environmental changes if freshwater inflows are reduced.[10] Although the amount of freshwater flow reduction appears to be potentially small considering the watershed area involved, the lack of data on the sensitivity of East Bay biotic production to even small reductions in freshwater inflows leads to the conservative conclusion that adverse impacts are possible. Therefore, removal of this drainage area is not desirable until further analysis shows that it would be ecologically insignificant to the East Bay estuary, especially during low rainfall years.

Use of saltwater cooling towers would significantly reduce the potential impacts from drainage area modifications, but cooling towers could significantly increase the salinity of drainage water from the site and its immediate surroundings. This alternative could in turn change the salinity gradients

and hence could adversely affect biotic productivity in the drainage area because of increased salinity.

Impingement and entrainment impacts. The potential for adverse impingement/entrainment impacts in the Gulf of Mexico from the Je-3 site are described in Sect. 2.3, Aquatic Ecology and Water Use. An additional consideration is that the Galveston Bay estuarine complex is one of the most productive estuaries along the Texas Gulf Coast. As one moves closer to the tidal passes, relatively higher densities of migrating schools of impingeable fish and entrainable ichthyoplankton should be seasonably present. Thus, there is some potential for seasonable impacts to impingeable and entrainable biota due to the general proximity of the proposed intake structure to Galveston Bay.

Impacts from cooling-water discharge. Cooling-water discharge should have the same impacts in the open Gulf habitat at the Je-3 site as described in Sect. 2.3. At two cycles of concentration and at relatively low release rates associated with cooling-reservoir operation, little impact from cooling-water releases in the Gulf would be expected. Because the discharge structure would be located approximately 29 km (18 miles) away from the main inlet to Galveston Bay, far-field thermal plume effects should not present any problem during periods of natural heat stress in the estuary.

Socioeconomics

The Je-3 site is approximately 60 km (37 miles) southwest of Beaumont, 63 km (39 miles) southwest of Port Arthur, 69 km (43 miles) northeast of Galveston and 116 km (72 miles) east of Houston by way of existing roads. The site includes land in both Chambers and Jefferson counties, with the reactor tentatively designed to be within Chambers County. Most of the land in this county is rural and will remain so, particularly in the site area.

In-migration to communities near the Je-3 site is estimated by the staff to be approximately 10% of the peak construction work force (300 workers; 690 persons). The Je-3 site is within commuting distance of not only Houston, but also of the Beaumont-Port Arthur metropolitan area and possibly Galveston, which are expected to supply about 2700 commuting workers. In-migrants would probably move to the Beaumont-Port Arthur metropolitan area or small communities in eastern Chambers County of Jefferson County.

Since the plant-related in-migration is expected to be quite low, total population impacts for the county would probably be slight. Most of the population growth for this area should be concentrated in Anahuac, Mont Belvieu, and the Winnie-Stowell area of eastern Chambers County. Construction of a nuclear power plant at the Je-3 site would likely reinforce this trend in Chambers County. In Jefferson County roughly 90% of the population resides in the Beaumont-Port Arthur Standard Metropolitan Statistical Area (SMSA), and recent projections by the South East Texas Regional Commission indicate that the county's population growth will concentrate in the same area.[44] Construction of Je-3 is not likely to affect population trends in Jefferson County because most workers would be expected to commute from the Houston and Beaumont-Port Arthur metropolitan areas. An adequate labor pool is in these areas. Because of available services, those workers in-migrating for the construction at Je-3 would more than likely move to the Beaumont-Port Arthur SMSA (Jefferson County) and commute. If this assumption is correct, no housing problems should develop, given the scale of the housing market (see Table 2.4). Alternatively, if the

workers decide to live in Chambers County, where most of the project's direct property taxes would be paid, the workers may encounter a tight housing market.

Construction of a nuclear power plant at the Je-3 site should have road impacts comparable with those at the Allens Creek site. Interstate 10 would provide access for most of the commuting labor force from the Houston or Beaumont area to State Highway 124; workers from Port Arthur would be able to take State Highway 73 to State Highway 124; and workers from Galveston would take the ferry to Port Bolivar to State Highway 87 to State Highway 124. Access from Interstate 10 to State Highway 124 might present some congestion and require additional traffic signals as mitigation. If many workers come from the Galveston area, congestion might occur both because of the ferry's limited capacity and because of the bridge on State Highway 124 which spans the Intracoastal Waterway.

Starting in 1985, a plant at the Je-3 site would pay more than $11 million per year in taxes to Chambers County and the East Chambers Independent School District if the majority of the site (including the reactor) is in Chambers County. Given impressive recent growth in assessed value in this county, the plant's relative tax contribution would not be substantial.

Constructing the plant at the Je-3 site would probably displace three residences, including two associated with White's Ranch.[45] The staff has identified no historical, archaeological, or natural features, or recreation resources that would be displaced or intruded upon by locating the plant at the Je-3 site.

The area surrounding the Je-3 site is characterized by a flat topography. The plant would be visible from Texas Route 73, 87, and 124; the Intracoastal Waterway; and the Gulf of Mexico. The plant and transmission lines would be dominant landscape features.

2.3.4 Follets Island (Bz-1) site

2.3.4.1 Site description

Site Bz-1, located in Brazoria County, was selected for analysis by the staff as a site appropriate for once-through cooling. The site is part of a relatively undeveloped barrier island, approximately 43 km (27 miles) southwest of Galveston and 80 km (50 miles) south-southeast of the center of Houston (Fig. 2.12). Access to the site by road is via Brazoria County Road 3005, which runs from Galveston to Freeport, crossing San Luis Pass approximately 4.1 km (2.5 miles) northeast of the site. The Gulf Intracoastal Waterway is 5.2 km (3.2 miles) northwest of the site across Christmas Bay and adjacent to low marshlands. The nearest railroad is a spur line of the Missouri Pacific, which terminates about 11 km (7 miles) northwest of the site. Access to the site by either rail or barge would require major construction and dredging through sensitive aquatic and wetland habitats associated with Christmas Bay.

The applicant has not shown precise site boundaries but has estimated that the site would be approximately 260 ha (640 acres). Water for the once-through condenser cooling system would be withdrawn from and returned to the Gulf of Mexico. It is estimated that a circulating-water flow of 57 m^3/s (2000 ft^3/s) would be required.

The intake and discharge pipelines would be about 1340 m (4400 ft) and 2070 m (6800 ft) long, respectively, and would cross the barrier beach just southeast of the site (Fig. 2.12). Two transmission line corridors totaling about 98 km (61 miles) would connect the facility to the Oasis and P.H. Robinson substations of the existing HL&P transmission system grid (Fig. 2.12).

The site is located on the bay side of a barrier island. The beach immediately south of the site is undeveloped and open for public use. Three distinct habitats exist on site: barrier flats of sand with salt-tolerant grasses, tidal marshes of cord grass and other species, and coastal ponds.[43,46] The Gulf shoreline in the area of the site is erosional, and the vegetation is important in stabilizing the sandy substrate. The site contains important waterfowl habitat and is suitable habitat for the alligator, a threatened species in this part of Texas.[29] Immediately adjacent to the proposed plant area are a channel dredged for small craft and an aircraft landing strip, neither of which appear to be heavily used.

The Soil Conservation Service has indicated that no prime or unique farmland is present on this site (Appendix B).

2.3.4.2 Impact summary

Terrestrial ecology and land use

The applicant has estimated that the size of the site would be 260 ha (640 acres). This area would require the majority of the bulge of Follets Island southwest of San Luis Pass bridge or would require extensive filling of shallow water areas in Christmas Bay. The staff considers it quite likely that the site would actually be smaller, and extensive filling of the Bay area could be avoided. To provide protection from hurricane flooding, the site would have to be raised 9 to 12 m (30 to 40 ft). Access to the site by barge or rail for shipment of large items would require extensive dredging in Christmas Bay and adjacent marshlands and would create a major impact on those areas.

From an ecological perspective, development of the site would destroy a major habitat for wintering waterfowl, alligator habitat, and habitat used by shore birds and sea birds. The site is part of a proposed natural area[27] and is some of the best preserved marshland along this section of the Gulf coast.

The two transmission line corridors connecting the site to the Oasis and P.H. Robinson substations (Fig. 2.12) would be about 98-km (61-miles) long and would affect approximately 600 ha (1480 acres) of land and water (Table 2.7). Major features crossed by the transmission lines would include Cold Pass, Christmas Bay, Chocolate Bayou, the Intracoastal Waterway, four railroad lines, at least one oil field, and at least eight major roads.

Important ecological constraints to transmission corridor routing are shown in Fig. 2.12. The large area encompassing Mud Island, Bird Island, the Brazoria National Wildlife Refuge, and their associated bays and marshlands is a proposed natural area.[27] Both transmission lines would have to cross parts of this area, and erecting towers, gaining access to tower bases, and stringing lines would cause local damage. The lines would also provide a potential hazard to waterfowl landing in the marshlands. The tentative P.H. Robinson corridor would cross a potential natural area designated as the Chocolate Bay "Sulphur Canal," which is a valuable aquatic habitat that also provides an important

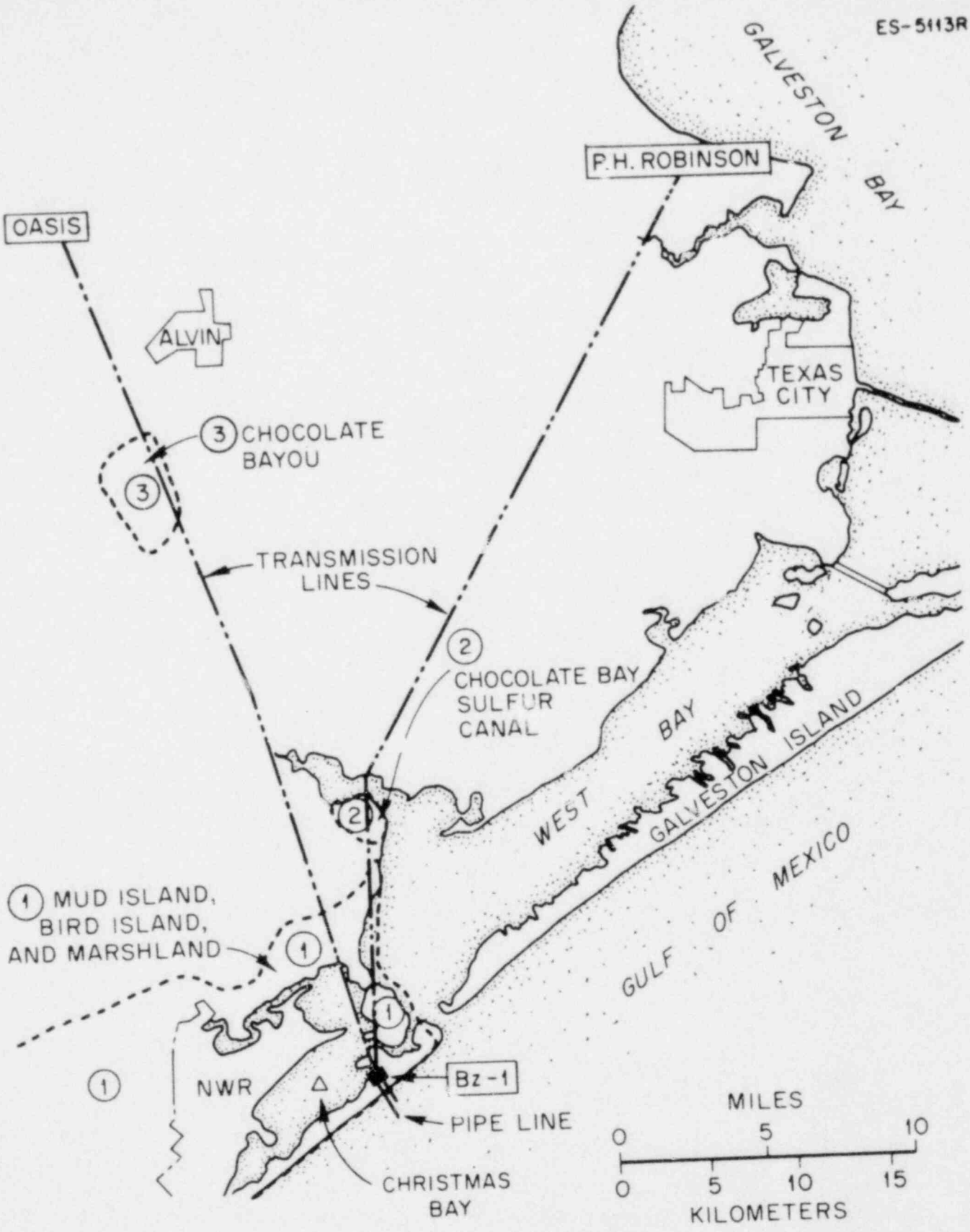

Fig. 2.12. Follets Island (Bz-1) site and transmission line routes. Ecological constraints associated with transmission line routes: (1) Mud Island, Bird Island, and Marshland; (2) Chocolate Bay Sulfur Canal; (3) Chocolate Bayou. NWR - Brazoria National Wildlife Refuge.

wintering area for ducks and geese.[27] The corridor to the Oasis substation would cross near the proposed Chocolate Bayou natural area, which supports loblolly pine, chestnut oak, and important aquatic habitat.[27]

The intake and discharge pipelines would run from the site across the barrier beach in the Gulf. The applicant estimates that about 3 ha (8 acres) of land would be affected.[43] Disruption of this area could result in increased beach erosion. Revegetation and rapid stabilization of the corridor would be essential.

Aquatic ecology and water use

The Bz-1 facility would have a once-through cooling system using Gulf water withdrawn by an intake structure located about 1375 m (4400 ft) offshore and returned to the Gulf through a discharge structure located about 2125 m (6800 ft) offshore.[47] The plant site is listed as prime saltwater marsh and is permeated by many small channels which connect to adjacent Christmas Bay. This site serves as an important source of food production (detritus) for Christmas Bay, and it is designated a prime nursery habitat for finfish and shellfish resources.[4,35]

Impacts to onsite aquatic habitats. Site construction would eliminate a significant amount of important nursery habitat in the multitude of small waterways existing in the marsh habitat that connect to Christmas Bay. Removal of this habitat would have an adverse effect on the shellfish and finfish production of Christmas Bay.

Cooling-water pipeline routing impacts. Routing of the pipeline offshore should have no permanent aquatic impacts.

Consumptive water-use impacts. Site development would remove a small amount of the freshwater drainage to Christmas Bay. However, because mainland drainage to the Bay is not affected and most site drainage is expected to continue flowing to the Bay, little impact is expected.

Impingement and entrainment impacts. The proposed intake location is within a few miles of San Luis Pass, which serves as the primary tidal flow conduit for the West Bay of Galveston Bay and for Christmas Bay.[35] This pass is one of only three such passes for the highly productive Galveston Bay estuary. The staff believes that intake structures located near tidal passes have a very high potential for significant adverse impacts to migrating and spawning aquatic biota[7,8] (Sect. 2.3). These adverse effects would include impingement/entrainment impacts on (1) migrating juvenile finfish and shellfish and (2) estuarine-dependent ichthyoplankton.

Impacts from cooling-water discharge. The potential effects of waste and biocide discharges are described in Sect. 2.3. In addition, if waste heat entered West Bay and Christmas Bay during natural high-temperature stress periods, some estuarine organisms may suffer adverse effects from heat stress.[48]

Socioeconomics

The impacts of the Bz-1 site on population in Brazoria County would very likely be of several dimensions. Currently, land use in areas adjacent to the site is devoted to second-home development along the Gulf of Mexico, but there is much industrial development in the Freeport area. Future growth in the communities of Alvin and Pearland will probably be suburban development since

they are within easy commuting distance of metropolitan Houston. Construction of a nuclear power plant at the Bz-1 site could restrict second-home development in the adjacent areas, but may help support population growth in the Freeport area.

The staff estimates that the amount of in-migration that would be induced by building a plant at the Bz-1 site would be approximately 25% of the peak construction work force (750 workers) or, assuming 2.85 persons per family, a total of just over 1700 persons. This site is farther from Houston than the Allens Creek site but closer to Houston than the STP or Ma-3 sites. It is anticipated that the construction work force, whether indigenous or in-migrating, would probably reside in Galveston or the Freeport-Angleton area, which are both within 48 km (30 miles) of the site by way of existing roads.

The housing growth figure for Brazoria County (9.1% per year) does not disaggregate second or recreation homes from the total, and the staff does not assume that this growth would accommodate all construction-related in-migration. Recent information indicates that although the housing market is tight in Angleton and Lake Jackson, there is considerable housing construction to accommodate new growth. It is likely that additional housing capacity in Galveston would further relieve the problem.

Impacts on educational infrastructure should be slight as a consequence of locating the nuclear power plant at the Bz-1 site. As shown in Table 2.5, the staff estimates that the plant would induce an influx of approximately 180 students to two school districts which have an excess capacity of 700 slots. However, if the area continues to experience substantial economic expansion, excess capacity may be exhausted relatively soon.

The commuting road system for the Bz-1 site is State Highway 332 and Brazoria County Road 257 for workers from the Freeport area and the Termini-San Luis Pass Road and San Luis Bridge (toll) for workers from the Galveston area. Both parts of this system may experience serious road problems with the construction of a nuclear power plant at Bz-1. Brazoria County Road 257 presently provides access to a large number of waterfront second homes and is in poor condition. Assuming an equal distribution of commuters from Galveston and Freeport and even a favorable shift and carpool system, traffic congestion on Brazoria County Road 257 and the San Luis Pass Toll Bridge would increase temporarily and diminish the utility of the roads for other users.

Plant-related property tax revenues to Brazoria County and the Brazosport Independent School District would amount to approximately $9.38 million per year beginning in 1985, with the bulk of that going to the school district. Since the county, and particularly the Brazosport-Freeport area, has experienced rapid industrial growth in recent years the contribution of a plant at Bz-1 would not result in a major increase in tax revenues to the local jurisdictions.

No residential or commercial establishments would be displaced by a plant at the Bz-1 site. The plant would, however, likely be viewed by many of the local residents as constituting a visual and aesthetic intrusion. There are no known historical or archaeological sites which would be affected by a plant at the Bz-1 site. Although no recreational facilities are located on the site, bird watching, swimming, and the 433-ha (1075-acre) Mud Island State

Recreational Park, (Fig. 2.12), would very likely be affected by the presence of a nuclear power plant at the Bz-1 site.[47]

Due to the site's flat topography, the plant and associated transmission lines would be visible at considerable distances, including Brazoria National Wildlife Refuge, FM 523 and 2004, the San Luis Pass toll bridge, County Road 257, the Intracoastal Waterway, and the Gulf of Mexico. The plant and transmission towers would be the dominant landscape features.

2.3.5 Matagorda County (Ma-3) site

2.3.5.1 Site description

The Ma-3 site is located in Matagorda County, approximately 4.8 km (3 miles) north of East Matagorda Bay, 21 km (13 miles) south-southeast of Bay City, and 117 km (73 miles) southwest of the center of Houston (Fig. 2.13). Road access to the site is via Highway 60 from Bay City or Highway 521 from Brazoria. The South Texas Project is approximately 14 km (9 miles) west of Ma-3. A branch line of the Sante Fe Railroad runs from Bay City to Matagorda and passes within 1 km (0.6 mile) of the northwest corner of the site. The Gulf Intracoastal Waterway is approximately 4.8 km (3 miles) to the south.

The Ma-3 site is suitable for either a cooling-pond or cooling-tower system for dissipating plant excess heat. The applicant estimates that for a cooling-pond system, the site would include approximately 1940 ha (4800 acres), with the cooling pond occupying about 1540 ha (3800 acres). If a cooling-tower system were used, the size of the site would be reduced to approximately 260 ha (640 acres). Water for the cooling pond or cooling towers would be drawn from the Gulf through pipelines running south-southwest from the site for approximately 24 km (15 miles). It is assumed that each system would require approximately 4.9×10^7 m^3 (40,000 acre-ft) of makeup water annually and would operate with a concentration factor of 2. Two transmission line corridors, approximately 169-km (105-miles) long, would connect the proposed facility to the Oasis and the W. A. Parish substations of the existing HL&P transmission system (Fig. 2.13).

The site is in the coastal prairie region of Texas. At the present time approximately 60% of the site is used for rice farming, and the remainder is used for rangeland (Table 2.6). The topography is relatively flat with elevations ranging from 2 to 8 m (5 to 25 ft). The major drainage from the site is via Big Boggy Creek. Some woody vegetation occurs along fence rows and the creek and provides important local habitat for wildlife, including alligators. Waterfowl wintering in the coastal region use the site for feeding. The Soil Conservation Service (Appendix B) has estimated that approximately 47% of the Ma-3 site (913 ha) would be classified as prime farmland. Flood Insurance Rate maps provided by the applicant[38] indicate that parts of the site adjacent to Big Boggy Creek are within the 100-year floodplain.

2.3.5.2 Impact summary

Terrestrial ecology and land use

Development of the site for a nuclear power plant will require about 1164 ha (2880 acres) of riceland with an estimated gross production of 6.9 million kg (15.1 million lb) of rice (Table 2.6). Much of this riceland is classified as

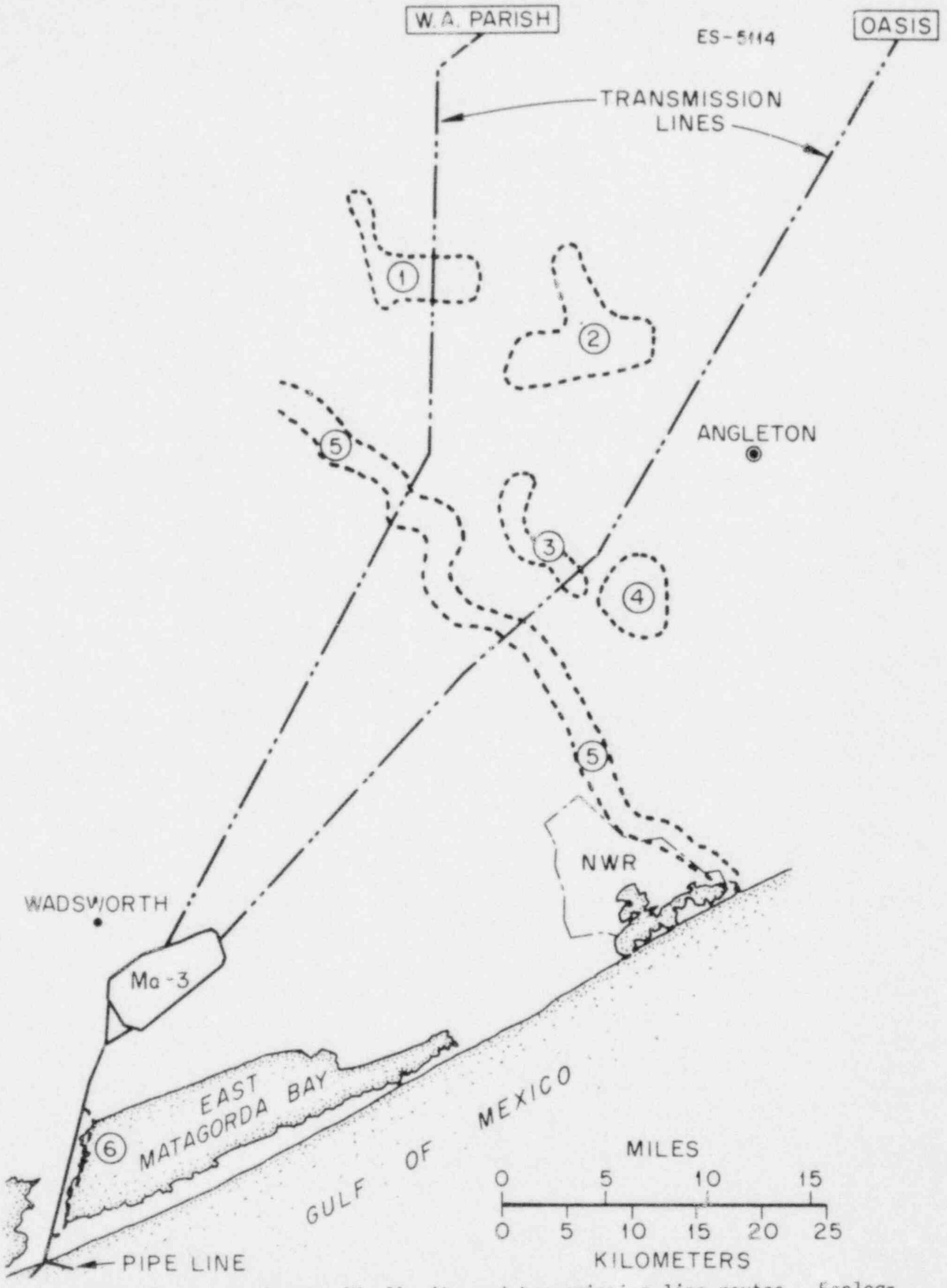

Fig. 2.13. Matagorda County (Ma-3) site and transmission line routes. Ecological constraints associated with transmission line routes: (1) Attwater's prairie chicken habitat, (2) Eagle Nest Lake and Harris Reservoir - eagle nesting habitat, (3) Brazos River bottomland forest, (4) Brazoria Reservoir - eagle nesting habitat, (5) San Bernard River forest and prairie habitat, (6) marshlands and waterfowl habitat. NWR - Brazoria National Wildlife Refuge.

prime farmland. Rice yield in Matagorda County is high compared with that of other counties shown in Table 2.8 and compared with that of the state as a whole. Table 2.9 shows that about 18,800 ha (46,500 acres) of rice was harvested in Matagorda County in 1977. Preemption of the site would therefore affect approximately 6% of the county's riceland. The 776 ha (1920 acres) of rangeland onsite will also be removed from its present use. General statistics on the abundance of rangeland in Matagorda County (Table 2.9) indicate that approximately 44% (132,600 ha) of the county is in pasture or range. Loss of onsite rangeland would therefore have little effect on the amount of land available for this use.

From an ecological perspective, development of the site will remove or disturb a large percentage of the 1940 ha (4800 acres) of terrestrial habitat. Clearing the site and eventually filling the cooling pond will displace or destroy resident fauna and will remove the rice fields and rangelands which are presently used as feeding areas by waterfowl. The saline cooling lake may provide a feeding area for fish-eating birds, but it is unlikely to attract the type of waterfowl presently using the site. These waterfowl will probably shift their feeding activities to other ricelands in the vicinity. The U.S. Fish and Wildlife Service has recently proposed the establishment of a National Wildlife Refuge encompassing 1620 ha (4000 acres) of Big Boggy Marsh immediately to the south of the Ma-3 site (43 FR 39957, June 12, 1980). The marshlands in this proposed refuge have been recognized as some of the finest remaining marshlands on the Texas Gulf Coast. The construction and operation of the cooling lake will reduce the catchment basin of Big Boggy Creek and will reduce or modify to an unknown extent the amount of freshwater drainage into the marshlands, including those of the proposed refuge, south of the site. Reduction in freshwater input could favor some development of saline and brackish water marshes at the expense of freshwater marshes.

The impacts of saltwater cooling towers discussed for the Je-3 site would be essentially the same for the Ma-3 site.

Approximately 169 km (105 miles) of transmission line corridor and 1030 ha (2545 acres) of land would be needed if the proposed facility were located at the Ma-3 site. Land use along the tentative corridors is a mixture of cropland (21%), rangeland (40%), and woodland (39%) (Table 2.7). Ecological constraints present in the general areas through which the corridors would run (Fig. 2.13) include the following: (1) bottomland forests along the San Bernard and Brazos rivers, which contain areas of virgin hardwoods, heavily timbered areas, freshwater swamps of cypress, important wildlife habitat, and moderate-to-high densities of deer;[27] (2) prime coastal prairie with large oak and pecan trees adjoining the San Bernard River;[27] (3) Brazoria Reservoir, Eagle Nest Lake, and Harris Lake, which provide nesting habitat for the endangered bald eagle, excellent wildlife habitat, and prime fishing areas;[27,46] and (4) a population of endangered Attwater's prairie chickens northwest of Eagle Nest Lake.[27]

The impact of the transmission line corridors on agricultural land should be minimal, since the land could be returned to agricultural use after construction. The impacts of the corridors on the ecological features noted above could be minimized by using existing corridors and by selective routing to avoid some of these important features.

Table 2.9. County land use

County	Total	Range and/or pasture	Cropland	Forest	Urban	Federal	Other
Austin							
Hectares X 10^3	171	91	40	25	5	0	10
Percent	100	53	23	15	3	0	6
Brazoria							
Hectares X 10^3	369	153	108	71	33	0	4
Percent	100	42	29	19	9	0	1
Chambers							
Hectares X 10^3	159	59	70	14	3	5	8
Percent	100	37	44	9	2	0	5
Jefferson							
Hectares X 10^3	246	102	77	22	33	0	12
Percent	100	41	31	9	14	0	5
Liberty							
Hectares X 10^3	306	51	58	184	10	0	3
Percent	100	17	19	60	3	0	1
Matagorda							
Hectares X 10^3	300	133	115	39	7	0	6
Percent	100	44	39	13	2	0	2

Source: U.S. Department of Agriculture, *Basic Statistics – National Inventory of Soil and Water Conservation Needs, 1967*, Stat. Bull. No. 461, 1969.

The applicant estimates that the 24 km (15 miles) intake-discharge pipeline corridor would require approximately 15 ha (38 acres) of land which is rangeland or saline marsh.[43] The staff believes that this value is too low and has estimated the area required to be about 74 ha (182 acres), assuming a 30-m (100-ft) corridor. The pipeline would run through marshland, which is important waterfowl habitat, along the isthmus separating East Matagorda Bay from Matagorda Bay. The impact could be mitigated to a large extent by having the pipeline closely parallel the existing highway and ensuring that drainage conditions are established that will promote the survival of the marshland.

Aquatic ecology and water use

Development of the Ma-3 site would involve the construction of either a 1540-ha (3800-acre) cooling pond or cooling towers, both of which would withdraw water from and discharge water to the Gulf through a 24-km (15-mile) pipeline paralleling the Colorado River. The site is adjacent to East Matagorda Bay, which is a major finfish and shrimp nursery and contains numerous oyster reefs.[4,5]

Impacts to onsite aquatic habitats. Onsite water bodies include portions of the drainage of Big Boggy Creek. Removal of this aquatic habitat should, in itself, present no significant impacts considering the similar aquatic resources in the area.[5,23] However, the loss of freshwater drainage may have some effect on downstream marshes.

Cooling-water pipeline routing impacts. The pipeline corridor would cross the Colorado River delta marsh, which built up rapidly during the 1930s at the western edge of East Matagorda Bay.[5] The route would run near a road which currently acts as a levee between East Matagorda Bay and the Colorado River. The marsh habitat along the road is diminishing and is losing up to 2.4 m (8 ft) per year to subsidence, compaction, and wave erosion because of the lack of sufficient silt inflow to replace annual losses.[5,20] This marsh habitat is considered prime nursery area for finfish and shellfish.[5] Pipeline routing through this area would have to be highly controlled to preserve the integrity of the marsh slope and flows from the river and from the bay. Technical capabilities apparently exist to restore original grade in such marshland and to replace the topsoil. Therefore, construction impacts may be reversible and only short-term. Enhancement of existing aquatic resources in East Matagorda Bay would be possible if, during pipeline construction, conduits to the river are laid under the existing road to improve freshwater flows through the marsh habitat from the river. These additional freshwater flows would provide silt for stabilization of the marsh and for recovery from construction impacts, and would provide additional freshwater flushing for the bay. This process would help sustain the marsh as prime nursery habitat and also add additional detritus to East Matagorda Bay, which should improve aquatic production.[5,16]

Consumptive water-use impacts. Construction of a 1540-ha (3800-acre) cooling pond would capture portions of the drainage of Big Boggy Creek. The immediate downstream habitat is a freshwater and brackish marsh area located north (inland) of the Intracoastal Waterway.[5,23] This marsh is not currently considered a prime nursery habitat for finfish and shellfish, although it undoubtedly serves that function to some degree.[5] However, its area has recently been selected as a wildlife refuge site (43 FR 39957, June 12, 1980). Any capture of upslope fresh water drainage would adversely affect its wildlife maintenance potential.

The use of saltwater cooling towers would remove any drainage area capture problem, but would substitute saltwater drift that could have some effect on local aquatic production.

Impingement and entrainment impacts. The intake structure would be located in 6 to 7 m (20 to 23 ft) of water, approximately 1.6 km (1 mile) off the mouth of the Colorado River. Impacts associated with cooling-water withdrawal from the Gulf are essentially the same as for Je-3 (described in Sect. 2.3). In addition, Matagorda Bay contributes significantly to the Gulf coast shrimp fisnery, and consequently offshore concentrations of spawning white shrimp in the area of the Colorado River mouth are to be expected.[10] Potential impacts to white shrimp spawning habitat would need further investigation before cooling-water withdrawal in this area could be licensed. The Texas Parks and Wildlife Department[20] also states that croaker, drum, and redfish are abundant at the mouth of the Colorado, and cooling-water withdrawal could have some effect on this recreational fishery.

Impacts from cooling-water discharge. The discharge structure will be located approximately 1.6 km (1 mile) offshore near the mouth of the Colorado River. Potential impacts should be minimal and are similar to those described in Sect. 2.3. Migration of waste heat is not likely to cause thermal stress problems in estuaries as discussed for the Bz-1 site. Tidal passes other than the mouth of the Colorado are relatively far away, and the thermal plume is unlikely to migrate up the salt wedge extending under the river surface at its mouth.

Socioeconomics

In-migration estimates for the Ma-3 site are influenced by the current presence of the peak construction force (4650 workers) at STP. Experience at STP indicates that roughly 35% of the construction work force in-migrated to Matagorda County.[49] Most of the work force resides in the towns of Bay City and Palacios in Matagorda County and Port Lavaca in Calhoun County.[49] Prior experience at STP indicates that construction of a new plant at site Ma-3 could normally be expected to induce 35% of the peak construction work force (3000), or 1050 workers, to Matagorda County. Based on an average family or household size of 2.85, a total of almost 2400 persons would move to Matagorda County, 60% of whom would live in Bay City, Palacios, and Matagorda. Approximately 2000 workers would be expected to commute from areas outside the primary impact zone. The estimates of in-migrating and commuting workers could be high if one assumes that some present STP construction workers would remain in the area to work at site Ma-3. It is not possible, however, to determine what proportion of STP workers would elect to remain.

The population projections in Table 2.3 are probably a little low for Matagorda County. Since the Ma-3 site is isolated from large residential communities, most of the growth will probably occur in Bay City and Palacios, the current population centers of the county.

More recent information than that presented in Table 2.4 indicates that housing availability in Matagorda is quite low, particularly in Bay City and Palacios, and that there are no vacancies in apartment complexes in these two communities.[49] In time normal housing growth in this county should alleviate the tightness of the housing market.

As shown in Table 2.5, the staff estimates that approximately 250 students would be added to affected school districts by a plant at the Ma-3 site. Given the substantial excess capacity in all the districts (except Matagorda), plant construction would have little impact on educational infrastructure.

According to a recent study of the socioeconomic impacts of the STP project,[49] some road conditions (i.e., congestion) in Matagorda County have worsened because of increased traffic. This is particularly the case just south of Bay City, the principal residence of the STP construction work force. Local residents and merchants have requested lower speed limits and additional traffic signals to mitigate this problem.

Construction of a nuclear plant at the Ma-3 site should not further worsen traffic problems in the area. State roads 60 and 35 and Farm to Market 521 would continue to experience some congestion because of workers commuting from residential areas, but this disruption is temporary and mitigatable. For instance, the applicant's labor force shift system can significantly help in avoiding adverse impacts.

A new plant at site Ma-3 would be expected to generate substantial tax payments to local jurisdictions. Assuming a $1.0 billion value for the plant and current assessment ratios, taxes payable annually to Matagorda County would amount to approximately $2.3 million. Annual property tax payments would deliver over $10 million to the Bay City Independent School District.

Constructing a power plant at the Ma-3 site would displace 11 residences. No known historical, archaeological, or natural features or recreation resources would be displaced or disrupted.

Because of the relatively flat topography, the plant and associated transmission lines and towers would be visible from Texas Routes 60 and 36 and from the town of Matagorda. The plant would be the dominant feature of the landscape.

2.3.6 South Texas Project (STP) site

2.3.6.1 Site description

The STP site is located on the west side of the Colorado River, approximately 19 km (12 miles) south of Bay City and 145 km (90 miles) southwest of the center of Houston (Fig. 2.14). A detailed description of the 5000-ha (12,352-acre) site is given in the STP FES.[14] Units 1 and 2 have been under construction since 1975. A 2954-ha (7300-acre) cooling pond that will receive makeup water from, and discharge blowdown to the Colorado River, has been constructed. Access to the site is provided by Farm to Market Road 521 and a branch of the Missouri Pacific Railroad. Transmission line corridors totaling 409 km (304 miles) in length will connect Units 1 and 2 with the Hill Country, Holman, Velasco, and Blessing substations.

The site is flat coastal plain, with less than 4.6 m (15 ft) of relief between the north and south boundaries, and is approximately 12 m (40 ft) higher than the present Colorado River channel bottom. Prior to construction of Units 1 and 2, the principal land uses on the site were rice fields, upland pastures, floodplain forest, and the upper reaches of Little Robbins Slough. Approximately

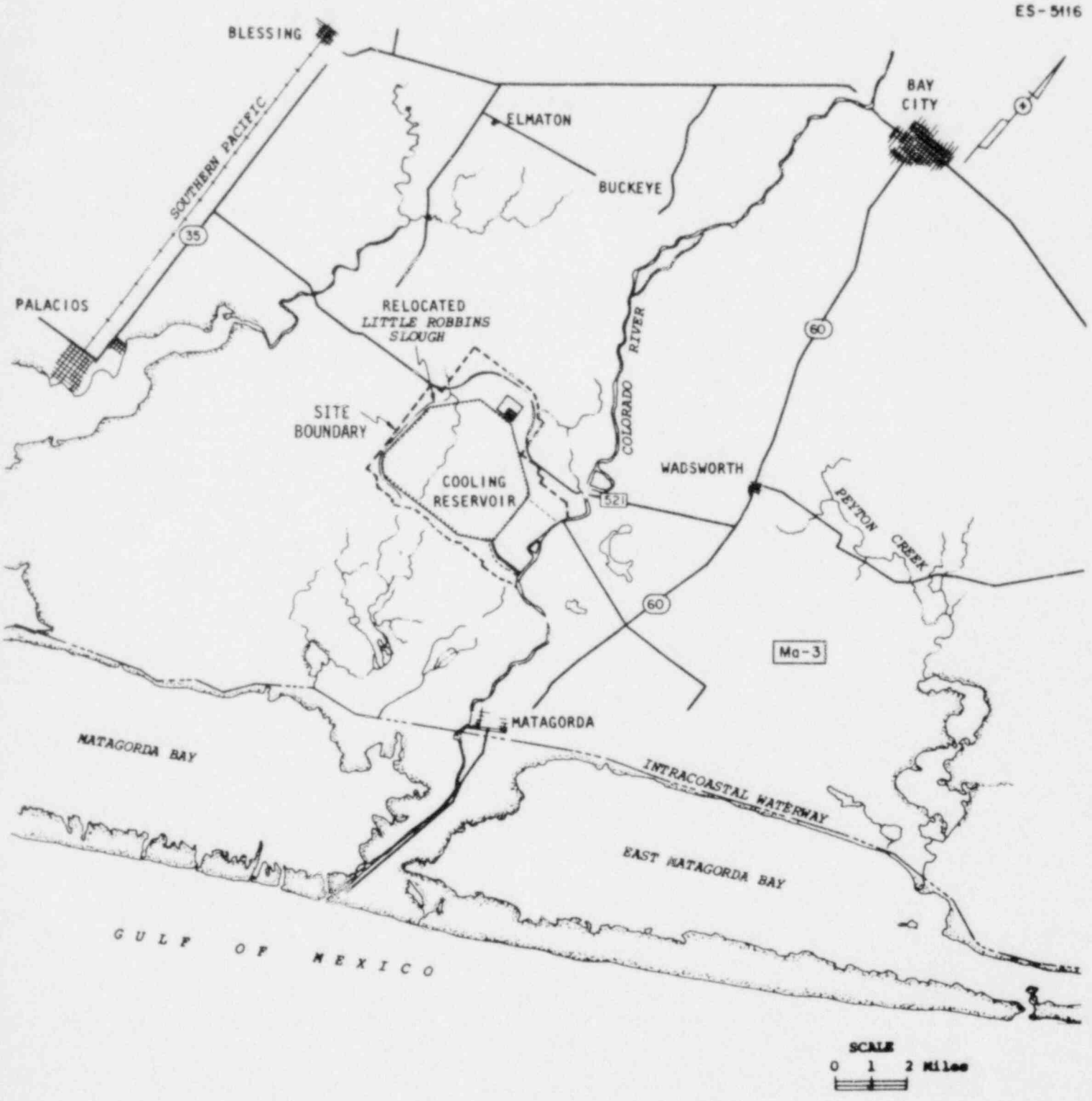

Fig. 2.14. South Texas Project (STP) site. Source: Houston Lighting and Power Company, Environmental Report, Operating License Stage - South Texas Project, Units 1 and 2, Docket Nos. STN 50-495 and 50-499, July 1978 (modified from Fig. 6.1-22, Amendment 1, November 22, 1978).

1660 ha (4102 acres) of the site, including a 688 ha (1700 acres) wildlife preserve of bottomland habitat, has not been altered by construction.

The addition of a third unit to STP as an alternative to building ACNGS was addressed in the first FES Supplement (Sect. S.9.2), but is reconsidered here as part of the overall review of alternative sites. A third unit at STP would probably be located immediately west of Units 1 and 2, in an area already cleared and presently being used for a construction storage area. Many of the required site improvements for a third unit (e.g., cooling pond, access roads, intake and discharge structures) are already in place or under construction.

The staff has revised previous estimates of transmission line corridor requirements for a third unit at STP on the basis of new information provided by the applicant.[50] The new corridor routing would parallel the existing corridor from the STP site to the Danevang tie point, and then parallel another existing corridor northeast to the W. A. Parish substation. The existing corridors would be widened about 30 m (100 ft) to accommodate the new transmission towers and lines. However, the staff has assumed this additional corridor width to be about 45 m (150 ft) (FES Supplement, Sect. S.9.2). The expanded corridor would be approximately 108-km (67-miles) long, and an additional land area of 493 ha (1218 acres) would be needed. In addition, the existing STP-Velasco substation corridor would be improved (e.g., new insulators, larger conductors) to ensure reliable power transmission to the main HL&P grid.

2.3.6.2 Impact summary

Terrestrial ecology and land use

The impacts associated with construction and operation of Units 1 and 2 at STP have been analyzed in the STP FES.[14] Construction of a third unit would involve minimum impacts to land use and terrestrial ecology (FES Supplement, Sect. S.9.2). The staff estimates that about 40 ha (100 acres) of land would be required for construction of a third unit. Much of this area has already been cleared and is presently being used as a construction storage area. Although much of this land is classified as prime farmland, its proximity to Units 1 and 2 would preclude its use for agriculture.

In the original assessment of STP as an alternative site for ACNGS (FES Supplement, Sect. S.9.2), two alternative transmission line routes were discussed. In the present analysis, information provided by the applicant[50] permits a third alternative routing to be considered. With the third alternative, the transmission line corridors would parallel existing corridors in a northwest direction from STP to the Danevang tie point, and then follow another existing corridor northeast to the W. A. Parish substation. The corridors would be about 108 km (67 miles) long, and [on the basis of an additional 45 m (150 ft) of corridor width] would require about 493 ha (1218 acres) of new land (Table 2.7). Additional transmission lines along these existing corridors will result in an increased number of bird collisions but the incremental increase in bird mortality because of the additional towers and lines is expected to be low and have little impact on populations in the region. Since the lines would parallel existing corridors their entire length, impacts on land use and terrestrial ecology should be minimal.

Aquatic ecology and water use

The primary impacts resulting from construction and operation of a third unit at the STP site are those associated with additional freshwater consumption. The staff has estimated that the operation of a third unit at STP would increase the forced evaporation from the cooling pond by about 2.1×10^7 m^3 (17,000 acre-ft) per year, which would require additional withdrawals from the Colorado River. Impacts would also result from increased entrainment/impingement mortalities at the makeup water intake location. Impacts associated with site development for a third unit would not change from the analysis presented in the STP FES.[14]

Consumptive water-use impacts. The additional consumption of freshwater from the Colorado River would have a significant impact on the amount of freshwater available for lateral dispersion at the river's mouth. At the present time, this lateral flow is insufficient to maintain the productive estuarine habitats, including many oyster reefs, as they recently existed in Matagorda Bay and in East Matagorda Bay.[20] Freshwater flow and associated organic detritus are considered the limiting natural resources for maintaining and enhancing the aquatic biotic productivity of this coastal region. As a result, a large project to divert some of the Colorado River flow into West Matagorda Bay has been authorized by the U.S. Senate (The Mouth of the Colorado River, Texas, Project) to enhance the aquatic resources in this area.[51,52] This project is being supported by the Texas Parks and Wildlife Department,[53] the National Marine Fisheries Service,[54] and the U.S. Fish and Wildlife Service[51] because of its potential benefits to the important estuarine-dependent finfish and shellfish resources at the river's mouth. Any additional consumption of the already depleted flows of the Colorado River would directly conflict with this proposal and hence would necessitate further environmental tradeoffs in an already degraded ecological system.

Impingement and entrainment impacts. Entrainment/impingement impacts would be associated with increased mortalities of anchovy, menhaden, croaker, mullet, shrimp, and blue crab taken from the tidal flow area of the Colorado River.[14] The staff has special concern for the potential loss of substantial numbers of ichthyoplankton, young shrimp, and crabs during cooling-water withdrawal when relatively low river-flow conditions prevail. Because the availability of water from upstream sources is limited (FES Supplement, p. S.9-15), additional removal of river water to operate a third unit could result in significant adverse impacts on the developmental stages of important finfish and shellfish resources of the river.

Socioeconomics

Many of the socioeconomic impacts related to constructing a third unit at the STP site are identical to those noted for the Ma-3 site (Sect. 2.3.5.2). The STP site is also located in Matagorda County, approximately 14 km (9 miles) west of the Ma-3 site (Fig. 2.14).

In-migration estimates for a third unit at STP are also influenced by the current peak construction force (4650 workers) at STP. Experience indicates that roughly 35% of the construction work force in-migrated to Matagorda County.[49] Most of the work force resides in the towns of Bay City and Palacios

in Matagorda County and Port Lavaca in Calhoun County.[49] Thus, construction of a third unit at STP could normally be expected to induce 35% of the peak construction work force (3000), or 1050 workers to Matagorda County. Based on an average family or household size of 2.85, a total of almost 2400 persons would move to Matagorda County, 60% of whom would live in Bay City, Palacios, and Matagorda (Fig. 2.14). Approximately 2000 workers would be expected to commute from areas outside the primary impact zone. The estimates of in-migrating and commuting workers are high if one assumes that some present STP construction workers would remain in the area to work on a third unit at STP. However, it is not possible to determine what proportion of STP workers would remain.

The population projections in Table 2.3 are probably a little low for Matagorda County. Since both of these sites are isolated from large residential communities, most of the growth will probably occur in Bay City and Palacios, the current population centers of the county.

More recent information than that presented in Table 2.4 indicates that housing availability in Matagorda is quite low, particularly in Bay City and Palacios, and that there are no vacancies in apartment complexes in these two communities.[49] In time, normal housing growth in this county should alleviate the tightness of the housing market.

As with the Ma-3 site (Sect. 2.3.5.2), the staff estimates an influx of 250 students with the construction of a third reactor at STP. Excess classroom capacity should be adequate to meet this potential demand.

Construction of a third unit at STP should not increase traffic problems in the area. State roads 60 and 35 and Farm to Market 521 would continue to experience some congestion due to workers commuting from residential areas, but this disruption is temporary and mitigatable. For instance, the applicant's labor force shift system can significantly help in avoiding adverse impacts.

A third unit at STP would be expected to generate substantial tax payments to local jurisdictions. Assuming a $1.0 billion value for the plant and current assessment ratios, total taxes payable annually to Matagorda County would amount to approximately $2.3 million. Major annual property tax payments to other jurisdictions for a third unit at STP would amount to the following: Palacios Independent School District, $8.2 million; Hospital District, $1.0 million; other, $1.7 million.

It is likely that many of the fiscal burdens imposed by an in-migrating construction work force would not be offset by increased tax revenues. Bay City, which has received the plurality of STP construction workers and must provide services for them, may not recoup sufficient taxes to pay for those services. This is particularly true for education, since school district taxes would go to the Palacios Independent School District even though a large plurality of the plant-related school-age children would attend Bay City schools.

No residences would be displaced by constructing a third unit at the STP site. Similarly, no historical, archaeological, or natural features, or recreation resources would be displaced or disrupted. The staff does not believe that a third unit at STP would create any adverse aesthetic impacts since the site already contains two nuclear reactors and associated plant structures and transmission lines.

2.4 COMPARISON OF ALTERNATIVE SITES WITH ALLENS CREEK

2.4.1 Terrestrial ecology and land use

In Sect. 2.3 the staff has described the probable impacts associated with the development of the proposed ACNGS site and five alternate sites, based upon the findings of a reconnaissance-level study. A summary comparison of the alternative sites with the ACNGS site is presented in Table 2.10 for major features of the terrestrial environment. A brief discussion follows of the comparisons made and the conclusions reached.

2.4.1.1 Site Li-3

Onsite impacts for the Li-3 site would be less severe than those for the ACNGS site. The Li-3 site is not located on a floodplain, whereas the ACNGS cooling lake and associated structures occupy at least 2214 ha (5471 acres) of floodplain. Development of the Li-3 site would remove from production approximately 233 ha (576 acres) of agricultural land that is not classified as prime farmland, the proposed development at the ACNGS site would remove approximately 1994 ha (4927 acres) of prime farmland.

Offsite impacts associated with developing the Li-3 site are considered to be much more severe than offsite impacts for the ACNGS site. Construction of the transmission corridors from the site to the existing HL&P transmission system would require only 83% of the land needed for the ACNGS transmission line corridors, but the Li-3 corridors would be routed through the bottomland hardwood forests associated with the Trinity River. The makeup and discharge pipeline would affect an additional 22 ha (55 acres) of bottomland forest. The construction of offsite transmission line and pipeline corridors has a high potential for degrading the bottomland forest of the Trinity River, which the staff considers an important ecological area. Extensive mitigation involving selective routing along existing corridors would be needed before the corridors could be viewed as ecologically acceptable.

In comparison with the predicted impacts at Allens Creek, the staff finds that the onsite terrestrial ecology and land-use impacts at Site Li-3 will be less than at Allens Creek, but that the potential offsite impacts associated with site Li-3 transmission corridor and pipeline routes are severe. No terrestrial resources of similar high ecological value would be affected by siting at Allens Creek. The staff concludes that the Allens Creek site is preferable to site Li-3 from the standpoint of terrestrial ecology and land use.

2.4.1.2 Site Je-3

Onsite impacts for the Je-3 site would generally be equivalent to those for the ACNGS site (Table 2.10). Development of the Je-3 site with a saltwater cooling pond would result in an estimated loss of 7% of the gross rice production in Jefferson County and would require about 1900 ha (4695 acres) of prime farmland compared with the 1994 ha (4927 acres) of prime farmland needed for development of the ACNGS site. Since the entire Je-3 site is classified as a special flood hazard area, the impact of developing this site would be similar to that of constructing the cooling lake on the floodplain at the ACNGS site.

Table 2.10. Comparison of alternative sites with the Allens Creek site for terrestrial ecology and land use

Impacts	Site				
	Li-3	Je-3	Bz-1	Ma-3	STP
Onsite impacts					
Prime farmland/agriculture	+	0	+	+	+
Floodplain	+	–	–	+	+
Terrestrial habitat	0	0	–	0	+
Endangered or threatened species	0	0	–	0	0
Cooling towers	0	–	NA	–	NA
Offsite impacts					
Transmission line corridors	–	–	–	–	+
Makeup and discharge pipelines	–	–	–	–	+
Site preference	Allens Creek	Allens Creek	Allens Creek	Allens Creek	STP

Legend: +, less impact than at Allens Creek; 0, equivalent impact; –, greater impact than at Allens Creek.

If cooling towers were used at the Je-3 site, the amount of agricultural land used for the proposed facility would be greatly reduced. By analogy to studies done for Blue Hills and P. H. Robinson nuclear power plants (Sect. 2.3.3.2), it appears that effects of cooling-tower drift on surrounding cropland and marshes would be restricted to areas close to the towers (i.e., within a 2.4-km radius). However, the possibility exists of long-term salinization of poorly drained soils in the general vicinity of the site as well. These long-term effects could possibly be mitigated by improving soil drainage in affected areas.

Offsite impacts associated with the development of the Je-3 site are considered to be much more severe than offsite impacts for the proposed ACNGS site. The routing of the transmission line corridors from the Je-3 site would require approximately the same amount of land area as would the corridors for ACNGS. However, the corridors would potentially affect a number of important ecological areas and would require extensive mitigation in the form of selective routing to avoid these areas. Such mitigation could increase the length of the corridors considerably. Pipeline construction would impact an additional 29 ha (73 acres) of rangeland and marsh. However, the staff believes the area disturbed for pipeline construction could be returned to its prior use after construction.

The staff concludes that the agricultural impacts of the Je-3 site with a cooling pond combined with potential impacts along the transmission line corridors, are sufficiently great to conclude that Allens Creek is preferable. Use of cooling towers at the Je-3 site is considered a viable alternative, and would reduce the agricultural impacts. However, this option would not reduce potential transmission line impacts. The staff concludes that from the standpoint of terrestrial ecology and land use, Allens Creek is preferable to site Je-3 with either a cooling pond or cooling towers.

2.4.1.3 Site Bz-1

When compared with the ACNGS site, development of the Bz-1 site poses significantly greater onsite and offsite terrestrial impacts (Table 2.10). The staff finds that the following major ecological problems exist with the Bz-1 site: (1) the site is located on a barrier island which is sensitive to disturbance and is subject to hurricane flooding; (2) the site supports well-preserved wetlands which provide excellent waterfowl habitat; and (3) the routing of transmission lines from the site to the existing HL&P transmission system would cause major disturbances to important wetlands north of the site. Because of these potentially severe problems, the staff concludes that Allens Creek is preferable to the Bz-1 site from the standpoint of terrestrial ecology and land use.

2.4.1.4 Site Ma-3

Terrestrial onsite impacts associated with the Ma-3 site would be generally equivalent to those at the ACNGS site (Table 2.10). Although parts of the Ma-3 site are located on the 100-year floodplain, less impact to floodplains would occur than would be the case at the proposed site. Development of the Ma-3 site would affect an estimated 6% of the county's rice production and approximately 913 ha (2256 acres) of prime farmland compared with 1994 ha (4927 acres) of prime farmland at Allens Creek. Use of cooling towers at the

Ma-3 site would reduce the impact on agricultural land but could result in possible salt drift impacts on crops and other types of vegetation near the site.

Offsite impacts of transmission lines and pipelines would be more severe for the Ma-3 site than for the ACNGS site. Construction of transmission line corridors for the Ma-3 site would require approximately 1.4 times as much land as would the corridors for the ACNGS site. The Ma-3 corridors would be routed through more areas that pose potential ecological problems than is the case for the ACNGS facility. The potential impacts of reducing freshwater input to marshes south of the Ma-3 site and the disruption which would be caused by construction of a pipeline corridor along the isthmus separating East Matagorda Bay from Matagorda Bay could pose a threat to important waterfowl habitat, alligator habitat, and wetland vegetation in that region.

On the basis of the considerations noted above, the staff concludes that from the perspectives of land use and terrestrial ecology, Allens Creek is preferable to the Ma-3 site with a saltwater cooling pond. If saltwater cooling towers were used, the impact on county agriculture could be reduced, but the potential problems associated with transmission lines and pipelines would still exist. The effects of cooling-tower drift on the surrounding landscape are not certain but would appear to be restricted to an area close to the plant. The staff concludes that, the Ma-3 site with cooling towers is a practical alternative, but that Allens Creek remains preferable to the Ma-3 site.

2.4.1.5 Site STP

Construction of a third unit at STP would take about two percent of the land required for constructing the ACNGS and its cooling lake (41 ha compared with 2315 ha). The land at STP used for a third unit has already been removed from agricultural production, is presently cleared, and contains little terrestrial habitat. By comparison, development of the ACNGS facilities and lake would remove approximately 2030 ha (5016 acres) of prime and unique farmland for at least the lifetime of the plant. Although the staff has concluded that this farmland has only average productivity and represents only a small fraction of the total prime and unique farmland in Texas, the impact of removing such a large acreage is clearly more severe than adding a third unit to STP. The transmission lines for a third unit at STP would require only 66% of the land area needed for the ACNGS lines and would parallel existing rights-of-way for their entire length.

The staff finds that the total land commitment for adding a third unit at STP is much less than for the proposed ACNGS facilities. Additionally, locating a unit at STP would avoid the removal of a large area of prime and unique farmland at the ACNGS site. The staff concludes that the STP site is preferable to the ACNGS site from a land use and terrestrial ecology perspective.

2.4.2 Aquatic ecology and water use

Table 2.11 presents results of the staff's comparison of the alternative sites with the Allens Creek site for aquatic ecology and water use. The staff comparison is based primarily on a gradient of preferability associated with

Table 2.11. Comparison of alternative sites with the Allens Creek site for aquatic ecology and water use

Impacts	Site				
	Li-3	Je-3	Bz-1	Ma-3	STP
Impacts to onsite waterbodies	+	0	–	0	+
Impacts to water quality	–	U	–	U	–
Impacts to spawning or nursery grounds	–	U	–	U	–
Impacts to feeding areas or migration routes	–	U	–	U	–
Habitat sensitivity	–	–	–	–	–
Habitat quality	–	–	–	–	–
Impacts to "important" aquatic biota[a]	–	U	–	U	–
Impacts to threatened or endangered species	0	0	0	0	0
Freshwater flow	–	U	+	U	–
Site preference	Allens Creek	Allens Creek	Allens Creek	Allens Creek	Allens Creek

[a]The following definition of "important" is taken from the U.S. Nuclear Regulatory Commission's Environmental Standard Review Plans, NUREG-0555:

> For the purposes of these environmental reviews a species is "important" if a specific causal link can be identified between the proposed project and the species and if one or more of the following criteria applies: (a) the species is commercially or recreationally valuable, (b) the species is threatened or endangered (Pub. Law 93-205, 87 Stat. 884), (c) the species affects the well-being of some important species within criteria (a) or (b), or (d) the species is critical to the structure and function of the ecological system or is a biological indicator of radionuclides in the environment.

Legend: +, less impact than at Allens Creek; 0, equivalent impact; –, greater impact than at Allens Creek; U, uncertainty exists.

the potential degradation of aquatic resources, either freshwater or marine. The aquatic resources compared in this gradient are (1) estuaries and their associated marshes, (2) rivers supporting prime fisheries, (3) rivers supporting degraded fisheries, and (4) offshore Gulf coast pelagic and benthic habitats.

Because of the high economic value of marine finfish and shellfish resources and their dependence upon an adequate quantity and quality of estuarine habitat for critical life-stage development,[18] the least preferable habitats to disturb are productive estuaries and their associated marshlands (freshwater and brackish water marshes that supply detritus and nutrients to an estuary). Compared to estuaries, freshwater fisheries are only slightly more desirable recipients of power plant impacts. Because most large-river fisheries are currently much degraded, quality river fisheries especially should be protected.

The remaining two aquatic resources in the gradient, degraded freshwater habitats and offshore Gulf coast areas, are both more desirable recipients of power plant impacts, but preference between them is less easily established. Large rivers that have poor estuaries at their mouths and support a degraded river fishery but have adequate flows for cooling-water withdrawal should be acceptable for location of power plants. This is the situation for the Allens Creek site on the Brazos River. In comparison, such river sites should be more acceptable than power plant sites located along the coast on farmland (not on marsh land) which have Gulf coast offshore intake and discharge locations. The reasons are that (1) potential near shore Gulf impacts are relatively unknown, (2) prime marine resources do exist in the near-shore area (white shrimp spawning grounds, schools of small impingeable fish, croaker, redfish, etc.), and (3) without extensive site-specific studies (additional environmental sampling and analysis) the specific offshore intake and discharge locations conservatively must be considered less acceptable.

The staff's comparisons for each alternative site are given below.

2.4.2.1 Site Li-3

Compared with the Brazos River fishery at the Allens Creek site, the existing fishery in this area of the Trinity River is rated as both more productive and more unique. Any impacts to this fishery are not replaceable by mitigation. Additional freshwater consumption in the lower Trinity River could adversely impact the tremendously productive Trinity Bay estuary. Because of the unique river fishery, the quality of this river section, and the potential to adversely affect a major estuary region, development of the Li-3 site is less preferable than development of the Allens Creek site from the standpoint of aquatic ecology and water use.

2.4.2.2 Site Je-3

Impacts associated with the Je-3 site would primarily result from a potential decreased flow of freshwater to a productive estuary (the upper arm of East Bay), and from entrainment/impingement impacts in the offshore Gulf environment. Neither of these impacts can be quantified precisely on the basis of available reconnaisance-level information. The staff has adopted a conservative approach and, in consideration of the potential for impacts to saltwater species (Sect. 2.4.2), considers that the potential low-level impacts at the Allens

Creek site, which are reasonably well quantified, will be less adverse than the predicted impacts at site Je-3. The staff concludes that Allens Creek is preferred to site Je-3 from the standpoint of aquatic ecology and water use.

2.4.2.3 Site Bz-1

Development of the Bz-1 site would lead to potential impacts on prime estuarine nursery grounds for finfish and shellfish located in Christmas Bay. Additional impacts would come from locating intake and discharge structures near a major tidal pass, San Luis Pass. No impacts of this potential magnitude exist for the Allens Creek site, and thus Allens Creek is preferred to the Bz-1 site from the standpoint of aquatic ecology and water use.

2.4.2.4 Site Site Ma-3

Development of the Ma-3 site could potentially affect the East Matagorda Bay estuary and would have offshore entrainment/impingement impacts. The eventual impact of pipeline routing through the marshes along the western edge of East Matagorda Bay cannot be predicted with any degree of assurance at this time. However, the offshore area is known to have concentrations of spawning white shrimp and good resources of redfish, croaker, and other valuable species, leading to the conservative conclusion that aquatic ecology and water-use impacts at this site would be more severe than the impacts predicted at the Allens Creek site. On the basis of available reconnaisance-level information, the staff concludes that the Allens Creek site is preferable to site Ma-3 from the standpoint of aquatic ecology and water use.

2.4.2.5 Site STP

Impacts at the STP site would result primarily from increased freshwater consumption at the mouth of the Colorado River. Because freshwater flows are considered to be the limiting natural resource for preservation and enhancement of the tremendously productive estuaries at the mouth of the Colorado, any additional consumptive use of fresh water in this area would be much less acceptable than the impacts associated with fresh water consumption at the Allens Creek site. If additional river water is pumped from the present intake location, additional impacts at the STP site would include increased impingement/entrainment mortalities on valuable marine resources present in the river salt wedge. The staff concludes that Allens Creek is preferable to the STP site from the standpoint of aquatic ecology and water use.

2.4.3 Socioeconomics

Table 2.12 presents results of the staff's comparison of the alternative sites with the Allens Creek site for socioeconomics. The following are the staff's comparisons for each alternative site.

2.4.3.1 Site Li-3

The Li-3 site is judged to be equivalent to the Allens Creek site from a socioeconomic standpoint. The Li-3 site would be accompanied by more available housing than the Allens Creek site, but substantial mitigation would be required for the commuting road system. On all the other factors, the two sites would have equivalent impacts.

Table 2.12. Comparison of alternative sites with the Allens Creek site for socioeconomics

Impacts	Site				
	Li-3	Je-3	Bz-1	Ma-3	STP
In-migration	–	+	–	–[a]	–[a]
Demography[b]	0	+	–	+	+
Housing	+	0	0	0	0
Education	0	+	0	0	0
Roads	–	0	–	0	0
Fiscal	0	0	0	0	–
Site preference	Equal	Je-3	Allens Creek	Equal	Allens Creek

[a] Assuming that no workers on STP 1 and 2 remain in the area to work on a third unit at STP or on Ma-3.

[b] This takes into account the compatibility of a nuclear power plant with present and emerging land use and population growth patterns.

Legend: +, less impact than at Allens Creek; 0, equivalent impact; –, greater impact than at Allens Creek.

2.4.3.2 Site Je-3

From a socioeconomic standpoint, the Je-3 site is judged preferable to the Allens Creek site, primarily because of the very small in-migrating construction work force (which impacts education and housing). Additionally, construction of a nuclear power plant should not affect present and emerging land-use development and population growth patterns, and the commuting system is judged equivalent to the one for the Allens Creek site. Fiscal impacts should be beneficial and help eastern Chambers County to develop its infrastructure. There may be some jurisdictional mismatches between plant-related costs and benefits for Chambers County, which would receive the bulk of the property tax payments, and Jefferson County, which would probably attract some in-migrants. The Beaumont-Port Arthur Standard Metropolitan Statistical Area should not be greatly affected by the level of in-migration anticipated.

2.4.3.3 Site Bz-1

From the standpoint of socioeconomics, the Allens Creek site is judged preferable to site Bz-1. Despite the advantages of site Bz-1 in terms of potentially available housing and fiscal equity, the large in-migrating and commuting construction labor force would have an adverse impact on present land-use patterns and the capacity of the local road system.

2.4.3.4 Site Ma-3

The staff finds site Ma-3 to be equivalent to the Allens Creek site from the standpoint of socioeconomics (Table 2.12). However, if the construction of Ma-3 could be coordinated with the completion of the current construction activity at STP, site Ma-3 would be preferable. The preferability would arise from the following factors:

1. The construction labor force would be more permanent and thereby stabilize population growth patterns.

2. Because of past experience the affected jurisdictions would be able to plan better for growth.

However, as previously noted, the staff cannot place a high degree of probability on this advantageous phasing of construction activity, nor is the staff able to estimate the number of construction workers that would elect to remain in the Bay City area in anticipation of future employment at a possible Ma-3 site. Therefore, the staff concludes that site Ma-3 can be judged as no more than equivalent to Allens Creek from the standpoint of socioeconomics.

2.4.3.5 Site STP

The staff finds that the Allens Creek site is preferable to site STP from the standpoint of socioeconomics (Table 2.12). This conclusion is based on the assumption that construction currently in progress at STP will have been completed and the construction workers dispersed before the initiation of construction of a third unit. However, even if this construction activity could be properly phased, the staff judges that site STP would still be no more than equivalent to the Allens Creek site. This conclusion is based on the significant adverse fiscal impact associated with construction activities

at STP vs the areas in which these construction workers reside. This situation would be further exacerbated if a third unit were to be constructed at STP.

2.5 CONCLUSIONS

Table 2.13 summarizes the major environmental impacts for the alternative sites considered and presents the staff conclusions as to environmental preferability of these sites with respect to Allens Creek. Based on the reconnaissance-level information used in this assessment, and taking into account all of the terrestrial ecology and land use, aquatic ecology and water use, and socioeconomics factors as summarized in Tables 2.10, 2.11, and 2.12, the staff concludes that none of the sites considered are environmentally preferable to the Allens Creek site.

Liberty County (Li-3)

Allens Creek was rated as preferable to the Li-3 site for the impact categories of terrestrial ecology and land use, and aquatic ecology and water use. The sites were rated as equivalent (no preference) for socioeconomics. The predicted impacts to terrestrial and aquatic ecology are more severe for the Li-3 site than for Allens Creek, and on this basis the staff has rated Allens Creek as environmentally preferable to site Li-3.

Jefferson County (Je-3)

Allens Creek was rated as preferable to the Je-3 site for the impact categories of terrestrial ecology and land use, and aquatic ecology and water use. Site Je-3 was rated as preferable to Allens Creek for socioeconomics. The staff considers the terrestrial and aquatic impacts predicted for site Je-3 to be of overriding environmental consideration, and further notes that no significant adverse socioeconomic impacts have been predicted for the Allens Creek site. The staff has rated Allens Creek as environmentally preferable to site Je-3.

Follets Island (Bz-1)

Allens Creek was rated as preferable to the Bz-1 site for all impact categories considered. Because of potentially significant adverse environmental impacts to terrestrial ecology and land use, licensing a power plant at site Bz-1 may prove to be extremely difficult. Accordingly, the staff has rated Allens Creek as environmentally preferable to site Bz-1.

Matagorda County (Ma-3)

Allens Creek was rated as preferable to site Ma-3 for the impact categories of terrestrial ecology and land use, and aquatic ecology and water use. The sites were rated as equivalent for socioeconomics. On the basis of the predicted impacts to terrestrial and aquatic resources, the staff has concluded that the Allens Creek site is environmentally preferable to site Ma-3. The staff has also considered the possibility that construction schedules would be such that construction at site Ma-3 could be phased into completion of construction activities at STP. Under these circumstances, Ma-3 would be judged preferable to Allens Creek from the standpoint of socioeconomics. Even if this were to be the case, the staff is of the opinion that the terrestrial and aquatic

Table 2.13. Major environmental impacts for the alternate sites and the Allens Creek site

Site	Terrestrial ecology and land use	Aquatic ecology and water use	Socioeconomics	Comparison with Allens Creek
ACNGS	2072 ha of Brazos River floodplain to be used for cooling lake; 2030 ha of prime and unique farmland to be used; transmission line will cross habitat of the endangered Attwater's prairie chicken.	Loss of small ephemeral stream; replacement by large cooling reservoir; little impact expected in degraded river fishery or in poor estuary at mouth of Brazos River.	Increase in local tax base; shift in geographic pattern of suburban Houston residential development.	Reference
Li-3	Transmission line will cross ecologically important Trinity River floodplain; pipeline will potentially affect Tanner Bayou.	Water consumption impacts could affect productive downstream Trinity Bay estuary; impacts on productive Trinity River fishery are probable and cannot be mitigated.	Adverse but mitigable impacts on commuting road system and local traffic; increase in local tax base	Not preferable
Je-3	1904 ha of prime farmland located on 100-year floodplain to be used; transmission lines will cross important natural and wildlife areas.	Potential water consumption impacts on East Bay estuary; entrainment/impingement impacts on Gulf of Mexico fisheries may occur.	No major impacts anticipated.	Not preferable
Bz-1	Excellent wetland, wildlife habitat will be destroyed or disturbed on site; high risk of flooding; transmission lines must cross important wetland and wildlife areas.	Important nursery habitat on site to be destroyed or disturbed; adverse impacts on Christmas Bay estuary are likely; intake/discharge location near major tidal pass could adversely impact migrating marine organisms.	Adverse impacts on recreational land use on Follet's Island; adverse impacts on commuting road system and local trafic.	Not preferable
Ma-3	913 ha of prime farmland located partly on 100-year floodplain will be used; pipeline will cross important wetlands and waterfowl habitat; transmission lines have potential of affecting several natural areas.	Pipeline will cross important nursery habitat at west end of East Matagorda Bay estuary; adverse impacts are probable unless disturbance is mitigated; impingement/entrainment impacts on white shrimp spawning grounds and on recreational fishery are possible.	Temporary exhaustion of housing market; major increase in local tax base, particularly in the Bay City Independent School District	Not preferable
STP	No major impacts anticipated.	Additional fresh water consumption would be in direct conflict with ongoing plans to enhance the Matagorda Bay estuary; increased entrainment/impingement impacts on estuarine organisms in river salt wedge would occur.	Temporary exhaustion of housing market; increase in local tax base, particularly in the Palacios School District.	Not preferable

impacts associated with site Ma-3 would be of overriding consideration, and that Allens Creek would still be judged as environmentally preferable.

South Texas Project (STP)

Allens Creek was rated as preferable to STP for aquatic ecology and water use, and for socioeconomics, while STP was rated as preferable to Allens Creek for terrestrial ecology and land use. The staff remains concerned that the potential impacts to aquatic resources (both freshwater and marine) described in Sect. 2.3.6.2 would be significant and would affect aquatic ecosystems of more importance than those potentially affected at the Allens Creek site. The staff also notes that operation of three units at the STP site may not meet the mixing zone limitations imposed by Texas water quality standards for discharges from the cooling pond and that the existing makeup-water pumping limitations would probably have to be relaxed (FES Supplement, Sect. S.9.2). Also, construction at STP would further extend the fiscal burden of Bay City. This community would probably continue to provide services to in-migrating construction workers without sufficient new tax income to pay for them. For these reasons, the staff has reconfirmed the first FES Supplement conclusions that Allens Creek is environmentally preferable to STP.

In conclusion, the five candidate alternative sites evaluated by the staff are potentially licensable, but no site displays a combination of environmental costs and benefits that would lead the staff to conclude that the alternative site is environmentally preferable to the Allens Creek site. Of the sites considered, site Bz-1 would be the most difficult to license because of potential major adverse impacts to terrestrial ecology and land use. These impacts could be mitigated to some extent by site relocation, but the staff believes that for the Gulf coast area under consideration it is probable that no plant located on the Gulf coast and using once-through saltwater cooling could be found environmentally preferable to the Allens Creek site-plant combination. Finally, the staff has reconfirmed the FES Supplement conclusion that an appropriately conditioned construction permit should be issued for the ACNGS. Having found the Allens Creek site to be an acceptable nuclear power plant site, and having found none of the alternative sites to be environmentally preferable, the staff concludes that none of the alternative sites is obviously superior to Allens Creek.

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3. ANALYSIS OF REACTOR PRESSURE VESSEL TRANSPORTATION

3.1 BACKGROUND

3.1.1 Introduction

On March 12, 1979, the applicant announced plans to bring the reactor pressure vessel to the Allens Creek site via a combination of barge and overland (highway) transportation.[1] In an Order dated March 30, 1979, the Atomic Safety and Licensing Board for the Allens Creek project directed that evidence be heard on the following subjects:

1. Whether barging of the reactor pressure vessel and other items on the San Bernard River will require dredging or channeling and the environmental effects thereof;

2. Environmental impacts of the movement of the reactor pressure vessel and other items on a barge up the San Bernard River;

3. Environmental impacts of the construction of the barge unloading facility, including any attendant dredging; and

4. Environmental impacts of the overland transportation of the reactor pressure vessel and other items from the barge unloading facility to the Wallis site

The staff initiated its investigation of potential impacts resulting from these transportation modes after being advised of the applicant's plans. Information has been obtained to permit staff conclusions with respect to barge transportation up the San Bernard River and an assessment of the impacts of constructing the barge landing slip and of overland transport of the reactor pressure vessel from that point to the Allens Creek site. The staff visited the proposed barge unloading site and surveyed the proposed overland transportation route on November 29-30, 1979 and on November 13, 1980.

3.1.2 Description of proposed transportation

3.1.2.1 Barge transportation

The reactor pressure vessel will be transported by barge from the manufacturer's loading facility to an unloading point approximately 42 km (26 miles) up the San Bernard River. An unloading facility will be constructed on the east bank of the river at that point, just downstream from the Farm-to-Market Road 522 (FM-522) bridge. The applicant reports that the barge will displace about 2.4 m (8 ft) of water when loaded with the reactor pressure vessel.[2] The San Bernard River channel, a Federally developed project maintained by the Corps of Engineers, is 30 m wide by 2.7 m deep (100 ft wide by 9 ft deep), and extends from the confluence of the San Bernard River and the Gulf Intracoastal Waterway to the proposed unloading point.[3] Three bridges cross this portion of the San Bernard River. Two highway bridges, at River Miles 11.1 and 17.3, are fixed-span structures with nominal 34 m (110 ft) horizontal and 14 m (45 ft) vertical clearances. The third bridge, at River Mile 20.7, is a swing span railroad bridge with a 15 m (50 ft) horizontal clearance.[4]

3.1.2.2 Overland transport

The proposed overland transportation route from the barge unloading point to the Allens Creek site is shown in Fig. 3.1. Details of the 92 km (57-mile) route are as follows:[5]

8.2 km (5.1 miles)	FM 522 to State Highway 36;
34.4 km (21.4 miles)	State Highway 36 through West Columbia, Damon, and Guy to FM 360;
14.6 km (9.1 miles)	FM 360 through Needville to U.S. Highway 59;
1.1 km (0.7 miles)	U.S. 59 to FM 1875;
7.6 km (4.7 miles)	FM 1875 to U.S. Highway 90A;
1.9 km (1.2 miles)	U.S. Highway 90A to FM 1952;
15.4 km (9.6 miles)	FM 1952 to State Highway 36; and
8.4 km (5.2 miles)	State Highway 36 through Wallis to the Allens Creek site.

At least one bridge along this route (the Varner Creek crossing, just north of West Columbia) will be bypassed. Traffic control during the estimated 12 days required to transport the reactor pressure vessel from the barge unloading point to the Allens Creek site will be handled by the Brazoria, Fort Bend, and Austin County sheriffs' departments in conjunction with the Texas Highway Department.[5] Traffic signals and individual power and telephone lines in rural areas will be removed and replaced as needed during the course of the transportation operation. All other lines are expected to be raised prior to the transport operation to permit passage of the reactor pressure vessel.[5]

3.2 ANALYSIS OF TRANSPORTATION IMPACTS

3.2.1 Barge transit impacts to the San Bernard River

The applicant has reported contacts with the Galveston District Office of the Corps of Engineers indicating that the San Bernard River Channel is surveyed approximately every year.[3] These surveys indicate that the rate of shoaling in the channel has been minimal. The last major redredging of the channel occurred in 1973 on selected reaches of the river (River Miles 0.0-0.76, 17.5-17.7, 22.8-23.5, and 25.0-26.0). However, more frequent dredging is required at the river mouth, and the stretch between River Miles 0.0 and 0.76 was redredged in June 1977. Minimum depths range from 2.4 to 3.0 m (8 to 10 ft) for the middle half of the channel, as recorded during the most recent survey, in April, 1978. Surveys are based on Corps of Engineers mean low tide datum, which is approximately 0.5 m (1.5 ft) below mean sea level datum. In independent contacts with the Galveston District Office,[6] the staff was informed that the channel is dredged 30 m wide by 2.7 m deep (100 ft wide by 9 ft deep)

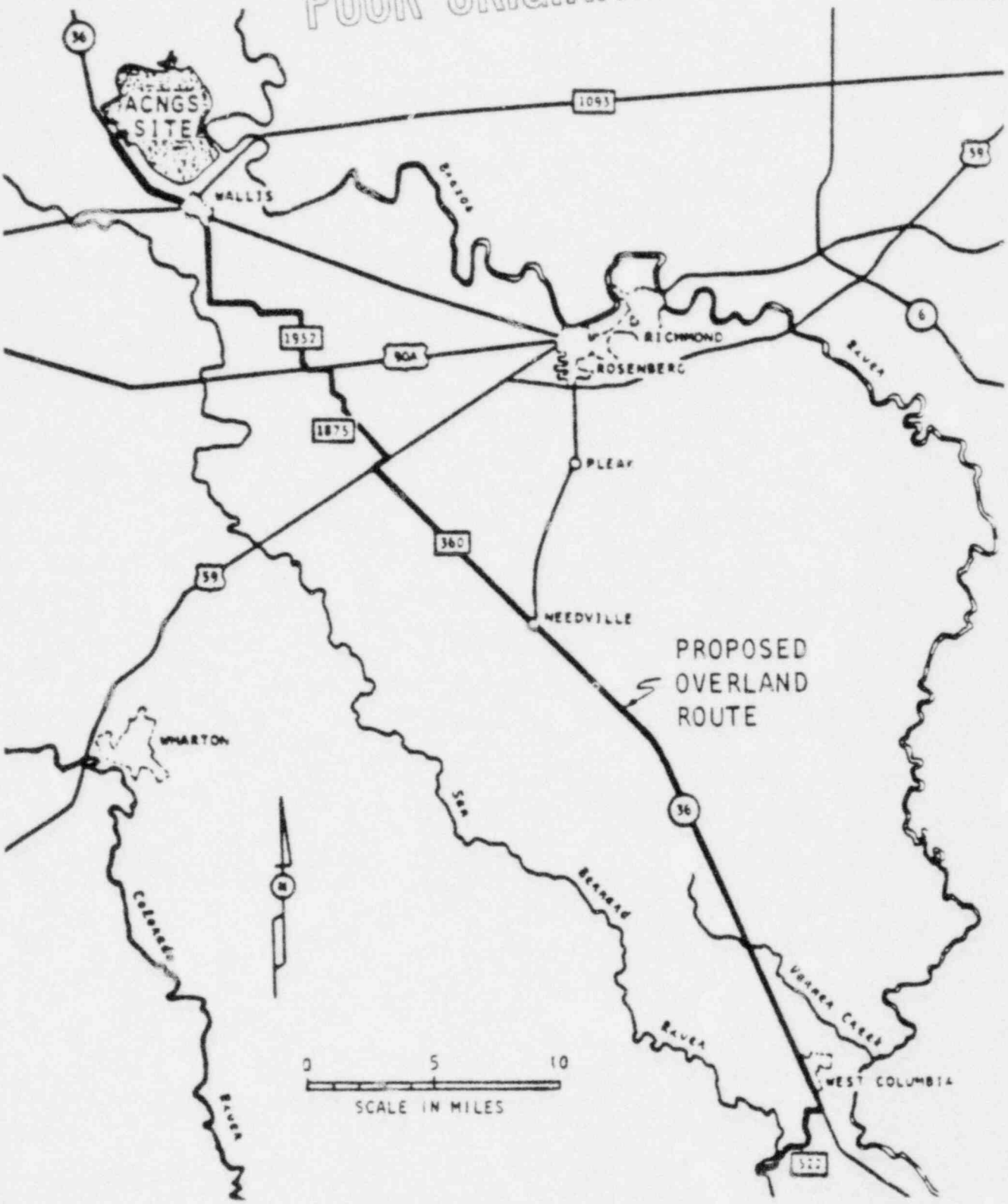

Fig. 3.1. Proposed overland route for reactor pressure-vessel transport. Source: Dames and Moore, 1980 Figure 1B.

at mean lower water reference to a point between River Miles 26 and 27. Dredging in the San Bernard River is yearly, and no snags have been encountered.

The applicant has reported that the loaded barge will displace about 2.4 m (8 ft) of water when loaded. The staff believes that this displacement is consistent with the 9.5×10^5 kg (1052 short ton) shipping weight of the reactor pressure vessel loaded on a barge of appropriate dimensions (about 200 ft. long by about 50 ft. wide).[2,7,8]

Information obtained during the site visit reveals that barge traffic on the San Bernard River is not infrequent, and that pilots experience no difficulties in transiting the river. Most of the barge traffic appears to be between River Mile 0.0 and docking facilities at River Mile 20.7 in the vicinity of the railroad swing bridge. However, a barge loading slip is maintained just across the river from the site of the proposed barge landing slip. The applicant reports that this slip could not be used because the FM 522 bridge, which extends across the river, could not support the load of the reactor pressure vessel and overland transporter, and that reinforcement of the bridge is impractical.

It is the staff's opinion that the Corps of Engineers maintains the San Bernard River Channel at sufficient width and depth to permit barge transportation of the reactor pressure vessel to the proposed unloading point without additional dredging or other channel modification. Further, no unique impacts to the river resulting from passage of the barge up the river are expected. Such impacts would be similar to those resulting from other barge traffic on the river, and there is no indication that this traffic has affected any element of the river system.

3.2.2 Impacts of unloading facility construction

3.2.2.1 Site description

The site of the proposed barge unloading facility is in Brazoria County, Texas, approximately 3.5 km north-northeast of Sweeny and 6.0 km south-southwest of West Columbia (Fig. 3.2). The proposed facility would occupy a 3.2-hectare site on the east bank of the San Bernard River (River Mile 26). Farm-to-Market Road 522 (FM-522) runs along the western boundary of the site.

The topography of the site is relatively flat, with two poorly drained depressions connected to the river by a recently constructed drainage ditch. The soils are Asa silty clay loams (Soil Conservation Service 1979) and are classified by the Soil Conservation Service as prime farmland soils.

The vegetation on the site is a fluvial woodland dominated by pecan trees (*Carya illinoensis*), with sycamore (*Plantanus occidentalis*) prevalent along the river banks. The most conspicuous features of the understory are the high percentage of exposed sandy soil and the abundant growth of palmetto (*Sabal minor*). Sedges occur along the margins of the wet, shallow depressions, and grasses are found in the more open areas of the site. Little evidence of wildlife activity was observed during the site visit made by the staff or the survey done by the applicant.[8]

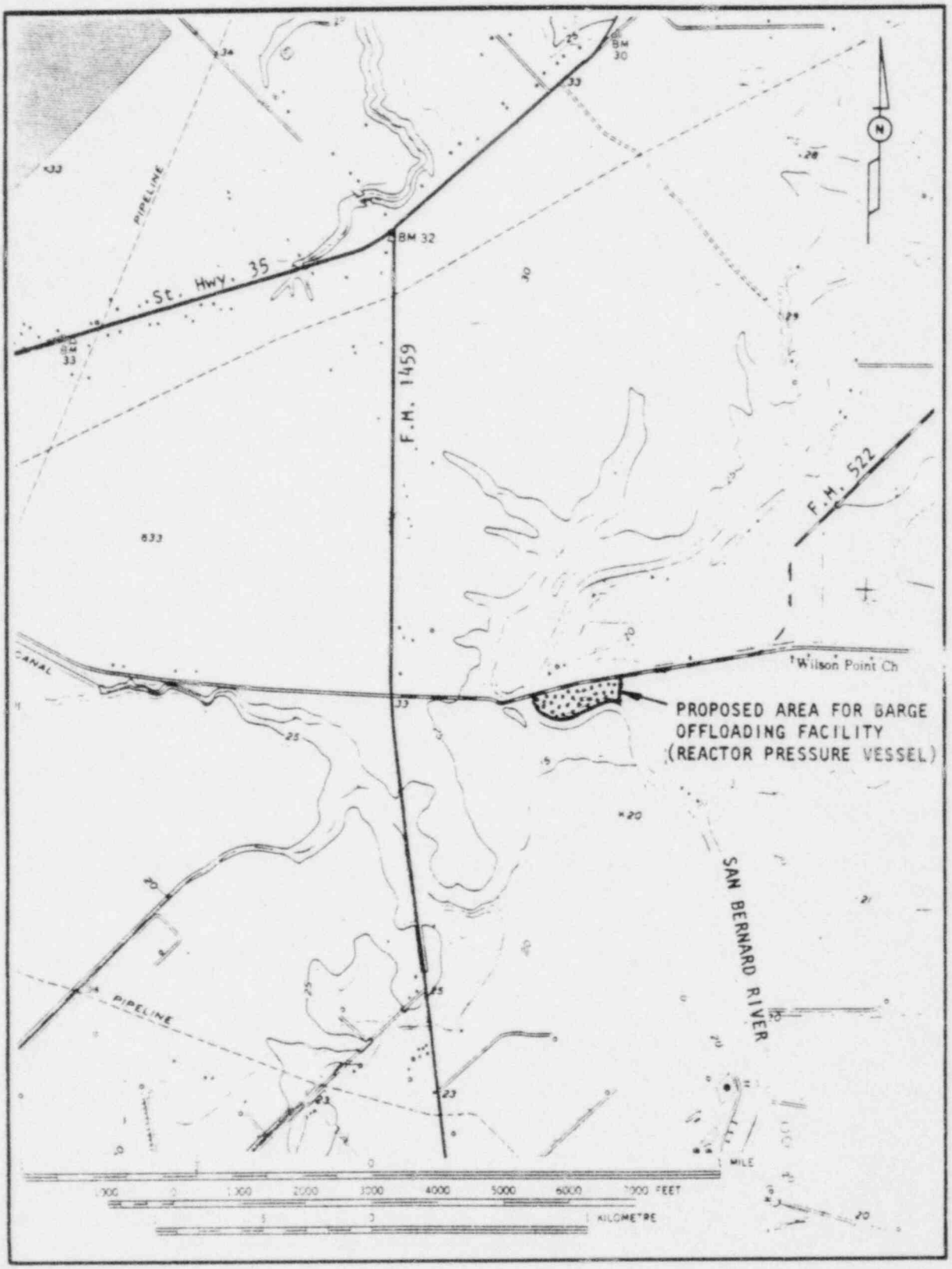

Fig. 3.2. Proposed location for barge unloading facility. Source: Dames and Moore, 1980, Fig. 1A.

3.2.2.2 Impacts to terrestrial ecology

The applicant has described barge slip construction in his environmental assessment.[8] Construction of the temporary barge slip will begin about seven months prior to the scheduled use of the facility.[8] Approximately 1.4 hectares of the 3.2 hectare site will be cleared to provide an access road, the work area for the barge slip, and a storage area and sedimentation pond for excavated materials. An estimated 11,500 m^3 of clay and silty sand will be excavated and dredged. All excavated materials will be stored at the site (Fig. 3.3) and will be used for restoring the barge slip area after the reactor pressure vessel has been transported. Plans for controlling erosion include construction of sediment ponds for saturated materials, stabilization of the slopes of the evacuated materials by seeding with grass as needed, and use of riprap aggregate to line the sidewalls, endwalls, and bottom of the barge slip.

Clearing and construction will destroy at least 1.4 hectares of fluvial woodlands and associated riverbank habitat. Two shallow, man-made wetlands will also be destroyed or disturbed. Fluvial woodlands and wetlands are generally considered to have high ecological value and provide excellent wildlife habitat.[9,10,11,12] The relatively small area that will be affected and the temporary nature of the facility, however, should minimize the magnitude of the impacts to the site. The applicant plans to restore the site by using the stockpiled materials to refill the barge slip and then reseed the area.

Endangered species listed by the U.S. Fish and Wildlife Service (USFWS) (45 FR 33768, May 20, 1980) that may occur in the area of the barge slip include the bald eagle (Haliaeetus leucocephalus) and the arctic peregrine falcon (Falco peregrinus tundrius). Bald eagles are frequently sighted in Brazoria County[13] and are known to nest there.[14] These birds nest in large, isolated trees such as pecans, sycamores, or cypress near open water bodies such as rivers or lakes.[15] The pecan and sycamore trees on the proposed site are not particularly large and do not occur as isolated individuals. No evidence of eagle nests was observed by the NRC staff or the applicant, and it is unlikely that the proposed barge facility would have a significant effect on bald eagle populations in this region.

Arctic peregrine falcons migrate through the Texas Gulf Coast region during the fall on their way to wintering areas in Central and South America.[16,17] Although it is possible that falcons may occasionally occur in the vicinity of the proposed site for short periods of time, it is unlikely that they make any more than a casual use of the site. The disturbance of a part of the existing woodland for a temporary barge facility should therefore have little, if any, impact on this species of falcon.

The American alligator (Alligator mississippiensis) is listed as a threatened species by the USFWS in the coastal region of Texas.[18] Large numbers of alligators occur in Brazoria County,[19] and they may be found along the San Bernard River. No evidence of alligator activity was observed by the staff or the applicant during their inspections of the site. The Louisiana milk snake (Lampropeltis triangulum amaura), a state-protected, nongame species,[15] could also occur in the vicinity of the site.

On the basis of information provided by the applicant's February survey of the site, it appears unlikely that any endangered, threatened, or state-protected

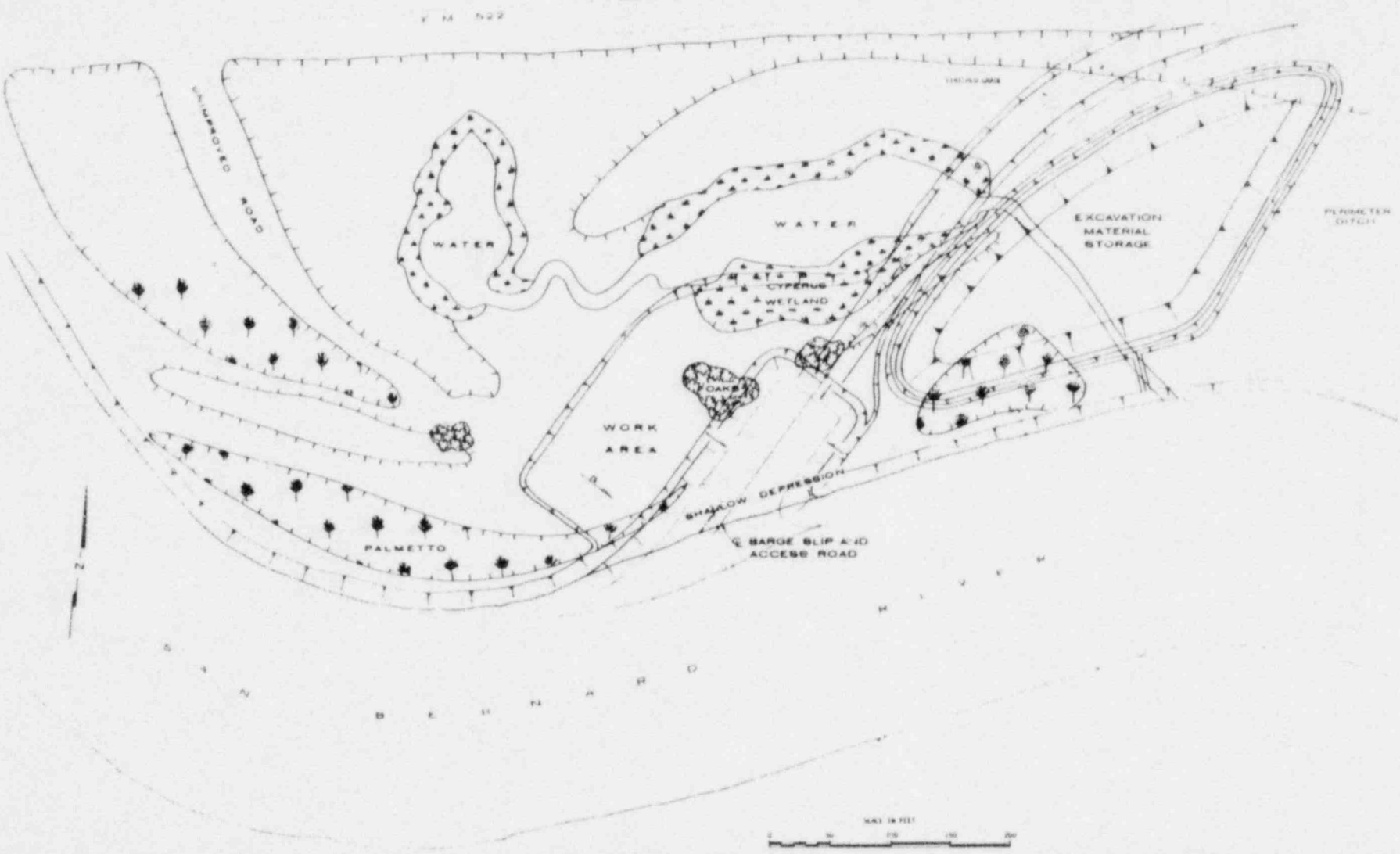

Fig. 3.3. Proposed barge unloading facility and vegetation map. Source: Dames and Moore, 1980, Figure 2.

species utilizing terrestrial habitat would be affected by construction of the proposed barge unloading facility. However, since the site was surveyed during a time of year when there is only a limited possibility of observing the species of concern, the staff requires the applicant to make confirmatory studies of the site before initiating any construction-related activities. These additional studies should be undertaken in consultation with the USFWS, the Texas Parks and Wildlife Department and the NRC staff.

In compliance with Section 7(c) of the Endangered Species Act Amendments of 1978 (P.L. 95-632, November 10, 1978), the U.S. Fish and Wildlife Service has been contacted for any additional information on Federally-listed endangered or threatened species. The results of this inquiry and any further assessment or consultation required by the USFWS will be included as part of the Final Second Supplement to the FES.

In summary, the information presently available indicates that impacts caused by construction of the barge facility to terrestrial ecology, including impacts on endangered or threatened species utilizing terrestrial habitat, would be minor.

3.2.2.3 Impacts to aquatic ecology

The San Bernard River is free flowing and void of major impoundments, but a small dam is located slightly upstream of the proposed site for the landing slip. The river originates in the Coastal Plains and flows southeastward to its confluence with the Gulf Intracoastal Waterway. No endangered and threatened species have been identified as occurring in the river, as determined from the U.S. Fish and Wildlife stream evaluation.[3] The Texas Department of Water Resources, formerly the Texas Water Development Board, in its 1976 Texas Water Quality Standards, has declared the river's desirable uses to include recreation and fish and wildlife propagation.[3]

The principal impacts to aquatic ecology are expected to occur as a result of dredging in the San Bernard River to connect the maintained channel to the barge landing slip. Other impacts can result from operations involving excavation for the landing slip, and disposal of the material dredged from the river bottom. However, the staff believes that these impacts to aquatic species and to downstream water users will be of short duration and will be reversible.[20]

3.2.2.4 Impacts to historical and archeological resources

The applicant commissioned an archeological survey of the proposed barge landing site[21] by the Texas Archeological Survey Team of the University of Texas at Austin. The field survey discovered no historic or prehistoric cultural remains within the project area and recommended no further archeological investigation. On the basis of this evaluation, the State Historic Preservation Officer has concluded that construction activities at the proposed site should not affect sites on the National Register of Historic Places nor any site presently in the process of submission to the National Register (Appendix C of this Supplement). One site in the area (the Sweeny Plantation) has been nominated for inclusion in the National Register of Historic Places. This site, however, is located on the west bank of the San Bernard River and will not be affected by the proposed project.[8]

3.2.3 Impacts of overland transportation

The proposed transportation route for the reactor pressure vessel extends approximately 92 km[5] from the barge unloading site to the Allens Creek site (Fig. 3.1). The route follows existing roads for its entire length, passing mainly through relatively flat agricultural land.

From the barge unloading facility, the route runs north-northeast along FM 522 to State Highway 36 at West Columbia, a distance of 8.7 km. This section of the route is narrow, with numerous fairly sharp curves. Several large live oak trees (Quercus virginiana) along this segment of the route will have to be removed or severely trimmed to allow passage of the reactor pressure vessel.

At the junction of State Highway 36, the route turns north-northwest through West Columbia and follows the State Highway to Needville, a distance of 34.4 km. Several oil fields occur along this segment of the route, which is flat and used mainly as pasture or cropland. About 9.5 km north-northwest of West Columbia, the route crosses East Varner Creek over a bridge which the applicant has determined will not support the weight of the transporter. A temporary bypass of this bridge will be constructed within the highway right-of-way, using steel culverts and fill as needed.[8] This construction will temporarily disturb the creek and existing roadside vegetation, and one large, partially destroyed live oak tree will be removed. Impacts to the creek and its immediate surroundings should be minimal, and the applicant plans to remove the fill and culvert immediately after the crossing has been used.

At Needville, the route follows FM 360 to Highway 59, a distance of 14.7 km. Several large trees in the village of Needville may require trimming to permit passage of the transporter. The route crosses one railroad at Needville and another near the junction of FM 360 and Highway 59.

The route follows Highway 59 for 1.1 km to FM 1875, where it again turns northwest. The applicant plans to avoid traffic delays on heavily-traveled routes such as Highway 59 by developing detours and utilizing traffic control personnel at strategic points.[8] A railroad crossing exists near the junction of Highway 59 and FM 1875.

The route follows FM 1875 for 7.6 km to U.S. Highway 90A west of Rosenburg. This portion of the route is a relatively narrow, paved road with numerous curves and narrow shoulders. At U.S. Highway 90A, the route turns west for 1.9 km and then turns northwest again at FM 1952. Detours and traffic control will be used to avoid major traffic problems on U.S. Highway 90A.

The transporter will travel 15.5 km along FM 1952 to Wallis. This portion of the route is similar to that of FM 1875. At Wallis, the route follows State Highway 36 northwest to the Allens Creek site, a distance of 8.4 km. A steep railroad crossing separates the site from State Highway 36. The applicant plans to construct temporary ramps of aggregate fill for making this crossing.

Numerous overhead power and telephone lines cross the proposed overland route. Many of these will need to be raised or disconnected prior to passage of the transporter. The applicant anticipates that disruption of service will be less than one hour in rural areas and can be avoided for population centers.

Transporter movement will result in minor impacts, including trimming of trees along the overland route, temporary disturbance to a small creek and highway right-of-way, and short-term disruption of telephone and power service. Disruption of normal traffic patterns will be unavoidable, but careful planning should prevent any serious problem developing. Emergency vehicles can be stationed on either side of the reactor pressure vessel for transportation segments where passage around the reactor pressure vessel is impossible due to the narrowness of the pavement or the inadequacy of road shoulders.

3.3 STAFF CONCLUSIONS

Based on reconnaissance-level information, the staff has assessed the potential environmental impacts of the applicant's proposal to transport the reactor pressure vessel from the San Bernard River to the Allens Creek site. The staff considered the impacts associated with (1) barge transportation up the San Bernard River, (2) construction and operation of the barge unloading facility, and (3) overland transportation to the Allens Creek site. Consideration was also given to alternative transportation routes. The staff's conclusions are:

The San Bernard River Channel is maintained at an adequate width and depth to accommodate barge transportation of the reactor pressure vessel. There will be no unique impacts to the San Bernard River as a result of barge transportation from the river's confluence with the Gulf Intracoastal Waterway to the barge landing slip site, other than those impacts normally associated with barge transport up this river.

Dredging operations, which are required to connect the landing slip to the maintained San Bernard River channel, will result in localized impacts to aquatic biota and water quality. These impacts, however, are expected to be minor and of short duration.

Development of the barge unloading facility will result in the clearing of at least 1.4 ha of land including some fluvial woodlands. Impacts on endangered, threatened, and state-protected species appear to be minor, but the applicant will be required to do a more extensive field study to determine the potential presence of these species on the proposed site before initiating any construction-related activities there.

Impacts of the overland transportation of the reactor pressure vessel will result from construction and later removal of a bypass for the East Varner Creek bridge on State Highway 36; removal of overhead obstructions for proper vertical clearance; and possible traffic congestion due to the slow moving caravan. Installation and removal of culverts at the Varner Creek bypass will result in increased turbidity for a short period of time but should not adversely affect local aquatic habitat. The streambed disturbed during these operations will be restored. The entire overland route is crossed by large numbers of utility lines which must be raised or removed and replaced to permit transit of the loaded transporter. Impacts to these utility users will depend on the number of lines that can be relocated prior to passage of the transporter and can be mitigated by early relocation of a maximum number of lines and by minimizing the amount of time required for removal and replacement of individual lines. Mature trees along parts of FM 522 will have to be trimmed but the

aesthetic impact should be minor. Impacts to normal traffic patterns are expected, but can be minimized by careful planning and coordination with law enforcement and traffic control officials. In addition to preplanning to limit the duration of these impacts, the applicant will limit the number of persons impacted by choice of route segments to avoid cities, towns, and heavily traveled highways. The staff believes that with these mitigation measures, the impacts taken as a whole will not be adverse.

Alternative routings to that proposed were also considered by the applicant. Other routings appear to be viable, but would not result in significantly less environmental impacts. The staff is of the opinion that the applicant has made a reasonable choice for transporting the reactor pressure vessel to the Allens Creek site.

In summary, the staff concludes that impacts associated with the proposed method of reactor pressure vessel transportation, including construction and operation of the barge landing slip, will be minor and of short duration. Additionally, the staff finds that the proposed method of reactor pressure vessel transportation will have no significant environmental impacts that would affect the staff's previous weighing of environmental benefits and costs for the Allens Creek Nuclear Generating Station Unit No. 1, and that alternatives to the proposed method would not result in a significant reduction in those impacts.

REFERENCES FOR SECTION 3

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2. Houston Lighting and Power Company, "Applicant's Answers to Hinderstein's Second Set of Interrogatories and Requests for Production of Documents," April 17, 1979.

3. Letter, W. F. McGuire, HL&P, to R. W. Froelich, USNRC, May 17, 1979.

4. Telephone conversation, Mr. Haynes, New Orleans Coast Guard office, and R. Codell, USNRC, October 1979.

5. Letter, W. F. McGuire, HL&P, to R. W. Froelich, USNRC, October 26, 1979.

6. Telephone conversation, Mr. Bissel, Galveston District Office, Corps of Engineers, and R. Codell, USNRC, October 1979.

7. Houston Lighting and Power Company, "Houston Lighting and Power Company's Response to Tex PIRG's Fifth Set of Interrogatories," November 26, 1979.

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15. Texas Parks and Wildlife Department (TPWD). Regulations for taking, possessing, and transporting protected nongame species. 127.70.12.001-.008. Austin, Texas, July 18, 1977.

16. Rogers, R. R. and G. Hunt. Peregrines on South Padre Island: Recent Years. IN: J. R. Murphy, C. M. White, and B. E. Harrell (eds.). Population States of Raptors. Proceedings of the Conference on Raptor Conservation Techniques, March 22-24, 1973. Raptor Research Foundation, Inc., Vermillion, S.D. Raptor Report No. 3.

17. Enderson, J. H. Coastal Migratory Data as Population Indices for the Peregrine Falcon, pp. 275-278. IN: J. J. Hickey (ed.) Peregrine Falcon Populations: Their Biology and Decline. Univ. of Wisc. Press, Madison, Wisc. 1969.

18. U.S. Fish and Wildlife Service (USFWS), "Reclassification of American Alligator to Threatened States in Certain Parts of its Range," Fed. Reg. 42(6): 2071-2077, January 10, 1977.

19. Smith, J. C. American Alligator Study. Job Performance Report, Nongame Wildlife Investigations, Job No. 60. Texas Parks and Wildlife Department, Austin, Texas, December 12, 1975.

20. Loar, J. M., L. L. Dye, R. R. Turner, and S. G. Hildebrand (1980), "Analysis of Environmental Issues Related to Small Scale Hydroelectric Development, Part I, Dredging. ORNL/TM-7228, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

21. Letter, W. F. McGuire, HL&P, to Truett Latimer, State Historic Preservation Officer, Texas Historical Commission, December 17, 1979.

Appendix A

COMMENTS

(Reserved for comments on Draft Supplement No. 2 to the Final Environmental Statement)

Appendix B

LETTERS FROM THE U.S. SOIL CONSERVATION SERVICE DESCRIBING THE PRESENCE OF PRIME OR UNIQUE FARMLAND

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

P. O. Box 391
Liberty, Texas 77575

June 27, 1979

Dr. Robert M. Reed
Environmental Sciences Division
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, Tennessee 37830

Dear Dr. Reed:

I am enclosing photo copies of soils survey for the alternate site in Liberty County, Texas.

Also, you requeste percentage of the area that is prime and/or unique farmland. None of the soils in the area are prime and/or unique at the present time; however, if drained, the Beaumont (1), Morey (7) and Aris (22) would be prime. They comprise about 22 percent of the site.

If further information is needed, please do not hesitate to ask.

Sincerely,

Thomas P. Smith, II
District Conservationist

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
855 I-H 10 South, Room 135
Beaumont, Texas 77701

SUBJECT: IM-Prime Farmland Acreage Estimates DATE: May 18, 1979

TO: Mr. Robert M. Reed

Dear Mr. Reed:

The information you requested concerning prime land in Jefferson and Chambers Counties, in the site JE-3 section is as requested. Approximately 5,900 acres is involved in the area outlined. In the JE-3 section, approximately 5,800 acres is considered prime agricultural land. This area breaks down in the following soils grouping:

85% Beaumont C
14% Morey Sil
1% Waller S

This being prime land because drainage has been installed, and is presently being used as irrigated farm lands, predominately in rice.

Approximately 69 acres of land is in what is called the White Ranch Reservoir, 19 acres of the area in public roads. Approximately 70 acres of Beaumont clay that does not have drainage, would be considered unique land.

I hope this information will be of service to you. If we can be of further assistance please call on us.

Sincerely,

James Green
District Conservationist

cc: Robert W. Williams

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. Box 698, Angleton, Texas 77515

May 21, 1979

Mr. Robert M. Reed
Environmental Science Division
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, Tennessee 37830

Dear Mr. Reed:

In reply to your request for identification of prime or unique farmlands in your letter to Frank Wheeler, April 24, 1979, the proposed site in Brazoria County BZ1 is on one soil type Mustang Fine Sand Saline. This soil is not considered prime or unique farmland. I am enclosing a copy of the soils map and legend for your information.

Johnson A. Campbell
District Conservationist

Enc. 3

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. Box 2146, Victoria, Texas 77901

June 12, 1979

Mr. Robert M. Reed
Environmental Sciences Division
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, Tennessee 37830

Dear Mr. Reed:

Attached is a computer generated mapping unit legend for identifying prime farmland in Matagorda County, Texas.

We have noted on this legend the estimated acres of the soils (both prime and non-prime farmland) occurring within the proposed site area in Matagorda County as you requested in your letter of April 24, 1979.

If we may be of further assistance, please let us know.

Sincerely,

Alfred Vander Stucken
Area Conservationist

Attachment

cc:
A. G. Kinsey, SCS, Bay City, Texas
W. L. Miller, SCS, Victoria, Texas

MAPPING UNIT LEGEND FOR IDENTIFYING PRIME FARMLAND SOILS
MATAGORDA COUNTY, TEXAS

PRELIMINARY DATA
SUBJECT TO CHANGE

POOR ORIGINAL

COUNTY	FIPS	ADM. AREA	MAP SYMBOL	MAPPING UNIT NAME	PRIME IN NATIVE STATE	PRIME IF IRRIG.	PRIME IF DRAIN.	LRA	SITE MA-3 ACRES		70 Acres on Site
MATAGORDA	48321	21	78	ASA FSL 0-1% SLOPES	YES	--	--	150	0		
MATAGORDA	48321	21	125A	ASA SICL 0-1% SLOPES	YES	--	--	150	0		
MATAGORDA	48321	21	125B	ASA SICL 1-3% SLOPES	YES	--	--	150	0		
MATAGORDA	48321	21	21	AUSTEWELL C SALINE	NO	--	--	150	0		
MATAGORDA	48321	21	7	BEAUMONT C	NO	--	YES	150	173	0	4%
MATAGORDA	48321	21	149	BERNARD AND EDNA SOILS 3-8% SLOPES				150	0		
				(BERNARD 55%)	NO	--	--			0	
				(EDNA 25%)	NO	--	--			0	
MATAGORDA	48321	21	149C3	BERNARD AND EDNA SOILS 3-8% SLOPES ERODED				150	0		
				(BERNARD 55%)	NO	--	--			0	
				(EDNA 25%)	NO	--	--			0	
MATAGORDA	48321	21	10A	BERNARD CL 0-1% SLOPES	YES	--	--	150	302	0	9%
MATAGORDA	48321	21	10B	BERNARD CL 1-3% SLOPES	YES	--	--	150	86	0	2%
MATAGORDA	48321	21	93	BERNARD-CONTEE COMPLEX				150	0		
				(BERNARD 55%)	YES	--	--			0	
				(CONTEE 25%)	NO	--	--			0	
MATAGORDA	48321	21	11A	DACOSTA CL 0-1% SLOPES	NO	--	--	150	0		
MATAGORDA	48321	21	85	DACOSTA CL SALINE	NO	--	--	150	0		
MATAGORDA	48321	21	49A	DACOSTA-MIDLAND COMPLEX 0-1% SLOPES				150	173	0	11%
				(DACOSTA 50%)	NO	--	--			0	
				(MIDLAND 40%)	NO	--	--			0	
MATAGORDA	48321	21	49B	DACOSTA-MIDLAND COMPLEX 1-3% SLOPES				150	0		
				(DACOSTA 50%)	NO	--	--			0	
				(MIDLAND 40%)	NO	--	--			0	
MATAGORDA	48321	21	150A	DACOSTA-TELFERNER COMPLEX 0-1% SLOPES				150	0		
				(DACOSTA 55%)	NO	--	--			0	
				(TELFERNER 25%)	NO	--	--			0	
MATAGORDA	48321	21	18A	EDNA FSL 0-1% SLOPES	NO	--	--	150	518	0	13%
MATAGORDA	48321	21	18B	EDNA FSL 1-3% SLOPES	NO	--	--	150	0		
MATAGORDA	48321	21	19	EDNA FSL DEPRESSED	NO	--	--	150	0		
MATAGORDA	48321	21	92	FRANCITAS C	NO	--	--	150	0		
MATAGORDA	48321	21	42B	FULSHEAR FSL 1-3% SLOPES	YES	--	--	150	0		
MATAGORDA	48321	21	42C	FULSHEAR FSL 3-5% SLOPES	YES	--	--	150	0		
MATAGORDA	48321	21	36	GALVESTON FS	NO	--	--	150	0		
MATAGORDA	48321	21	76	GOWEN CL OCCASIONALLY FLOODED	YES	--	--	150	0		
MATAGORDA	48321	21	6	GOWEN CL SALINE VARIANT	NO	--	--	150	0		
MATAGORDA	48321	21	87	HAPLAQUENTS	NO	--	--	150	0		
MATAGORDA	48321	21	5	HARRIS C	NO	--	--	150	216	0	5%
MATAGORDA	48321	21	71	LAM C	NO	--	--	150	0		
MATAGORDA	48321	21	20A	KATY FSL 0-1% SLOPES	YES	--	--	150	389	0	9%
MATAGORDA	48321	21	20B	KATY FSL 1-3% SLOPES	YES	--	--	150	302	0	7%
MATAGORDA	48321	21	8	LAKE CHARLES C 0-1% SLOPES	YES	--	--	150	864	0	20%
MATAGORDA	48321	21	8B	LAKE CHARLES C 1-3% SLOPES	YES	--	--	150	87	0	2%
MATAGORDA	48321	21	8C	LAKE CHARLES C 3-5% SLOPES	YES	--	--	150	0		
MATAGORDA	48321	21	8DE	LAKE CHARLES C 5-12% SLOPES	NO	--	--	150	0		
MATAGORDA	48321	21	9	LAKE CHARLES C DEPRESSED	NO	--	YES	150	0		
MATAGORDA	48321	21	75	LAKE CHARLES-SLICKSPOT (LIVIA) COMPLEX				150	0		
				(LAKE CHARLES 60%)	YES	--	--			0	
				(SLICKSPOT (LIVIA) 20%)	NO	--	--			0	
MATAGORDA	48321	21	186	LIVIA SIL	NO	--	--	150	0		
MATAGORDA	48321	21	90A	MATAGORDA VFSL 0-3% SLOPES	NO	--	--	150	0		
MATAGORDA	48321	21	48A	MIDLAND CL 0-1% SLOPES	NO	--	--	150	86	0	2%
MATAGORDA	48321	21	48	MIDLAND CL 1-3% SLOPES	NO	--	--	150	130	0	3%
MATAGORDA	48321	21	86	MIDLAND CL SALINE	NO	--	--	150	173	0	4%
MATAGORDA	48321	21	3	RIVERS SOILS DEPRESSED	NO	--	--	150			

									SITE MA-3 Acres		
MATAGOBNA	48321	21	148A	MIDLAND SOILS SALINE 3-8% SLOPES ERODED	NO	—	—	0		0	
MATAGOBNA	48321	21	74	MUSTANG FS	NO	—	—	150		0	
MATAGOCNA	48321	21	81	NORWOOD C	YES	—	—	150		0	
MATAGORNA	48321	21	44A	NORWOOD SICL 0-1% SLOPES	YES	—	—	150		0	
MATAGORNA	48321	21	44B	NORWOOD SICL 1-3% SLOPES	YES	—	—	150		0	
MATAGOBNA	48321	21	67	PLACEDO SIC	NO	—	—	150		0	
MATAGOENA	48321	21	111A	PLEDGER C 0-1% SLOPES	YES	—	—	150		0	
MATAGOENA	48321	21	110	PLEDGER C IMPERFECTLY DRAINED	NO	—	—	150		0	
MATAGOCNA	48321	21	41	PLEDGER C SALINE	NO	—	—	150		0	
MATAGOBNA	48321	21	64	PSAMMENTS	NO	—	—	150		0	
MATAGORNC	48321	21	89	PSAMMENTS SANDY SKELETAL	NO	—	—	150		0	
MATAGOENA	48321	21	145	ROEBUCK C				150		0	
MATAGOENA	48321	21	127	SHIFS AND PLEDGER SOILS 3-8% SLOPES							
				(SHIFS 55%)	NO	—	—				0
				(PLEDGER 25%)	NO	—	—				0
MATAGORNA	48321	21	100A	SHIFS C 0-1% SLOPES	YES	—	—	150		0	
MATAGORNA	48321	21	100B	SHIFS C 1-3% SLOPES	YES	—	—	150		0	
MATAGOKNA	48321	21	101	SHIFS C IMPERFECTLY DRAINED	NO	—	—	150		0	
MATAGOENA	48321	21	40	SHIFS C SALINE	NO	—	—	150		0	
MATAGOKNA	48321	21	34B	SHIFS C SHALLOW OVER BURIED SOILS 1-3% SLOPES	NO	—	—	150		0	
MATAGOENA	48321	21	34A	SHIFS C SHALLOW OVER BURIED SOILS 1-3% SLOPES	NO	—	—	150		0	
MATAGOENA	48321	21	3A	SHIFS SICL 0-1% SLOPES	YES	—	—	150		0	
MATAGOENA	48321	21	3B	SHIFS SICL 1-3% SLOPES	YES	—	—	150		0	
MATAGORNA	48321	21	23A	TELFERNER VFSL 0-1% SLOPES ✓	NO	—	—	150	605	0	14%
MATAGORNA	48321	21	23B	TELFERNER VFSL 1-3% SLOPES	NO	—	—	150		0	
MATAGOENA	48321	21	21	TELFERNER GESSNER COMPLEX ✓				150	216	0	5%
				(TELFERNER 55%)	NO	—	—				0
				(GESSNER 25%)	NO	—	YES				
MATAGOKNA	48321	21	33	YAHOLA SIL	YES	—	—	150		0	
MATAGOENA	48321	21	65	YAHOLA-NORWOOD COMPLEX FREQUENTLY FLOODED				150		0	
				(YAHOLA 55%)	NO	—	—				0
				(NORWOOD 25%)	NO	—	—				0
										0	

Appendix C

STATE HISTORIC PRESERVATION OFFICER COMMENTS, PROPOSED BARGE OFFLOADING FACILITY

TRUETT LATIMER
EXECUTIVE DIRECTOR

TEXAS HISTORICAL COMMISSION

P. O. BOX 12276
AUSTIN TEXAS 78711

March 19, 1980

Mr. W. F. McGuire
Principal Engineer
Houston Lighting & Power
Company
Electric Tower
P.O. Box 1700
Houston, Texas 77001

Re: Proposed barge off-loading
facility site - Brazoria Co.

Dear Sir:

We are in receipt of the archeological evaluation concerning the above-referenced undertaking. After a review of the findings, we conclude that, as described, the proposal should not affect sites on the National Register of Historic Places, nor any site presently in the process of submission to the National Register. The survey of sites in the area which may be eligible for inclusion within the National Register, however, has not been completed. Therefore, should cultural resources be encountered during construction, work will cease and the State Historic Preservation Officer and the Advisory Council on Historic Preservation will be afforded the opportunity to comment in accordance with the *Procedures for the Protection of Historic and Cultural Properties* (36 C.F.R., Part 800).

Thank you for the opportunity to participate in the review process in our common goal of providing the future with a past. If we may be of further service, please advise.

Sincerely,

Truett Latimer
State Historic Preservation Officer

by

Alton K. Briggs
Director
Cultural Resource Management

AKB/lft

cc: Ed Baxter
Mr. Froelich

The State Agency for Historic Preservation