Volume 3

INDIANTOWN COGENERATION PROJECT

Site Certification Application

Submitted by
Indiantown Cogeneration, L.P.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

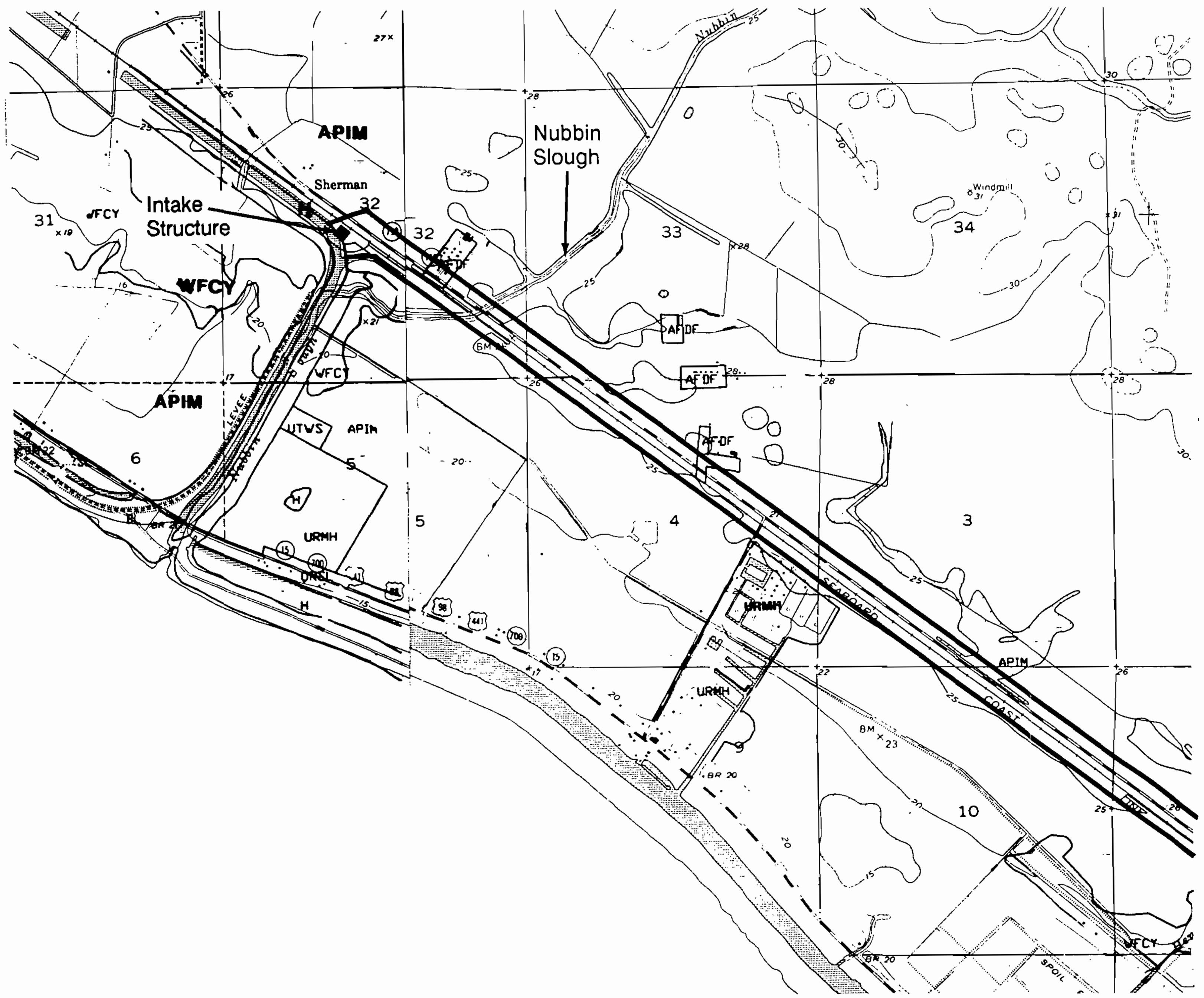
6.2 WATER PIPELINE

6.2.1 PROJECT INTRODUCTION

The Indiantown Cogeneration, L. P. (ICL) facility will require a 19-mile, single, 18- to 24-inch diameter water pipeline in Okeechobee and Martin Counties to support its operations. The pipeline will originate at a new intake structure to be located at the junction of Taylor Creek/Nubbin Slough and the C-59 canal in Okeechobee County. From this new intake structure, the buried water supply pipeline will be run along SR 710 and the CSX Railroad line (within the railroad ROW) into Martin County, terminating at the ICL site. This railroad ROW varies between 100 and 200 feet in width. Since the pipeline is to be located within the railroad ROW, no new corridor is requested for this project.

6.2.2 CORRIDOR LOCATION AND LAYOUT

The location of the pipeline is within the CSX ROW extending laterally about 50 feet on each side of the rail line and is shown in Figure 6.2.2-1. The corridor for the water pipeline that is being licensed for the ICL project is the CSX ROW between the ICL site and the ICL water intake at Taylor Creek/Nubbin Slough.



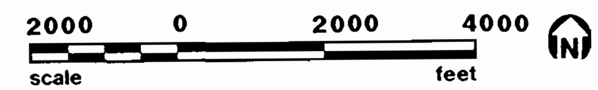


Figure 6.2.2-1. (Page 1 of 5)

CSX RIGHT OF WAY

LEGEND:

Corridor Containing CSX ROW

CSX ROW varies from 200 feet to 100 feet about rail line within corridor.

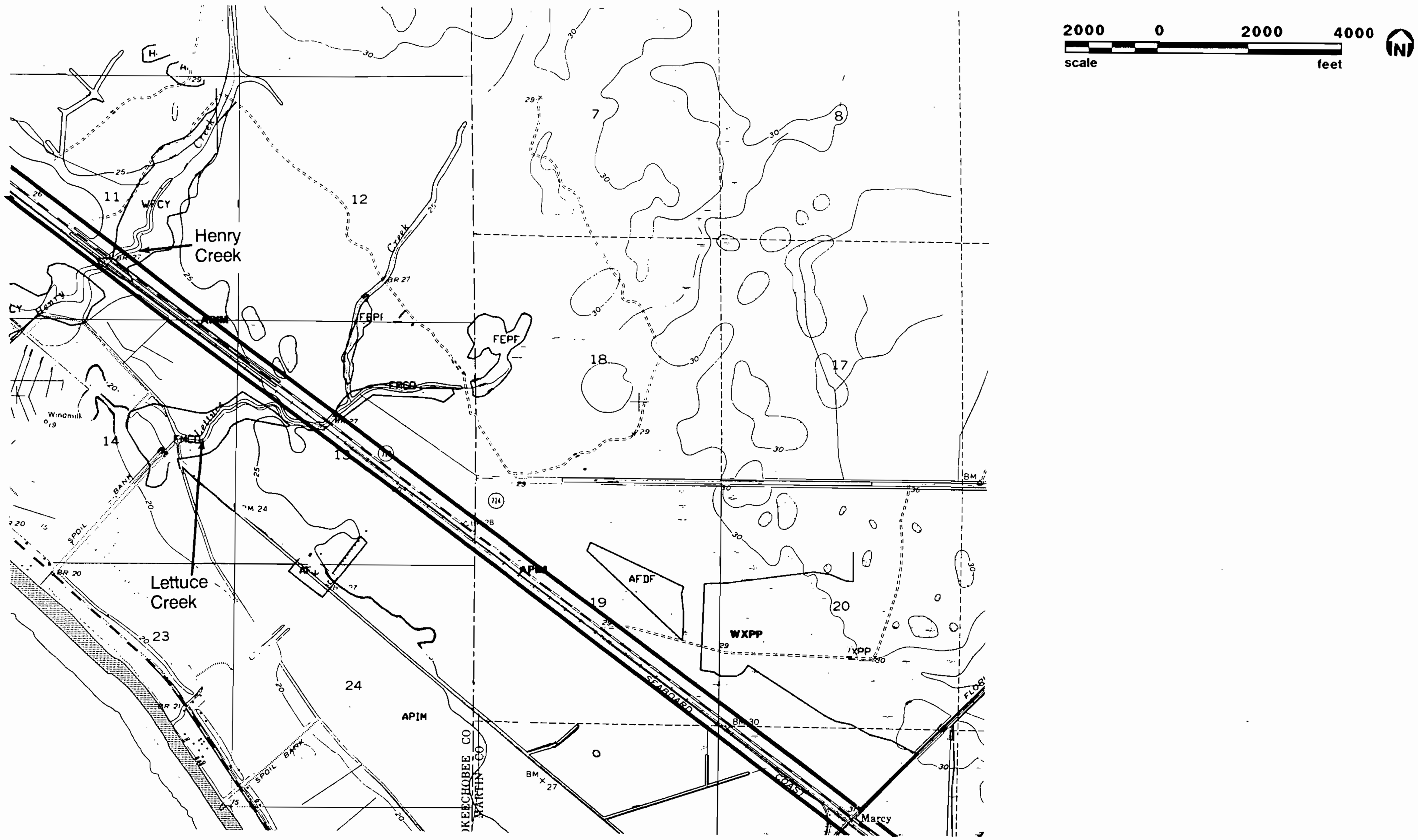
Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.2-1. (Page 2 of 5)

CSX RIGHT OF WAY



LEGEND:

Corridor Containing CSX ROW

CSX ROW varies from 200 feet to 100 feet about rail line within corridor.

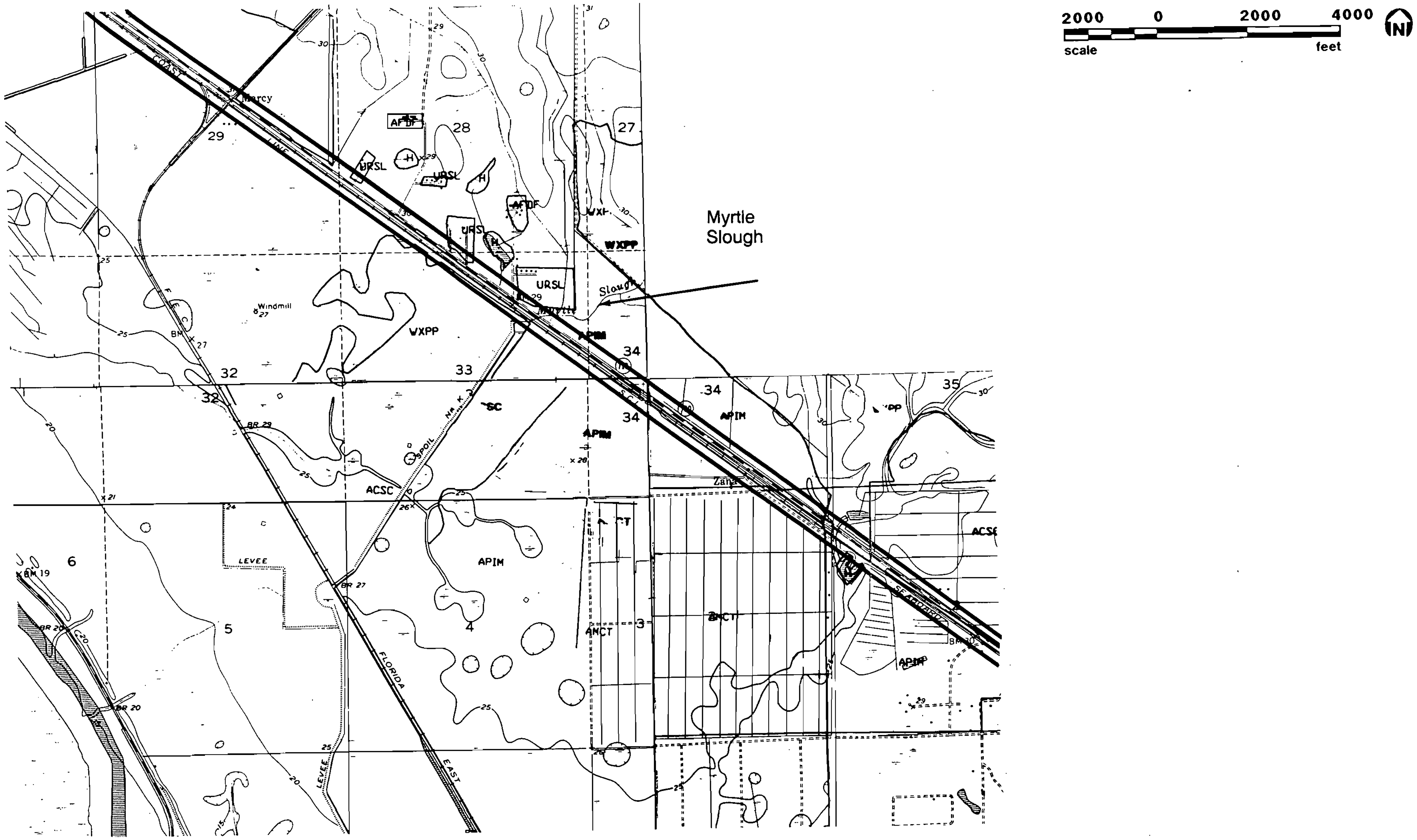
Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.2-1. (Page 3 of 5)

CSX RIGHT OF WAY



LEGEND:

Corridor Containing CSX ROW

CSX ROW varies from 200 feet to 100 feet about rail line within corridor.

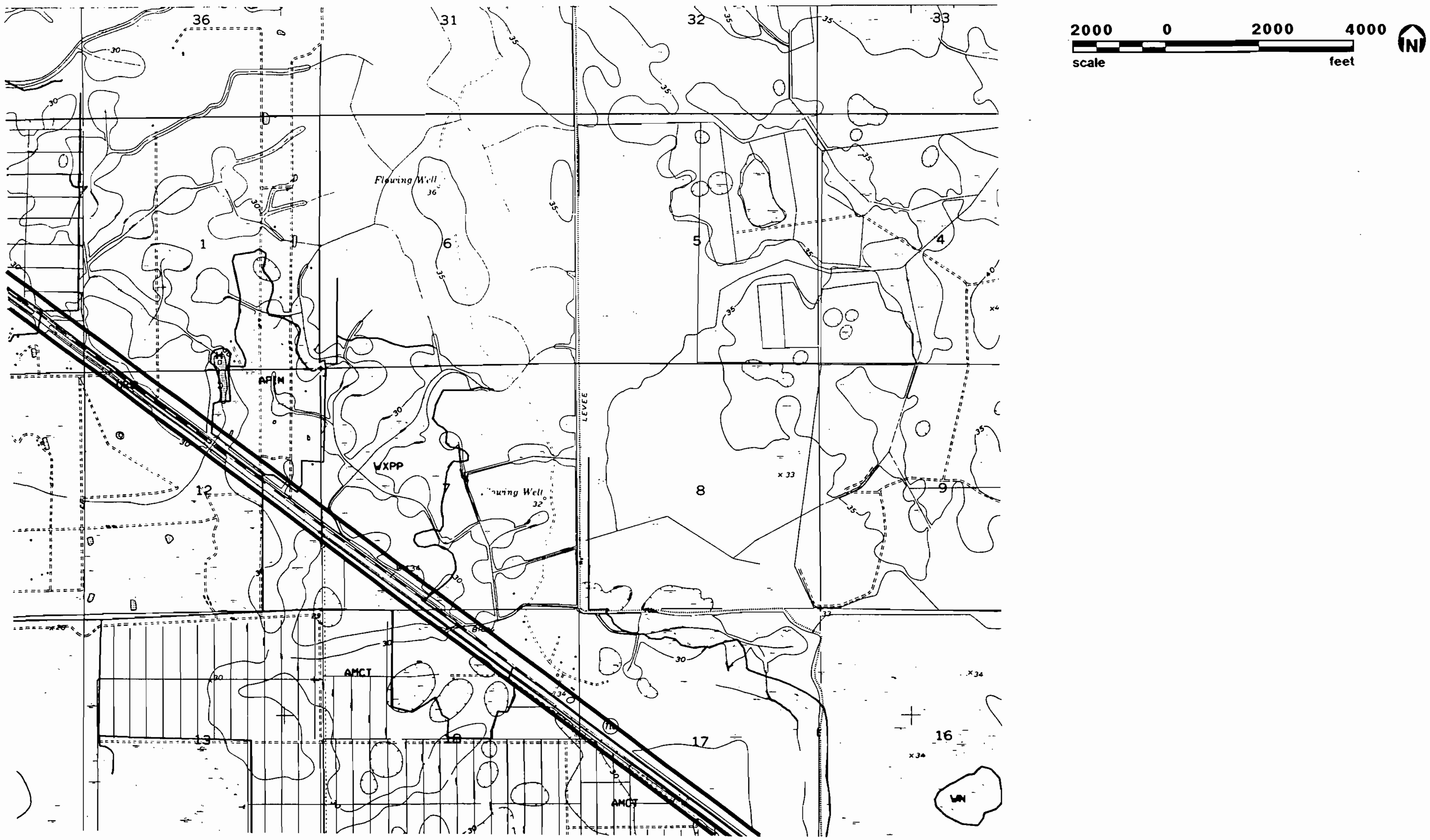
Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.2-1. (Page 4 of 5)

CSX RIGHT OF WAY



LEGEND:

Corridor Containing CSX ROW

CSX ROW varies from 200 feet to 100 feet about rail line within corridor.

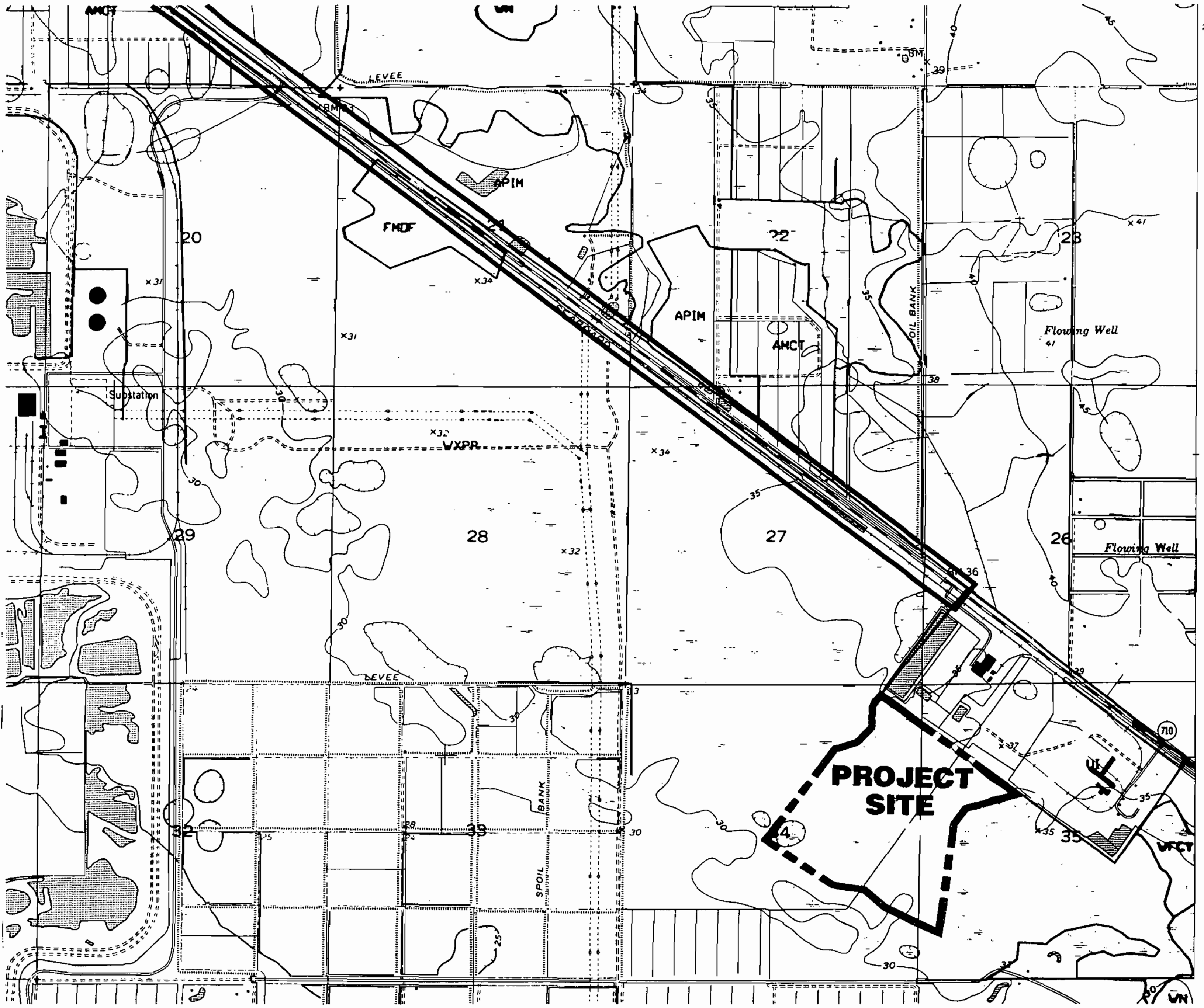
Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

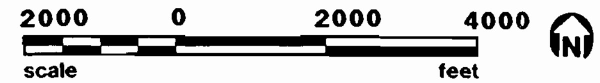
INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.2-1. (Page 5 of 5)

CSX RIGHT OF WAY





LEGEND:

Corridor Containing CSX ROW

CSX ROW varies from 200 feet to 100 feet about rail line within corridor.

Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

6.2.3 WATER PIPELINE DESIGN CHARACTERISTICS

The pipe will be approximately 18- to 24-inch diameter carbon steel or polyethylene pipe manufactured according to American Water Works Association (AWWA) standards. The pipe sections will be hydrostatically tested to at least 125 percent of the design pressure to confirm the pipe integrity and check for leakage.

If the pipe is carbon steel, it will have a protective external coating. Such coating will be checked electrically for breaks in the coating prior to shipping and prior to installation in the ground. The pipe will be installed in accordance with the requirements of AWWA and the regulatory agencies with jurisdiction over crossings. A cathodic protection system will be installed if soils testing shows its is necessary to prevent corrosion.

Since the pipeline will be constructed within the CSX ROW, no new access roads or bridges will be required.

6.2.4 COST PROJECTIONS

On a per mile basis, a 24-inch diameter pipeline is estimated to cost approximately $368,400. The total cost of the 19 miles of pipeline is estimated at $7,000,000 (Bechtel, 1990).

6.2.5 CORRIDOR SELECTION

Since the CSX Railroad right-of-way runs adjacent to the Taylor Creek/Nubbin Slough and the Indiantown Cogeneration, L. P. site, it was the only corridor considered for the project. The use of an existing railroad ROW results in minimal impacts to the environment and to the general population. Since the ROW is for an operational rail line, no additional disturbance to the environment will occur for maintenance of the ROW or of the pipeline.

6.2.6 SOCIOPOLITICAL ENVIRONMENT OF THE CORRIDOR

6.2.6.1 Governmental Jurisdiction

The cooling water pipeline associated with the Indiantown Cogeneration, L. P. (ICL) project commences at the project site located in Section 34, Range 38E, Township 39S, and traverses northwesterly along SR 710 and the CSX Railroad line into Okeechobee County with its terminus located at Taylor Creek/Nubbin Slough. The location of this pipeline, with a 0.5-mile corridor extended laterally on each side of SR 710, is shown in Figure 6.2.6-1.

Lands within this corridor fall under the jurisdiction of several governmental agencies which include the following: Martin County, Okeechobee County, TCRPC, Central Florida Regional Planning Council (CFRPC), and SFWMD.

The pipeline corridor follows existing roadway and rail ROWs and does not cross any local, regional, state, or federally designated or protected lands as described in the FDER Instruction Guide for Certification Applications.

6.2.6.2 Zoning and Land Use Plans

The ICL cooling water pipeline corridor crosses lands under the jurisdiction of Martin and Okeechobee Counties. Each county has its own comprehensive plan and zoning regulations.

As previously described in Section 2.2.2, the Martin County Growth Management Department has prepared the Martin County CGMP in accordance with requirements of the Local Comprehensive Planning and Land Development Regulation Act, Chapter 163, Part II, FS, and FAC, Chapter 9J-5. The Martin County CGMP was adopted by the Martin County Board of County Commissioners on February 20, 1990 (Martin County CGMP, 1990).

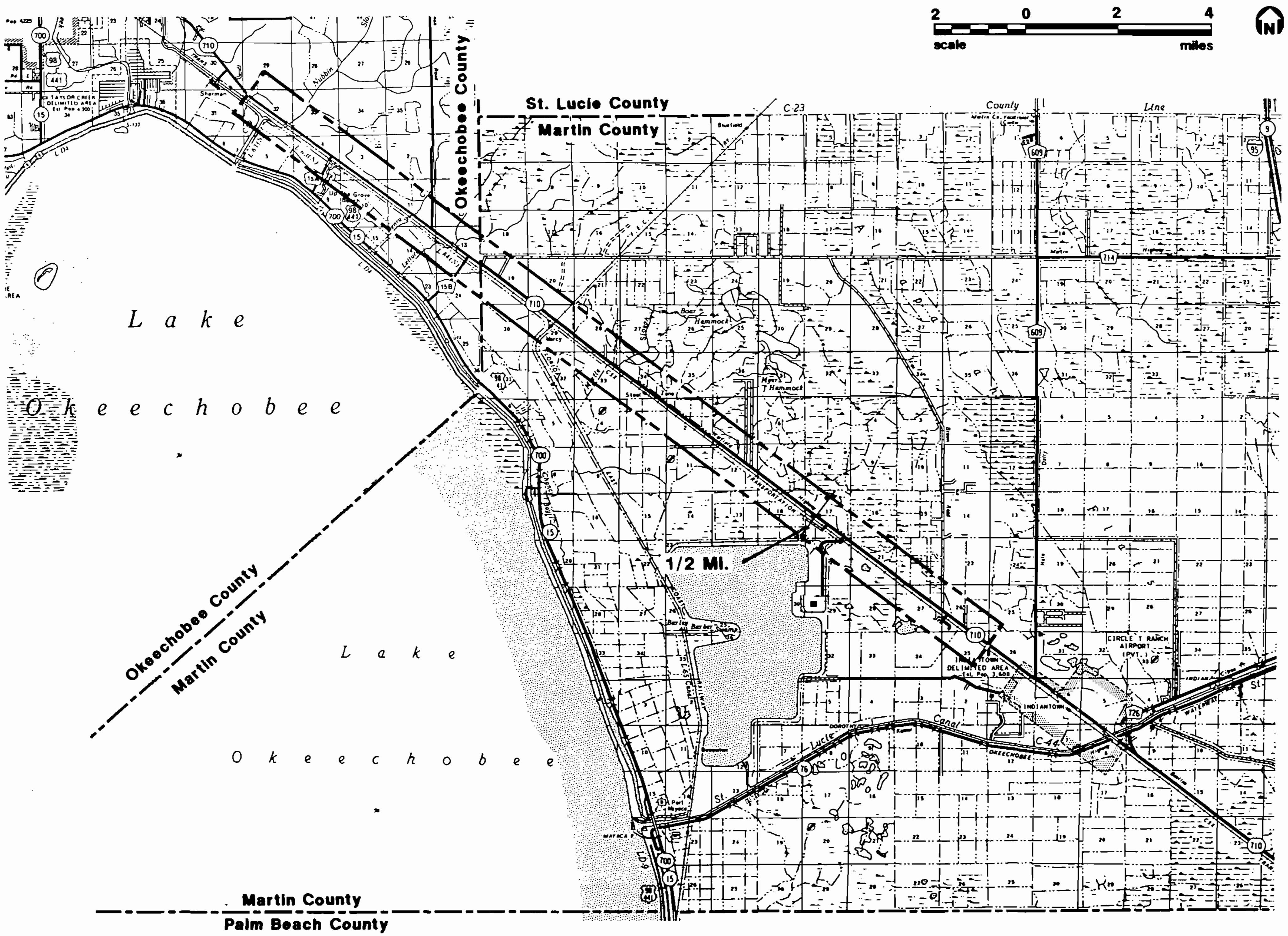


Figure 6.2.6-1.

GOVERNMENTAL JURISDICTIONS WITHIN ONE-HALF MILE ABOUT THE ICL WATER PIPELINE

Sources: FDOT, 1976, 1985, ECT, 1990.

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Indiantown Cogeneration, L.P.

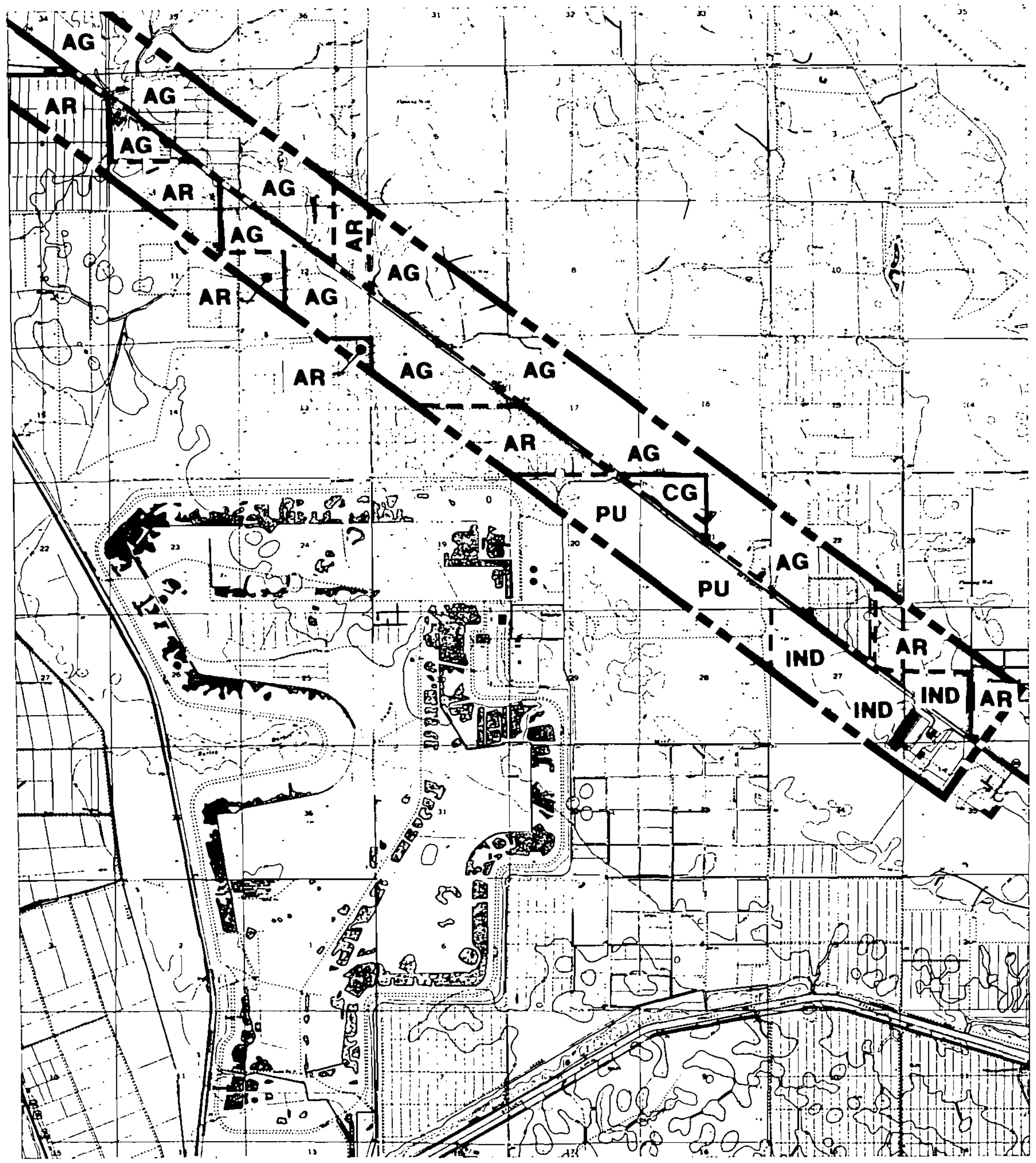
Land use designations crossed by the pipeline corridor within Martin County are shown in Figure 6.2.6-2, and primarily are agricultural in nature. The specific Martin County land use plan categories within the pipeline corridor are as follows:

- Agricultural (AG)
- Agricultural ranchette (AR)
- General commercial (CG)
- Industrial (IND)
- Public utilities (PU)

Summary descriptions of these categories are included in Section 10.3. The only policy identified in the Martin County CGMP which appears to be applicable to the cooling water pipeline corridor is Policy A.3.h included in Chapter 11, Potable Water Service. This policy states:

> "All public and private water system improvements shall be located, designed, and installed in a manner which is cost-effective, functional, responsive to fire protection needs of existing and planned future development, and compatible with surrounding natural systems. The extension of water mains shall be aligned and installed in a manner which prevents undue loss of established tree canopies or soil through induced erosion. Existing features of land altered by construction shall be returned as close as is reasonably possible to the original condition. The timing and staging shall be scheduled in a manner that minimizes disruptive impacts, including impacts on residential quality of life and traffic flow." (Martin County CGMP, p. 11-19).

The location of the cooling water pipeline within an existing railroad ROW and employment of the construction methods described in Section 6.2.8 ensure that the pipeline will comply with the above policy.



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LEGEND

Pipeline Corridor Boundary

Land Use Designation Boundary

FUTURE LAND USE:

Martin County

PU:	Public Utilities
IND:	Industrial
CG:	General Commercial
AR:	Agricultural Ranchette (1 DU/5 Ac.)
AG:	Agricultural

Okeechobee County

RLD:	Residential Low Density
A/OS:	Agricultural/Open Space

Figure 6.2.6-2. (Page 1 of 4)

LAND USE PLAN DESIGNATIONS WITHIN ONE-HALF MILE OF THE INDIANTOWN COGENERATION PROJECT WATER PIPELINE

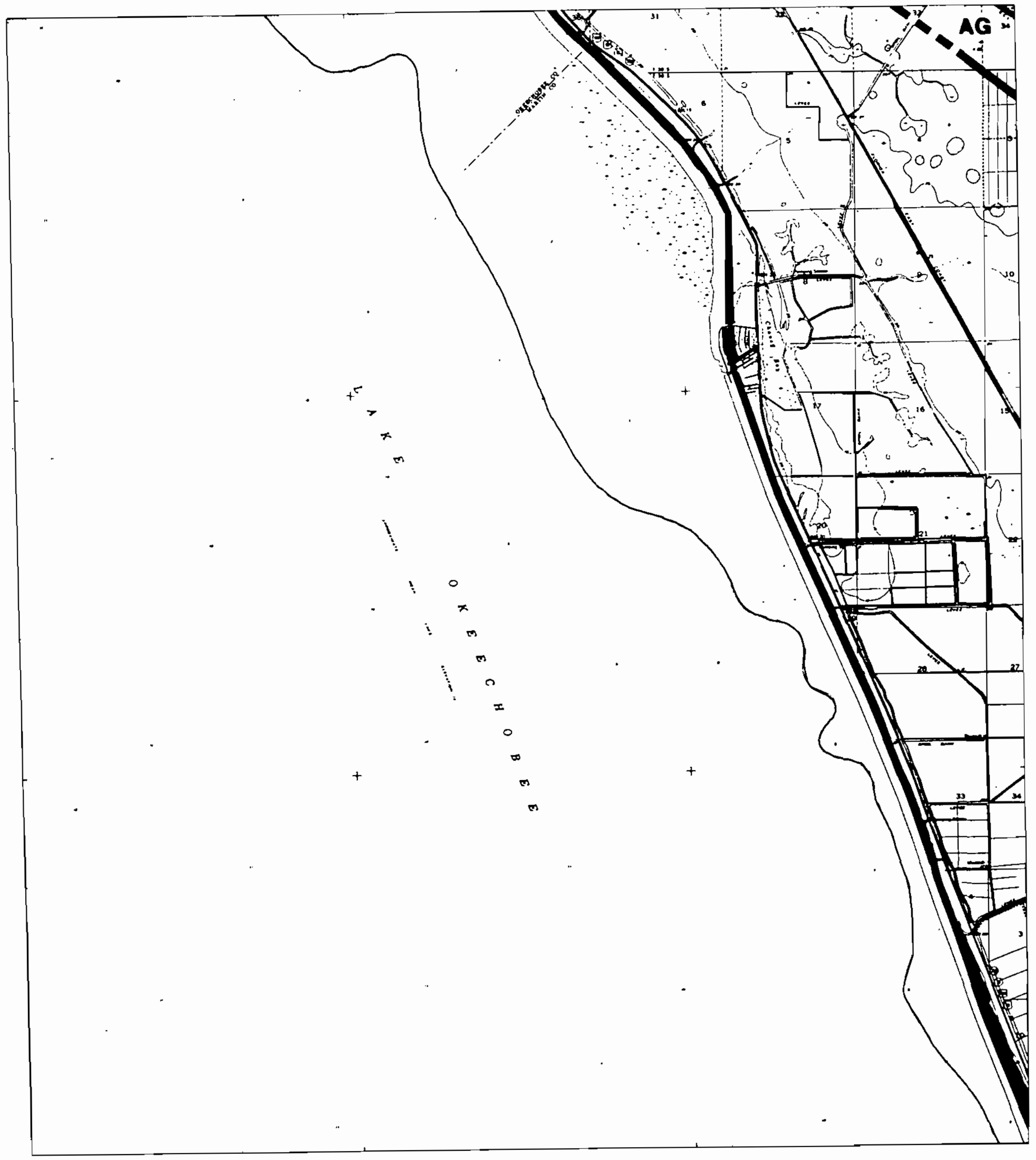
Sources: USGS, 1983. Martin County Growth Management Department, 1990. Central Florida Regional Planning Council, 1990. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.6-2. (Page 2 of 4)

LAND USE PLAN DESIGNATIONS WITHIN ONE-HALF MILE OF THE INDIANTOWN COGENERATION PROJECT WATER PIPELINE



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LEGEND

Pipeline Corridor Boundary

Land Use Designation Boundary

FUTURE LAND USE:

Martin County

PU:	**Public Utilities**
IND:	**Industrial**
CG:	**General Commercial**
AR:	**Agricultural Ranchette (1 DU/5 Ac.)**
AG:	**Agricultural**

Okeechobee County

RLD:	**Residential Low Density**
A/OS:	**Agricultural/Open Space**

Sources: USGS, 1983. Martin County Growth Management Department, 1990. Central Florida Regional Planning Council, 1990. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

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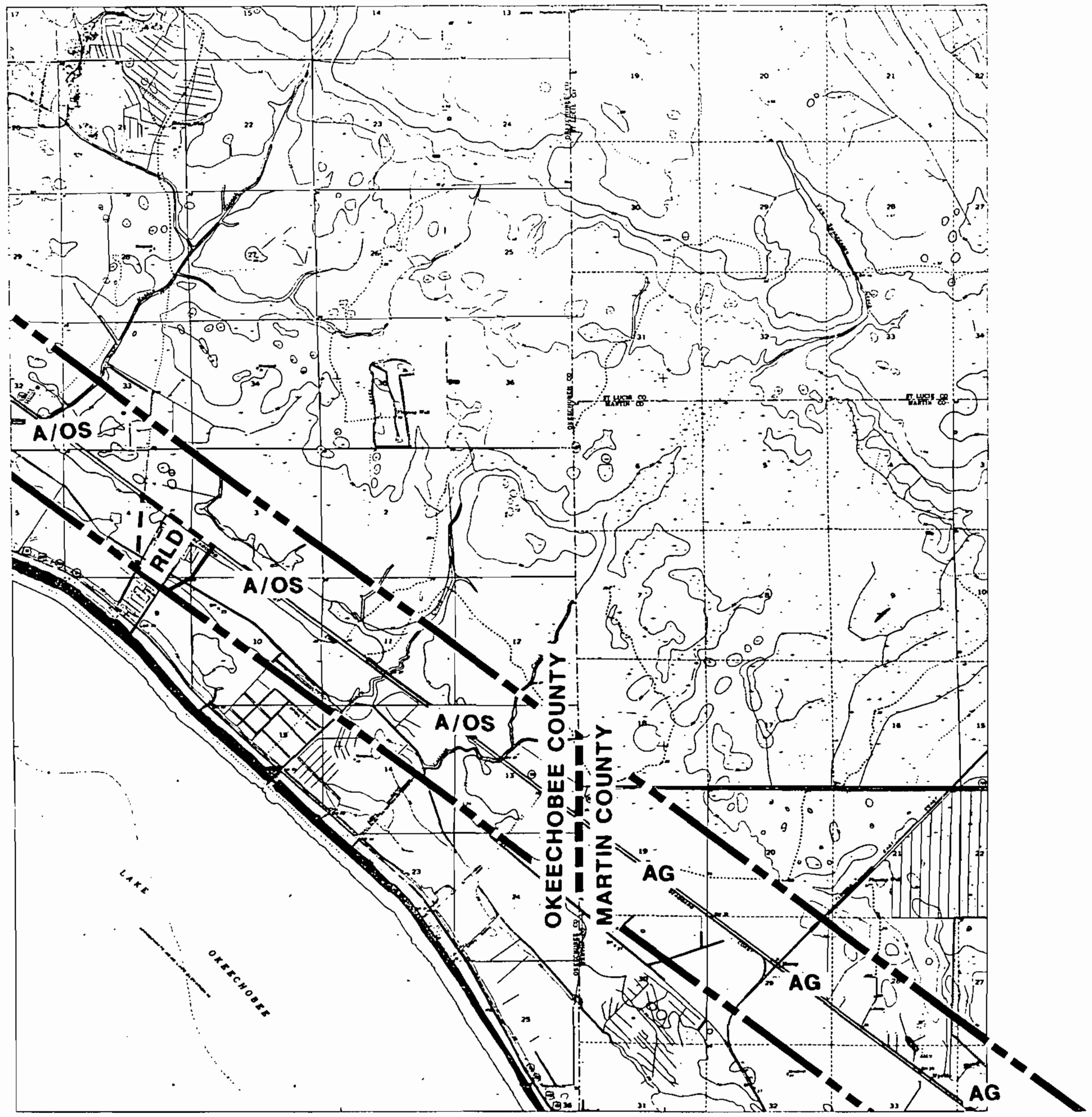
Figure 6.2.6-2. (Page 3 of 4)

LAND USE PLAN DESIGNATIONS WITHIN ONE-HALF MILE OF THE INDIANTOWN COGENERATION PROJECT WATER PIPELINE



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Pipeline Corridor Boundary

Land Use Designation Boundary

FUTURE LAND USE:

Martin County

PU:	Public Utilities
IND:	Industrial
CG:	General Commercial
AR:	Agricultural Ranchette (1 DU/5 Ac.)
AG:	Agricultural

Okeechobee County

RLD:	Residential Low Density
A/OS:	Agricultural/Open Space

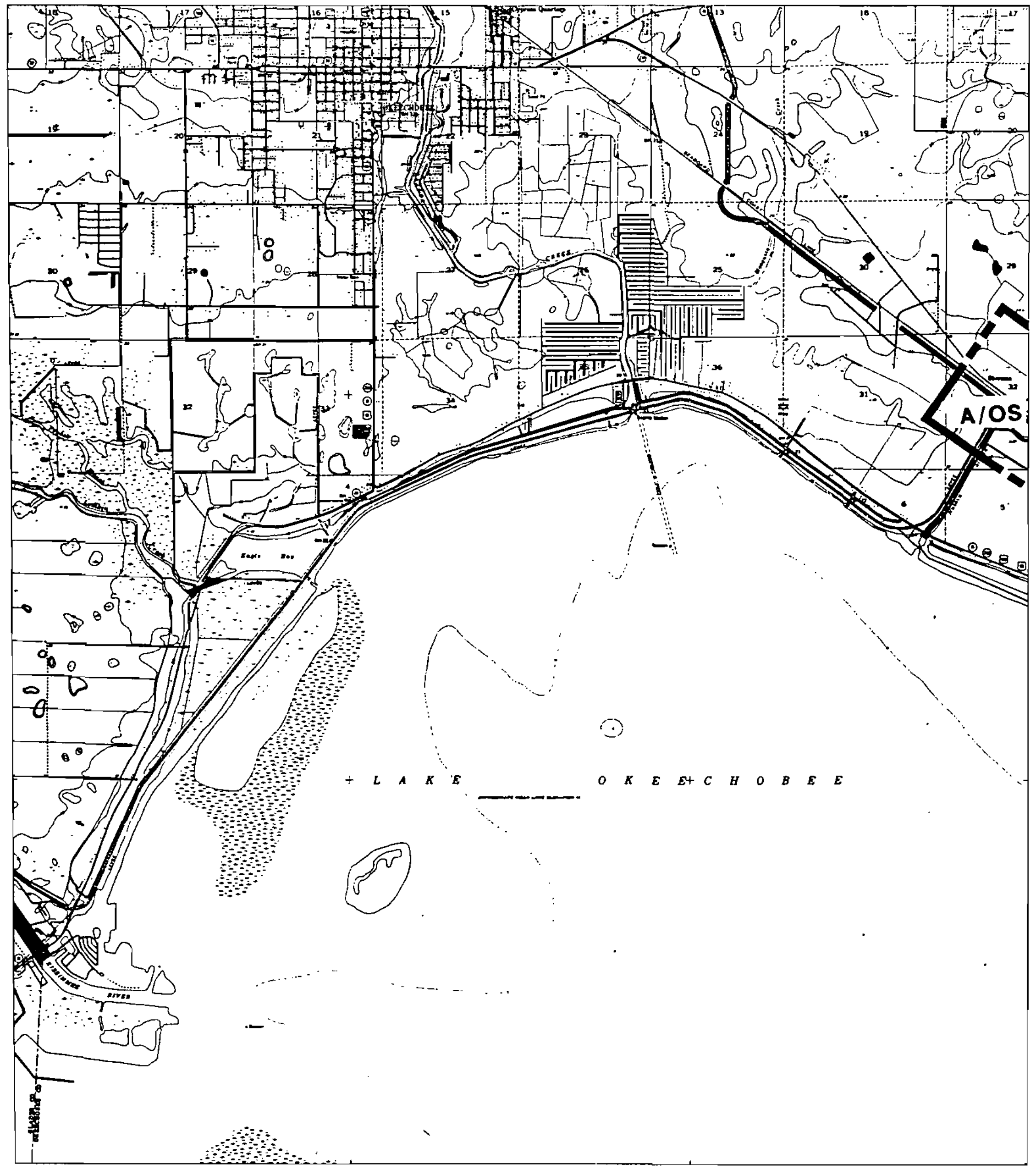
Sources: USGS, 1983. Martin County Growth Management Department, 1990. Central Florida Regional Planning Council, 1990. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.6-2. (Page 4 of 4)

LAND USE PLAN DESIGNATIONS WITHIN ONE-HALF MILE OF THE INDIANTOWN COGENERATION PROJECT WATER PIPELINE



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LEGEND

Pipeline Corridor Boundary

Land Use Designation Boundary

FUTURE LAND USE:

Martin County

PU:	Public Utilities
IND:	Industrial
CG:	General Commercial
AR:	Agricultural Ranchette (1 DU/5 Ac.)
AG:	Agricultural

Okeechobee County

RLD:	Residential Low Density
A/OS:	Agricultural/Open Space

Sources: USGS, 1983. Martin County Growth Management Department, 1990. Central Florida Regional Planning Council, 1990. ECT, 1990.

Zoning districts crossed by the pipeline corridor in Martin County are shown in Figure 6.2.6-3. Utilities "with the exception of normal distribution and/or collection facilities (i.e., poles, lines, cable in trench, and associated equipment)" are regulated as advertised conditional uses in Martin County [Section 35-5.5(A)(9), Martin County Code]. The water pipeline is considered a "normal distribution and/or collection facility," not subject to advertised conditional use review, and is, therefore, a permitted use within all zoning districts. No other applicable zoning regulations have been identified.

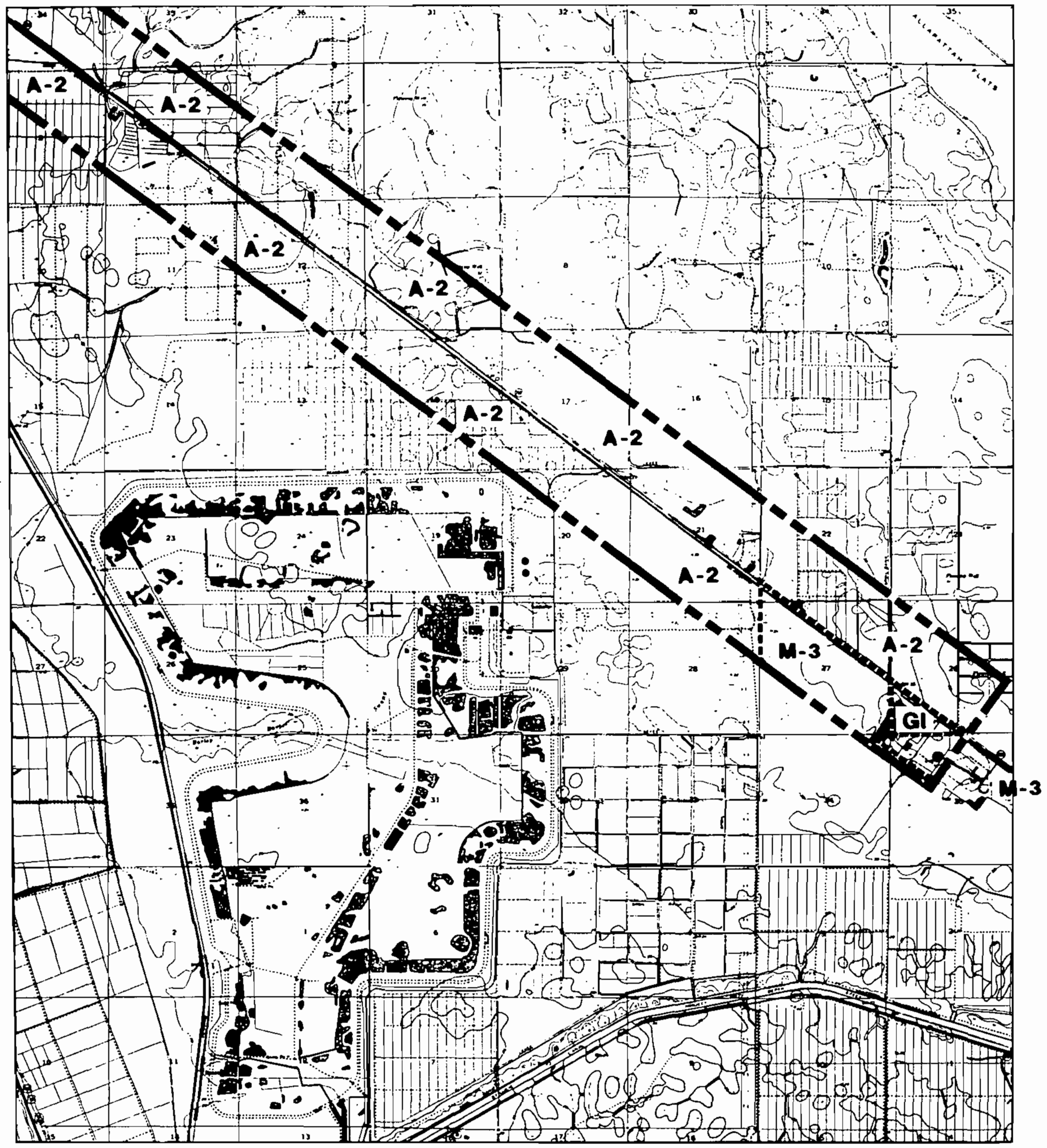
Okeechobee County has not yet adopted a comprehensive plan in accordance with the Local Government Comprehensive Planning and Land Development Regulation Act (Chapter 163, Part II, FS) and Chapter 9J-5, FAC. The comprehensive plan currently in effect in Okeechobee County was adopted in 1980. According to the Future Land Use Plan, the pipeline corridor crosses the Agriculture/Open Space and Residential (low density) land use categories. Although the plan does not define these categories, it does list general land use policies dealing with agricultural and residential land uses. Excerpts from the plan are included in Section 10.3. There are no land use policies that appear to be applicable to a water pipeline. However, the Utility Element of the adopted Okeechobee County comprehensive plan states:

> "Whatever support facilities are needed to provide electric utility service to existing land uses, to such future land uses as are authorized by other elements of this plan, and to such future land uses as may be lawfully authorized by the commission, shall be permitted in any use category and shall be deemed to be consistent with this comprehensive plan." (Okeechobee County Comprehensive Planning Program 1979 Update, p. 143).

The intake water pipeline is a necessary support facility to the ICL project.

Figure 6.2.6-3. (Page 1 of 4)

ZONING DISTRICTS WITHIN ONE-HALF MILE OF THE ICL WATER PIPELINE



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LEGEND

Pipeline Corridor

Zoning Designation Boundary

EXISTING ZONING:

Martin County

GI: General Industrial (Heavy)

M-3: Heavy Industrial

A-2: Agricultural (1 DU/5 Ac.)

(Note: All zoning designations except GI category are classified under the (old) Section 33 Ordinance.)

Okeechobee County

C: Commercial

RMH: Residential Mobile Home (5,000 S.F. min. lot size)

RSF: Residential Single Family (8,000 S.F. min. lot size)

RR: Residential Rural (8,000 S.F. min. lot size)

RG: Residential General (1 DU/2 AC. - S.F.; 1 DU/5 AC. - MH)

AC: Agricultural Conservation (1 DU/20 AC.)

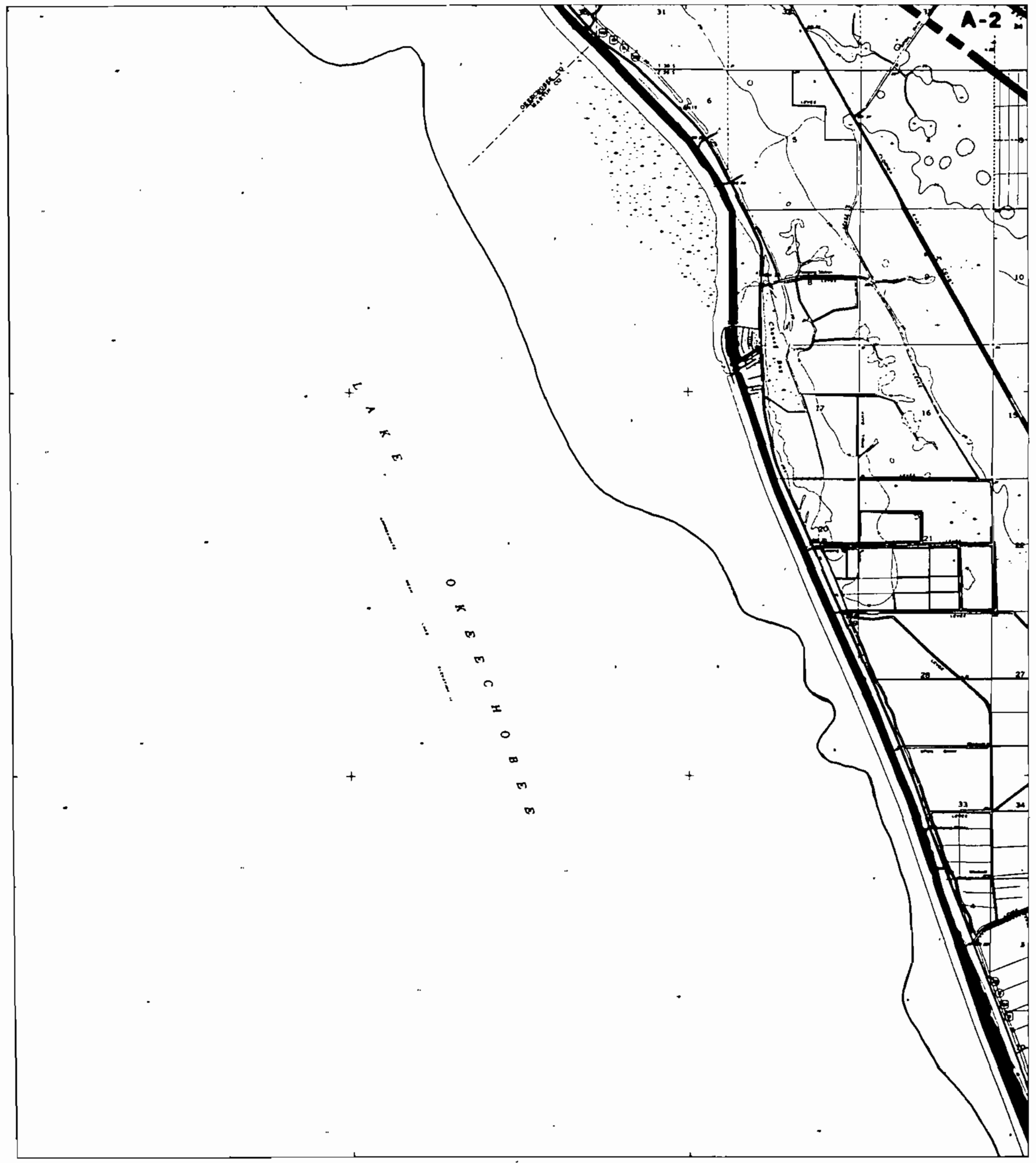
Sources: USGS, 1983. Martin County Building and Zoning Department, 1990. Okeechobee County Building and Zoning Department, 1990. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.6-3. (Page 2 of 4)

ZONING DISTRICTS WITHIN ONE-HALF MILE OF THE ICL WATER PIPELINE



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▬ ▪ ▬ ▬ **Pipeline Corridor**

------------ **Zoning Designation Boundary**

EXISTING ZONING:

Martin County

GI: **General Industrial (Heavy)**

M-3: **Heavy Industrial**

A-2: **Agricultural (1 DU/5 Ac.)**

(Note: All zoning designations except GI category are classified under the (old) Section 33 Ordinance.)

Okeechobee County

C: **Commercial**

RMH: **Residential Mobile Home (5,000 S.F. min. lot size)**

RSF: **Residential Single Family (8,000 S.F. min. lot size)**

RR: **Residential Rural (8,000 S.F. min. lot size)**

RG: **Residential General (1 DU/2 AC. - S.F.; 1 DU/5 AC. - MH)**

AC: **Agricultural Conservation (1 DU/20 AC.)**

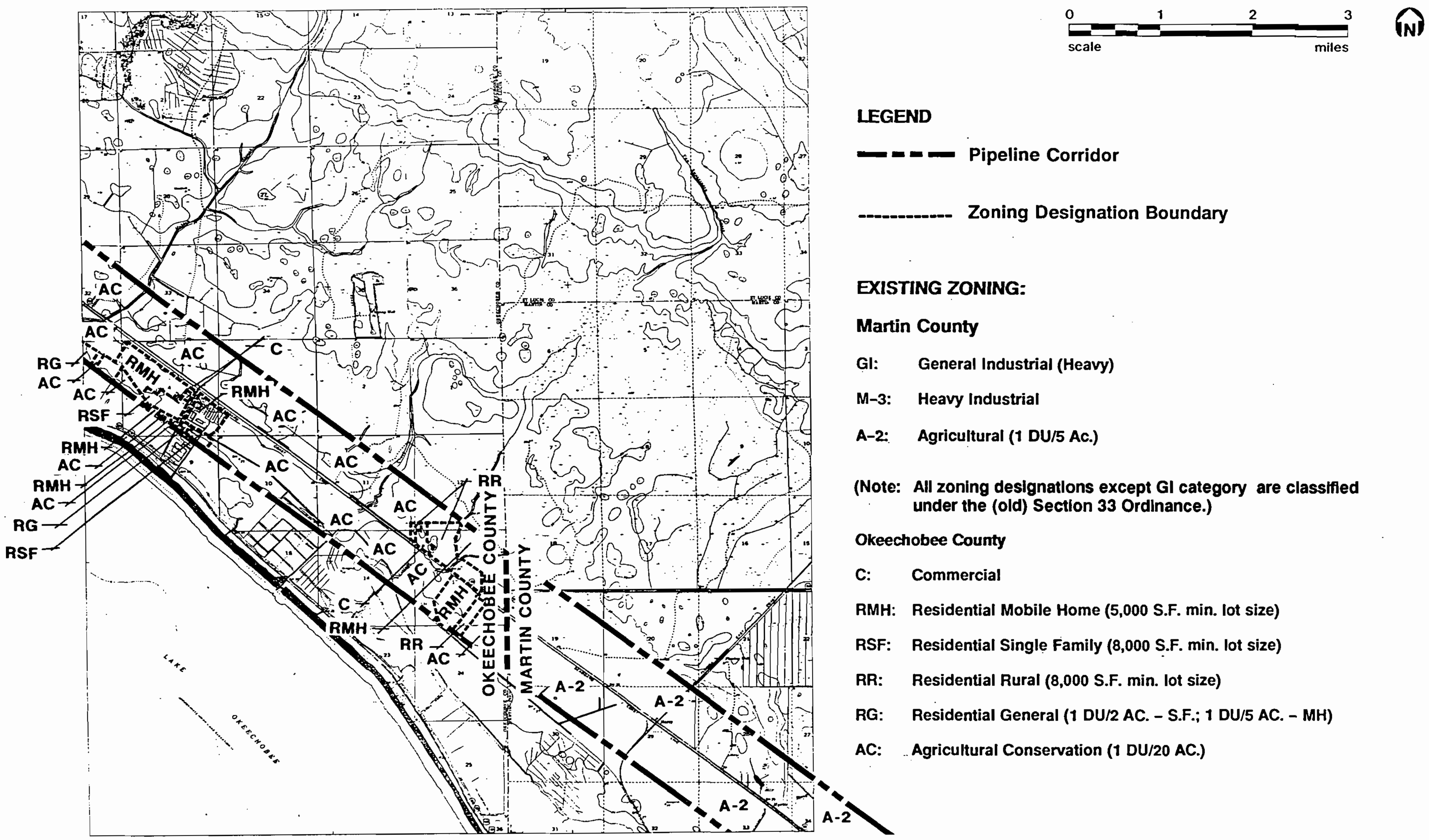
Sources: USGS, 1983. Martin County Building and Zoning Department, 1990. Okeechobee County Building and Zoning Department, 1990. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.6-3. (Page 3 of 4)

ZONING DISTRICTS WITHIN ONE-HALF MILE OF THE ICL WATER PIPELINE



LEGEND

Pipeline Corridor

Zoning Designation Boundary

EXISTING ZONING:

Martin County

GI: General Industrial (Heavy)

M-3: Heavy Industrial

A-2: Agricultural (1 DU/5 Ac.)

(Note: All zoning designations except GI category are classified under the (old) Section 33 Ordinance.)

Okeechobee County

C: Commercial

RMH: Residential Mobile Home (5,000 S.F. min. lot size)

RSF: Residential Single Family (8,000 S.F. min. lot size)

RR: Residential Rural (8,000 S.F. min. lot size)

RG: Residential General (1 DU/2 AC. - S.F.; 1 DU/5 AC. - MH)

AC: Agricultural Conservation (1 DU/20 AC.)

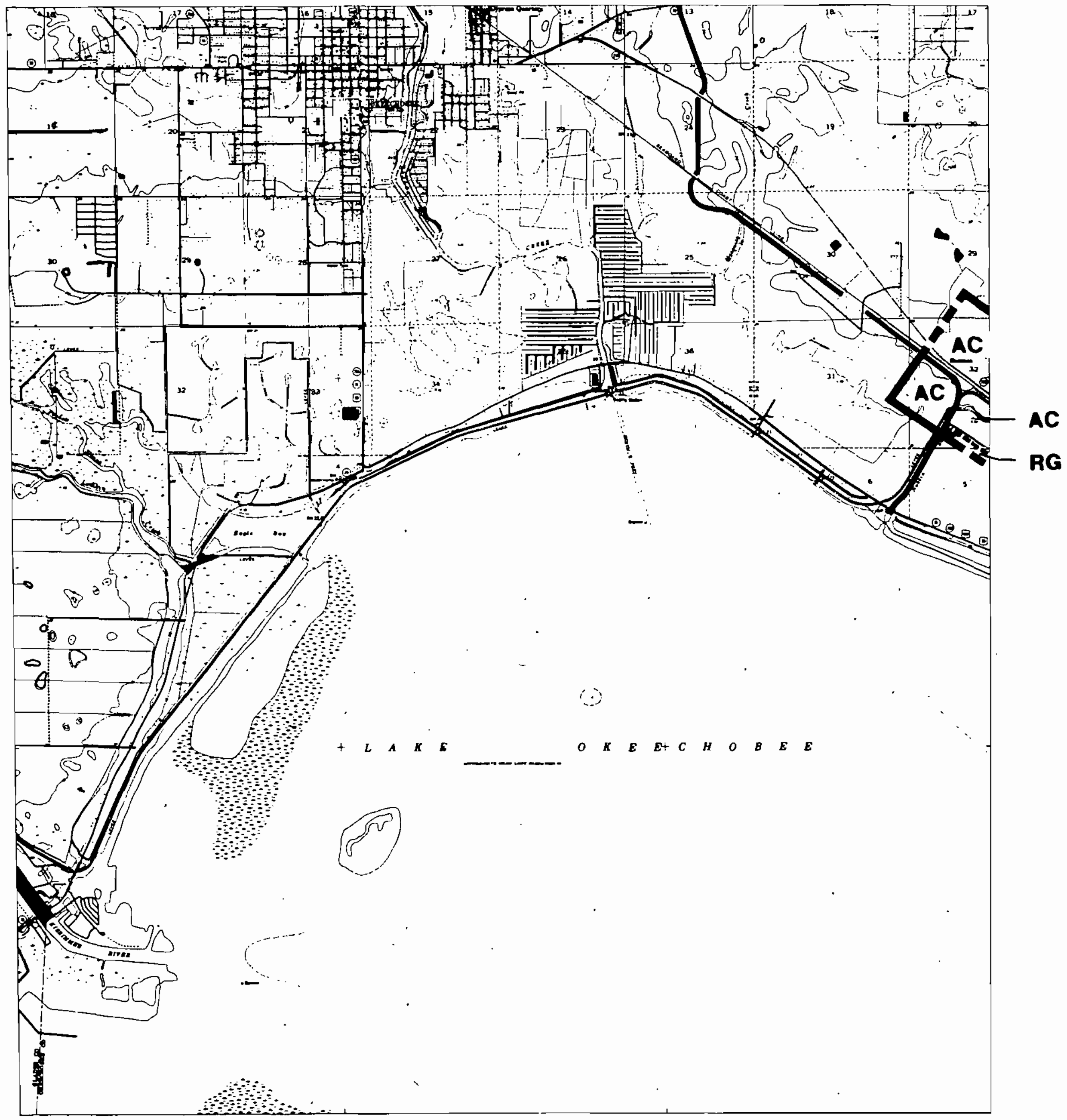
Sources: USGS, 1983. Martin County Building and Zoning Department, 1990. Okeechobee County Building and Zoning Department, 1990. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.6-3. (Page 4 of 4)

ZONING DISTRICTS WITHIN ONE-HALF MILE OF THE ICL WATER PIPELINE



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Pipeline Corridor

Zoning Designation Boundary

EXISTING ZONING:

Martin County

GI: General Industrial (Heavy)

M-3: Heavy Industrial

A-2: Agricultural (1 DU/5 Ac.)

(Note: All zoning designations except GI category are classified under the (old) Section 33 Ordinance.)

Okeechobee County

C: Commercial

RMH: Residential Mobile Home (5,000 S.F. min. lot size)

RSF: Residential Single Family (8,000 S.F. min. lot size)

RR: Residential Rural (8,000 S.F. min. lot size)

RG: Residential General (1 DU/2 AC. - S.F.; 1 DU/5 AC. - MH)

AC: Agricultural Conservation (1 DU/20 AC.)

Sources: USGS, 1983. Martin County Building and Zoning Department, 1990. Okeechobee County Building and Zoning Department, 1990. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

As shown in Figure 6.2.6-3, the majority of the land crossed by the pipeline corridor in Okeechobee County is zoned AC, Agricultural Conservation. Other zoning districts crossed include the following:

- Residential general (RG)
- Residential rural (RR)
- Residential single-family (RSF)
- Residential mobile home (RMH)
- Commercial (C)

Section 7.9 of the Okeechobee County Zoning Ordinance states:

> "9. Essential Services. Essential services shall be permitted in any zoning district. Essential services are hereby defined to include and be limited to water, sewer, gas, telephone, and electrical systems, including sub-stations, lift stations, and similar installations necessary for the performance of these services; provided, however, that this subsection shall not be deemed to permit the location in a district of such establishments as electric or gas generating plants, sewage treatment plants, or water pumping or water aeration facilities from which they would otherwise be barred; and provided further that this subsection shall not be deemed to include the erection of structures for commercial activities such as sales or the collection of bills in districts from which such activities would be otherwise barred. Under this subsection, where structures are involved, such structures shall conform insofar as possible to the character of the district as to architecture and landscaping." (Zoning Ordinance, Okeechobee County, Florida, p. 18a).

The cooling water intake structure at Taylor Creek/Nubbin Slough, described in Section 3.5.1.1, is located in the AC zoning district. According to Section 6, Schedule of District Regulations, of the Okeechobee County Zoning Ordinance

(1974), water pumping facilities are not barred from the AC district. Therefore, the cooling water pipeline and the intake structure are permitted uses under the Okeechobee County Zoning Ordinance.

6.2.6.3 Easements, Title, Agency Works

The pipeline ROW will be located within the existing CSX Railroad ROW located to the west of SR 710. The northern terminal of the pipeline ROW will cross a small portion of land belonging to SFWMD. Approval for crossing such state and county roads, easements, and agency works (e.g., county drainage districts) will be obtained as part of this SCA. Table 6.2.6-1 lists the facilities under title, easements, or agency works that will be crossed by the proposed pipeline.

6.2.6.4 Vicinity Scenic, Cultural, and Natural Landmarks

The pipeline corridor follows existing road and rail ROWs and does not cross any scenic, cultural, or natural landmarks.

6.2.6.5 Archaeological and Historic Sites

A comprehensive evaluation of archaeological and historic resources within the cooling water pipeline corridor was conducted by Piper Archaeological Research, Inc., and is located in Section 10.8.

This research revealed no previously recorded archaeological sites within the pipeline corridor, and a low probability of finding additional significant historical resources. During research and assessment, no archaeological or historic sites were found which would be eligible for inclusion on the National Register of Historic Places (Piper, 1990).

In an area south of the pipeline corridor in Section 2, Township 39 South, Range 27 East, a historic feature was found. Named the Zana Railroad Water Reservoir,

Table 6.2.6-1
EASEMENTS, TITLE, OR CROSSING APPROVALS NORMALLY REQUIRED FOR CONSTRUCTION OF THE COOLING WATER PIPELINE

Facility	Affected Agency	Type of Approval
CR 15A	Okeechobee County	Utility Permit
CR 15B	Okeechobee County	Utility Permit
FEC Railroad	FEC Railroad	Crossing Permit*
Myrtle Slough Lettuce Creek Henry Creek Nubbin Slough Unnamed streams	FDER, SFWMD, USACE*	General Permit (FDER) Industrial Wastewater Permit (FDER) Works of the District Permit (SFWMD) Section 404 Dredge- and Fill Permit (USACE)
Various unamed ditches and canals	Indiantown Drainage District Troup-Indiantown Drainage District Coquina Water Control District	Utility Permit

*Private permit not subject to local, county, or state jurisdiction.
+Permit may or may not be required depending on construction method of pipeline (i.e, attached to existing bridge structure versus buried under stream).

Sources: FDOT, 1990.
CSX, 1990.
Okeechobee County, 1990.
SFWMD, 1990.
USACE, 1990.

the feature contains a small camping shack and an angular concrete structure. The research conducted by Piper Archaeological Research, Inc. speculated that this site may have been a water reservoir for steam locomotives. However, this feature was not found to be eligible for listing in the National Register of Historic Places (Piper, 1990).

6.2.7 BIOPHYSICAL ENVIRONMENT OF THE CORRIDOR AREA

6.2.7.1 Land Use/Vegetation

The proposed pipeline will be located within the existing CSX Railroad right-of-way (ROW), with the exception of its northern terminus, which will cross a short section of maintained grassland belonging to SFWMD.

Land use and vegetation along the 19-mile long cooling water pipeline corridor and within 1/2-mile of the ROW are presented in Figures 6.2.7-1a and 6.2.7-1 (pages 1 through 5). The mapped information is labeled using the Level III designations of the SFWMD Land Use and Land Cover Classification Code (see Chapter 10). The corridor was surveyed by plant ecologists/taxonomists in July and October 1990.

The predominant agricultural land use type crossed by the corridor is improved pasture (APIM). Other conspicuous agricultural land use types occurring along the corridor are citrus groves (AMCT), sugar cane fields (ACSC), and dairy farms (AFDF). The corridor also crosses several areas classified as urban or built-up, which are primarily residential in nature. The urban land uses located within the corridor consist of the following: single-family residential (URSL), mobile home residential (URMH), industrial (UI), and water supply plants (UTWS). In addition, the corridor includes SR 710 and the CSX Railroad.

Vegetation communities found in the corridor are included in the descriptions provided in Section 2.3.5. The dominant forest types are pine and wet prairie (WXPP), old fields/forested old fields (FMOF), and cypress swamp (WFCY). Other vegetation types occurring within the corridor include pine/cabbage palms (FMPC), cabbage palm/oaks (FMCO), pine flatwoods (FEPF), and levees (BL).

One land use type that occurs within 1/2-mile of the pipeline corridor and was not previously described for the ICL project site is levees. Typically, levees have very

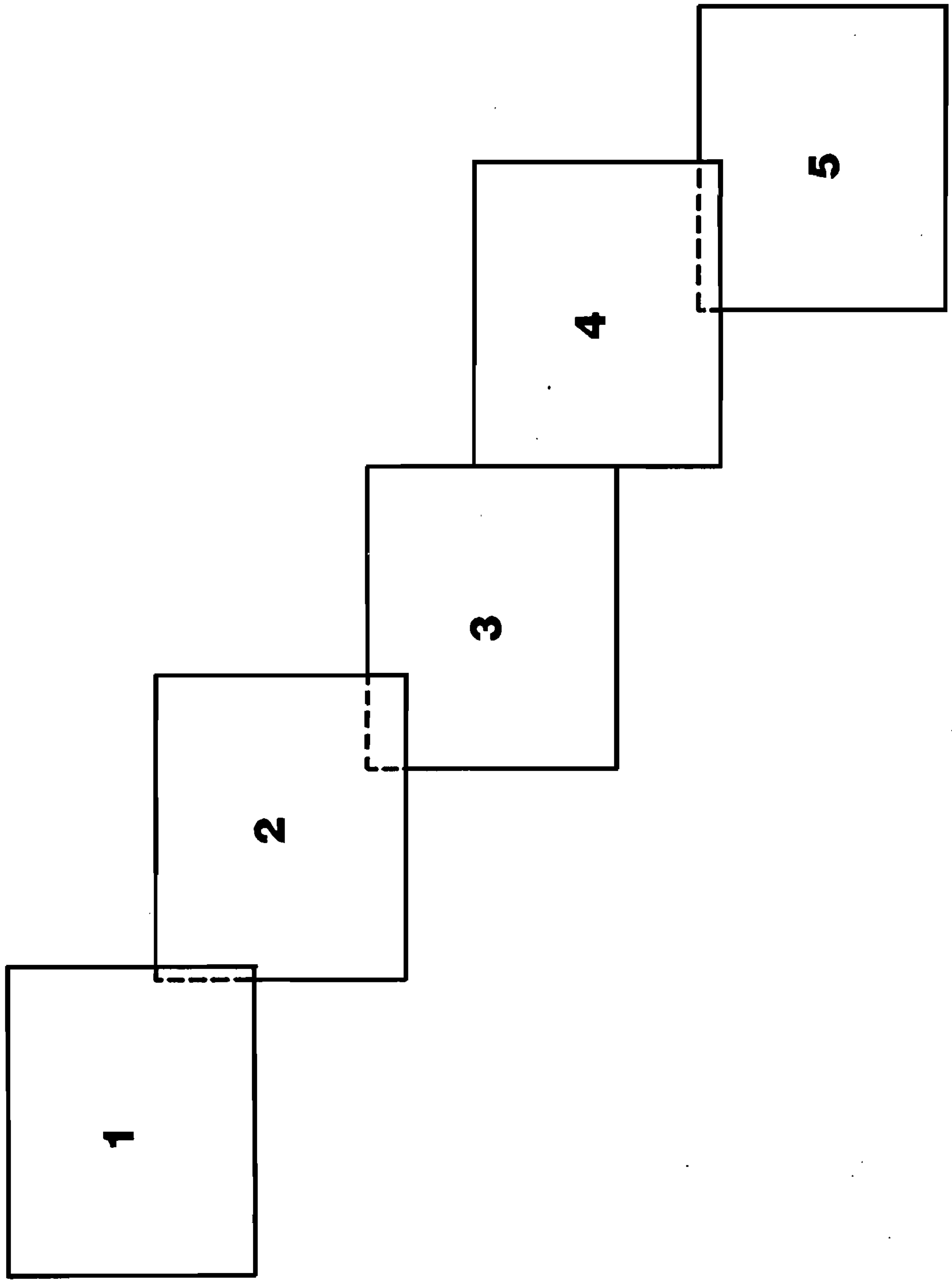

Figure 6.2.7-1a
LAND USE AND LAND COVER MAP KEY SHEET
FOR PIPELINE CORRIDOR AREA

Source: ECT, 1990.

INDIANTOWN
COGENERATION
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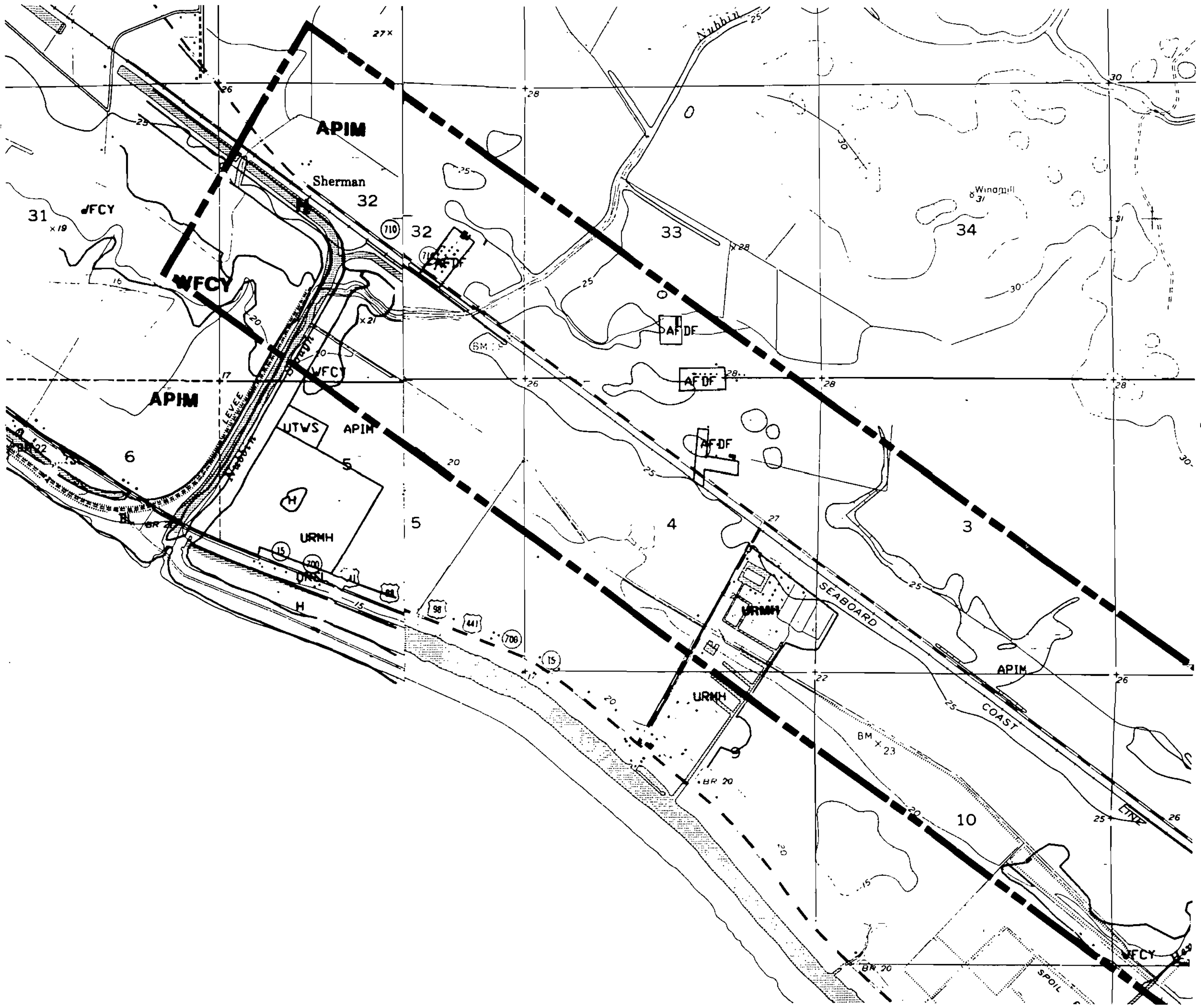
Indiantown Cogeneration, L.P.

Figure 6.2.7-1 (Page 1 of 5)
LAND USE AND LAND COVER WITHIN ONE-HALF MILE OF THE PIPELINE CORRIDOR



2000 0 2000 4000
scale feet

LEGEND

Pipeline Corridor

Agriculture

- ACSC Sugar cane
- ACTC Truck crops
- AFDF Dairy farms
- AMCT Citrus
- APIM Improved pasture

Forested Uplands

- FEPF Pine flatwoods
- FM Mixed forested
- FMCO Cabbage palms/Oaks
- FMOF Old fields forested
- FMPC Pine/Cabbage palms

Water Bodies

- H Water

Grassland

- RG Grassland

Scrub and Brushland

- RSPP Palmetto prairies
- RSSB Brushland

Commercial and Services

- UCMC Marine commercial (Marinas)
- UCSS Sales and services

Industrial

- UI Industrial

Open and Other

- UOCM Cemeteries
- UOGC Golf courses
- UOPK Parks
- UOUN Open and undeveloped within urban area

Residential

- URMF Multi-family building
- URMH Mobile homes
- URSL Single-family, Low Density (under 2 D.U./gross acre)
- URSM Single-family, Medium Density (under 2 to 5 D.U./gross acre)
- USED Educational
- UTAG Small grass airports
- UTEP Electrical power facilities
- UTTL Major highway and rights-of-way
- UTWS Water supply plants

Wetlands

- WFCY Cypress
- WN Non-forested fresh
- WXPP Pine and wet prairies
- WFMX Mixed forested

Barren Land

- BL Levees

Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

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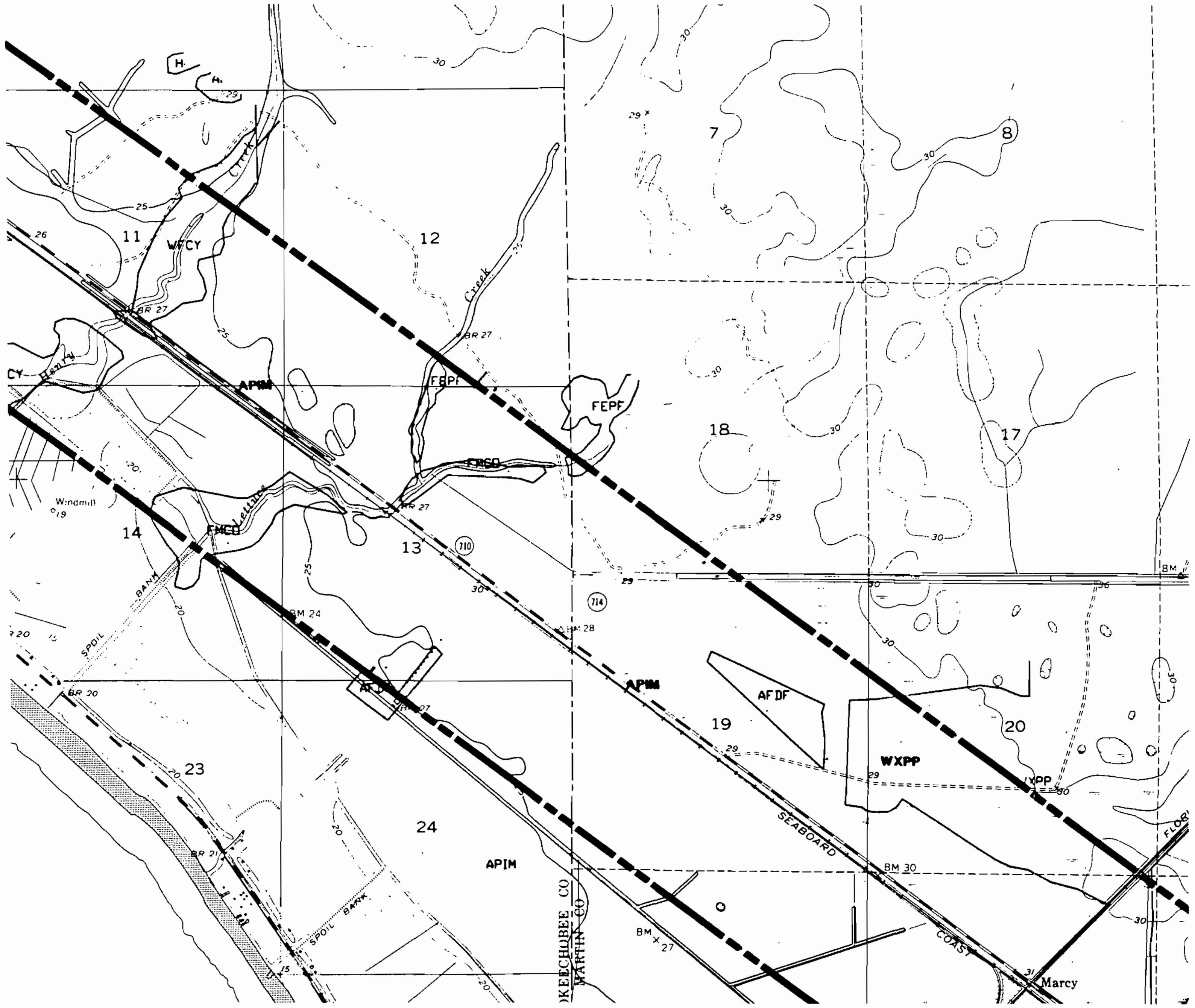
Figure 6.2.7-1 (Page 2 of 5)
LAND USE AND LAND COVER WITHIN ONE-HALF MILE OF THE PIPELINE CORRIDOR



2000 0 2000 4000
scale feet

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USED	Educational
UTAG	Small grass airports
UTEP	Electrical power facilities
UTTL	Major highway and rights-of-way
UTWS	Water supply plants

Wetlands

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WXPP	Pine and wet prairies
WFMX	Mixed forested

Barren Land

BL	Levees

Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

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Figure 6.2.7-1 (Page 3 of 5)
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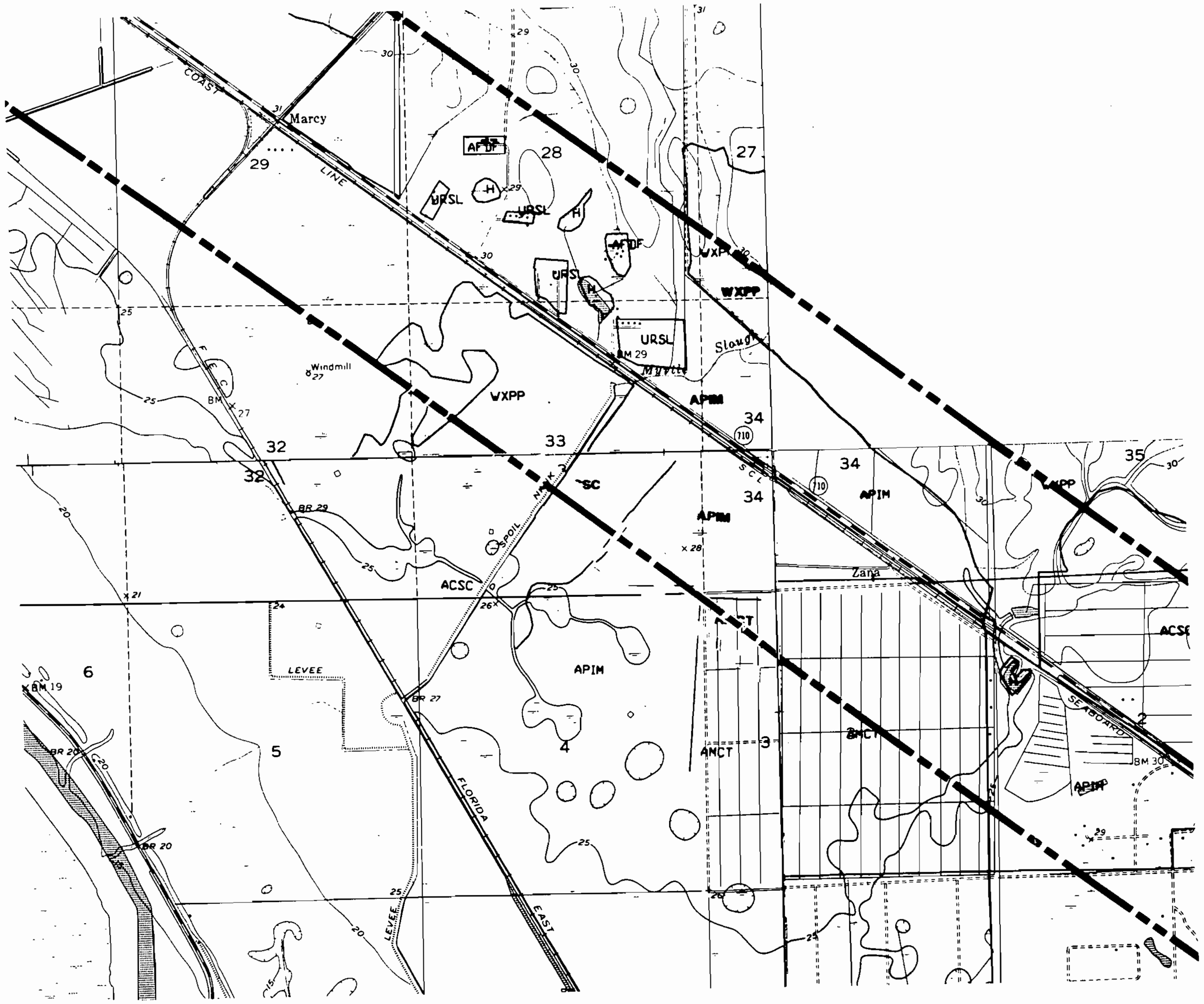

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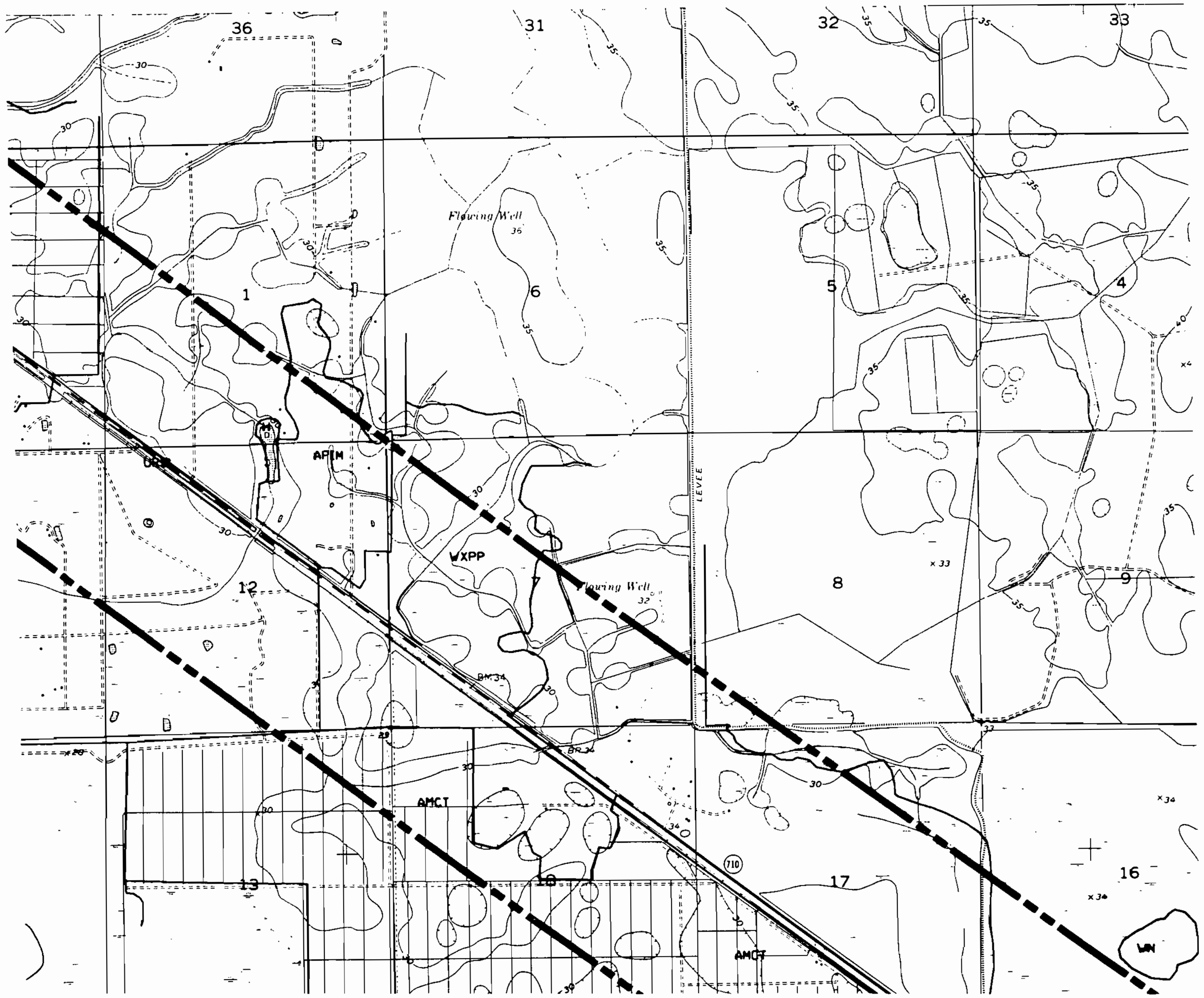
INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.7-1 (Page 4 of 5)
LAND USE AND LAND COVER WITHIN ONE-HALF MILE OF THE PIPELINE CORRIDOR



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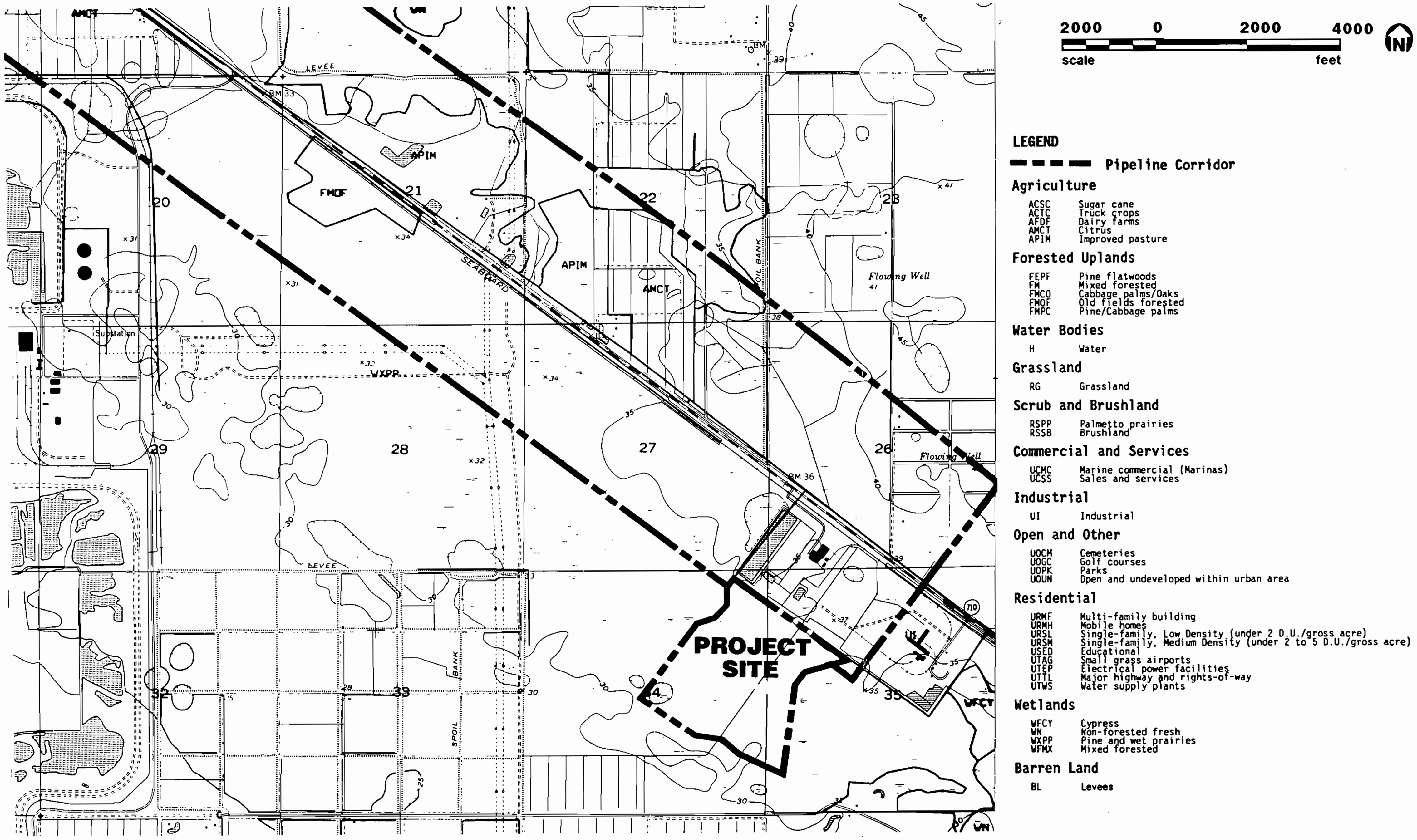
INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.7-1 (Page 5 of 5)
LAND USE AND LAND COVER WITHIN ONE-HALF MILE OF THE PIPELINE CORRIDOR



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little or no vegetation and limited ability to support life. The only mapped levee within the pipeline corridor is a raised, earthen berm situated along the Taylor Creek/Nubbin Slough (TC/NS) waterway connected to Lake Okeechobee. Only opportunistic, ruderal herbs and shrubs such as begger's tick, groundsel bush, Caesar's weed, partridge pea, and others would be expected along the levee.

The most important wetland types within 1/2-mile of the corridor are cypress swamps and wet prairie. Cypress swamps occur along drainageways and are dominated by bald cypress. Wet prairies are usually hydrologically isolated and occur in depressions within pine flatwoods (i.e., pine and wet prairie association) or in improved pasture.

Since the pipeline ROW is located within the CSX ROW, the land to be potentially affected by the pipeline has been previously altered and has low ecological value. Vegetation communities adjacent to the proposed corridor route (within 1/2-mile of either side) are common in the region.

6.2.7.2 <u>Affected Waters and Wetlands</u>

The preferred water pipeline corridor alignment was selected, in part, to minimize impacts to the environment including water bodies and wetlands. As a result, the corridor was collocated with existing linear facilities, and sited in a highly disturbed area located along existing railroad and road ROW. Because of the flat and low-lying physiography of the region and the linear nature of the proposed facility, the corridor cannot totally avoid wetlands along its 19-mile distance.

The area of the preferred corridor is characterized by previously disturbed soils and low, flat, sandy soils. Soils near the surface generally have high permeability and slow runoff rates. Runoff is channelled to an existing ditch paralleling the railroad ROW or to SR 710 drainage ditches. Drainage is toward TC/NS. The southern part of the corridor has similar types of drainage systems which drain runoff to the south, leading ultimately to the St. Lucie Canal.

The corridor crosses no major water bodies, only small canals and ditch systems which have generally been excavated for drainage of agricultural land located to the east of SR 710. Several such drainage ditches are shown within the corridor on USGS 7.5-minute quadrangle maps in Martin County, including Myrtle Slough. Lettuce Creek, Henry Creek, and Nubbin Slough are the major drainages crossed by the corridor in Okeechobee County.

6.2.7.3 Ecology

Terrestrial Biology

This section discusses the status and potential for occurrence of species identified as endangered, threatened, or species of special concern by USFWS, FGFWFC, TCRPC, FCREPA, and/or Martin County in and along the 19-mile cooling water pipeline ROW located within the existing CSX ROW. Thorough descriptions for these species, which potentially occur in Martin County and surrounding counties and which can occur at the project site, were previously presented in Section 2.3.6. Plant and animal species status listed in that section (Tables 2.3.6-1 and 2.3.6-2) apply, to a degree, to the cooling water pipeline corridor. The natural vegetation community types occurring in the corridor are similar to those occurring at the project site (i.e., pine flatwoods), but most of the corridor consists of ruderal roadside habitat in various stages of succession and maintenance.

The probability of occurrence of threatened and endangered species in the preferred corridor is based on seasonal ground surveys, habitat analyses, and discussions with agency personnel. Due to the high degree of habitat alteration and the disturbance caused by the use of the CSX rail line and adjoining SR 710, there are no records of nesting or breeding occurrences for any threatened or endangered animals in the corridor or its vicinity. Listed species such as herons, egrets, ibis, osprey, and alligator, for example, have been observed along TC/NS on the northernmost end of the ROW. The remaining ROW, offers no suitable habitat for species such as sandhill crane, woodstork, red-cockaded woodpecker, gopher frog, round-tailed muskrat, Sherman's fox squirrel, or Florida mouse.

The vegetation in the corridor is dominated by maintained right-of-way and other ruderal associations. With the exception of narrow wetland zones along watercourses, the corridor contains no mature, unimpacted vegetation communities.

No endangered plant species are known to occur within the corridor. Climbing dayflower may occur along the banks of TC/NS and other canals, creeks, and sloughs connected to Lake Okeechobee that cross the pipeline corridor. This plant is listed as threatened by both FCREPA and FDACS and is under review for federal listing.

6.2.7.4 <u>Other Environmental Features</u>

No additional information is required.

6.2.8 EFFECTS OF RIGHT-OF-WAY PREPARATION AND PIPELINE CONSTRUCTION

6.2.8.1 Construction Techniques

Survey

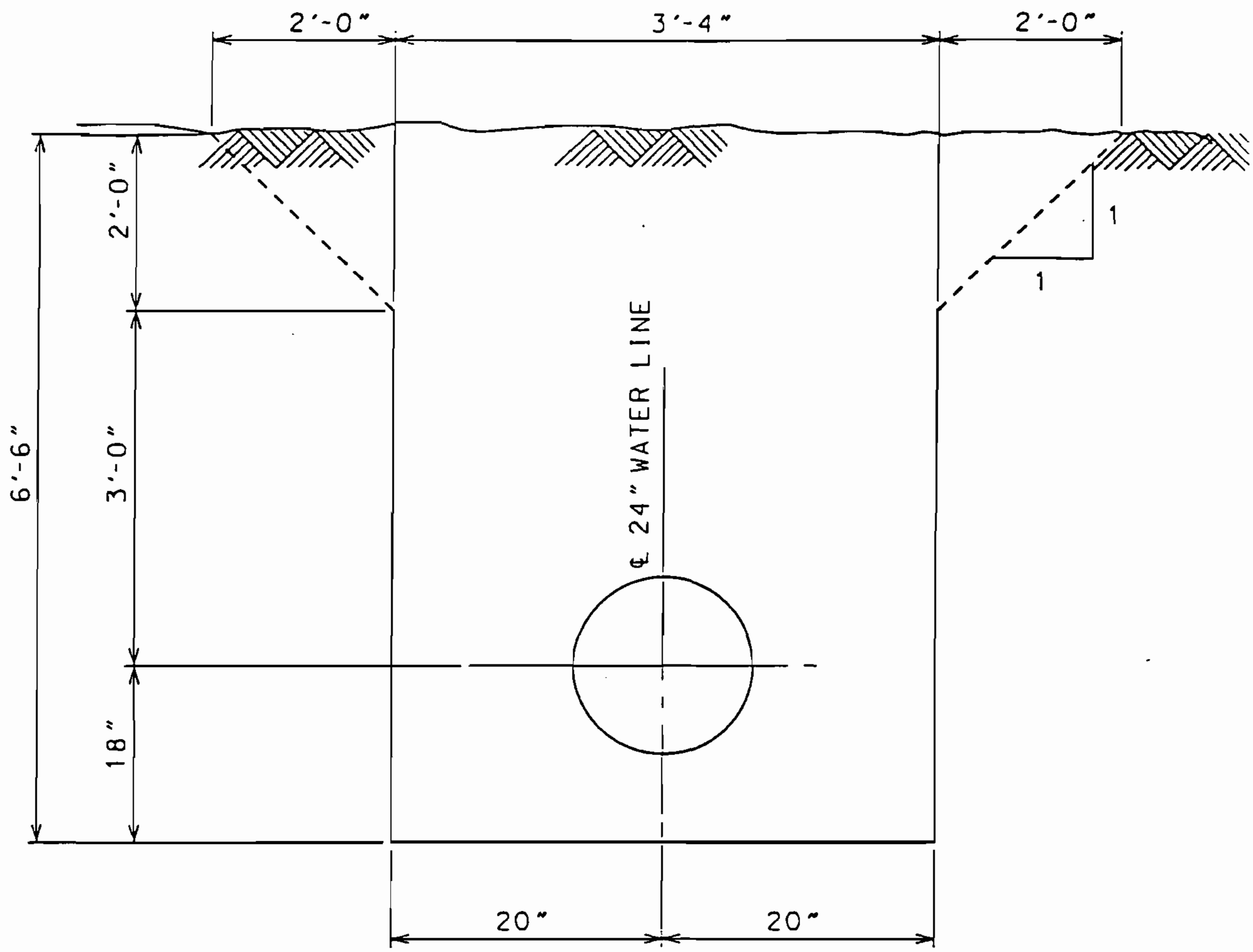
Following CSX approval of the right-of-way (ROW) application, the entire route will be surveyed. The centerline of the pipeline ROW will be marked at about 200-foot intervals.

Right-of-Way Clearing, Grubbing, and Excavation

Prior to clearing, field personnel responsible for clearing activities will be made familiar with conditions of easements, permits, regulatory approvals, and CSX railroad requirements. Clearing will be restricted to those areas within the 50-foot ROW required for ditching, pipe laying, and related activities. Temporary gates and fences will be installed when necessary and removed following construction. The disturbed land surface will be graded, seeded, and returned to its initial contour.

Where clearing of trees and brush will be required, chain saws or bulldozer-type machinery with special cutting blades will be used. Slash and brush will be hauled offsite. Tree stumps and roots will be mechanically removed and disposed of in a similar manner.

The pipe trench will be excavated to a minimum width to provide clearance for the pipe and any buoyancy control devices as needed. Excavation of a minimum of 8 inches on either side of the pipe will be required. A typical trench is shown in Figure 6.2.8-1. A combination of backhoes, clamshells, and draglines will be used. Matting will be used to support heavy machinery in wetlands areas. Temporary ditch crossings for equipment will be provided where necessary.



NOTES:
1. ANY SHORING REQUIREMENT FOR TRENCH DURING CONSTRUCTION WILL BE PROVIDED AS NEEDED.
2. BEDDING AND BACKFILL MATERIAL WILL BE PLACED AND COMPACTED AROUND AND ABOVE THE PIPE.

Figure 6.2.8–1
TYPICAL SECTION OF WATER PIPELINE TRENCH

Source: Bechtel, 1990

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Pipe Installation

Trucks or all-terrain vehicles will be used to transport pipe to the ROW, where the pipe will be placed on the side of the trench. To cross wet areas, pipe will be fitted up on the adjacent ROW and pulled or floated into place. No additional staging areas will be required.

Bending and welding (if required) will take place within the ROW. Welding procedure qualification tests will be conducted in accordance with applicable codes. Welders will be qualified in accordance with applicable codes by completing test welds, using the approved welding procedures. The field weld and adjacent uncoated pipe will be coated with a material that is compatible with the existing coating. After beveling of the existing coating, the bare area will be machine cleaned to remove dirt, rust, etc., to obtain a clean surface for coating.

Construction involves the installation of pipeline segments at a depth of 3 to 5 feet per CSX requirements in the ROW. Bedding materials may be required in the pipeline trench in areas where the bottom is irregularly shaped or where the excavated spoil materials are unacceptable for backfilling around the pipe due to possible coating damage. To protect the pipe in these areas and for support, sand or gravel, crushed rock and screened spoil materials, or a combination of each may be used for bedding. This bedding material will be placed in the bottom of the trench to a minimum depth of 6 inches prior to lowering of the pipe into place.

Only soils excavated from the pipeline trench and imported bedding materials will be used for backfilling; no other soils from the ROW will be used. Soil removed from the trench line will be used to form a slight crown over the trench centerline to compensate for soil settlement. Openings will be left in the completed crown to permit lateral surface drainage.

When backfilling has been completed, accumulated construction debris will be removed from the ROW, and drainage ditches, terraces, roads and fences will be restored to their former condition. Potholes, ruts, and depressions will be filled, and the pipeline ROW will be left in a neat condition. Pipeline markers and warning signs will be erected and maintained at roads, watercourses, and other points in accordance with applicable regulations. All surplus materials and construction equipment will be removed.

Major highways and railroads crossings will be bored and casing installed if required. All crossings will be constructed in accordance with applicable regulations. A minimum of 3 feet of covering will be utilized over the top of the pipe or casing except at water crossings where the pipe is above grade.

On unsurfaced and lightly traveled rural roads, road crossings may be made using open cut, conventional trenching methods (where permitted). Provisions will be made for temporary passage of traffic by either a detour acceptable to jurisdictional agencies, by temporary bridging over the excavated trench, or a combination of both. Detour and warning signs, lights, flagmen, barricades, pilot vehicles, watchmen, and any other features required for maintaining safe passage of traffic will be supplied and maintained as necessary. Construction pipeline crossings, including repair, restoration, and cleanup operations, will be expeditiously conducted in a neat and orderly fashion to minimize any disturbances.

All canal crossings will be installed in accordance with industry practice and applicable regulatory specifications. Continuous concrete-coated pipe, concrete weights placed over the pipe, or screw anchors may be employed to overcome buoyant forces in wet area crossings. Concrete weights will be fabricated by concrete structure manufacturers located near the proposed pipeline route as needed. An acceptable pad will be used to protect the pipe and pipe coating from possible damage. Placement of the weights over the pipe will be accomplished by the use of sidebooms or cranes. Special care will be taken to ensure that no damage is done to the pipe coating. Excavation of the pipeline trench, stream banks, and approaches will be performed by conventional trenching and grading equipment. Siltation from water disturbances will be held to a practical minimum. In addition, the following erosion control measures will be adhered to:

- Ditch and canal crossings will be made as close to perpendicular as possible.

- Cutting of banks and slope approaches will be held to a minimum.

Effort will be made to minimize suspended sediment release into watercourses during trench excavation. Backfill operations will be performed slowly to minimize agitation. In addition, silt curtains will be installed on each side of the ROW during construction to minimize turbidity effects. Pipe trenches at the banks will be backfilled with stable materials immediately after the pipe is laid so as to reduce erosion of fine materials from the trench immediately adjacent to the channel.

Hydrostatic Testing

The hydrostatic testing of the pipeline will be conducted in accordance with the regulations contained in AWWA or applicable ANSI standards. The pipeline will be pressure-tested to substantiate the proposed maximum allowable operating pressure and to locate any leaks. It is proposed that hydrostatic testing be employed with water as the testing medium. Where test sections are continuous, the quantity of water required will be held to a minimum by reusing the water, where feasible, from one tested section to the succeeding test section. The length of the test section will depend on factors such as elevation, availability of water, and scheduling. All manifold valving will have a working pressure, based on the maximum test pressure. The test heads and manifold pipe will be designed and fabricated so that no component will be stressed beyond its safe working strength. Water for this testing will be taken from local streams or trucked in as required.

Squeegees (pigs) will be positioned ahead of, as well as behind, the water fill connection for controlled filling and dewatering. In the filling process, the squeegee will be steadily pushed ahead by the water, forming a seal to eliminate air entrapment.

Erosion Sediment Control Measures

Unless otherwise noted, all management strategies, vegetative practices, and structural erosion and sediment control practices will be developed and maintained according to Florida standards and specifications.

Management Strategies

- Activities will be scheduled to minimize erosion of disturbed areas.
- Excavated areas will not be exposed to construction traffic.
- Protection measures will be implemented to prevent transport into any stream, wetland area, or adjacent storm water management system.
- Stockpiling of excavated material will be away from the wetland areas, and surrounded by silt fence or hay bales.
- Wetland banks and beds will be stabilized after construction.
- Surface areas will be restored to at least original condition.
- The construction superintendent will have overall responsibility for plan implementation. He shall also be responsible for seeing that appropriate construction workers and subcontractors are aware of the provisions of the plan.

Vegetative Practices

- Topsoil Stockpile: Topsoil shall be stripped from areas to be graded, and stockpiled for later use. Stockpile locations shall be approved by the construction superintendent. They will, however, be placed away from wetland areas and contained by structural measures (i.e., silt fencing or hay bales), as determined by the construction superintendent.

- <u>Seeding</u>: After construction is complete any previously vegetated areas will be established by seeding with an approved mixture.

Structural Practices

- <u>Silt Fencing</u>: Silt fencing will be utilized in areas of high sediment transport potential. In general, fencing will be used to protect adjacent properties. It can be placed along the run of construction utilizing a minimum of space. Fencing can also be reused along the route, if properly maintained. Essentially, as a pipeline segment is excavated silt fencing is placed along the outside of the work area (See Figure 3.8.4-7). This creates an enclosed and controllable area.

  Silt fence construction will be held to the following guidelines:
  - The height of a silt fence shall not exceed 36 inches (higher fences may impound volumes of water sufficient to cause failure of the structure).
  - The filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter cloth shall be spliced together only at a support post, with a minimum 6-inch overlap, and securely sealed.
  - Posts shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground (minimum of 12 inches). When extra strength fabric is used without the wire support fence, post spacing shall not exceed 6 feet.
  - A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of posts and upslope from the barrier.
  - When standard strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least 1 inch long, tie wires, or hog rings. The wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.

- The standard strength filter fabric shall be stapled or wired to the fence, and 8 inches of the fabric shall be extended into the trench. The fabric shall not extend more than 36 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.
- When extra strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts with all other provisions of the item above applying.
- The trench shall be backfilled and the soil compacted over the filter fabric.
- Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.
- Post of silt fences shall be either 4-inch diameter wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet. Steel posts shall have projections for fastening wire to them.
- Wire fence reinforcement for silt fences using standard strength filter cloth shall be a minimum of 42 inches in height, a minimum of 14 gauge and shall have a maximum mesh spacing of 6 inches.

Dewatering During Construction

During construction it will probably be necessary to remove groundwater from inside the work area. That water will be pumped out of the excavation and diverted through a hay bale filter into the existing stream down slope of the activity.

Construction Monitoring and Maintenance

In general, all erosion and sediment control measures will be checked weekly and after each significant rainfall. The following items will be checked in particular:

- All seeded areas will be checked regularly to see that a good stand is maintained. Areas shall be fertilized and reseeded as needed.
- Silt fences and filter barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.
- Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.
- Sediment deposits should be removed after heavy storm events. They must be removed when deposits reach approximately one-half the height of the barrier.
- Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, prepared, and seeded.

Permanent Stabilization

Prior to removal of the lateral silt fencing, the pipeline trench will be backfilled, compacted, graded over, and vegetation re-established. All vegetated areas will be re-established and stabilized by an approved seeding mixture.

6.2.8.2 Impact on Water Bodies and Uses

For almost the entire run of the pipeline from the Taylor Creek/Nubbin Slough to the project site, the pipeline will be located underground and in the CSX ROW, approximately parallel to and (±) 18 feet to the south of the center line of the railroad track. Except for the crossings at existing creeks, sloughs, and ditches, as shown on Figure 6.2.8-2 and listed in Table 6.2.8-1, the pipeline will be entirely located in an area where it will not impact any waters of the state. Further, depending on the width of the creek being crossed, the pipeline at most locations will either be supported from existing railroad bridges in accordance with the requirements of the CSX railroad or from new supports placed on either side of the creek away from the shoreline (Figure 6.2.8-3). However, some of the large pipe spans over streams such as Nubbins Slough, Henry Creek, and Lettuce Creek may require the addition of a pre-cast pile support(s) to be placed in the stream. During the design phase of the project, the option of using the railroad bridges to support the pipe will be analyzed. If the bridges are suitable and CSX agrees with the approach, these mid-stream supports may be eliminated. Since with these types of crossings the pipeline will remain above the waterline of the creeks which are not navigable, the impact on the quality and quantity of the water will be precluded. In addition, the pipe crossing will not affect the water level in the creeks crossed by the pipeline.

At a location south of Myrtle Slough, the pipeline will be traversing the edge of an elongated swamp. Since the length of the swamp parallel to the pipe run is sufficiently large, it will require an additional intermediate support in the middle of the water crossing as shown in Figure 6.2.8-3. This support will be a 12-inch diameter round pre-cast concrete pile driven into the ground. Considering the size of the proposed support and its location (i.e., close to the edge of existing railroad), it is determined that this structure will have an insignificant impact on the existing swamp. The proposed construction will not require any dredging or building of cofferdams in the existing water body and will be made from the railroad ROW.

6.2.8.3 <u>Solid Wastes</u>

Construction solid wastes such as trees, tree stumps, roots, etc., will be minimal and will be hauled offsite to an approved landfill.

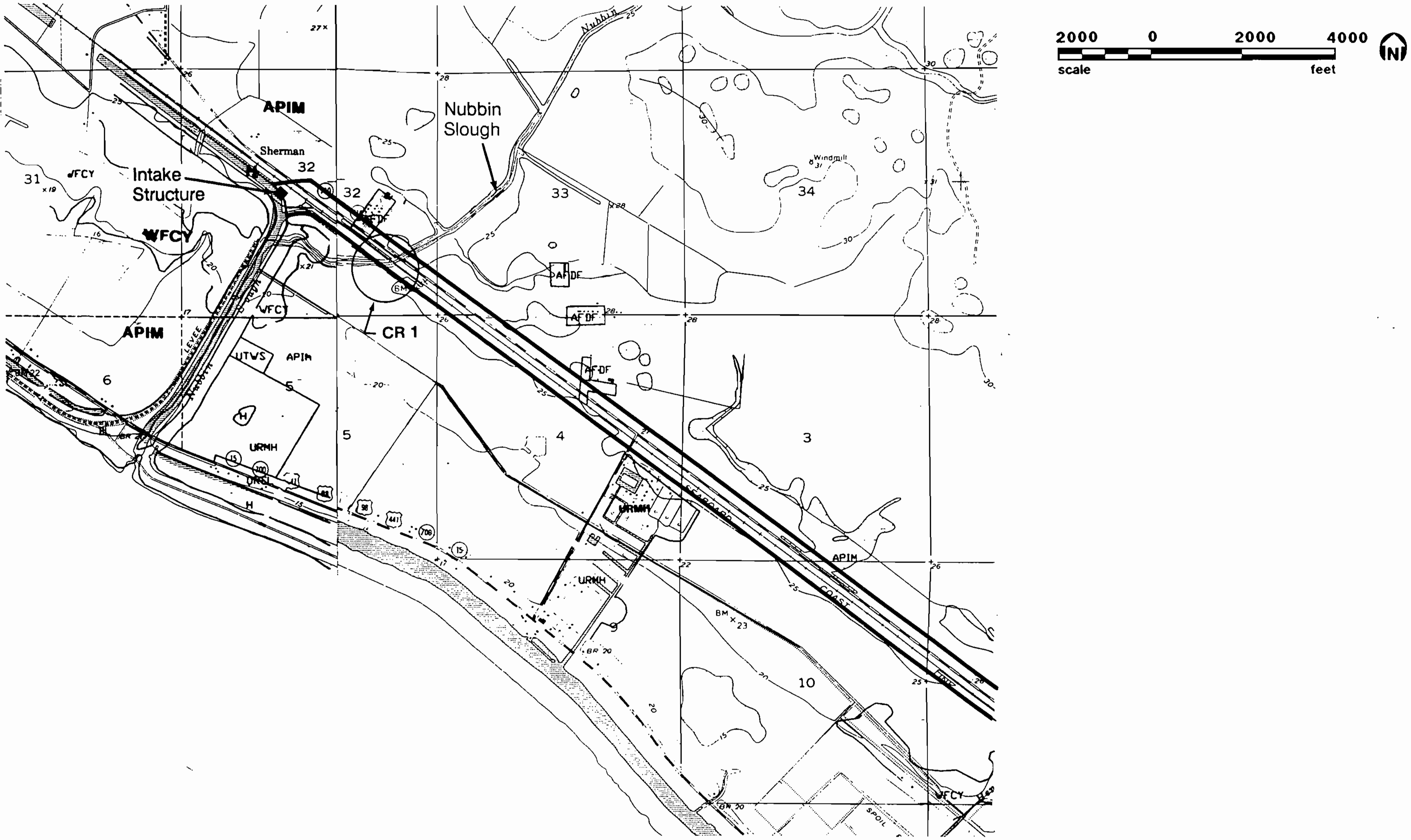

Figure 6.2.8-2. (Page 1 of 5)

ROUTING OF WATER PIPELINE

LEGEND:

Corridor Containing CSX ROW

CR __ Pipeline Crossing No.

Pipeline routed parallel to and approximately 18 feet from ℄ of railroad track on the south side.

Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

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Figure 6.2.8-2. (Page 2 of 5)

ROUTING OF WATER PIPELINE

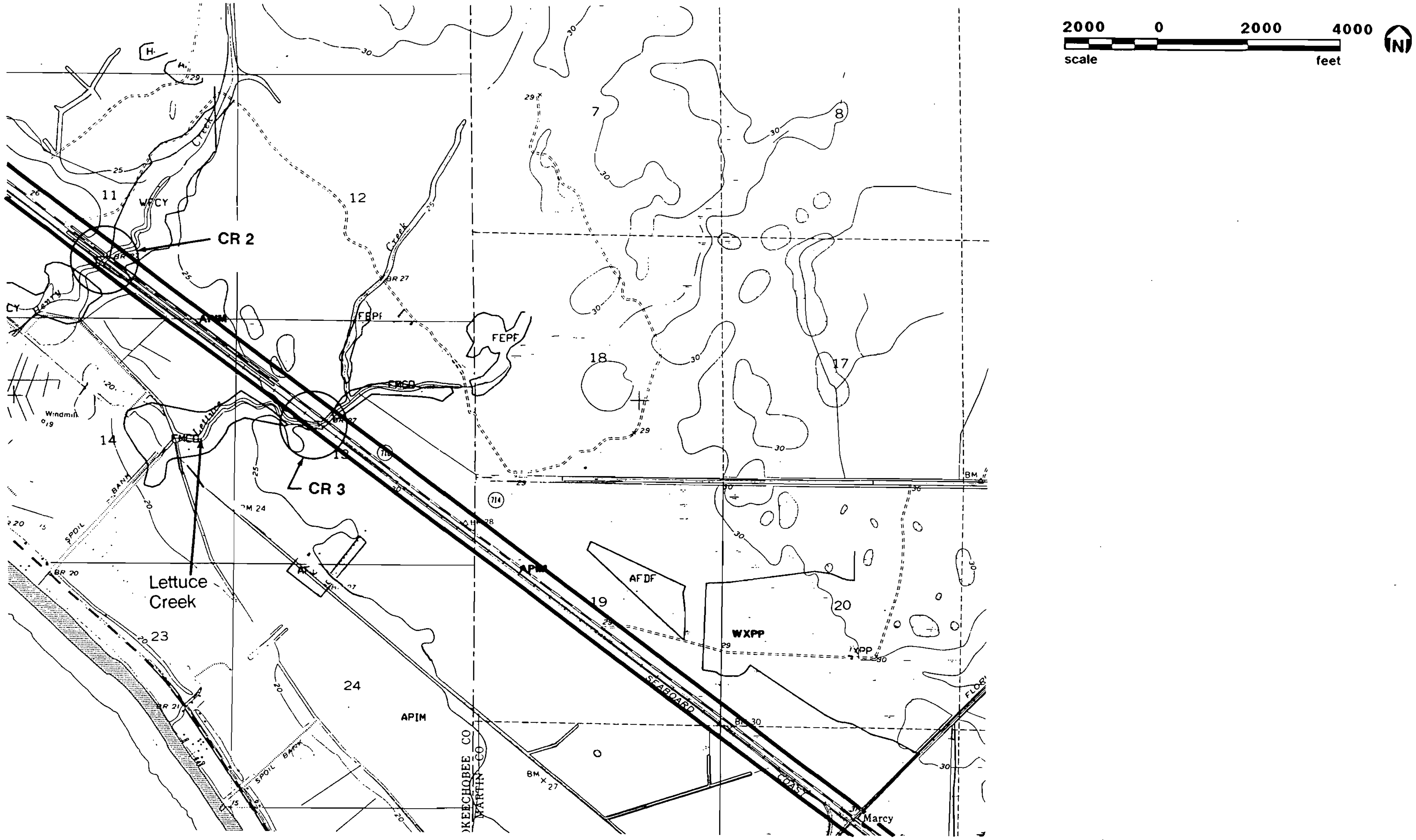

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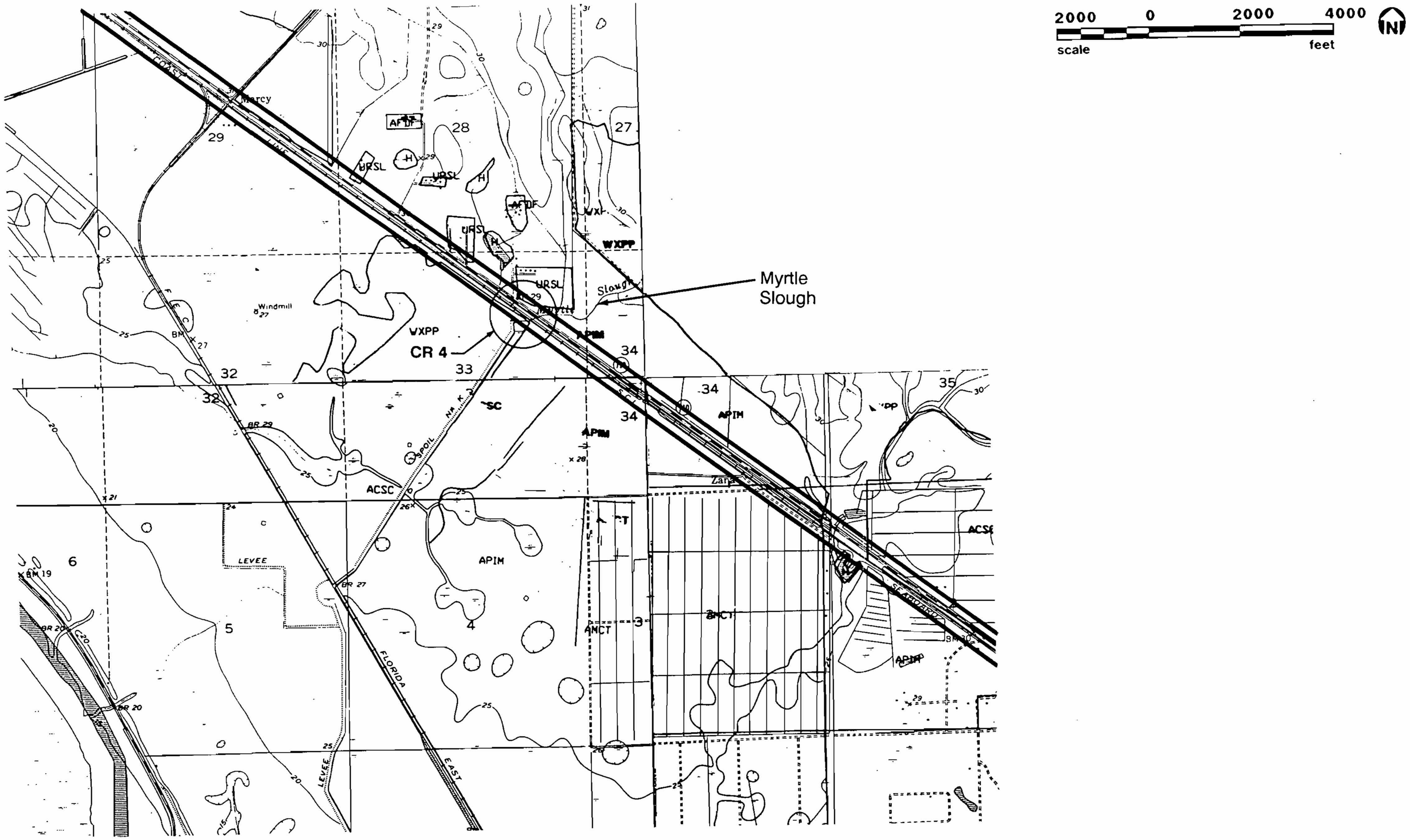
Figure 6.2.8-2. (Page 3 of 5)

ROUTING OF WATER PIPELINE



LEGEND:

Corridor Containing CSX ROW

CR __ Pipeline Crossing No.

Pipeline routed parallel to and approximately 18 feet from ℄ of railroad track on the south side.

Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Figure 6.2.8-2. (Page 4 of 5)

ROUTING OF WATER PIPELINE

LEGEND:

Corridor Containing CSX ROW

CR __ Pipeline Crossing No.

Pipeline routed parallel to and approximately 18 feet from ℄ of railroad track on the south side.

Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

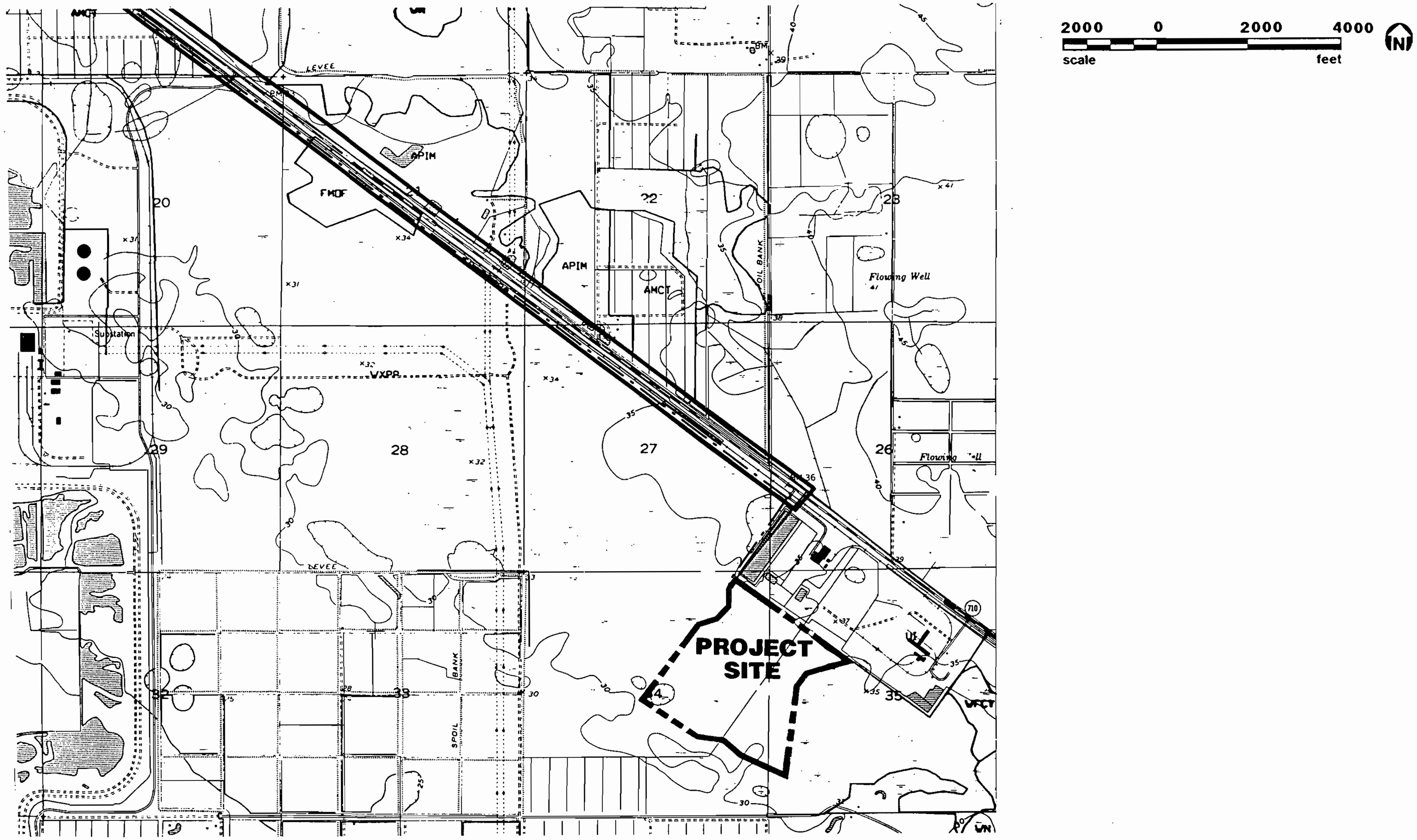


Figure 6.2.8-2. (Page 5 of 5)

ROUTING OF WATER PIPELINE

LEGEND:

Corridor Containing CSX ROW

CR __ Pipeline Crossing No.

Pipeline routed parallel to and approximately 18 feet from ℄ of railroad track on the south side.

Sources: USGS, 1983. SFWMD, 1986. ECT, 1990.

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

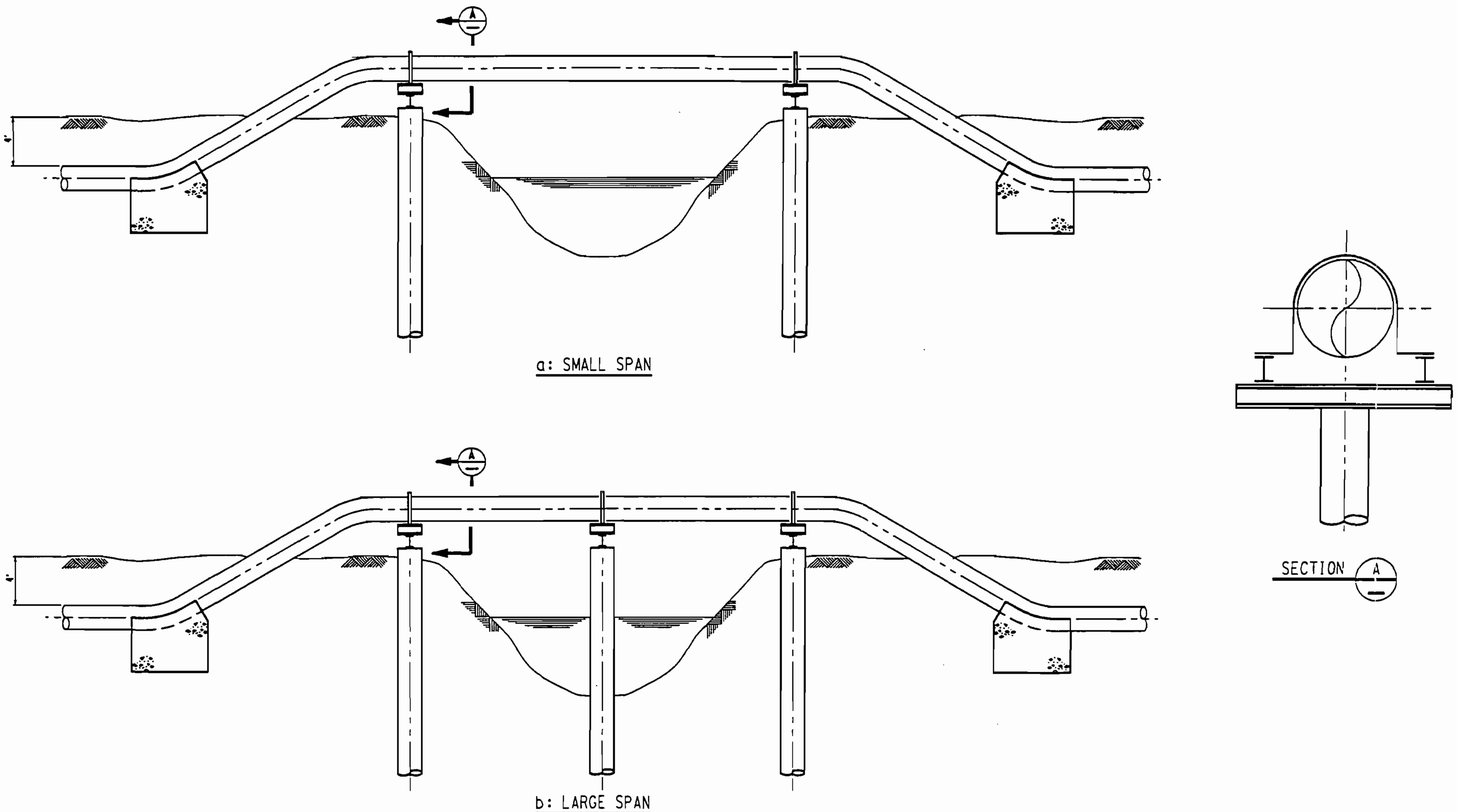


Figure 6.2.8-3.

PIPELINE SUPPORT OVER WATERCROSSINGS

Source: Bechtel, 1990

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

Table 6.2.8-1
LIST OF PIPELINE CROSSINGS

CROSSING NO.	CROSSING DESCRIPTION	RAILROAD MARKER	WIDTH OF CROSSING	CROSSING DETAILS
1	Nubbin Slough	915.0	93 ft.	Fig. 6.2.8-3
2	Henry Creek	918.3	129 ft.	Fig. 6.2.8-3
3	Lettuce Creek	919.7	100 ft.	Fig. 6.2.8-3
4	Myrtle Slough	923.7	26 ft.	Fig. 6.2.8-3
5	Swamp	927.0		Fig. 6.2.8-3
6	BR-34 (*)	928.3	34 ft.	Fig. 6.2.8-3

(*) Per USGS 4SE Quadrangle 7.5 minute series.

Note: For crossing number, see Figure 6.2.8-2.

6.2.8.4 <u>Changes to Vegetation, Wildlife, and Aquatic Life</u>

No significant permanent changes to animal and plant populations are expected. Most of the area around the corridor is currently in open land, as a result of the land being maintained in an early ecological successional state as part of the railroad ROW. Following construction, vegetation in these open areas, including wetlands, will be allowed to return to its original condition.

Forested areas, such as pine flatwoods, will be cleared only as required for construction.

No threatened and endangered animals or endangered plant species are known to occur in the area. No mitigation measures are planned beyond environmental protection procedures implemented during construction.

6.2.8.5 <u>Impact on Human Populations</u>

Construction will begin once final regulatory approval has been received, and is expected to take about 6 months to complete.

Population density in the vicinity of the proposed pipeline corridor is generally sparse. The impact of the pipeline on the surrounding human population will be negligible. The use of existing ROW and the short duration of construction activities will minimize any inconvenience which might occur.

6.2.8.6 <u>Impact on Regional Scenic, Cultural, and Natural Landmarks</u>

There are no areas identified in Section 6.2.6.1 as being valued specifically for their scenic, cultural, or natural significance within the proposed pipeline corridor; therefore, no impact needs to be assessed.

6.2.8.7 Impact on Archeological and Historic Sites

No archaeological or historic resources were previously listed along the section of the CSX ROW where the water pipeline will be constructed (see Section 10.8). In addition, no archaeological or historic resources eligible for inclusion in the National Register of Historic Places were found during research and field assessment. Therefore, activities involved with the construction of the pipeline should have no impact on significant archaeological or historic resources.

Should construction activities cause the discovery of unanticipated archaeological materials, those activities which potentially would disturb such materials will be postponed until a professional archaeologist can evaluate their potential significance. In the event the materials are believed to be significant, the State Historic Preservation Office (SHPO) will be contacted to identify appropriate measures.

6.2.9 POST-CONSTRUCTION IMPACTS AND EFFECTS OF MAINTENANCE

6.2.9.1 Maintenance Techniques

The pipeline is to be constructed in the CSX right-of-way (ROW), therefore, no additional maintenance techniques are proposed beyond current maintenance procedures.

6.2.9.2 Multiple Uses

No multiple or joint uses, such as agriculture, are proposed for the lands within the CSX ROW, the proposed location of the ICL pipeline. Other linear facilities, such as optical fiber telephone lines, have been installed in this ROW. Use of this ROW is controlled by CSX.

6.2.9.3 Changes in Species Populations

The status and potential for occurrence of important species in and along the proposed pipeline ROW was discussed in Section 6.2.7. The avoidance of ecologically unique or valuable habitats was achieved through collocation of the pipeline with the existing CSX railroad ROW.

Changes in local species populations are not expected as a result of the pipeline presence and maintenance. Displacement of individuals from the immediate ROW area which might occur as a result of construction activities would be temporary. These displaced species are expected to re-inhabit or repopulate the ROW area. No animal or plant species is expected to be permanently displaced out of the project area as a result of construction in the pipeline ROW and subsequent maintenance. In a short time, ground cover over the disturbed land will be indistinguishable from surrounding vegetation except for those small areas that are forested. Here, a decrease in structural diversity (loss of canopy trees) will occur; however, due to collocation with the CSX ROW, only a narrow strip of canopy will be lost. In these areas, clearing of overstory vegetation will not result in the loss of significant portions of regional wildlife habitat types.

No threatened or endangered plants or animals are known to require land included within the pipeline ROW. The current land use as ROW for the CSX railroad has resulted in habitat types poorly suited for habitation by such species. In summary, there are expected to be no measurable changes to populations of important species after construction or as a result of maintenance activities.

6.2.9.4 Effects of Public Access

No additional public access roads are proposed as part of the pipeline corridor. Therefore, no additional exposure to the public by wildlife should result as part of maintenance of the pipeline corridor.

6.2.10 OTHER POST-CONSTRUCTION EFFECTS

Because the proposed pipeline will be buried underground, no additional post-construction effects are expected.

REFERENCES

Section 6.2.6

Martin County Growth Management Department. Martin County Comprehensive Growth Management Plan (Adopted). 1990.

Piper Archaeological Research, Inc. Cultural Resource Assessment Survey of the Proposed Martin County Power Plant Site and Pipeline Right-of-Way, Martin County, Florida. (SCA Section 10.8). 1990.

Section 6.2.8

Piper Archaeological Research, Inc. Cultural Resource Assessment Survey of the Proposed Martin County Power Plant Site and Pipeline Right-of-Way. Martin County, Florida.(SCA Section 10.8). 1990.

7.0 ECONOMIC AND SOCIAL EFFECTS OF PROJECT CONSTRUCTION AND OPERATION

The development of the ICL project will have overall beneficial economic effects on Martin County, the surrounding region, and statewide. ICL will actively encourage the hiring of all operational employees from the local area or the relocation of new employees within Martin County. As such, operational-related economic and social effects are expected to be concentrated within Martin County. Construction-related economic and social effects are expected to be more widely distributed over a larger geographic area, due to the commuting nature of construction workers. This area may include Martin, Okeechobee, St. Lucie, and Palm Beach Counties, as well as the Fort Lauderdale and Miami metropolitan areas.

Any potential socioeconomic effects created by the development of the ICL site would primarily be the result of any population growth due to the construction and operations workers involved in the project. Discussions of the benefits and costs of the construction-related activities are found in Sections 7.1.1 and 7.2.1, respectively; discussions of the benefits and costs of the operational-related activities and workforce are found in Sections 7.1.2 and 7.2.2, respectively.

The projected size of the construction workforce, as previously described in Section 4.6.2, is expected to reach a peak of 800 individuals for 4 to 6 months during the third year of construction. The projected operational workforce is expected to total 80 persons. These operational workers will be employed after the construction is complete and startup of the unit is commenced which is expected in July 1995. The plant is expected to be placed in service in December 1995. The employment positions generated by the operation of the ICL plant will also create indirect positions required to service and support the direct operational workers.

The anticipated population growth resulting from the employment of the construction and operational workforce will have positive and, to a lesser extent, negative effects on the socioeconomic character of Martin County and the surrounding region. The positive impacts will include the additional payroll generated by these new employment positions and additional revenues generated by the taxes levied on capital investment in the plant and additional expenditures in the region.

The potential negative effects resulting from the construction and operation of the ICL plant revolve around any potential need to expand infrastructure and public services for this population. Elements of infrastructure typically include roads, parks, public landfills and solid waste management services, gas and electric utilities, potable water supply, and domestic wastewater treatment facilities. Public services which may be affected could include police and fire protection, education, and medical services.

The local supply of housing is another socioeconomic characteristic which may be impacted by the additional population. However, the potential effects on community services and housing are expected primarily to be involved with the long-term timeframe associated with the operation of the facility. Because of the commuting nature of the construction workforce, very few permanent relocations are anticipated during the construction period. Therefore, significant new residential construction and increased demands on the existing infrastructure and public services to support the construction workforce are not expected.

The following assumptions were made for the analysis of potential impacts caused by the construction and operation of the ICL plant:

- Most of the construction workers are expected to commute daily from their current residences. It is not uncommon for construction workers to commute up to 100 miles one-way, as opposed to relocating closer to the site. This 100-mile commuting distance therefore includes the urbanized areas of Miami, Fort Lauderdale, and West Palm Beach. This construction workforce is characterized by those specialized craftsmen, technicians, and construction workers typically involved in the construction of power plants. Some workers may be expected to temporarily relocate (i.e., during weekdays only), without families, to available rental housing and mobile home units within the Martin County and surrounding region.

- For this analysis, it is assumed that all of the 80 projected operational workers are assumed to relocate to Martin County. ICL will actively encourage any employees hired from outside the county to relocate to the local area.

- Since ICL will actively encourage the hiring of local residents to the extent possible, it is likely that some of the 80 direct jobs will be filled by persons who currently live and work in Martin County. However, because these individuals are most likely currently employed in Martin County and will vacate existing positions for employment at the ICL plant. It is assumed that newcomers will fill those vacated positions. Therefore, the assumption that 80 positions will be filled by newcomers remains unaffected. In the event that new positions are filled by local residents that are currently unemployed, this assumption will slightly overstate the number of newcomers required to fill all positions.

- It is assumed that all indirect employment, or those positions in the service industry created to support the project-related workforce, will be filled by workers who migrate to the area. This assumption is validated by the historical pattern of in-migration accounting for 100 percent of the region's population growth (Bureau of Economic and Business Research, 1988). In the event that these indirect jobs are filled by local residents that are currently unemployed, this assumption will again overstate the number of newcomers to the area.

- The final assumption is that the average household of in-migrating workers will equal the statewide average of 2.47 persons per household, with 0.9 children per household (U.S. Department of Commerce, 1988). It is also assumed that 75 percent of the children are of school age.

7.1 SOCIOECONOMIC BENEFITS

A primary benefit resulting from the ICL facility will be the provision of a new, efficient, and reliable energy source. In addition to the provision of energy, the implementation of the ICL power plant will provide temporary economic benefits during construction and long-term benefits during its operation to the local, regional, and statewide economics.

Section 7.1.1 discusses the temporary benefits associated with construction, which may include the direct benefits of the employment and payrolls, and indirect benefits such as increased rent payments, spending within local and regional economies, and additional revenues generated through sales taxes.

Section 7.1.2 discusses the long-term benefits associated with the operation of the ICL facility. These benefits are expected to include increased employment and payrolls, and greater revenue sources through property and ad valorem taxes, and also through impact fees, primarily in Martin County. Some of these operational-related positive impacts are single-event benefits that will not accumulate over time, such as impact fees, while others, such as property taxes, will be cumulative over the 30-year life of the project.

7.1.1 CONSTRUCTION-RELATED BENEFITS

Socioeconomic benefits anticipated within Martin County and the surrounding region as related to the construction of the ICL facility include additional employment and payrolls, additional rents and increased levels of spending, and additional sales tax revenues on localized spending and investment in construction supplies and materials.

Based on the size of the available workforce in the region (i.e., within a 100-mile commuting distance), most of the construction workers for the project are expected to commute daily from their current residences. Therefore, any relocation of construction workers to Martin County and the region is expected to be minimal, and any population growth and resulting demands on public services in the region during the construction activities are also expected to be minimal.

This anticipated commuting and non-relocation pattern will result in minimizing any potential negative socioeconomic effects of the ICL project from direct and indirect population growth in the region during construction. However, the project construction activities will have positive effects on the local and regional economies by providing employment opportunities and associated payrolls which will maintain or increase (i.e., to the extent unemployed workers are hired) spending levels in Martin County and the region. The Martin County, regional, and statewide economies will also benefit from the purchase of supplies, materials, and services required for the construction of the project.

Table 7.1.1-1 provides the estimated number of direct employment positions created due to the construction of the ICL plant and annual payrolls. The construction payroll is estimated to be as large as $17.7 million during the third year of construction. This was determined by multiplying the projected number of employees by the total work hours in a year based on a 40-hour work week (2,080 hours), and multiplying that by the average heavy construction wage of $14.21 as reported to the Florida Department of Labor and Employment Security

Table 7.1.1-1
ESTIMATED NUMBER OF DIRECT CONSTRUCTION EMPLOYMENT POSITIONS AND ANNUAL PAYROLLS (IN 1989 DOLLARS) DURING THE CONSTRUCTION OF THE ICL PROJECT

Construction Period	Average Annual Construction Jobs	Change from Previous Year	Construction Payroll
7/92 - 12/92	200	+200	$2,955,680
12/92 - 12/93	400	+200	$11,822,720
12/93 - 12/94	600	+200	$17,734,080
12/94 - 12/95	200	-400	$5,911,360
12/95 - 12/96	0	-200	0
TOTAL	--	--	$38,423,840

Sources: Bechtel, 1990.
Florida Department of Labor and Employment Security, 1990.
ECT, 1990.

for 1989. Over the 4 years of construction, the total estimated payroll is $38 million.

The construction-related workforce is also expected to create indirect economic benefits to the region through those individuals that temporarily relocate closer to the ICL site during weekdays. These individuals will create positive economic impacts through rental payments for housing, such as multi-family and mobile home units, or recreational vehicle lots. Since a few individuals may permanently relocate during construction, potential benefits may also be created by mobile home or single-family home purchases. The existing housing stock within the region is adequate to meet the needs of the few expected permanent relocations. Therefore, additional revenues in the form of ad valorem taxes and impact fees for new residential development are expected to be minimal.

The construction workers commuting through the local area and those who temporarily live in the region during the weekdays should also increase levels of spending at retail establishments in the region. This potential increase in spending will generate additional revenues to Martin and surrounding counties and the state through sales and gasoline taxes.

Additional sales taxes will also be generated in the region and statewide from projected investment in construction materials and supplies. Anticipated expenditures totaling $4,264,215 for construction materials are estimated within the local area, equating to a total $255,600 in sales taxes. The use of heavy equipment for construction of the facility will also generate a personal property tax of approximately $158,000 per year of construction.

7.1.2 OPERATIONAL-RELATED BENEFITS

Socioeconomic benefits resulting from the operation of the ICL power plant are expected to take the form of additional employment and payroll; additional revenues from the capital investment in the plant facilities, land, and heavy equipment; additional ad valorem taxes associated with the anticipated residential relocations; and impact fees collected for the development of the ICL facility and for potential new residences associated with the anticipated relocations. These economic benefits are expected to occur primarily in Martin County.

The operational workforce will be 80 employees. Of this permanent operational workforce, 65 are expected to be employed during the weekdays, distributed in three shifts. The day shift, working 7 a.m. to 4 p.m., will be the largest and is expected to total 45 persons, with the remaining 20 individuals equally divided between evening and night shifts. The other 15 employees will work weekends, also divided in three shifts.

Table 7.1.2-1 contains the estimated annual payroll for the employees directly involved in the operation of the ICL facility. This estimate is based on the 1989 annual average salary of $28,687 for all workers listed under the category of transportation, communication, and public utilities in Martin County by the Florida Department of Labor and Employment Security (FDLES, 1990). The estimated operational-related payroll for the ICL facility is therefore projected to be approximately $2.3 million annually in 1989 dollars. Assuming that the operational wages remain constant in 1989 dollars, a total of $68.8 million in direct wages would be generated as a long-term cumulative benefit primarily to Martin County over the 30-year life of the facility. The total number of operational workers is predicted to remain constant throughout the life expectancy of the project. Therefore, this estimated payroll is also predicted to remain relatively constant, with respective increases due to inflation and cost-of-living increases.

Table 7.1.2-1
ESTIMATED NUMBER OF DIRECT AND INDIRECT OPERATIONAL-RELATED EMPLOYMENT POSITIONS AND ANNUAL PAYROLLS (IN 1989 DOLLARS) CREATED BY THE OPERATION OF THE ICL PROJECT IN MARTIN COUNTY

Operational Period	Operational Jobs	Indirect Jobs (1.93 multiplier)	Operational Payroll	Indirect Payroll	Total
Annual	80	155	$ 2,294,960	$ 2,986,400	$ 5,281,360
Cumulative (over 30-year life)	--	--	$68,848,800	$89,592,000	$158,440,800

Sources: Bechtel, 1990.
Florida Department of Labor and Employment Security, 1990.
ECT, 1990.

The total estimated annual payroll for the 155 indirect jobs created by the operational workforce is also shown on Table 7.1.2-1, and is estimated to be approximately $3.0 million annually. This estimate was first calculated by multiplying the projected 80 operational employees by a 1.93 indirect multiplier as used in the U.S. Department of Commerce, Bureau of Economic Analysis RIMS II economic model to determine the estimated indirect employment positions (U.S. Department of Commerce, 1989). This estimate of indirect employment was then multiplied by the average annual 1989 wage for all industries in Martin County as reported to the Florida Department of Labor and Employment Security ($19,267). Assuming that the indirect wages remain constant at 1989 levels, total long-term economic benefits of $89.6 million in wages would be generated over the life of the facility.

Operation of the ICL project is also expected to generate considerable public revenues in Martin County. These revenues are expected to be generated in the form of additional property taxes levied on the ICL facility once it is fully improved, ad valorem taxes levied against home purchases made by operational employees relocating to the area, and impact fees paid to develop the ICL facility and for new home purchases. The total projected revenues for Martin County in 1996, the first year of plant operation, are shown in Table 7.1.2-2.

The largest source of revenue generated by the ICL facility will be through property taxes levied against the property and facilities once fully improved and operational. As shown in Table 7.1.2-2, using the 1989 millage rate applied to a capital investment forecasted in 1996 dollrs, an estimated $4.0 million in property taxes will be paid to Martin County annually in 1996 dollars by ICL. The revenues generated through property taxes will be cumulative. Over the 30-year life of the project (based on 1996 dollars and 1989 millage rate), the ICL facility itself would generate approximately $120.0 million in property tax revenues to Martin County.

Additional revenues for Martin County will also be generated from residential property taxes. Based on the assumption that all operational workers will purchase

Table 7.1.2-2
PROJECTED PUBLIC REVENUES IN MARTIN COUNTY IN 1996 ASSOCIATED WITH THE ICL PROJECT (1996 DOLLARS)

Revenue Source	1996
Property tax[1]--plant facilities	4,000,000
Impact fees[2]--plant facilities (combined county-wide average)	28,770
Residential ad valorem taxes[3] (operational employees)	137,824[6]
Residential ad valorem taxes[3] (indirect employment)	56,625[6]
State revenue sharing[4] ($80.84 per capita)	12,530
State educational funds[5] ($1,087 per full-time equivalent student)	173,920
Impact fees--new residential development from operational workforce home purchases (road impact fee portion of total represents a per-dwelling unit county-wide average)	73,680
TOTAL	**4,483,349**

Note: [1]Cumulative value of capital investment.
[2]Calculated at build-out.
[3]1989 millage rates.
[4]Florida Department of Banking and Finance, 1990.
[5]Calculated for 160 students.
[6]Values escalated 5 percent annually for estimated 1996 values. Millage rates, impact fee rates, revenue sharing, and educational funds were assumed to be constant at 1989 rates.

Sources: ICL, 1990.
ECT, 1990.

a home instead of renting, and using the assumption that the residences purchased will be new homes, an estimated 80 new home purchases may occur in Martin County. If this occurs, the estimated residential property tax revenues generated within Martin County is shown in Table 7.1.2-2. Because it is assumed that all operational employees will purchase a new home, the figures shown in Table 7.1.2-2 represent the maximum tax benefit. The potential residential property tax revenues are calculated by using the estimated 1996 selling price less a $25,000 homestead exemption and Martin County's 1989 millage rates. The estimated residential values were calculated for 1996 using a 5 percent annual escalation rate applied towards the average 1989 home value. The total annual property tax revenue for Martin County is estimated to be approximately $138,000 for the direct employees associated with the operation of the ICL project.

Since ICL will encourage the operational workforce to be hired from or relocate to Martin County, it is reasonable to assume that population growth resulting from new indirect service jobs created to support the operational employees and their families will also occur in Martin County. Based on 1989 Florida Department of Labor and Employment Security data, lower annual incomes are typical for retail or service-related occupations. Due to estimated lower incomes for this indirect population, it is likely that a lower percentage would be able to afford new homes. Data from the Bureau of the Census and U.S. Department of Housing and Urban Development's Annual Housing Survey for Florida Households (Bureau of Economic and Business Research, 1988) indicates that 55 percent of those individuals earning between $10,000 and $19,888 annually live in owner-occupied homes. The remaining 45 percent of these individuals within this income range occupy rental units. Table 7.1.2-2 shows the predicted tax revenues to be generated by those indirect employees purchasing homes, as based on the assumption of 55-percent owner-occupied households. The total property tax revenues generated within Martin County from indirect employment is estimated to be $56,625. This is based on 1989 existing market home values escalated 5 percent annually to an average 1996 home value.

Impact fees are assessed by local governments to offset the costs of providing additional capital facilities and public services such as roads, parks, and police and fire services as necessitated by new developments. Industrial development, such as the ICL facility, is subject to both road and public facility impact fees in Martin County. As shown in Table 7.1.2-2, the total impact fee on the plant facilities collected by Martin County is $28,770, using a constant 1989 impact fee rate. The estimated road impact fee generated by the development of the ICL facility is $25,240, and the estimated public facilities impact fees generated by the ICL facility is $3,530.

Impact fees within Martin County are also assessed against residential developments, and include a park impact fee in addition to the road and public capital facilities impact fees. Because it is estimated that all of the direct employment population will in-migrate to the area, impact fees from new residential development attributable to the project-related population growth can be calculated. A total of $73,680 in impact fees is estimated to be generated by residential development as related to the ICL plant, as shown in Table 7.1.2-2. This impact fee calculation assumed 1989 rates would remain constant. This total is estimated to be broken down as follows: $50,160 in road impact fees, $15,200 in public capital facilities impact fees, and $8,320 in park impact fees. These projected residential impact fees related to operational workforce relocations would be single-event economic benefits that would not reoccur over the life of the facilities.

Table 7.1.2-2 also summarizes several other sources of increased revenues to Martin County. These other revenues include shared state revenues and education funds. Local school districts receive state educational funds which are distributed based on population and need. Jurisdictional need for funds is determined by the student population and by availability of local revenues from ad valorem taxes and impact fees. For the 1989-1990 school year, Martin County received $1,087 per full-time equivalent student (Martin County School Board, 1990). The additional revenues generated by new student population attributable to the ICL project is shown on Table 7.1.2-2.

7.1.3 OTHER BENEFITS

Another economic benefit of cogeneration is the production of waste steam as a supplementary source of energy for a secondary user. A significant rationale for siting the ICL plant in this particular location is because of the cogeneration opportunities available, due to the proximity of the Caulkins Citrus processing plant. Excess steam is expected to be sold to the Caulkins facility as a source of energy, thus offsetting a portion of the facility's energy requirements.

7.2 SOCIOECONOMIC COSTS

It is projected that both short- and long-term socioeconomic costs associated with the ICL facility will not be significant and will be offset by the anticipated project benefits. These projected benefits are expected to come in the form of additional payrolls due to the related population growth, enhanced tax base, and increased revenues, primarily within Martin County.

As previously described in Section 5.11.3, the ICL site is currently used for limited cattle grazing purposes. This is the only land use that will be displaced due to the proposed power plant development, and is not expected to represent a significant economic loss to Martin County, or the region in general.

Section 7.2.1 discusses the temporary costs associated with the construction of the ICL facility. Section 7.2.2 addresses the long-term costs primarily associated with the operation of the plant. These costs are primarily confined to offsite considerations associated with the projected population growth due to in-migration, and the movement of the workforce, materials, and machinery. Some of these long-term operational-related economic costs are considered to be single-event impacts that will only initially occur upon completion of the ICL facility.

These initial, single-event impacts may include any required expansions to roadways and recreational areas. The long-term operational-related costs associated with educational and public services represent initial expansions to support the operational workforce and their families. However, once the additional manpower has been incorporated, those associated additional costs will remain constant, and the expanded employment will be absorbed in the existing workforce.

Section 7.3 compares the benefits and costs within Martin County and is primarily concerned with comparing the projected additional costs of providing the necessary services required to support the project-related population growth, to the additional revenues generated by the development of the project.

7.2.1 TEMPORARY EXTERNAL COSTS

Temporary external costs are those costs impacting persons and local governments within the defined region of influence. In this analysis, the term temporary is defined as the 42-month period during which construction takes place, from July 1992 to December 1995.

Construction is anticipated to commence in July 1992, with an estimated workforce of 200. During the first year and a half of the construction schedule, the activities anticipated will include heavy civil engineering and construction work which will include clearing and grubbing existing vegetation, hauling fill material, and pouring ready mix concrete, and later, deliveries of steel and plant facilities machinery (ICL, 1990). The construction workforce is anticipated to reach peak employment of 800 during the third year of construction. The construction schedule is based on a single shift operating 40-hour workweeks.

As discussed previously, it is assumed that most of the construction workforce will commute daily to and from the site, with a few workers temporarily (i.e., during weekdays) occupying various forms of rental housing available within Martin County and the region. The available workforce within a reasonable commuting distance (i.e., up to 100 miles) is of sufficient size to provide the construction employment requirements of the ICL project. In addition to Martin County and the surrounding counties of Palm Beach, Okeechobee, and St. Lucie, the construction workforce could also be drawn from the large metropolitan areas of Miami and Fort Lauderdale.

Since most of the construction workforce is expected to commute daily from their current residences, the impacts on publicly supplied facilities and services such as schools and hospitals in Martin County and in the surrounding region are not expected to be significant. The small portion of the construction workforce expected to temporarily relocate to Martin County or the region during the weekdays would be expected to occupy existing rental housing or mobile home stock within the region. As such, the commuting pattern and temporary or potential minor permanent relocations of the construction workforce are not expected to create the need for new residential construction, which would in turn require expansion of the infrastructure in Martin County or the region.

Temporary impacts on public potable water and sanitary sewer services due to the construction workforce are not expected to be significant. Temporary potable water and sanitary sewer services will be supplied at the site by ICL, and therefore, will not create any impacts on those existing services. Temporary impacts on other public services and facilities in Martin County, such as police and fire protection services, educational facilities, and medical services, are also expected to be insignificant due to the commuting nature of the construction workforce.

Land use impacts on adjacent properties are also not expected due to the developed nature of adjacent facilities. Because of the proximity of this project to existing power generating and industrial and previous industrial developments, potential land use impacts are expected to be minimal.

Visual impacts resulting from the construction of the ICL facility are expected to be minimal, due to a lack of directly adjacent residential populations, the set-back distance of the site to SR 710, and limited access to the site. In addition, a screen of vegetation will be preserved along the west side of the CSX railroad to visually buffer the proposed power plant from travellers on SR 710.

Primary access to the ICL site will be provided by an existing intersection on SR 710. A secondary entrance on Southwest Farm Road is also proposed. An emergency entrance will also be provided on SR 710 via the existing FSC entrance road. For conservative traffic analysis purposes, it was assumed that all of the project trips will be generated through the main entrance.

During the peak of the construction schedule, it is estimated that 800 construction workers will be employed at the site for 4 to 6 months during the third year of construction. It is also assumed that the entire construction workforce would be employed in a single daytime shift during the weekdays. A complete traffic analysis, conducted in accordance with criteria established in the Martin County CGMP Traffic Impact Study Guidelines, is provided in Section 10.10. A vehicle occupancy rate of 1.3 is anticipated at a trip generation rate of 2.0. This equates to a peak of a total of 1,200 peak construction daily trips to the site. These 600 inbound a.m. peak hour trips and 600 outbound p.m. peak trips, in addition to a total of 20 daily construction vehicle trips yield an estimated 1,240 total daily trips during the peak of construction. When these trips are combined with a 5.6-percent annual average growth rate of background traffic in 1994, the level of service on SR 710 in northwest and southeast directions during morning and evening rush hours is expected to be at LOS C or better. LOS C is the accepted Martin County standard for level of service on roadways outside the urban service boundary (Martin CGMP, 1990). Based on the traffic analysis, the construction of a southbound right-turn lane on SR 710 at the project entrance is recommended to assist traffic operations, prior to the initiation of construction of the ICL facility (Kimley-Horn, 1990). Due to the remoteness of the site, a vehicle occupancy rate higher than 1.3 may result, equating to even lower construction-related traffic impacts.

In an additional attempt to minimize construction-related traffic impacts and improve the efficiency of construction workforce transportation, ICL is currently examining means of providing private transit transportation of construction workers by bus to the site. In the event that this busing program is implemented, construction-related traffic impacts will be greatly reduced.

Construction-related recreational impacts are expected to be insignificant since the commuting workforce are expected to utilize recreational facilities in relation to their existing residences.

7.2.2 LONG-TERM EXTERNAL COSTS

Long-term external costs are those costs which may accrue to the local government resulting from the permanently employed operational workers and their families, and the populations filling the indirect employment positions created to service and support the additional operational-related populations.

Within Martin County, the project-related population growth may necessitate some additional public services, at an additional cost to the county government. These additional services may include education, police and fire protection, recreation, and transportation. The projected costs for providing these additional services to Martin County are shown in Table 7.2.2-1.

Population growth in Martin County is expected to result from the direct workforce involved in the operation of the ICL plant, and the projected indirect population required to service and support the direct employees and their families. A total of 80 operational employees is anticipated for the ICL plant. The in-migration of these workers to Martin County is expected to create an additional 155 indirect jobs in the county.

The educational system in Martin County is experiencing growth in nearly all grade levels. The projected additional costs due to population growth associated with the ICL project for additional educational services in Martin County are shown on Table 7.2.2-1. Table 7.2.2-1 shows that approximately 10 new teachers would be required in Martin County to maintain existing teacher-to-student ratios.

Projected long-term transportation impacts resulting from the operation of the ICL plant are expected to be caused by the additional vehicles accessing the site as occupied by the plant's operational workforce, and also by rail deliveries of coal. A copy of comprehensive operational traffic analysis study is provided in Section 10.7.

Table 7.2.2-1
INCREASED COSTS TO MARTIN COUNTY FOR 1996 ASSOCIATED WITH THE OPERATION OF THE ICL PROJECT

Item	Martin County
Total number of workers (direct and indirect)	235
Total associated population growth[1] (2.47 persons per household	581
Education	
1989-1990 average teacher/student ratio[2]	1:16
Additional school-age children (0.68 per household)[1]	160
Additional teachers required	10.0
Additional teachers' salaries required[3]	$386,390[8]
Additional capital outlay required[3]	$126,640
Public Safety	
Officers per 1,000 population[4]	1:2.70
Additional officers required	0.64
Additional officers' salaries	$19,642[8]
Firefighters per 1,000 population[5]	1:3.60
Additional firefighters required	0.85
Additional firefighters' salaries required[5]	$23,215[8]
Transportation	
Additional new dwelling units	80
Additional lane miles per dwelling unit[6] (0.003128 per dwelling unit)	0.25
Cost ($372,882 per lane mile)	$93,220[8]
Recreation	
Level of service standard (AC per 1,000 population)[7]	2
Additional recreational acreage required	0.48
Acquisition and development costs[6]	$47,279[8]
General Governmental Service[7]	$39,950
TOTAL ANNUAL	**$736,336**
PER CAPITA EXPENDITURE	**$3,133**

Sources:
[1] U.S. Department of Commerce, 1990.
[2] Florida Department of Education, 1990.
[3] Martin County Board of Education, 1990.
[4] Martin County Sheriff's Department, 1990.
[5] Martin County Fire Department, 1990.
[6] Treasure Coast Regional Planning Council, 1989.
[7] Bureau of Economic and Business Research, 1988.
[8] Calculated by using 1988 values applied against a 5 percent annual escalation rate to estimate a value on 1996 dollars.

The analysis of the projected traffic volumes generated with the proposed power plant operating show that roadway links and intersections within the study area are expected to operate at acceptable levels of service (Kimley-Horn, 1990). The acceptable LOS rating for roadways outside the Martin County Urban Service Boundary is LOS C (Martin CGMP, 1990). Because the projected increase in operational traffic is not expected to lower the existing capacity of roadway segments within the study area, no improvements are warranted. However, for the benefit of traffic operations, it is recommended that a southbound right-turn lane on SR 710 at the project entrance be constructed prior to the initiation of construction of the proposed ICL facility.

As previously discussed in Section 2.2.7.6, FDOT currently has an improvement scheduled on SR 710 within Indiantown, with construction commencing in 1993 (FDOT, 1990). This improvement will consist of widening SR 710 to a five-lane facility with continuous-turn center lane for a length of approximately 2.2 miles. This programmed roadway improvement is expected to reduce traffic congestion through Indiantown. Also, FDOT has committed to a maintenance improvement of resurfacing and repaving essentially the entire length of SR 710 in Martin County (FDOT, 1990). This maintenance improvement should address any deteriorating conditions of SR 710.

As shown on Table 7.2.2-1, new lane miles as projected to be required for new residential development associated with residential relocations within Martin County are expected to be minimal. Less than one-fourth mile of new lanes would be potentially required for new residential roads.

Additional minor transportation impacts associated with the operation of the ICL facility may result as part of weekly rail deliveries of coal. It is estimated that between two and three 90-car unit trains per week will deliver coal to the site from mines in Appalachia. This averages to 130 coal deliveries per year, which is not expected to result in a significant impact on transportation systems in the area.

Long-term impacts on public potable water and sanitary sewer services due to the operation of the ICL facility are expected to be minimal due to the existing available capacities at the Indiantown Utilities Company and other water and wastewater services in Martin County. The operation of the ICL facility and residential relocations resulting from the operational workforce are not expected to increase demand beyond these existing capacities.

Impacts on public safety services such as police and fire protection associated with the projected population growth resulting from the operation of the ICL plant are not expected to be significant. As shown on Table 7.2.2-1, less than one additional police officer and firefighter are projected to be required to maintain current service ratios per 1,000 population. Impacts on medical facilities are also expected to be minimal. Public safety services to the ICL facility will be provided by sheriff's and fire stations located in Indiantown. EMS facilities are located in the Indiantown station, and response time for both police and fire service is projected to be between 8 and 10 minutes.

Because of the amount of existing parks and recreational facilities, new additional acreage for parks required to support the population growth resulting from the operation of the ICL facility is expected to be minimal. As shown on Table 7.2.2-1, using Martin County's recreational LOS standard would result in required additions of less than 1 acre of recreational land.

Visual impacts resulting from the operation of the ICL facility affecting the aesthetic character of the region are expected to be minimal. The immediate vicinity of the proposed ICL plant contains existing industrial development, and the addition of a cogeneration facility should not be in visual conflict with the character of existing development. Dense vegetation exists along SR 710, which should effectively screen the view to the ICL site from travellers on SR 710. The existing screen of pine trees along the west side of the CSX rail line will be preserved to act as a visual buffer to the site.

Within the ICL site, Martin County landscape requirements will be satisfied for areas surrounding the administration building and employee parking areas. A 30-day inactive coal pile will be grassed over to minimize visual impact and fugitive dust emissions. Also, as part of the PUD(i) submittal requirements, significant wetlands and uplands habitats will be preserved onsite, which will represent a positive visual impact.

7.3 BENEFIT/COST ANALYSIS

Table 7.3.0-1 provides a summary of the benefits and costs within Martin County resulting from the operation of the ICL facility for the year 1996, the first year of operation. The figures shown in Table 7.3.0-1 are based on those calculations previously presented in Tables 7.1.2-2 and 7.2.2-1. This table illustrates a significant net benefit to Martin County. As shown on Table 7.3.0-1, the net benefit to Martin County is projected to be $3,747,013 in 1996, the first year of operation of the ICL facility.

In summary, primarily because of additional revenues associated with its operation, the ICL facility is expected to have net positive economic benefits for Martin County in 1996 and will continue to provide positive economic benefits to the county over the 30-year life of the facility.

Table 7.3.0-1
BENEFIT/COST SUMMARY FOR MARTIN COUNTY IN 1996 AS ASSOCIATED WITH THE OPERATION OF THE ICL PROJECT

	Martin County ($)
Benefits	4,483,349
Costs	736,336
Net benefit	**3,747,013**

Source: ECT, 1990.

REFERENCES

Section 7.0

Bureau of Economic and Business Research. Florida Statistical Abstract, University of Florida, Gainesville, FL. 1988.

U.S. Department of Commerce. Personal Communication. 1988.

Indiantown Cogeneration Limited. Personal Communication. 1990.

Section 7.1.2

Bureau of Economic and Business Research, Florida Statistical Abstract, University of Florida, Gainesville, FL. 1988.

Florida Department of Labor and Employment Security, Bureau of Labor Market Information. Quarterly County Reports on Employment and Wages Covered Under the Florida Unemployment Compensation Law and Unemployment for Federal Employees, Martin County, Florida. 1990.

Martin County Board of Education, Martin County, Florida. 1990.

U.S. Department of Commerce, Unpublished RIMS II Output for Martin County, Florida. U.S. Department of Commerce, Bureau of Economic Analysis, Washington, DC. 1989.

Section 7.2.1

Indiantown Cogeneration Limited. Personal Communication. 1990.

Kimley-Horn. Indiantown Cogeneration Project, Construction Traffic Analysis. (SCA Section 10.10). 1990.

Martin County Comprehensive Growth Management Plan (Adopted). Martin County Growth Management Department. 1990.

Section 7.2.2

Florida Department of Transportation. Martin County Five-Year Work Program 1990-1991 (FY91) Through 1994-1995 (FY95). Fort Lauderdale, FL. 1990.

Hahn and Company, Inc. Indiantown Action Plan. Submitted to the Martin County Growth Management Department. 1990.

Kimley-Horn. Indiantown Cogeneration Project, Construction Traffic Analysis. (SCA Section 10.10). 1990.

Martin County Comprehensive Growth Management Plan (Adopted). Martin County Growth Management Department. 1990.

8.0 SITE AND PLANT DESIGN ALTERNATIVES

The proposed Indiantown Cogeneration, L.P. plant is designed to generate and export steam to the Caulkins Citrus Processing Facility which is located to the north of the site. It is necessary for a cogeneration plant (steam supplier) to be within a close proximity of the receiving processing facility (steam user), which in this case is the Caulkins Citrus Processing Facility. Therefore, alternative site locations and plant designs are not applicable.

9.0 COORDINATION

The following table lists people within federal, state, regional, and local government agencies who were contacted to provide input to this project.

Table 9.0-1
LIST OF CONTACTS WITHIN FEDERAL, STATE, REGIONAL AND LOCAL GOVERNMENT AGENCIES CONCERNING INDIANTOWN COGENERATION PROJECT
(Page 1 of 8)

Date	Project Rep.	Subject	Agency	Contact
5/9/89 5/16/89	Bechtel	Cross Sections of C-59, L63 N&S	COE	J. Vearil
5/23/89	Bechtel	S-191 & St. Lucie Water Quality Data	SFWMD	B. Jones
7/26/89	Bechtel	Operation Procedure of S-191 Structure	SFWMD	J. Lane
1/11/90	Bechtel	S-191 Water Level and Flow Data	SFWMD	S. Coughanour
1/16/90	Bechtel	Evaporation Data of Okeechobee Field Station	SFWMD	T. Morris
2/23/90	Bechtel	Rainfall/Evaporation Data - Martin and Okeechobee Counties	SFWMD	E. Gallego
4/6/90	ICL	Project Introduction	FDER	H. Oven
4/17/90	ICL	Water Resources	SFWMD	S. Coughanour
4/26/90	Bechtel	Ash Rules (draft)	DER	J. Reese
4/26/90	Bechtel	UIC List of Contractors	DER	K. Conrardy
5/10/90	Bechtel	UIC Permit Process	DER	A. Mueller

Date	Project Rep.	Subject	Agency	Contact
5/10/90	Bechtel	SFWMD Permit Files	SFWMD	S. Coughanour
5/23/90	ICL	PSC Overview of Project	PSC	J. Dean
6/7/90	Bechtel	Amendments to PPSA	DER	H. Oven
6/7/90	Bechtel	Floridan/Surficial Aquifers	SFWMD	S. Coughanour
6/19/90	Bechtel	Use of Caulkins Floridan Aquifer Well	SWFMD	S. Coughanour
7/5/90	Bechtel	Air Modeling Protocol	DER	T. Rogers
7/6/90	ICL	Water Resources Update	SFWMD	S. Coughanour
7/6/90	ICL	S-191 Operations	SFWMD	R. Mireau
7/16/90	Bechtel	Pipeline Aerials	DER	H. Oven
7/19/90	Bechtel	Canal Modeling	SFWMD	S. Lin
7/26/90	Bechtel	S-191 Operations Procedure	SFWMD	J. Lane
8/3/90	ICL	BACT Meeting	DER	B. Andrews
8/17/90	Bechtel	POS Comments/Aquifers	SWFMD	S. Coughanour
8/20/90	Bechtel	Use of FPL's APT	SFWMD	J. Giddings

Date	Project Rep.	Subject	Agency	Contact
9/27/90	Bechtel	Field Work in ROW	SFWMD	T. Fratz
9/28/90	Bechtel	St. Lucie Canal Water Levels	COE	J. Vearil
10/4/90	ICL	PUD(i) Pre-Ap Meeting	Martin County	H. Epstein
10/8/90	Bechtel	Fire Protection	Martin County	T. Seawell
10/8/90	Bechtel	Potable Water Supply	Indiantown Water Co.	W. Hanna
10/9/90	Bechtel	Groundwater Analyses	SFWMD	G. Rawl
10/11/90	GYS	PUD(i) Submittal	Martin County	H. Epstein
10/16/90	Bechtel	TC/NS Water Users	SWFMD	P. Bomgardner
10/16/90	Bechtel	Impact Analysis	SFWMD	S. Coughanour
10/18/90	Bechtel	Deepwell Injection Permit	DER	H. Oven
10/23/90	Bechtel	Deepwell Injection TAC Meeting	DER	A. Mueller
11/2/90	GYS	PUD(i) Sufficiency	Martin County	H. Epstein
11/6/90	ICL	Surface Water Analysis	DER	S. Coughanour
7/10/90	ECT	Future land use designations and maps, status of comprehensive plan	Martin County Growth Management Department	C. Honig

Table 9.0-1

Date	Project Rep.	Subject	Agency	Contact
7/10/90	ECT	Zoning designations and maps	Martin County Zoning Department	N. Ihle
7/11/90	ECT	Regional policy plan	Treasure Coast Regional Planning Council	B. St. Hill
7/11/90	ECT	Future land use designations and maps, status of comprehensive plan	Martin County Growth Management Department	C. Honig
7/16/90	ECT	Labor force and employment	Florida Department of Labor and Employment Security	S. Connell
7/16/90	ECT	Population growth, housing statistics, building activity, income	University of Florida, Bureau of Economic and Business Research	C. McLarty
7/16/90	ECT	Future land use designations and maps, status of comprehensive plan	Martin County Growth Management Department	C. Honig
7/16/90	ECT	School and student characteristics	Martin County School Board	R. Madison
7/16/90	ECT	Educational characteristics and teacher-to-student ratios	Florida Department of Education, Division of Public Schools	L. Harageones

Date	Project Rep.	Subject	Agency	Contact
7/16/90	ECT	Revenues and expenditures	Florida Department of Banking and Finance, Bureau of Local Government Financing	H. Foy
7/17/90	ECT	Sheriff's department characteristics	Martin County Sheriff's Department	Sgt. Bates
7/18/90	ECT	Capacity of public utilities	Martin County Utilities Department	E. Falken
7/18/90	ECT	Capacity of landfill	Palm City Landfill	L. Yates
7/19/90	ECT	Medical facilities characteristics	Martin County Medical Society	C. Coffee
7/19/90	ECT	Martin County medical facilities characteristics	Department of Health and Rehabilitative Services, Monitoring Department	R. Pannell
7/25/90	ECT	Aerial photographs	Martin County Property Appraiser's Office	D. Souza
7/25/90	ECT	Aerial photographs	Okeechobee County Property Appraiser's Office	L. Chandler
7/30/90	ECT	Population growth, housing statistics, building activity, income	University of Florida, Bureau of Economic and Business Research	C. McLarty

Date	Project Rep.	Subject	Agency	Contact
7/30/90	ECT	Population growth, housing statistics, building activity, income	University of Florida, Bureau of Economic and Business Research	C. McLarty
8/8/90	ECT	Future land use designations and status of comprehensive plan	Central Florida Regional Planning Council	J. Hopper
8/16/90	ECT	PUD(i) requirements	Martin County (Growth Management Department)	D. Saskowsky
8/17/90	ECT	Future land use designations and status of comprehensive plan	Central Florida Regional Planning Council	J. Hopper
8/29/90	ECT	Wetlands jurisdiction verification	Martin County	M. Goralski
9/5/90	ECT	Zoning designation boundaries	Martin County Zoning Department	L. Eule
9/10/90	ECT	Zoning designation boundaries	Martin County Zoning Department	L. Eule
9/13/90	ECT	Sheriff's department characteristics	Martin County Sheriff's Department	Lt. Atchison
9/13/90	ECT	Fire department characteristics	Martin County Fire Department	Chief Billington

Date	Project Rep.	Subject	Agency	Contact
9/18/90	ECT	Zoning maps	Okeechobee County Building and Zoning Department	E. Hrapchak
9/26/90	ECT	Revenues and expenditures per capita	Florida Department of Banking and Finance	E. Maninero
10/4/90	ECT	Zoning ordinance	Okeechobee County Building and Zoning Department	L. Turner
10/4/90	ECT	Future land use designations and status of comprehensive plan	Central Florida Regional Planning Council	J. Hopper
10/5/90	ECT	Programmed turnpike improvements	Florida Turnpike Authority	S. Daniels
10/5/90	ECT	Programmed roadway improvements in Martin County	Florida Department of Transportation, District 4 Office	M. DeRosa
10/15/90	ECT	Future land use designations and status of comprehensive plan	Central Florida Regional Planning Council	J. Hopper
10/15/90	ECT	Future land use designations and maps, status of comprehensive plan	Martin County Growth Management Department	C. Honig
10/17/90	ECT	County millage rate	Martin County Tax Assessor	L. Lyon

Date	Project Rep.	Subject	Agency	Contact
10/19/90	ECT	Impact fees and impact fee ordinances	Martin County Growth Management Department	R. Steiner
10/19/90	ECT	Population growth, housing statistics, building activity, income	University of Florida, Bureau of Economic and Business Research	C. McLarty
10/19/90	ECT	Average construction wage	Florida Department of Labor and Unemployment Compensation	E. McRanie
10/25/90	ECT	Educational state matching funds, per student capital outlay	Martin County School Board	Mr. Pearson
11/27/90	ECT	PUD(i) requirements	Martin County (Growth Management Department)	D. Saskowsky
11/27/90	ECT	Zoning ordinance	Okeechobee County Building and Zoning Department	L. Turner

Source: ECT, 1990.

10.0 APPENDICES

10.0 APPENDICES
TABLE OF CONTENTS

10.0 APPENDICES
TABLE OF CONTENTS (Continued)

10.1 FEDERAL PERMIT APPLICATIONS OR APPROVAL

10.1.1 316 DEMONSTRATIONS

No 316 demonstrations are required because the wastewater will be discharged into an injection well and the intake structure location, design, construction, and capacity reflect the best available technology.

10.1.2 NPDES APPLICATIONS/PERMITS

NPDES permits/applications are not applicable to the Indiantown Cogeneration Project since pollutant discharges are not released to the surface waters.

10.1.3 HAZARDOUS WASTE DISPOSAL APPLICATIONS/PERMITS

Since the disposal of hazardous wastes will not occur on site, applications and/or permits are not applicable.

10.1.4 SECTION 10 OR 404 APPLICATIONS/PERMITS

Any required Section 10 or 404 application will be provided in early 1991, per discussion with Hamilton Oven, DER Siting Coordinator, on December 14, 1990.

10.1.5 PSD APPLICATIONS/PERMITS

A. BACT Analysis

B. Air Quality Impact Analysis

TABLE I

INDIANTOWN COGENERATION EMISSION SOURCES

Main Boiler Stack

Auxiliary Boiler Stack

Coal Handling Areas

Ash Handling Areas

Cooling Tower

Lime Handling Areas

II.A. The Indiantown Cogeneration Plant will generate 330 MWe (net) of electrical power (with zero export process steam) using a pulverized coal reheat boiler and an extraction-condensing turbine generator. During the period from November to June, approximately 225,000 pounds per hour of export process steam can be supplied to the Caulkins citrus processing plant.

The pollution control equipment for the project is noted below. The project will result in full compliance with all applicable federal, state and local air quality regulations.

Pollution Control Equipment

Selected Non-Catalytic Reduction System

Spray Dryer Absorber System

Baghouse

III. C.

Name of Contaminant	Emission Max. #/Hr.	Emission Actual T/Yr.	Allowed Emission Rate	Allowable Emission #/Hr.	Potential Emission #/Hr.	Potential Emission T/Yr.	Relate to Flow Dia. (Loc.#)
Main Stack (continued):							
Lead	0.064	0.28	None	None	3.19	13.97	12
Beryllium	0.0094	0.041	None	None	0.46	2.03	12
Mercury	0.040	0.172	None	None	0.08	0.34	12
Arsenic	0.175	0.765	None	None	5.81	25.47	12
Fluorides	5.09	22.3	None	None	25.38	111.14	12
Auxiliary Boiler:							
Sulfur Dioxide	17.8	8.9	0.80	27.3	17.8	8.9	11
Particulates	1.4	0.7	0.03	10.2	1.4	0.7	11
Nitrogen Dioxide	68.2	34.1	0.3	102.5	68.2	34.1	11
Carbon Monoxide	47.3	23.7	None	None	47.3	23.7	11
VOC	0.63	0.32	None	None	0.63	0.32	11
Fugitive Emissions:							
Particulate	0.34	1.49	None	None	34.5	151.1	1
Particulate	0.696	3.05	None	None	3.78	16.6	2
Particulate	0.0007	0.0031	None	None	0.352	1.54	3
Particulate	0	0	None	None	0	0	4
Particulate	0.288	1.26	None	None	144.4	632.3	5
Particulate	0.001	0.0044	None	None	0.51	2.26	6
Particulate	0.209	0.915	None	None	104.4	457.3	7
Particulate	0.059	0.26	None	None	29.4	128.8	8
Particulate	0.0012	0.053	None	None	6	26.3	9
Particulate	0.0012	0.0053	None	None	0.6	2.63	10
Particulate	0.0024	0.011	None	None	1.2	5.26	13
Salt	43	188	None	None	43	188	15

III. C

INDIANTOWN
FUGITIVE DUST EMISSIONS TABLE

SOURCE NUMBER	EMISSION POINT	CONTROL METHOD	DISCHARGE FLOW CFM	DISCH. ELEV. ABOVE GRADE FT
1	COAL UNLOAD AREA	FABRIC FILTER	30000	25
2	STORAGE/TRANS. TOWER AREA	FABRIC FILTER	30000	60
3	COAL RECLAIM AREA	FABRIC FILTER	20000	25
4	EMERG. RECLAIM AREA	FABRIC FILTER	20000	25
5	CRUSHER TOWER AREA	FABRIC FILTER	10000	75
6	SILO BAY AREA	FABRIC FILTER	10000	180
7	ASH SILO AREA	FABRIC FILTER FABRIC FILTER	3000 5000	120 120
8	ASH RECYCLE SILO	FABRIC FILTER	3000	75
9	LIME SILO AREA	FABRIC FILTER	3000	120
10	LIME SLURRY PLANT	FABRIC FILTER	3000	60
	SODA ASH SILO	FABRIC FILTER	3000	75

III. G. Liquid and Solid Waste Generation and Disposal

Liquid Wastes	Disposal
Sanitary Wastes	Sent to Indiantown Municipal System
Wastewater	Treated, then reused in process where possible remainder to deep well injection
Spent Solvents	Off-site disposal
Coal Pile Runoff/Leachate	Treated and sent to cooling tower

Solid Wastes	
Office Wastes	Off-site disposal
Air Filters	Off-site disposal
Resin Beds	Off-site disposal
Bottom Ash	Off-site disposal at coal mine
Fly Ash and Reaction Products	Off-site disposal at coal mine

III. H

INDIANTOWN

AUXILIARY BOILER STACK PARAMETERS

	AUXILIARY BOILER	
	No. 2 FUEL OIL	NATURAL GAS
EXHAUST STACK TEMP	500°F	480°F
STACK EXIT VELOCITY	103 FT/SEC	102 FT/SEC
STACK HEIGHT	90 FT	90 FT
STACK EXIT DIAMETER	5.5 FT	5.5 FT

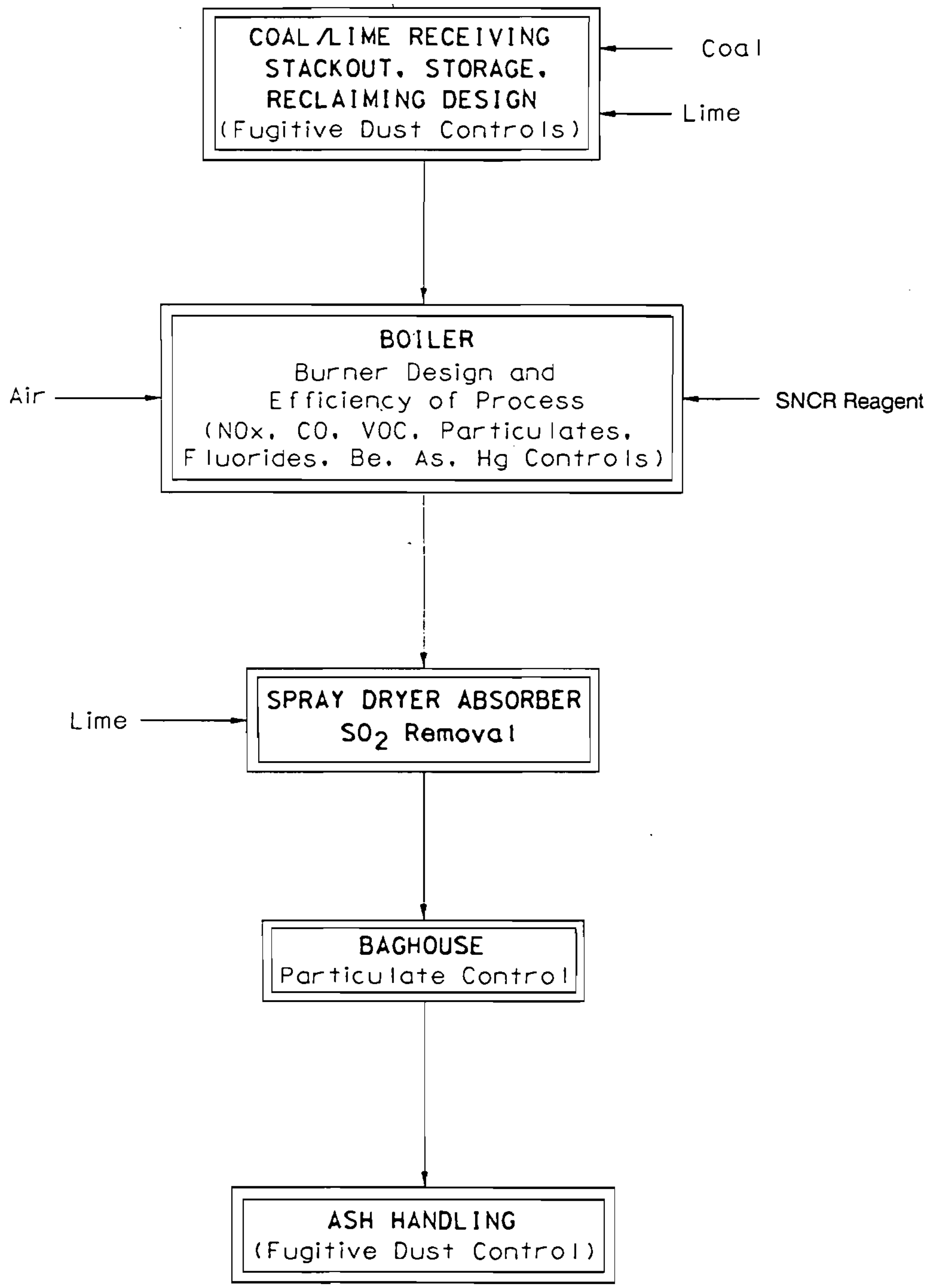


Figure 3.4.4-1.

AIR EMISSIONS CONTROL EQUIPMENT DIAGRAM

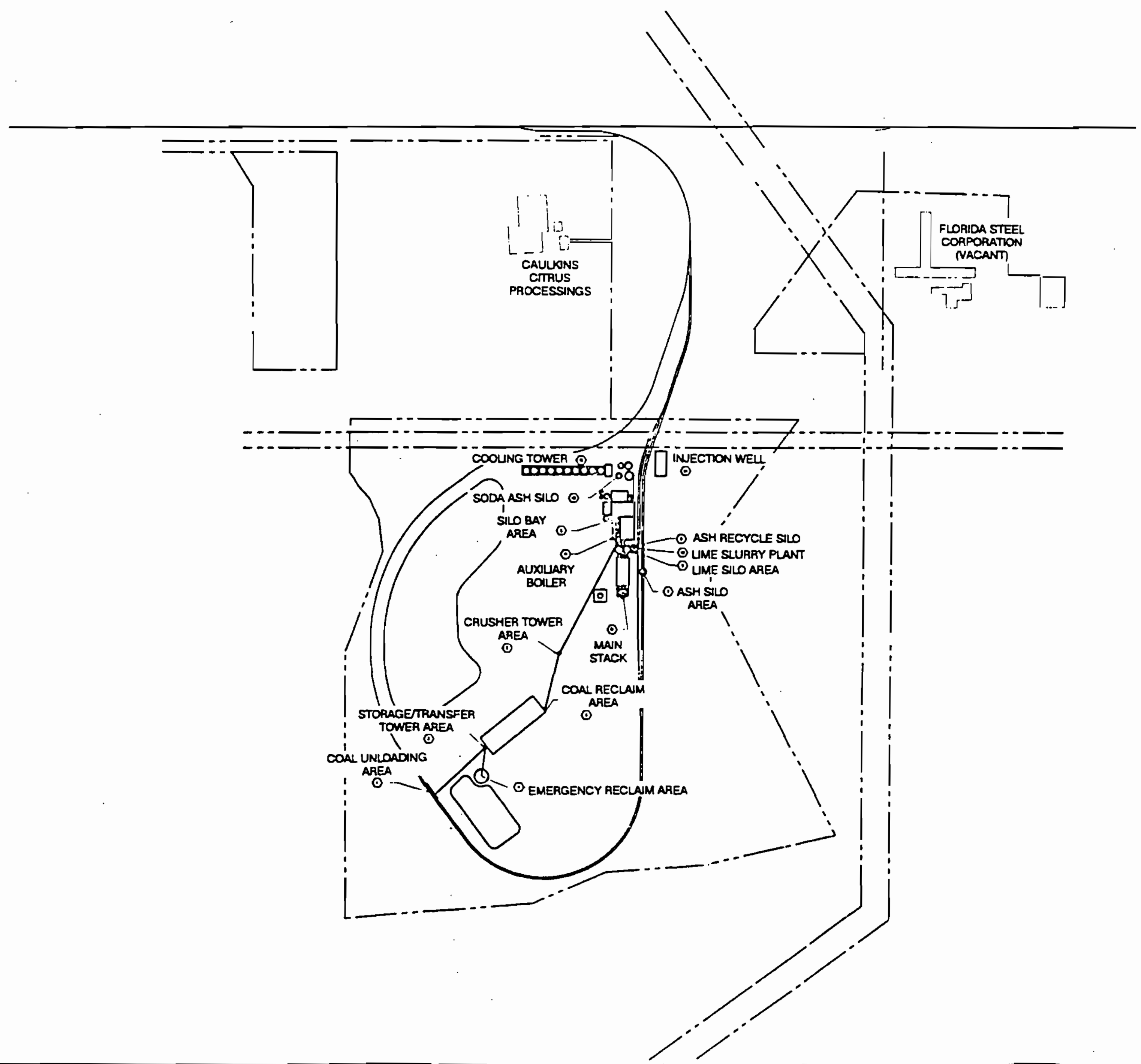
Source: Bechtel 1990

INDIANTOWN
COGENERATION
PROJECT

Indiantown Cogeneration, L.P.

Figure 3.2.0-4

EMISSION POINT DIAGRAM



SOURCE NUMBER	EMISSION POINT	DISCH. ELEV. ABOVE GRADE (FT.)
1	COAL UNLOAD AREA	75
2	STORAGE/TRANSFER TOWER AREA	75
3	COAL RECLAIM AREA	75
4	EMERGENCY RECLAIM AREA	75
5	CRUSHER TOWER AREA	75
6	SILO BAY AREA	180
7	ASH SILO AREA	120
8	ASH RECYCLE SILO	75
9	LIME SILO AREA	120
10	LIME SLURRY PLANT	60
11	AUX BOILER STACK	80
12	MAIN STACK	500
13	SODA ASH SILO	75
14	INJECTION WELL	0
15	COOLING TOWER	56

C		ISSUED FOR SCA	
B		REVISED FOR PERMITTING	CHC
A		ISSUED FOR PERMITTING	CHC

SCALE 1"=300' DATE 9-6-90

BECHTEL
GAITHERSBURG, MARYLAND

INDIANTOWN COGENERATION PROJECT
INDIANTOWN FLORIDA

SITE PLAN
EMISSION POINT
DESIGNATION

JOB NO.	DRAWING NO.	REV.
20524	SK-P-9690	C

INDIANTOWN
COGENERATION
PROJECT

Indiantown Cogeneration, L.P.

Best Available Copy

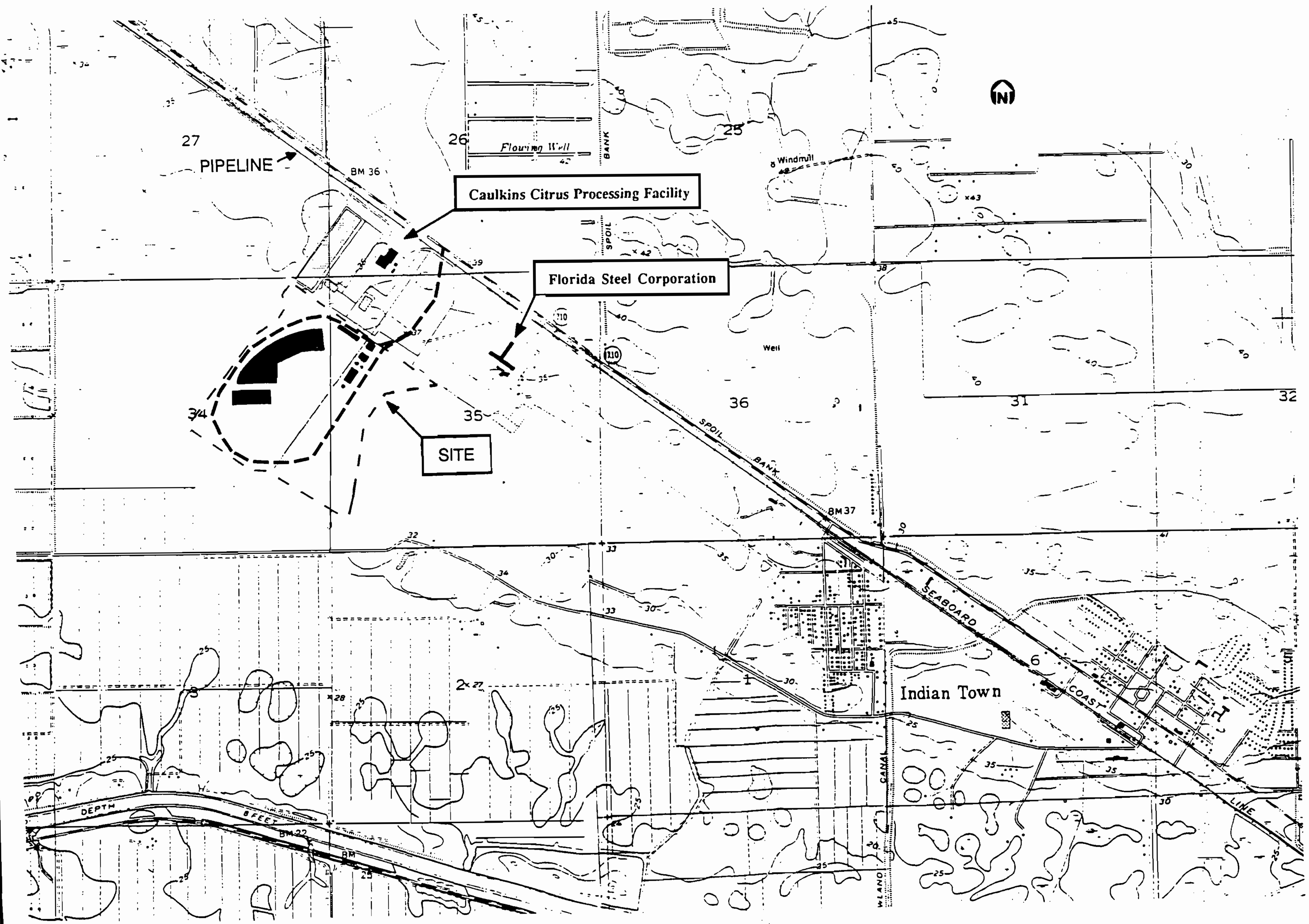


Figure 2.1.0-1.

SITE VICINITY PLAN

LEGEND:

— — SITE BOUNDARY

Scale: 1 Inch = 2000 Ft.

Source: Bechtel, 1990

INDIANTOWN COGENERATION PROJECT

Indiantown Cogeneration, L.P.

A. BACT Analysis

INDIANTOWN COGENERATION, L.P.

Indiantown Cogeneration Facility

ENSR

BACT Analysis

ENSR Consulting and Engineering

December 1990

Document Number 5402-008

ENSR

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ENSR CONTACT —

CONTENTS

CONTENTS
(Cont'd)

CONTENTS
(Cont'd)

CONTENTS
(Cont'd)

LIST OF TABLES

1.0 INTRODUCTION

1.1 Project Description

PG&E/Bechtel Generating Company is proposing to install and operate a coal-fired cogeneration facility near Indiantown FL capable of generating 330 net megawatts (MW) of power from a PC boiler-based generating plant. During the period from November to June, 225,000 lb/hr of process steam will be supplied to Caulkins Citrus Processing; during these periods the plant will supply a nominal 310 MW of electrical power to the local utility grid.

Major equipment for the facility will consist of a pulverized coal boiler, an extraction-condensing turbine electrical power generator, air pollution control equipment, a water-cooled surface condenser, boiler feedwater systems (including condensate and feedwater pumps, feedwater heaters and a deaerator), a circulating water system (including circulating water pumps, a mechanically-induced draft cooling tower, a water supply pipeline, and a water storage pond), coal unloading and storage facilities, ash handling equipment, water treatment facilities, an auxiliary fuel-oil or natural gas fired boiler, as well as plant support equipment including HVAC, fire protection, plant air, potable water and sanitary sewer lines.

The main boiler heat input at full load is estimated at 3,422 MMBtu/hr. The heat input of the auxiliary boiler firing #2 fuel oil is estimated at 342 MMBtu/hr (358 MMBtu/hr firing natural gas). The auxiliary boiler will operate an estimated 1,000 hours per year.

The flue gas cleanup system for the PC boiler will consist of spray dryer absorbers (SDAs) for desulfurization and acid gas control, and a baghouse for particulate matter (including trace metals) control.

Flue gas from the air heater will enter the two 50-percent capacity SDAs, where it will be humidified and cooled by spraying with lime slurry. Simultaneously, the flue gas will provide drying energy to the atomized slurry. The cooled gas, along with the entrained reaction products and fly ash, will flow to the the fabric filter where solids will be separated from the gas.

The system will use lime (calcium hydroxide) slurry as the absorbing medium. Pebble lime will be slaked in the lime preparation system, diluted and stored in the lime feed tanks. Lime slurry will be pumped from the feed tank to the agitated atomizer head tank, from which the slurry will be pumped to the absorbers.

Lime will be delivered to the site by rail or self-unloading truck and stored in a totally enclosed structure to eliminate fugitive emissions.

Flue gas from the FGD system will enter the baghouse through an inlet manifold, which will distribute the gas to the bag filter compartments. Gas will pass through the fabric of the bags from the inside to the outside; collected particulate will be retained on the inside surface of the bags. When the particulate buildup on the surface of the bags produces a preset flue gas pressure drop, an automatic reverse-air cleaning cycle will be initiated.

Hoppers below the bags will collect the particulate released from the bags during the cleaning cycle. A pneumatic transer system will transport the particulate ash from the hoppers to the ash storage silo, in preparation for off-site disposal.

1.2 Emission Estimates

The facility will be an emission source of nitrogen oxides, sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), and unburned hydrocarbons (UBHC's) and other regulated pollutants. Peak hourly and annual average emission rates are shown in Table 1-1. Total facility emission rates are shown in Table 1-2.

1.3 Proposed BACT

1.3.1 PC Boiler

For the pulverized coal boiler, the proposed BACT level for NO_x is 0.17 lb/MMBtu, which will be achieved through the use of Selective Non-Catalytic Reduction (SNCR) and advanced combustion controls. The proposed BACT level of SO_2 is 0.17 lb/MMBtu, which will be achieved through the use of lime spray drying. The proposed BACT for particulate matter is 0.018 lb/MMBtu, which will be achieved with a fabric filter. For CO and VOC, the proposed BACT levels are 0.11 and 0.0036 lb/MMBtu, respectively, achieved through advanced combustion controls. For beryllium, mercury and arsenic, the proposed BACT levels are 2.73 x 10^{-6}, 11.4 x 10^{-6}, and 51.1 x 10^{-6} lb/MMBtu, respectively. Control of particulate matter through fabric filtration will simultaneously achieve control of beryllium and arsenic, while control of SO_2 with spray drying will also control mercury emissions.

TABLE 1-1
FACILITY EMISSION RATES

Pollutant	lb/MMBtu	Full Load 100% Capacity (lb/hr)	(ton/yr)
PC BOILER			
Nitrogen Oxides	0.17	582	2549
Carbon Monoxide	0.11	376	1647
Hydrocarbons	0.0036	12.3	54
Particulate Matter	0.018	61.6	270
Sulfur Dioxide	0.17	582	2549
Lead	18.7×10^{-6}	0.064	0.28
Beryllium	2.73×10^{-6}	0.0093	0.041
Mercury	11.4×10^{-6}	0.039	0.172
Arsenic	51.1×10^{-6}	0.175	0.765
AUXILIARY BOILER (based on #2 oil firing)			
Nitrogen Oxides	0.20	68.4	34.2
Carbon Monoxide	0.14	47.3	23.7
Hydrocarbons	0.0018	0.63	0.31
Particulate Matter	0.0041	1.4	0.7
Sulfur Dioxide	0.052	17.8	8.9
Lead	10.5×10^{-5}	3.6×10^{-2}	1.8×10^{-2}
Beryllium	12.0×10^{-8}	4.1×10^{-5}	2.0×10^{-5}
Mercury	149×10^{-8}	5.1×10^{-4}	2.6×10^{-4}
Arsenic	19.9×19^{-6}	6.8×10^{-3}	3.4×10^{-3}

TABLE 1-2
TOTAL FACILITY EMISSIONS

	Annual Tons	PSD Significance
Nitrogen Oxides	2549	40
Carbon Monoxide	1647	100
Hydrocarbons	54	40
Particulate Matter	270	25
Sulfur Dioxide	2549	40
Lead	0.28	0.6
Beryllium	0.041	0.0004
Mercury	0.172	0.1
Arsenic	0.765	0

1.3.2 Auxiliary Boiler

For the #2 fuel oil- and natural gas-fired auxiliary boiler, the proposed BACT level for NO_x is 0.2 lb/MMBtu, achieved through the use of low NO_x burners. The proposed BACT levels for SO_2 and particulate matter are 0.052 and 0.0041 lb/MMBtu, respectively, achieved using very low sulfur fuels. For CO and VOC, the proposed BACT levels are 0.14 and 0.0018 lb/MMBtu, achieved through the use of combustion controls. The proposed BACT levels for beryllium, mercury and arsenic from the auxiliary boiler are 12.0×10^{-8}, 149×10^{-8}, and 19.9×10^{-6} lb/MMBtu, respectively. Control of particulate matter emissions through low sulfur fuel firing will also simultaneously control emissions of these trace elements.

2.0 BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS - METHODOLOGY

2.1 Introduction

The Prevention of Significant Deterioration (PSD) rules of the Florida DER require a determination of Best Available Control Technology (BACT) for each regulated pollutant potentially emitted from a new or modified major stationary source in excess of the emission significance levels in Table 1-2. Based on the emission estimates shown in Section 1.2, the proposed cogeneration facility is subject to BACT with respect to nitrogen oxides (NO_x), carbon monoxide (CO), hydrocarbons (VOC), particulate matter (PM_{10}), sulfur dioxide (SO_2), beryllium, arsenic, mercury, and radionuclides.

BACT is defined in the Florida Air Pollution Rules as

> "An emission L imitation, including a visible emissions standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of each such pollutant."

The BACT requirements are intended to insure that a proposed facility will incorporate control systems that reflect the latest techniques used in a particular industry, allow for future growth in the vicinity of the proposed facility, and comply with National Ambient Air Quality Standards. Compliance with New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), or state regulations may be considered application of BACT. Nevertheless, an evaluation of the air pollution control techniques and systems is required, taking into account energy, environmental and economic impacts. This analysis may require the documentation of performance levels, technical limitations, and the materials, energy, and economic penalties associated with the technically achievable alternative control systems, as well as the environmental benefits derived from these systems.

2.2 Cost Determination Methodology

An economic analysis of certain BACT alternatives may have to be performed, which compares their capital and operating costs in terms of cost effectiveness, i.e. dollars per ton of pollutant removed.

In this analysis, both capital and annual costs are analyzed. Capital costs include both the initial cost of various components intrinsic to the complete control system (the actual control technology hardware: reactors, piping, rotating equipment, instrumentation, monitoring equipment, and supports) and installation costs. The annual operating costs consist of the financial requirements to operate the control system on an annual basis, including overhead, maintenance, labor, raw materials, and utilities.

This BACT analysis utilizes the cost estimating methodology outlined in the most recent EPA Guidance document on the subject, the OAQPS Control Cost Manual (EPA 1990).

2.2.1 Capital Costs

A number of methods with varying degrees of accuracy are available for estimating capital costs. The estimating technique used in this analysis is based on a factored method of determining direct and indirect installation costs. This technique is a modified version of the "Lang Method" whereby installation costs are expressed as a function of known equipment costs.

The capital costs estimation factors, shown in Table 2-1, represent the delivered equipment costs for the basic control equipment and all auxiliary equipment, plus direct and indirect installation costs for a turnkey, ready-to-operate installation. These costs are comprised of purchased equipment costs, installation costs, and indirect costs.

Purchased equipment costs represent the delivered cost of the control equipment, auxiliary equipment, and instrumentation. Auxiliary equipment consists of all structural, mechanical, and electrical components required for efficient operation of the device. These include such items as fuel storage and supply piping and exhaust gas ductwork. Auxiliary equipment costs are taken as a straight percentage of the basic control equipment costs, the percentage being based on the average requirements of typical systems and their auxiliary equipment (Vatavuk 1980). Instrumentation and controls are usually not included in the basic equipment cost; typical cost factors range from 10 to 15% of the basic equipment cost, depending on the specific application. The purchased equipment costs, which include the FOB equipment cost, auxiliaries, instrumentation and controls, taxes and freight, are then the basis for determining the direct and indirect installation costs.

Installation costs consist of the direct expenditures for materials and labor for site preparation, foundations, structural steel, erection, piping, electrical, painting, and facilities, and the indirect costs for contractor's engineering and supervision, construction and field expenses, construction fees, contingencies, start-up and performance tests, working capital, and interest during construction. Direct installation costs are expressed as a function of the basic equipment cost,

TABLE 2-1
CAPITAL COST ESTIMATION FACTORS

Direct Costs:	
(1) Purchased Equipment	
(a) Basic Equipment	Vendor Data
(b) Auxiliaries	Vendor Data
(c) Instrumentation	0.10(1a)
(d) Structural Support	0.10(1a)
(e) Tax and Freight	0.08(1a -> 1d)
(2) Direct Installation	0.30(1a -> 1e)
Total Direct Cost (TDC):	(1) + (2)
Indirect Costs:	
(3) Indirect Installation	
(a) Engineering & Supervision	0.1(TDC)
(b) Construction & Field Expenses	0.1(TDC)
(c) Construction Fee	0.05(TDC)
(d) Contingencies	0.20(TDC)
(4) Other Indirect Costs	
(a) Startup & Testing	0.01(TDC)
(b) Working Capital	30 days O&M Costs
Total Indirect Cost (TIC):	(3) + (4)
Total Capital Costs:	TDC + TIC

Source: EPA OAQPS (1990)

based on average installation requirements of typical systems. Indirect costs are designated as a percentage of the total direct cost (purchased equipment cost plus the direct installation cost) of the system. The factors are based on the assumption that the installation is performed by an outside contractor and not by plant personnel.

2.2.2 Annualized Costs

Annualized costs, as shown in Table 2-2, are comprised of the direct costs of materials and labor for maintenance and operation, utilities, and waste disposal, and the indirect charges including plant overhead, general administration, taxes, insurance and capital charges.

Labor and material costs for operation and maintenance will vary depending on the system operating mode and the operating time. The maintenance requirement is 5% of the total direct cost. A 40/60 split on labor/materials is applied to the maintenance cost estimate. Overhead is applied to operating and maintenance labor.

Utility costs are based on the estimated total annual consumption and unit costs. The latter were supplied by PG&E/Bechtel and are based on current (second quarter 1990) prices.

Indirect operating costs include the cost of plant overhead, general administration, taxes, insurance, and capital charges. These costs are a direct function of the total capital cost. Capital charges are based on the operation life of the system, interest and capital depreciation rates, and total capital cost. These charges are based on the capital recovery factor (CRF), defined as:

$$CRF = \frac{i(1 + i)^n}{(1 + i)^n - 1}$$

where i is the annual interest rate and n is the equipment life (years). The estimated equipment life of each alternative is 10 years, and the average interest rate is assumed to be 10%.

2.2.3 Cost Effectiveness

The cost effectiveness of an alternative control approach is based on the annualized cost of the system and its annual pollutant emission reduction. It is determined by dividing the annualized operating cost of an alternative by the tons of pollutant removed by that alternative per year. The basis for determining the uncontrolled tons, control effectiveness, and controlled tons of each pollutant are summarized within each appropriate section of this report.

TABLE 2-2
ANNUALIZED COST FACTORS

Direct Operating Costs:	
(1) Operating Labor	\$20.00/man-hour
Supervisor	15% of operating labor
(2) Maintenance	5% of Direct Costs
(3) Replacement Parts	As Required
(4) Raw Materials	
(a) Ammonia	\$175/Ton
(b) Limestone	25/Ton
(c) Lime	70/Ton
(5) Utilities	
(a) Electricity	\$0.071/kwhr
(b) Water	2.00/1000 gal
(c) Fuel Oil	7.00/MMBtu
(d) Steam Generation	8.00/ton
(6) Disposal Costs	
(a) Spent Catalyst	\$300/yd^3
(b) Solid Waste	\$28.60/ton
(c) Wastewater	0.05/gal
Indirect Operating Costs:	
(7) Overhead	30% Labor + 12% Maintenance
(8) Property Tax	1% Total Capital Cost
(9) Insurance	1% Total Capital Cost
(10) Adminsitration	2% Total Capital Cost
(11) Capital Recovery	16.3% Total Capital Cost
Total Annualized Cost:	(1) -> (11)
Cost Effectiveness	Annual Cost/Tons Removed

2.3 Organization of Analysis

The following sections discuss the applicable alternative control techniques and devices available for the proposed cogeneration facility and provide an analysis of the impacts of these alternative control technologies.

3.0 BACT FOR NITROGEN OXIDES

3.1 Introduction

3.1.1 Formation

Nitrogen Oxides (NO_x) are formed in combustion sources by either the thermal oxidation of nitrogen in the combustion air or the reduction and subsequent oxidation of fuel nitrogen. Virtually all NO_x emissions originate as nitric oxide (NO) as both nitrogen and oxygen dissociate into atomic form at the high temperatures within the boiler and then recombine to form NO. A minor fraction of the NO is further oxidized in the flue gas system to form NO_2. As can be seen from the analysis of the coal proposed for this project (Table 3-1), the fuel will contain some nitrogen compounds. In typical domestic coals, these take the form of aromatic nitriles, pyridines, and pyrroles (EST 1984). However, the bulk of the NO_x formation in this facility will be through thermal oxidation of nitrogen from the combustion air, referred to as thermal NO_x.

The rate of formation of thermal NO_x is a function of the residence time, free oxygen, and peak flame temperature. Therefore, most NO_x control techniques for thermal NO_x are aimed at minimizing one or more of these variables. Other control methods, known as "tail gas" or "back-end" techniques, remove NO_x from the exhaust gas stream.

3.2 NO_x Emissions from PC Boiler

The design and operation of a coal-fired boiler has a significant impact on both the formation and subsequent emission of NO_x, as well as the potential application of add-on back-end NO_x control equipment. The various alternative coal-fired boiler configurations, including PC, circulating fluidized bed (CFB), and spreader stoker, each exhibit unique design and operational characteristics which affect the technical feasibility of certain NO_x control alternatives. Spreader stoker and CFB boilers are not available in the size range being considered for the Indiantown Cogeneration Facility.

3.2.1 Permitted Control Levels

The Federal New Source Performance Standard (NSPS) for coal-fired steam generating units greater than 100 MMBtu/hr heat input is 0.6 lb/MMBtu (40 CFR Part 60, Subpart Db). Appendix A contains a list of the coal-fired boilers included in the EPA's BACT/LAER Clearinghouse. Of the recently-permitted boilers (post-1980), the predominant design listed in

TABLE 3-1
COAL ULTIMATE ANALYSIS

Component	% (As Fired)
Carbon	65.37%
Hydrogen	4.63%
Oxygen	4.69%
Nitrogen	1.16%
Sulfur	2.00%
Chlorine	0.15%
Ash	12.00%
Water	10.00%
TOTAL	100.00%

the Clearinghouse is circulating fluidized bed (CFB) including Applied Energy Services, Scrubgrass Power Corp., Cambria Cogen, Inc., Goodyear United Development, North Branch Energy Partners, Inc., United Development Group, Fort Howard Paper, Northeastern Power Co., Edensburg Power Co., Tennessee Valley Authority, Panther Creek Energy, and GWF Power Systems Co., Inc. Since there are differences between the PC and CFB in terms of operating temperature and NO_x emission rates, these CFB permit limits are not applicable to the proposed PC boiler design.

The alternative NO_x controls which are applicable to the proposed PC boiler include combustion controls, selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR). It should be noted that the latter two alternatives, SNCR and SCR, have not been demonstrated on a US PC boiler firing domestic coals. They have, however, been applied to PC units in Japan and Europe, as detailed further in subsequent sections of this analysis. For the purposes of providing a complete review, they are included in this analysis.

3.2.2 Selective Catalytic Reduction

3.2.2.1 Technical Analysis

The NO_x control alternative that has been demonstrated to achieve the greatest potential for NO_x reduction on certain combustion sources is SCR. However, this technology has never been applied to domestic coal-fired sources. Although it has been applied to sources firing coal in both Japan and Europe, there are differences in the coals and boiler operating practices between these applications and domestic applications which may hinder the use of SCR in the US on coal. There are unresolved technology-related issues relating to the use of this alternative in a US application, including lack of demonstration on pilot-scale units firing US fuels, differences between US and either Japanese or European fuels, as well as differences between the proposed Indinatown equipment configuration and units where SCR has been applied. As described in greater detail below, for these and other reasons SCR is not commercially applicable, and thus not BACT, at the present time.

<u>Description</u>

The SCR process involves postcombustion removal of NO_x from the flue gas with a catalytic reactor. Ammonia (NH_3) is injected into the flue gas stream upstream of the catalyst bed, and NO_x and NH_3 combine at the catalyst surface, forming elemental nitrogen and water. The function of the catalyst is to effectively lower the activation energy of the NO_x decomposition reaction.

Catalyst Types

There are several commerically available SCR catalysts, including platinum-based, vanadium-based, zeolite, and ceramic molecular sieve-based. Each catalyst type exhibits advantages and disadvantages in terms of operating temperature, reducing agent/NO_x ratio, and optimum oxygen concentration. A characteristic common to all types is the narrow "window" of temperatures in which the reactions will proceed. Below the lower operating temperature limit, the reduction reactions do not take place. Operation above the maximum temperature results in oxidation of NH_3 to either nitrogen oxides (thereby actually increasing the NO_x emissions) or the formation of ammonium nitrate and ammonium nitrite, both of which are explosive compounds.

Optimum operating temperature for most catalyst systems has been shown to be in the range of 500-850°F. For combustion sources such as the proposed PC boiler, a prime concern is the location of the catalyst bed to insure that this temperature is maintained.

Catalyst Deactivation

The SCR process is subject to loss of catalyst activity over time. Since the catalyst itself is the most costly part of the process, steps to prevent catalyst deactivation must be taken to effect economical operation of the process. Catalyst deactivation occurs through two primary mechanisms: physical deactivation and chemical poisoning. The former is generally the result either of prolonged exposure to excessive temperatures or masking of the catalyst due to entrainment of particulate. Chemical poisoning is caused by the irreversible reaction of the catalyst with a contaminant in the gas stream and is a permanent condition. Catalyst suppliers generally assign a two to three-year lifetime to catalyst systems; thus a loss of 33% per year is to be expected.

SCR catalyst poisoning by arsenic

During initial trials with Japanese technology in Europe, it was discovered that for certain coals and firing configurations, the activity of the catalyst decreased markedly after only a few hundred hours of operation (Schonbucher 1989). After extensive laboratory and pilot scale investigations (Kuroda et al 1989), the reason for this decline was identified as catalyst poisoning by arsenic (Balling and Hein 1989, Goldschmidt 1987, Kuroda et al 1989, Necker 1989, Schonbucher 1989). Gaseous arsenic trioxide (As_2O_3), formed by oxidation of elemental arsenic in coal, condenses within the catalyst pores and adsorbs onto active sites, thereby blocking the adsorption of NO_x and ammonia and preventing the NO_x reduction reaction from taking place (Kuroda et al 1989).

Although the Japanese had performed extensive testing of the SCR process on laboratory- and pilot-scale equipment prior to full commercial application (Kuroda et al, 1989), the phenomena of catalyst poising by gaseous arsenic was not observed until SCR was tried in Europe (Goldschmidt 1987).

Fuel Sulfur

The sulfur content of the coal proposed for Indiantown is an additional concern. Catalyst systems will promote oxidation of sulfur dioxide (SO_2) to sulfur trioxide (SO_3), which combines with water to form sulfuric acid. Corrosion of flue gas piping and heat transfer surfaces, as well as catalyst deactivation, is thus a concern for using SCR with sulfur-containing fuels. In addition, SO_3 combines with unreacted ammonia to form ammonium bisulfate, which condenses out in the low temperature section of the unit and fouls the air heater, as described further below.

Another irreversible decline in catalyst activity is related to acidic attack of catalyst materials. Damon presented a technical review of the potential applicability of SCR to US coal-fired sources, and identified SO_3 adsorption as a potential problem area. For low and medium sulfur coals, he states that catalyst activity will be reduced if the reaction temperature falls below 580°F (below 650°F for high sulfur coals) (Damon et al, 1989)

Cichanowicz and Offen note that catalyst poisioning by sulfur compounds is aggravated by constituents of fuel which promote high SO_2 and SO_3 concentration, including fuel sulfur, high fly ash iron content (which may catalyze the oxidation of SO_2 to SO_3), and low ash alkalinity (which neutralizes SO_3) (Cichanowicz and Offen 1987).

Thus differences in coal sulfur, alkalinity and trace element concentration may present unexpected difficulties in applying the European experience directly to domestic fuel firing.

Indiantown Configuration

As described in more detail in subsequent sections, sulfur dioxide and particulate matter will be controlled in the proposed facility with a spray dryer/fabric filter. SCR has never been used in conjunction with a spray dryer/fabric filter before; based on the European experience and preliminary information from one US pilot study, there are unresolved technical issues. In particular the effect that SCR will have on the fabric filter is of concern.

When SCR is applied to sources firing fuels containing sulfur, various ammonium salts are formed, including ammonium bisulfate (NH_4HSO4_4) and ammonium sulfate ($[NH_4]_2SO_4$) (Damon 1987, Novak and Rych 1989, Lowe 1989, Robie 1989). The amount of each of these salts formed in a given source is dependent on the coal sulfur, the coal alkalinity, and the level of ammonia slip (Damon 1987). Ammonium bisulfate is a hygroscopic solid at room temperature, but has a melting point of 300°F (CRC 1975). It is formed according to the following series of reactions:

$$S + O_2 \dashrightarrow SO_2$$
$$SO_2 + 1/2\, O_2 \dashrightarrow SO_3$$
$$SO_3 + NH_3 + H_2O \dashrightarrow NH_4HSO_4$$

Thus all other factors being equal, the greater the coal sulfur content, the greater the formation of ammonium bisulfate. Similarly, the greater the ammonia slip (hence the greater the amount of free ammonia in the flue gas) the greater the formation of ammonium bisulfate. Finally, the higher the concentration of alkaline components of coal (calcium, magnesium, sodium, potassium), the greater the tendency for acidic SO_3 to be neutralized, thereby lower its concentration in the flue gas and lowering the formation of ammonium bisulfate. These factors are variable and interrelated, thus it is difficult to predict what the formation and subsequent condensation rate of ammonium bisulfate will be for a new application.

In order to estimate the range of the amount of ammonium bisulfate which would be formed in the Indiantown boiler, two major assumptions were made. If it is assumed that ammonia slip is the rate-limiting reactant, approximately 95 lb/hr of ammonium bisulfate will be formed. If, however, it is assumed that the formation of SO_3 is rate-limiting, then based on the anticipated coal properties, more than 290 lb/hr of bisulfate would be formed. Based on full load operation for 8760 hrs/yr, this represents a loading of between 416 and 1,270 ton/yr of additional particulate matter.

The relatively low melting point of this material results in its condensing on the cooler portions of the boiler backend equipment, including air preheater and flue gas ductwork. In the proposed Indinatown configuration, it would tend to condense in the spray dryer and fabric filter as well.

As a hygroscopic material, ammonium bisulfate will tend to absorb water and become sticky once it has condensed. The EPRI pilot study at Arapaho found that high levels of ammonia slip resulted in an increase in pressure drop across the baghouse, which was the result of fouling of the bags by ammonium bisulfate (EPRI 1986). It was also found that this material was not removed by normal bag operation (reverse-jet cleaning) and that a unit shutdown was required in order to clean the equipment (EPRI 1986).

European installations equipped with SCR have also found that ammonium bisulfate fouling increases the pressure drop accross the air preheater (Damon 1987, Robie 1989). In some installations, additional ductwork is installed to route the flue gas around the economizer to prevent the flue gas temperatue at the inlet to the SCR reactor from dropping low enough to allow formation and condensation of ammonium bisulfate, however this practice is not effective at low loads (Koppius-Odink 1989). The material has proven difficult to dislodge with conventional air sootblowers (Damon 1987), and in some installations daily washing of the air preheater with hot water is recommended (Necker 1989).

Table 3-2 summarizes the information contained in Appendix A comparing the Japanese and European coal-fired boilers equipped with SCR with the proposed Indiantown boiler. None of the European or Japanese installations utilize SCR in conjunction with a baghouse filter. Thus the effect of SCR system operation on baghouse performance in general, and ammonium bisulfate formation in particular, is not well known. Therefore SCR technology from Japanese and European coal-fired sources, none of which are equipped with the type of particulate control which Indiantown will employ, may not be directly transferrable in this application.

Ammonia Injection System

Specific problems have been associated with the design and operation of the ammonia injection system. Two considerations affecting the breakthrough of unreacted NH_3 from the catalytic reactor ("ammonia slip") are the control of the NO_x/NH_3 ratio for variable load conditions, and location and operation of the NH_3 injection nozzles. SCR manufacturers typically estimate less than 10 ppm of ammonia slip; however, improper system operation will result in higher emissions.

To achieve high (greater than 90%) NO_x reduction rates, SCR vendors suggest a higher ammonia injection rate than stoichiometrically required, to overcome the effects of incomplete mixing. The net result is that a larger fraction of the injected ammonia will pass through the SCR system unreacted (increased ammonia slip). Thus an emissions trade-off between NO_x and ammonia occurs in high NO_x reduction applications.

Other Considerations

In addition to the problems which arose with catalyst poisons, other features unique to European sources became evident during initial pilot studies and early commercial applications of Japanese technology. Necker noted that the type of coal being fired influences the level of NO_x generated by a particular boiler. This factor in turn influences the performance of the SCR system in any given application, such that "...unrestricted use of all coal types available on the German market was not possible" (Necker 1989).

Another consideration is the degree of NO_x control required by the SCR system. According to Lowe, et al, in Japan the utility boiler NO_x control approach is based on applying extreme

TABLE 3-2
COAL-FIRED SCR EXPERIENCE

Japanese Utility Boilers

CUSTOMER	PLANT	SIZE	EFFICIENCY (%)	COMMERCIAL OPERATION	SCR Location	SO2 Control	Particulate Control
HOKKAIDO	TOMATO ATSUMA 1	280,000 nM3/hr	80	1980	High Dust	NA	NA
E.P.D.C.	TAKEHARA 1	399,500 nM3/hr	80	1981	NA	NA	NA
E.P.D.C.	TAKEHARA 3	2,320,000 nM3/	80	1983	NA	NA	NA
TOHOKU	SENDAI 3	599,000 nM3/hr	60	1983	NA	NA	NA
TOHOKU	SENDAI 2	599,000 nM3/hr	60	1983	NA	NA	NA
CHUGOKU	MIZUSHIMA 1	450,000 nM3/hr	80	1984	NA	NA	NA
CHUGOKU	MIZUSHIMA 2	540,000 nM3/hr	80	1984	NA	NA	NA
TOYAMA JOINT	TOYAMA SHINKO 1	629,000 nM3/hr	53	1984	NA	NA	NA
TOYAMA JOINT	TOYAMA SHINKO 2	629,000 nM3/hr	53	1984	NA	NA	NA
E.P.D.C.	WAKAMATSU	188,700 nM3/hr	60	1987	NA	NA	NA
E.P.D.C.	MATSUURA 1	3,100,000 nM3/	80	1990*	NA	NA	NA
CHUBU	HEKINAN 2	(700 MW)	80	1992*	NA	NA	NA
SOMA JOINT	SHINCHI 1	(1000 MW)	—	1994*	NA	NA	NA
CHUGOKU	SHIMONOSEKI 1	175 MW	NA	1980	NA	NA	NA
CHUGOKU	SHIN-UBE 1	75 MW	NA	1981	NA	NA	NA
CHUGOKU	SHIN-UBE 2	75 MW	NA	1981	NA	NA	NA
CHUGOKU	SHIN-UBE 3	156 MW	NA	1981	NA	NA	NA
KYUSHU	MINATO	600 MW	NA	1983	NA	NA	NA
SHIKOKU	SAIJO	156 MW	NA	1983	NA	NA	NA
SAKATA	SAKATA 1	350 MW	NA	1983	NA	NA	NA
SAKATA	SAKATA 2	350 MW	NA	1984	NA	NA	NA
TOKYO	YOKOSUKA 1	265 MW	NA	1985	NA	NA	NA
TOKYO	YOKOSUKA 2	265 MW	NA	1985	NA	NA	NA
KYUSHU	MATSUURA 1	700 MW	NA	1989	NA	NA	NA
HOKURIKU	TSURUGA 1	500 MW	NA	1990*	NA	NA	NA
CHUBU	HEKINAN 1	700 MW	NA	1991*	NA	NA	NA

Japanese Industrial Boilers

CUSTOMER	PLANT	SIZE	EFFICIENCY (%)	COMMERCIAL OPERATION	SCR Location	SO2 Control	Particulate Control
IDEMITSU KOUSAN	HYOGO	NA	60	1986	NA	NA	NA
YOSHINO SEKKO	CHIBA	NA	66	1987	NA	NA	NA
SUMITOMO METAL INUSTRIES		NA	NA	1985	NA	NA	NA
SUMITOMO CHEMICAL CO		NA	NA	1985	NA	NA	NA
TAKEDA CHEMICAL INDUSTRIES		NA	NA	1986	NA	NA	NA
DAICEL CHEMICAL CO		NA	NA	1989	NA	NA	NA
PROPOSED ICL	INDIANTOWN	330 MW	—	—	—	SPRAY D	BAGHOUSE

* – not currently in operation

TABLE 3-2 (CONTINUED)

European Boilers

CUSTOMER	PLANT	SIZE	EFFICIENCY (%)	COMMERCIAL OPERATION	SCR Location	SO2 Control	Particulate Control
VKG/DURNROHR 1	(AUSTRIA)	(405 MW)	80	1986	NA	NA	NA
EVN/DURNROHR 2	(AUSTRIA)	(320 MW)	80	1986	NA	NA	NA
VKR/KNEPPER C	(FRG)	(370 MW x 1/4)	90	1986	High Dust	NA	NA
IAW/LEININGERWERK	(FRG)	(450 MW)	70	1988	NA	NA	NA
KW MEHRUM/MEHRUM 3	(FRG)	(700 MW)	75	1988	NA	NA	NA
STEAG/WALSUM-7	(FRG)	(150 MW)	90	1988	Low Dust	Wet Scrub	NA
STW FRANKFURT/WEST-2	(FRG)	(90 MW)	80	1989	NA	NA	NA
STW FRANKFURT/WEST-3	(FRG)	(90 MW)	80	1989	NA	NA	NA
BAYERWERK/SCHWANDOR	(FRG)	(100 MW)	80	1989	NA	NA	NA
PREUSSENELEKTRA/HEYDE	(FRG)	(800 MW)	75	1989	NA	NA	NA
VKR/KNEPPER C	(FRG)	260,000 nM3/hr	—	1988	High Dust	NA	NA
VKR/KNEPPER C	(FRG)	(370 MW x 1/2)	90	1989	High Dust	NA	NA
WESER/VELTHEIM 1	(FRG)	(100 MW)	82	1989	NA	NA	NA
IAW/LEININGERWERK 5	(FRG)	(450 MW)	70	1990	NA	NA	NA
STEAG/BERGKAMEN	(FRG)	750 MW	NA	1989	High Dust	Wet Scrub	NA
STEAG/VOERDE A	(FRG)	710 MW	NA	1989	High Dust	Wet Scrub	NA
STEAG/VOERDE B	(FRG)	710 MW	NA	1989	High Dust	Wet Scrub	NA
STEAG/HERNE 1	(FRG)	150 MW	NA	1989	Tail End	Wet Scrub	NA
STEAG/HERNE 2	(FRG)	150 MW	NA	1989	Tail End	Wet Scrub	NA
STEAG/HERNE 3	(FRG)	300 MW	NA	1989	Tail End	Wet Scrub	NA
STEAG/LUNEN 10	(FRG)	150 MW	NA	1989	Tail End	Wet Scrub	NA
STEAG/LUNEN 11	(FRG)	350 MW	NA	1989	Tail End	Wet Scrub	NA
STEAG/WALSUM 9	(FRG)	410 MW	NA	1989	High Dust	Wet Scrub	NA
STEAG/WEST 1	(FRG)	350 MW	NA	1989	Tail End	Wet Scrub	NA
STEAG/WEST 2	(FRG)	350 MW	NA	1986	Tail End	Wet Scrub	NA
TWS MUNSTER 15		50 MW	NA	1986	High Dust	NA	ESP
EVS HEILBRONN		700 MW	NA	1986	High Dust	NA	ESP
TWS MUNSTER 12		50 MW	NA	1988	High Dust	NA	ESP
TWS MUNSTER 25		NA	NA	1988	High Dust	NA	ESP
GKM NO.18		NA	NA	1986	High Dust	NA	ESP
STEWEAG MELLACH		260 MW	NA	1987	High Dust	NA	ESP
PGEM CENTRALE GELDERLAND		130 MW	NA	1989	High Dust	NA	ESP
SAARBERGWERKE BEXBACH		740 MW	NA	1988	High Dust	NA	ESP
STADWERKE DUISBURG		140 MW	NA	1989	Low Dust	NA	ESP
CHEMISCHE WERKE HULS-3		75 MW	NA	1990*	High Dust	NA	ESP
GOBKRAFTWERKE FRANKEN-2		200 MW	NA	1990*	High Dust	NA	ESP
STODTWERKE BREMEN-15		NA	NA	1990*	High Dust	NA	ESP
BAYERNEWERKE ASCHAFFENBURG-21		150 MW	NA	1990*	High Dust	NA	ESP
BAYERNEWERKE ASCHAFFENBURG-31		150 MW	NA	1990*	High Dust	NA	ESP
STADTWERKE BREMEN KRAFTWERK HAFEN-6		NA	NA	1990*	High Dust	NA	ESP
ODK VOITSBERG		320 MW	NA	1990*	High Dust	NA	ESP
GOBKRAFTWERKE FRANKEN-1		200 MW	NA	1990*	High Dust	NA	ESP
STADTWERKE BREMEN KRAFTWERK HAFEN-5		NA	NA	1991*	High Dust	NA	ESP
BAYERNWERK MUNCHEN INGOLSTADT-4		NA	NA	1991*	High Dust	NA	ESP
GKW MANNEHEIM-9		NA	NA	1992*	High Dust	NA	ESP
EPON-NIJMEGEN	(NETHLDS)	NA	80	1987	High Dust	NA	ESP
NECKARWERKE/ALTBACH-DEIZISAU		420	NA	1987	High Dust	Wet Scrub	ESP
NECKARWERKE/WALHEIM		150	NA	1987	High Dust	Wet Scrub	ESP
PROPOSED ICL	INDIANTOWN	330 MW	—	—	—	SPRAY D	BAGHOUSE

* - not currently in operation

combustion modifications to remove 200-300 ppm of NO_x (compared to uncontrolled emissions), followed by SCR to remove an additional 70-100 ppm. This is often not clearly stated in literature presented by SCR manufacturers, who reference system performance as a percentage of the NO_x that enters the SCR reactor, and not as the percentage reduction of the uncontrolled emissions.

Additionally, even though the Japanese systems are designed for NO_x removals of 70% or greater, they are frequently only required by permit to achieve much lower levels of removal (Lowe 1989). In particular, utility boilers located in urban areas do not push their SCR systems to the maximum degree of reduction possible. In general, such sources are concerned with excess ammonia slip and crowded plant sites in addition to NO_x reduction requirement. Since lower ammonia slip is acheived at the expense of space (more catalyst required) and/or less NO_x control (lower ammonia injection rate), urban utility boilers which are retrofit with SCR are allowed by regulators to operate at lower NO_x removal rates than design, avoiding potential SCR problems and not restricting plant power capacity or availability (Lowe 1989).

Execution of Pilot-Scale Studies

Japanese and European Studies Prior to the full-scale commercialization of the SCR process in both Japan and Europe, the process underwent a considerable degree of development and trials on small scale equipment. In Japan, the process was throughly studied in both laboratory and pilot-scale equipment for many years prior to commercialization (Kuroda 1989, Kobayashi 1987).

Kuroda noted that twenty pilot studies were conducted by Babcock-Hitachi in West Germany, Austria, Denmank and Sweeden between 1984 and 1989 (Kuroda 1989); Schonbucher states that seventy pilot plants were operated within the same time frame (Schonbucher 1989). These studies were carried out prior to construction of the first commercial unit in order to determine important design and operating parameters such as optimum space velocity, effect of European fuel supplies on SCR system performance, variability of ammonia slip, process control alternatives and others. From a process development standpoint, these pilot studies were an important step in the transfer of Japanese SCR technology to European sources.

Domestic Studies The US utility industry has concluded that "Applicability of SCR to coal-fired power plants in the US burning domestic coals can be determined only with representative pilot plant testing" (Cichanowicz 1988), and "Since SCR suppliers in the US have not undertaken pilot or demonstration programs such as was done in Japan and Germany in order to qualify SCR designs for the specific fuels and operating conditions that are anticipated, the level of risk at a US application is greater than that from a Japanese appliciation" (Lowe 1989).

The Electric Power Research Institue (EPRI) has been conducting pilot-scale demonstration studies for the US utility industry on SCR systems on domestic coal supplies. In 1982, EPRI began testing a Babcock-Hitachi SCR system on the 2.5 MW pilot plant at the Arapahoe Test Facility in Denver, Co. The objective of this testing program was "...to evaluate the technical feasibility and increase in electricity costs attributable to selective catalytic reduction NO_x control on coal-fired power plants" (EPRI 1986).

In a recent communication between Bechtel Power Corporation and EPRI, it was learned that six additional coal-fired SCR pilot projects are planned for 1990. These pilot efforts will be conducted by EPRI and Southern Company Services, and will study the effect of fuel composition on catalyst aging, system performance, and ammonia slip (Bechtel 1990). According to the project manager of these EPRI studies, critical issues to be resolved include catalyst lifetimes, impact on air heater, FGD, liquid- and solid-waste management, process control and catalyst replacement strategies (Cichanowicz 1989).

Given the early stage of progression of these pilot studies, the US utility industry and PG&E/Bechtel do not feel that SCR is commercially applicable, and thus not BACT, at the present time.

3.2.2.2 Environmental and Energy Analysis

Environmental Considerations

Adverse environmental impacts associated with the use of SCR include disposal of spent catalyst, storage and handling of ammonia, and issues pertaining to emissions of unreacted ammonia.

Spent Catalyst Disposal - The SCR catalyst material will be subject to loss of activity and poisoning and will be periodically replaced. The disposal of spent catalyst is complicated by the fact that many SCR catalysts contain various heavy metals, including titanium and vanadium, which are considered to be hazardous wastes. Thus, use of SCR entails hazardous waste handling and disposal; an environmental burden and potential liability.

Certain catalyst formations must be washed annually in order to be cleaned and regenerated. Mitsubishi estimates that the wastewater resulting from cleaning their catalyst could be ten times the catalyst volume and contain 250 ppm V_2O_5, a listed hazardous waste. Wastewater treatmant and secure discharge and/or hazardous waste disposal of the wastewater treatment residues or the untreated wastewater to a licensed treatment facility would pose additional adverse economic and environmental impacts with certain SCR systems.

In light of the water availability restrictions and stringent wastewater discharge requirements in the area surrounding the proposed Indiantown facility, the generation of large amounts of hazardous wastewater represents a significant adverse impact for this potential application.

Ammonia Storage - An additional adverse environmental impact associated with SCR is the onsite storage of anhydrous ammonia. Ammonia is a designated "Extraordinarily Hazardous Substance" (EHS) under the Federal SARA Title III requirements set out in the Federal Register, 52 FR 13397, April 22, 1987. The quantity of on-site ammonia storage required for the SCR process at Indiantown will exceed the 100 pound threshold for reportable quantities under the Federal program.

Facilities employing the process must review the process to define specific safety features necessary for operation of the SCR process. Technical guidelines were developed by the American National Standards Institute, ANSI, K61.1-1981 "Safety Requirements for the Storage and Handling of Anhydrous Ammonia". Additionally, specific ongoing maintenance procedures would have to be developed to ensure proper operation of the safety features selected.

Anhydrous ammonia is purified ammonia gas, liquified under pressure. Acute human exposure to this material may threaten life or cause permanent physical impairment. Because it is stored under pressure, an accidental release would result in the sudden escape of large quantities of toxic ammonia gas, with the accompanying risk to human health and welfare.

Some SCR systems now employ aqueous ammonia, which is stored as a water-based solution. This material does not present the acute accident potential of anhydrous ammonia, however the use of this material is not widespread.

Ammonia Slip - As with any chemical process, not all the reactant ammonia will be consumed in the NO_x reduction reactions. Emissions of unreacted ammonia ("ammonia slip") are thus another adverse environmental consideration in any application of SCR. Although vendors claim that the design and proper operation of the catalyst reactor will keep ammonia slip to less than 10 ppm, catalyst design is governed principially by NO_x removal required and allowable ammonia slip, amoung other considerations. Therefore, requiring either higher NO_x removal or lower residual ammonia requires greater amounts of catalyst, thereby increasing costs. Consequently, to a certain extent there is a tradeoff between NO_x and ammonia emissions in any application of SCR.

Increased Particulate Loading - As discussed above, the operation of an SCR system on a source firing sulfur-bearing fuels will result in the formation of ammonium bisulfate and ammonium sulfate. These salts will condense out in the cooler portions of the boiler, in the air preheater, and the spray dryer, resulting in increased particulate loading on the fabric filter. The maximum estimated increase in loading is 290 lb/hr, which translates to a maximum increase in annual loading of 1,270 ton/yr to the particulate control device.

Energy Considerations

Energy requirements for the SCR alternative for the PC boiler consist of increased fan power to overcome the pressure drop of the catalyst, electrical power for pumping aqueous ammonia from storage to the injection nozzles, and steam for ammonia vaporization. Total additional electrical power requirements are approximately 1,678 kw, or 9,806 kw-hr/ton NO_x controlled.

3.2.2.3 Economic Analysis

Capital and annual operating costs associated with operation of an SCR system on the PC boiler were estimated from vendor information. These costs are presented in Tables 3-3 and 3-4. Since no SCR system has ever been installed on a PC boiler firing US coals, the design of the equipment, including amount of catalyst included, has to be conservative and contain sufficient contingency to account for indeterminant process variables, including catalyst life, formation of ammonium salts, and effect operation of the SCR system may have on downstream equipment such as the spray dryer absorber and fabric filter.

Estimated direct costs for the SCR system, including catalyst, catalyst housing, ammonia storage, piping and instrumentation are $19,908,000. Considering indirect charges, the total capital cost is estimated at $29,307,000. Annual costs for SCR include operating labor charges (one additional operator/shift), replacement parts including catalyst replacement (based on a three-year catalyst life) additional electrical cost for fan power associated with increased pressure drop due to the catalyst, ammonia cost, catalyst disposal cost, and indirect operating costs. Total annualized cost, including capital recovery charges (based on 10% interest rate and 10 year equipment life), is estimated at $8,961,400.

Based on an emission limit of 0.17 lb NO_x/MMBtu, the SCR alternative would control an estimated 1,499 tons of NO_x per year more than the use of advanced combustion controls (which would have an estimated emission rate of 0.27 lb/MMBtu). Cost effectiveness for SCR is thus estimated to be $5,978/ton of NO_x controlled, which is not considered cost effective.

TABLE 3-3
CAPITAL COSTS FOR NO_x ALTERNATIVES, PC BOILER

	SCR	SNCR
(1) Purchased Equipment		
(a) Basic Equipment	9,900,000	3,000,000
(b) Auxiliaries	2,300,000	included
(c) Instrumentation and Controls	990,000	included
(d) Structural Support	990,000	300,000
(e) Freight & Taxes	1,134,000	264,000
(2) Direct Installation	4,594,000	1,069,000
Total Direct Costs (TDC)	$19,908,000	$4,633,000
(3) Indirect Installation		
(a) Engineering & Supervision	1,991,000	463,000
(b) Construction & Field Expense	1,991,000	463,000
(c) Construction Fee	995,000	232,000
(d) Contingencies	3,982,000	927,000
(4) Other Indirect Costs		
(a) Startup & Performance Test	199,000	46,000
(b) Working Capital	241,000	207,000
(c) License Fee	–	1,137,000
Total Indirect Costs (TIC)	$9,399,000	$3,475,000
Total Capital Cost (TCC)	$29,307,000	$8,108,000
(5) Annualized Capital Recovery (ammortized over 10 years straight line @ 10% interest rate)	$4,757,000	$1,316,000

Cost Factors: 1990 OAQPS Control Cost Manual

TABLE 3-4
ANNUAL COSTS FOR NO_x ALTERNATIVES, PC BOILER

	SCR	SNCR
Direct Operating Costs		
(1) Labor		
(a) Operating (8 hours/shift)	$175,200	$175,200
(b) Supervisory	26,000	26,000
(2) Maintenance		
(a) Labor	214,200	214,200
(b) Supplies (50% Maint. Labor)	107,000	107,000
(3) Replacement Parts		
(a) Catalyst	957,000	-
(4) Utilities - Electricity (2)(3)	1,193,000	1,567,000
(5) Raw Materials - Ammonia (2)(3)	248,000	427,000
(6) Catalyst Disposal (2)	13,000	-
Indirect Operating Costs		
(7) Overhead	99,000	99,000
(8) Taxes	293,000	81,000
(9) Insurance	293,000	81,000
(10) Administration	586,000	162,000
Annual Operating Costs	$4,204,400	$2,939,400
Annual Capital and Operating Costs	$8,961,400	$4,255,400
Annual Tons Removed (4)	1,499	1,499
Cost Effectiveness ($/ton)	$5,978	$2,839

Notes:
(1) catalyst replacement at 100% in five years
(2) per Bechtel Power
(3) based on 100% capacity
(4) based on 0.17 lb/MMBtu emission limit
–compared to boiler emission rate 0.27 lb/MMBtu

3.2.2.4 Conclusion

Selective Catalytic Reduction has been applied to commercial scale coal-fired sources in both Japan and Europe. The application of this technology, however, took place as a result of intensive R&D and process development work on laboratory-scale and pilot-scale equipment. In transferring SCR technology from the commercial applications in Japan to European sources, technical problems arose which were not anticipated given the Japanese experience.

Furthermore, the Japanese philosophy regarding NO_x control for coal-fired boilers is to achieve the maximum degree of reduction possible using advanced combustion controls, followed by appilcation of SCR to "trim" emissions. In urban areas, regulatory agencies allow SCR systems to be operated so as to avoid excessive levels of ammonia slip and ammonim bisulfate formation.

SCR has never been applied to a commercial-scale unit firing domestic coals, and has never been applied to a commercial PC unit in either Japan or Europe using a baghouse for particulated control. Since problems comparable to those encountered in Europena SCR applications are expected for US applications, pilot-scale studies to validate this technology on US coals are in their early stages. Therefore, SCR is not considered technically feasible, and thus not BACT, for Indiantown.

The inmposition of this technology would result in an increase in annual operating costs of $8,961,400/yr and $5,978 ton/$NO_x$ controlled, which is also considered unreasonable given the current developmental status of this alternative in the US on coal-fired sources.

3.2.3 Selective Non-catalytic Reduction (SNCR)

The SNCR process is based on a gas phase homogeneous reaction, within a specified temperature range, between NO_x in the flue gas and either injected NH_3 or urea to produce gaseous nitrogen and water vapor. As the name implies, these systems do not employ a catalyst, and therefore operate at higher temperatures than SCR systems. Although SNCR, like SCR, has never been installed on a domestic PC boiler, there are fewer technical uncertainties associated with this alternative. SNCR at an emission level of 0.17 lb NO_x/MMBtu is thus proposed as BACT.

3.2.3.1 Technical Analysis

Process Description - There are two commercially available SNCR processes, including EPRI's NO_xOUT process and Thermal $DeNO_x$®, a system patented by Exxon Corporation in 1976. In general, aqueous or anhydrous NH_3 or urea is injected into the hot flue gas as an atomized aqueous solution or by means of air or steam carrier gas at a point in the flue specifically selected to provide optimum reaction temperature and residence time.

SNCR has been applied to numerous petroleum heaters, as well as to a limited number of utility and industrial boilers fired with natural gas or oil. Most of the existing applications are in the United States and Japan, with a few installations in Europe. Table 3-5 is a summary table of coal-fired SNCR installations (Exxon, 1990). NO_x reductions ranging from 30 to 80 percent have been tested on these units (SCAQMD). The highest NO_x removal efficiency ever tested, 85 percent, was achieved on a coal-fired utility boiler in West Germany. Although Exxon literature (Lyon, 1987) claims that 90 percent reductions have been achieved, further contact with Exxon shows that 85 percent was the absolute maximum NO_x reduction achieved using Thermal $DeNO_x$®, with 80 percent being the maximum reduction ever tested on more than one unit.

The actual chemical mechanism of the SNCR process is complex, involving at least 31 significant chemical reactions in conventional combustion applications. The chemical reactions typically governing the $DeNO_x$ control process are:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O \quad (1)$$
$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O \quad (2)$$

The NO_xOUT process using urea ($CO(NH_2)_2$) is similar to the $DeNO_x$ process except that CO_2 is generated along with N_2 and H_2O. Critical to the successful reduction of NO_x in these applications is the prevailing temperature of the flue gas at the injection point. In conventional combustion processes at flue gas temperatures of 1600°F to approximately 1740°F, the first reaction dominates, reducing NO and limiting further NO production. As temperatures increase above 1740°F, reaction (2) becomes more significant, limiting NO reduction efficiency, and at temperatures above 2200°F, reaction (2) dominates, creating more NO, a counterproductive situation. At flue gas temperatures below 1600°F, the rate of both reactions slows down, such that some of the ammonia does not react and passes through the system into the ambient atmosphere. The optimum temperature depends upon a number of factors including flue gas composition, but is typically below 2,000°F. Research efforts have succeeded in understanding the chemical kinetics to the point where computer modeling are used to predict the removal efficiency.

Table 3-5
Coal-Fired Boilers Equipped with SNCR

Project Name	Location	Boiler Type	Output (MW)	Pollution Control Devices	SNCR Vendor	Fuel	Operating History
Stockton Cogen (previous name = Corn Products)	San Joaquin County CA	CFB	49.9	NH3 & limestone inj., Baghouse	Other	Coal Coke	Start-up in 1988
Cogeneration Nat'l (POSDEF) - 2 units	San Joaquin County CA	CFB	23.2 each	NH3 & limestone inj., Baghouse	CPC	Coal	Start-up on coal in early February 1988.
RWE A.G.	Weisweiller W. Germany	PC	75	Urea Injection Unspecified PM Control	Fuel Tech	Brown Coal (0.2% S)	Installed in 1988; Not currently operating
Kerr McGee	Trona CA	PC	75	Urea Injection ESP	Fuel Tech	Coal (0.5% S)	Started as a full-scale demonstration unit in 1989; commercial oper- ation to commence soon.
KMW (2 units)	Mainz W. Germany	CY	45	NH3 Injection ESP, FGD - Unspecified	Exxon	Coal (1% S)	Start-up in 1989; due to success of 1st unit, 2nd unit was installed with NOx control; NOx removals of 83%.
STEAG	Herne W. Germany	PC	500	NH3 Injection ESP, FGD - Unspecified	Exxon	Coal (1.5% S)	Start-up in 1989; NOx removals of 55%.
Mount Poso	Kern County CA	CFB	49.9	NH3 & limestone Inj., Baghouse	Other	Coal	Start-up March 20, 1989; NOx reductions of 80%.
Rio Bravo (2 projects)	Poso & Jasmin CA	CFB	36 each	NH3 & limestone Inj., Baghouse	Exxon	Coal	Start-up February 2, 1990
BIOGEN	Ivanpah CA	CFB	15	NH3 & limestone Inj., Baghouse	CPC	Coal	Start-up in 1989.
BAPS (3 units)	Antioch & Pittsburg CA	CFB	16.6 each	NH3 & limestone Inj., Baghouse	CPC	Coal	Start-up in 1990.
Proposed Indiantown	Indiantown FL	PC	330	SNCR Spray Dryer/Baghouse	NA	Coal (2% S)	

Notes

CFB – Circulating Fluidized Bed

PC – Pulverized Coal

CY – Cyclone-fired

BH – Baghouse

SD – Spray Dryer

Because the NO_x reduction reactions occur within a narrow window of temperature, the location in the furnace at which the ideal reaction temperature is found to exist is difficult to predict with absolute certainty and is not considered to remain constant. The furnace temperature profile varies with boiler load, fuel composition, and combustion air temperature. This variability in the temperature profile through time means that the flue gas at the ammonia injector nozzles will not always be at the optimum temperature for the reactions which control NO_x emissions to occur. This problem generally results in provision of more than onset of injection nozzles.

Generally, the equipment that comprises a $DeNO_x$ system includes the following items:

- multiple rows of injection headers and nozzles for each combustion unit (only one row utilized, but two provided to allow for process modifications required due to furnace temperature profile)

- necessary piping for delivery of aqueous ammonia (or urea), carrier gas, and mixed gas into the injection headers

- air compressors and reservoir to provide air for carrier gas and ammonia injection requirements (sufficient carrier gas pressure is necessary to achieve uniform distribution of ammonia throughout the combustion zone)

- aqueous ammonia storage facility

Additional Technical Considerations - Operating/maintenance problems with SNCR may arise in new applications, such as the proposed PC boiler, because of operating/maintenance problems with the combustion unit itself. For example, the Commerce Resource Recovery facility in California, the first resource recovery facility in the United States to be equipped with SNCR, had operating and maintenance problems with the combustor such that the performance of the SNCR system was affected. Because of the problems in the combustion unit, reduction of the level of excess air was necessary, resulting in greater furnace temperatures. Because of the higher temperatures and the associated decrease in the NO_x removal efficiency of the SNCR system, the ammonia injectors had to be relocated to accomodate the new temperature profile within the boiler (Exxon 1988), a costly interruption which could not be foreseen. This risk is a major concern for all new boiler applications where the actual flue gas temperatures, flowrates and composition may vary considerably from the theoretical values developed during the design stages.

Achievable NO_x Reduction Level - Based on the fact that there are currently no commerical PC units operating on domestic coals using SNCR to control NO_x, it is difficult to predict precisely what control level can be attained for the Indiantown unit. There are currently only two PC units in the world operating with Thermal $DeNO_x$; both units are located in West Germany and differ significantly than the proposed Indiantown unit.

The first unit, a cyclone-fired wet bottom boiler, was first tested with Thermal $DeNO_x$ in 1986. The system was designed for NO_x reductions of 80% with less than 10 ppm of ammonia slip. Due to its wet bottom design, however, the uncontrolled NO_x concentration (840 ppm) is much higher than the proposed Indinatown unit (250 ppm). This difference is important as SNCR is "sensitive to initial NO_x concentration" (Hurst 1981) and "It's easier to get more reduction if the initial level of NO_x is high" (Hofmann, 1990).

In addition, the system was designed as a development and demonstration project with multiple ammonia injection ports to attempt to match temperature variations expected with changing loads.

The second full scale application is a 500 MW commercial unit designed for 50% NO_x removal with an ammonia slip level of 5 ppm (Fellows, 1990). This unit was tested in January 1990 and met all design criteria (Fellows, 1990), although long-term confirmation of these results has not yet been obtained.

Neither of these units, nor any of the operating domestic CFB boilers currently employing SNCR for NO_x control has the same air pollution control train (spray dryer/fabric filter) proposed for Indiantown.

Therefore, the degree of actual NO_x reduction which can be expected for this alternative at Indiantown is not well defined. Application of this technology thus involves a degree of risk and uncertainty. Based on data from the two German boilers using SNCR (NO_x reductions 50-80%), from the major equipment supplier (Exxon: 40-60% reductions for PC units), and the baseline NO_x emission from the boiler without controls (0.27 lb/MMBtu), the anticipated control level for SNCR is 0.17 lb/MMBtu based on a maximum ammonia slip of 5 ppm.

3.2.3.2 Environmental and Energy Analysis

<u>Environmental Considerations</u>

The potential adverse environmental impacts associated with the use of SNCR are effects of residual ammonia in the flue gas ("ammonia slip"), and safety related issues due to ammonia storage.

Ammonia Slip Emissions - As with SCR, emissions of unreacted ammonia represent an adverse environmental consideration with SNCR. However, stack concentrations of ammonia can generally be maintained below 10 ppmdv. At this level, the estimated ground level ammonia concentration would be well below the threshold limit value of 18,000 $\mu g/m^3$ established by the American Conference of Governmental Industrial Hygienists.

Ammonium Salt Formation - As discussed above, ammonium salts are formed in sources employing ammonia injection NO_x control. The use of SNCR will therefore encounter similar technical difficulties and environmental impacts involving ammonium salts than would be expected with the use of SCR since both techniques emit unreacted ammonia (ammonia slip).

For the proposed Indiantown boiler firing 2.0% sulfur coal, the estimated SO_3 formation rate is 1.65 lbmol/hr, which would generate 209 lb/hr of ammonium bisulfate if availability of SO_3 is assumed to be rate limiting. (see calculation in Appendix B). For a CFB with the same heat input firing the same 2.0% sulfur fuel, in-bed limestone SO_2 control would reduce the SO_3 formation rate to 0.17 lbmol/hr, equivalent to 19 lb/hr of ammonium bisulfate.

As discussed in Section 3.2.3.1, the effect on fabric filters of the higher formation rate of ammonium bisulfate is not well known. In fact, a paper from Exxon states, "...there is minimal experience on the effect of ammonia or ammonium salts on scrubbers and baghouses and thus this is a problem area" (Hurst and White 1986).

Compared to SCR, however, the formation and subsequent condensation rate of ammonium bisulfate is expected to be lower with SNCR. SCR systems have been shown to catalytically oxidize SO_2 to SO_3 by as much as 1% (Damon 1987); SO_3 is thus formed both through high-temperature oxidation of SO_2 in the boiler as well as catalytically in the SCR unit. For SNCR, the only SO_3 available to participate in the formation reaction will arise from furnace oxidation of SO_2.

Odors - Ammonia is an odorous compound. Kirk-Othmer's Encyclopedia of Chemical Substances shows that ammonia is first perceptible at 20 ppm; another source lists the odor threshold as 46.8 ppmv (Cheresiminoff, 1975). Exxon estimates that the ammonia slip concentrations in the stack for resource recovery applications could be as high as 50 ppm as reported for Commerce (McDannel, et al., 1988b) for ammonia - NO_x mole ratios of 2.5. Ground level concentrations, however, will be much lower because of ambient air dilution, such that odors should not be detected. No odor complaints have been lodged against the Commerce facility. It is interesting to note, however, that several odor complaints have been lodged in California by residents living near gas turbine applications equipped with selective catalytic reduction (Fogman, 1988), a NO_x control technique which should emit less ammonia slip than Thermal DeNO$_x$®.

Ammonia Storage - Application of SNCR requires the storage and handling of ammonia, which in anhydrous form is classified as an "Extraordinarily Hazardous Substance," requiring specific storage and handling practices to insure safety. Accidental release of this material could potentially result in severe environmental impacts. However, these safety and adverse environmental concerns can be eliminated by using aqueous ammonia rather than anhydrous ammonia as the reducing agent in the SNCR process.

Energy Considerations

Energy requirements for the SNCR alternative for the PC boiler consist of electrical power for pumping aqueous ammonia from storage to the injection nozzles. Total additional electrical power requirements are estimated at approximately 775 kw, or 4,529 kw-hr/ton NO_x controlled.

3.2.3.3 Economic Analysis

Capital and annual operating costs associated with operation of an SNCR system on the PC boiler were estimated from vendor information, and are presented in Tables 3-3 and 3-4. Total direct costs for SNCR, including injection nozzles, ammonia storage, piping and instrumentation are $4,633,000. Considering installation charges and indirect charges, the total capital cost is estimated at $8,108,000. Annual costs for SNCR include operating labor charges (one additional operator/shift), additional electrical cost for fan power associated with ammonia vaporization and pumping, ammonia cost, and indirect operating costs. Total annualized cost is estimated at $4,255,400.

Based on an emission limit of 0.17 lb NO_x/MMBtu, SNCR would control an estimated 1,499 tons of NO_x per year more than the use of advanced combustion controls at 0.27 lb/MMBtu. Cost effectiveness for SNCR is thus estimated to be $2,839/ton, which is considered reasonable.

3.2.3.4 Conclusions

SNCR has never been applied on a commercial scale to a PC boiler firing domestic coals, although there are coal-fired units operating with the technology. In addition, there are several domestic CFB facilities employing SNCR. These facilities, however, differ from the proposed Indiantown boiler in terms of air pollution control train design. CFB unit in particular exhibits inherently different furnace temperatures, flue gas mixing characteristics, and potential flue gas SO_3 levels than the Indiantown design. There are, therefore, a number of unresolved technical issues which result in uncertainties concerning application of this technology in this instance, in particular the degree of NO_x reduction which can be expected and the level of ammonia slip which can be tolerated. Based on vendor information and SNCR systems operating on CFB's and in Europe, the appropriate emission level for SNCR on Indiantown is 0.17 lb/MMBtu. At this level, this alternative would have a cost effectiveness of $2,839/ton controlled, compared to the use of advanced combustion controls, which is considered reasonable.

This emission level is consistent with the most stringent emission level for PC units, and is thus concluded to be representative of BACT.

3.3 NO_x Emissions from Auxiliary Boiler

3.3.1 Control Alternatives

NO_x emissions from the oil- and natural gas-fired auxiliary boiler, as with the coal-fired PC boiler, can be controlled either through combustion modifications or add-on control technology. Add-on controls include SCR and SNCR; combustion modifications include low excess air (LEA) firing, flue gas recirculation (FGR) and low NO_x burner (LNB) design.

3.3.1.1 Add-on NO_x Controls

Both SCR and SNCR have been applied to oil- and gas-fired boilers in previous applications. In Japan, SCR has been applied to more than fifty boilers firing oil (Nakabayashi and Abe, 1987), and the Exxon Thermal $DeNO_x$ SNCR process has been installed on several domestic oil-fired industrial boilers and petroleum heaters (Hurst and White, 1986).

Burner design and boiler modifications, however, are more commonly applied to oil- and gas-fired boilers in the size range proposed for Indiantown; particularly for standby or auxiliary boilers used only for startup and shutdown heat requirements.

Technical descriptions of the SCR and SNCR control alternatives are discussed extensively in Sections 3.2.3 and 3.2.4. SCR catalysts designed for oil firing will be different than catalysts designed for coal firing. In particular, the lower particulate grain loading associated with oil and gas firing allows for a smaller pitch size, and the lower sulfur content of the fuel results in less of a consideration of formation and condensation of ammonia salts.

Thus the feasibility for utilizing either SCR or SNCR on in an application such as the Indiantown auxiliary boiler becomes a question of economics, as detailed in Section 3.3.2

3.3.1.2 Combustion Controls

NO_x controls involving burner design, boiler design, or operational considerations aim to reduce NO_x emissions through minimization of NO_x formation. Such controls can be classified as flue gas recirculation (FGR), various types of low NO_x burners (LNB's) or low excess air (LEA) operation, as described further below.

Flue Gas Recirculation

This NO_x control technique involves extraction a portion of the flue gas from the boiler and returning it to the furnace through the burner or windbox. The primary effect of FGR is a reduction of the peak flame temperature through absorption of the combuston heat by the relatively inert flue gas. Furthermore, the addition of flue gas reduces the oxygen concentration in the combustion air, effecting a reduction in NO_x formation by decreasing the available oxygen.

The effectiveness of this alternative depends to a large degree on the fuel being fired. Since FGR reduces NO_x formation by targeting peak flame temperature, it has little effect on fuel NO_x formation. FGR is thus less effective on fuels with a high nitrogen content, such as residual oils.

NO_x removal efficiency is directly related to the flue gas recirculation rate; an increase in the recirculation rate results in a decrease in thermally generated NO_x. At recirculation rates greater than 25-30%, however, flame stability becomes compromised. In addition, decreasing the peak flame temperature by increasing the recirculation rate lowers the thermal output of the boiler. Therefore the tradeoff between lower NO_x emissions and heat output generally limit FGR recirculation rates to below 25%.

Implementation of FGR requires a capital expense associated with the required additional ductwork and fan capacity. The recirculation fan must be designed to operate in a high temperature environment, necessitating the use of more expensive materials of construction.

Low NO_x Burners

LNB design falls into one of two general categories: staged air design, and staged fuel design.

Staged Air Combustion - The staged air design involves diverting a portion of the combustion air from the burner(s) and injecting it into the furnace beyond the burner. By reducing the amount of air fed to the burners to the stoichiometric requirement, NO_x formation is reduced through promotion of a localized fuel-rich combustion region. Complete combustion is then effected downstream of the burners in a fuel-lean environment, resulting in lower overall NO_x formation.

Maintaining proper air flow represents the major operational consideration for effective NO_x control. Comercially available air flow controls can be used to maintain the required separate air rates, but careful control of operating parameters is necessary to avoid feeding too much air at low load conditions, resulting in ineffective NO_x removal and reduced boiler efficiency.

Staged Fuel Combustion - In the staged fuel design, or reburning, the fuel is fired in primary and secondary combustion zones similar to staged air combustion. In this method, however, the fuel is diverted to the two zones.

NO_x control is accomplished by injecting part of the fuel into the bulk of the combustion air and the remainder of the fuel into primary and secondary combustion zones. Thermal NO_x generation in the primary combustion zone is limited in this fuel-lean zone by the reduced peak flame temperature that results. The combustion products from this primary zone (hydrogen, carbon monoxide and hydrocarbons) are carried into the secondary combustion zone, lowering the local oxygen concentration and reducing the prak flame temperature in this zone as well. Combustion products from the primary zone also provide reducing agents for NO_x reduction in the secondary zone. Finally, zoned combustion permits complete combustion with lower excess air levels than standard burners, which further enhances NOx emission recuctions.

Potential adverse impacts with this technique are increased smoke, CO and HC emissions associated with incomplete combustion caused by incomplete mixing of the secondary air with the primary combustion products. Improper mixing of secondary air is also associated with flame carryover to the boiler section, potentially causing tube failure.

Low Excess Air

Boilers are designed to operate with the lowest air level consistent with complete combustion and safe operation. In practice, however, boilers are commonly operated with a greater amount of excess air than recommended, primarily to avoid smoke emissions during sudden load surges. This additional air is detrimental to efficient system operation since it both reduces the thermal efficiency by increasing the volume of heated gas released to the atomosphere, and promotes an increase in NO_x emissions.

With Low Excess Air (LEA) firing, the amount of primary combustion air is reduced, thereby reducing the formation of NO_x by decreasing the availability of oxygen in the primary combustion zone. The technique is applicable to all types of fuels and combustion sources, but the greatest potential NO_x reductions are on existing sources not specifically designed for LEA operation.

Maintaining the correct air flow rate is crucial to effective NO_x control with LEA and requires the use of an oxygen trim system. Primary air flow is adjusted based on the flue gas oxygen content. A minimum excess air level must be maintained, however, to insure complete combustion and avoid formation of carbon monoxide (CO) and hydrocarbons (HC). This minimum level varies with the fuel used, furnace design, and boiler load; oxygen trim control systems are generally field adjusted during the initial break-in period to achieve the optimum excess air level for each particular application.

3.3.1.3 Permitted Control Levels

The NSPS for #2 fuel oil-fired steam generating units with heat inputs greater than 100 MMBtu/hr is 0.2 lb/MMBtu (40 CFR 60, Subpart Db). A list of the oil-fired boilers in the BACT/LAER Clearinghouse with limits on NO_x emissions is included in Appendix A. Although there are no facilities listed in the Clearinghouse employing SCR for NO_x control, one facility (Hopco) is listed as utilizing SNCR to achieve 0.12 lb/MMBtu. Other facilities employing LNBs and FGR are also listed as having limits of 0.12 lb/MMBtu

3.3.2 Economic Analysis

SCR, SNCR and FGR capital and annual operating costs for the auxiliary boiler were estimated based on vendor information for a similar project. These costs are presented on Tables 3-6 and 3-7. Capital equipment for the SCR and SNCR alternatives would be the same as described in Sections 3.2.3 and 3.2.4 (above), although the size of the equipment would be reduced in size compared to the equipment designed for the PC boiler. In addition, a different catalyst would be used for the oil- and gas-fired auxiliary boiler than would be employed for the PC boiler.

Total capital costs for the SCR alternative on the auxiliary boiler are $1,500,000. Based on 1,000 hours/hr annual operation, the annual cost of this alternative is estimated at $735,000/yr. Compared to the NSPS for this size unit, an SCR system designed for 80% control would reduce annual NO_x emissions by 27.4 ton/yr for a cost effectiveness in excess of $26,864/ton, which is considered unreasonable and unrepresentative of BACT.

Total capital costs for the SNCR alternative on the auxiliary boiler are estimated at $1,222,000; annual costs are estimated at $611,500/yr. Based on a design control efficiency of 60%, this alternative would control 20.5 ton/yr and have a cost effectiveness of $29,800/ton. This is also considered unrepresentative of BACT costs for similar sources.

TABLE 3-6
Capital Costs for NO_x Control Alternatives, Auxiliary Boiler

	SCR	SNCR	FGR
(1) Purchased Equipment			
(a) Basic Equipment	675,000	470,000	318,000
(b) Auxiliaries	included	included	included
(c) Instrumentation and Controls	68,000	47,000	32,000
(d) Structural Support	68,000	47,000	32,000
(e) Freight & Taxes	65,000	45,000	31,000
(2) Direct Installation	263,000	183,000	124,000
Total Direct Costs (TDC)	$1,139,000	$792,000	$537,000
(3) Indirect Installation			
(a) Engineering & Supervision	114,000	79,000	54,000
(b) Construction & Field Expense	114,000	79,000	54,000
(c) Construction Fee	57,000	40,000	27,000
(d) Contingencies	34,000	24,000	16,000
(4) Other Indirect Costs			
(a) Startup & Performance Test	11,000	8,000	5,000
(b) Working Capital	31,000	26,000	14,000
(c) License Fee	-	175,000	-
Total Indirect Costs (TIC)	$361,000	$431,000	$170,000
Total Capital Cost (TCC)	$1,500,000	$1,223,000	$707,000
(5) Annualized Capital Recovery (ammortized over 10 years straight line @ 10% interest rate)	$243,000	$198,000	$115,000

Cost Factors: 1990 OAQPS Control Cost Manual

TABLE 3-7
Annual Costs for NO_x Control Alternatives, Auxiliary Boiler

	SCR	SNCR	FGR
Direct Operating Costs			
(1) Labor			
(a) Operating	$87,600	$87,600	-
(b) Supervisory	13,000	13,000	-
(2) Maintenance			
(a) Labor	107,100	107,100	87,600
(b) Supplies (50% Maint. Labor)	54,000	54,000	44,000
(3) Replacement Parts			
(a) Catalyst (1)	41,000	-	-
(b) Equipment	68,000	47,000	32,000
(4) Utilities			
(a) Air	-	-	-
(b) Steam	-	4,000	-
(c) Electricity	7,100	600	4,400
(5) Raw Materials - Ammonia	2,900	2,200	-
(6) Catalyst Disposal	1,300	-	-
Indirect Operating Costs			
(7) Overhead	50,000	50,000	16,000
(8) Taxes	15,000	12,000	7,000
(9) Insurance	15,000	12,000	7,000
(10) Administration	30,000	24,000	14,000
Annual Operating Costs	$492,000	$413,500	$212,000
Annual Capital and Operating Costs	$735,000	$611,500	$327,000
Annual Tons Removed (2)	27.4	20.5	17.1
Cost Effectiveness ($/ton)	$26,864	$29,800	$19,123

Notes:
(1) catalyst replacement at 50% in five years
(2) compared to NSPS 0.2 lb/MMBtu with 1000 annual operating hours

Capital costs for the FGR alternative, including additional ductwork, recirculation fan, insulation and control instrumentation, are estimated at $707,000. Annual costs are estimated at $327,000/yr with 17.1 ton/yr controlled assuming a reduction efficiency of 50%. Cost effectiveness of FGR is thus $19,123/ton; similarly this is considered excessive and unrepresentative of BACT.

There are no adverse economic impacts associated with the use of Low NO_x Burners.

3.3.3 NO_x Control for Auxiliary Boiler - Conclusion

For the auxiliary boiler, SCR is considered the most stringent control alternative, however due to the limited operating hours of this source, this alternative would result in unreasonable annualized costs. SNCR, as the next-most stringent alternative, is similarly concluded to be economically infeasible. FGR would be the third-most stringent alternative; this control method is similarly concluded to be unreasonable based on excessive cost effectiveness.

The use of Low NO_x Burners, as the next alternative, would not have unreasonable annual economic or energy impacts, and use of this alternative would not result in adverse environmental impacts. It is therefore concluded to represent BACT for control of NO_x from the auxiliary boiler.

3.4 BACT for Nitrogen Oxides - Conclusions

3.4.1 PC Boiler

Nitrogen oxides are formed in combustion sources via the thermal oxidation of nitrogen in combustion air, or the reduction and subsequent oxidation of nitrogen compounds in the fuel. For coal fired sources such as the proposed PC boiler, control alternatives consist of SCR, SNCR and combustion controls.

SCR has been applied to commercial scale coal-fired sources in both Japan and Europe after intensive R&D and process development work on laboratory-scale and pilot-scale equipment. In transferring SCR technology from the commercial applications in Japan to European sources, technical problems arose which were not anticipated given the Japanese experience.

SCR has never been applied to a commercial-scale unit firing domestic coals, and has never been applied to a commercial PC unit in either Japan or Europe using a baghouse for particulated control. Since problems comparable to those encountered in Europena SCR applications are expected for US applications, pilot-scale studies to validate this technology on US coals are in their early stages. Therefore, SCR is not considered technically feasible, and thus not BACT, for Indiantown. Finally, the imposition of this technology would result in an increase in annual operating costs of $9,806,900/yr, which is also considered unreasonable given the current developmental status of this alternative in the US on coal-fired sources.

SNCR has similarly never been applied on a commercial scale boiler firing domestic coals, and there are technical issues which must be addressed involving minimization of the condensation of ammonium salts, handling and transportation of ammonia, maintenance of system operating temperature during reduced load conditions, and compatibility of the system with downstream air pollution control equipment. The technology is currently in use at domestic coal-fired CFBs, and although these applications may be more favorable for the application of SNCR, the technical issues can be addressed in the system design. Compared to the base case combustion controls, the application of SNCR to Indiantown with an emissions level of 0.17 lb/MMBtu results in a cost effectiveness of $2,248/ton.

Therefore, based on these technical and economic factors, the use of SNCR is concluded to be representative of BACT for control of NO_x for the PC boiler.

3.4.2 Auxiliary Boiler

The use of Low NO_x Burners is considered representative of BACT for NO_x control from the auxiliary boiler. The imposition if SCR, SNCR or FGR would have unreasonable annual economic impacts based on the limited annual operating hours of this source.

4.0 BACT DETERMINATION FOR SULFUR DIOXIDE AND ACID GASES

4.1 Introduction

In the following analysis, the compounds SO_2, HF and H_2SO_4 are discussed together since removal methods and are common for each.

4.1.1 Formation

Emissions of sulfur oxides (SO_x) and acid gases (H_2SO_4 and HF) are generated in fossil-fuel-fired sources from the release in the furnace of sulfur and fluorine present in the fuel. Sulfur compounds are formed when the organic and pyritic sulfur is oxidized, forming primarily sulfur dioxide (SO_2) with smaller quantities of sulfur trioxide (SO_3) and sulfates (SO_4). Sulfur trioxide further reacts with water present in the flue gas to form H_2SO_4.

4.1.1.1 SO_2 Formation

Approximately 98% of the sulfur in bituminous coal is emitted on combustion as gaseous sulfur oxides (EPA 1985a). Uncontrolled emissions of SO_2 are thus affected only by the fuel sulfur content and not by the firing mechanism, boiler size or operation.

4.1.1.2 Acid Gas Formation

Sulfuric acid (H_2SO_4) and hydrogen fluoride (HF) gas emissions are created in coal and oil-fired combustion sources (such as the proposed PC boiler and auxiliary boiler) after sulfur, and fluorine are released in the furnace from burning fuel containing these elements. "Acidic" emissions can also result when nitrogen and other nonmetallic elements (principally carbon) are oxidized in the furnace. NO_x emissions, however, have been discussed in a separate section.

Conversion of fluorine to HF depends on air/fuel mixing, combustion temperature, and the presence of other trace elements. The formation and emission of H_2SO_4, however, depends on the quantities of gaseous SO_3 and moisture in the flue gas. SO_3 reacts rapidly with water in the flue gas and stack vapor plume to form H_2SO_4; further reaction between H_2SO_4 and water may occur and result in the formation of sulfate salt aerosols.

The amount of SO_3 present in the flue gas depends on the fuel sulfur content as well as conditions supportive of secondary oxidation of sulfur dioxide to sulfur trioxide. Combustion temperature, alkali component concentration in the fuel and excess oxygen level are a few of the factors governing SO_2/SO_3 conversion.

4.1.2 Control Alternatives

Control of SO_2 and acid gas emissions is primarily effected by removing these pollutants from the flue gas with either wet or dry scrubbing alternatives. Such systems are generally designed to reduce SO_2 and are referred to as flue gas desulfurization (FGD) devices.

In addition, limiting the fuel sulfur content is an applicable control alternative, particularly for fuel-oil fired sources.

4.1.2.1 Wet Scrubbing

General Description

Wet scrubbing is a diffusion process in which pollutants (in the forms of gases or mists) are transferred from the gas stream to the scrubbing liquid under water saturated conditions. The conventional wet scrubbing processes, therefore, generate a liquid slurry wastewater effluent and must be accompanied by wastewater treatment and disposal system.

The types of wet scrubbing systems may be generally classified as sodium-based scrubbers, calcium-based scrubbers, and dual-alkali scrubbers. The classification occurs mainly because the calcium-based reagents produce insoluble salts (calcium sulfite and calcium sulfate), which some scrubbing systems cannot handle well, while the sodium-based reagents produce soluble reaction products (sodium sulfite, sodium bisulfite, and sodium sulfate). For example, packed tower absorbers normally use a sodium reagent, such as sodium hydroxide (NaOH) or soda ash (Na_2CO_3), since the soluble reaction products will not foul the packing. Spray towers, on the other hand, are not affected by the presence of salts, and therefore can take advantage of the less expensive calcium-based reagents such as pebble lime (CaO) or limestone ($CaCO_3$).

Regardless of the reagent, the waste effluent can be recycled to reduce water consumption and reagent use, but a blowdown stream must be handled prior to discharge. In calcium-based systems, waste products (calcium salts, water, and unreacted reagent) may be pretreated using clarifiers to remove suspended solids, followed by a filter press to remove the solids for subsequent landfilling. The clarified liquid is returned to the scrubber system for reuse. In sodium-based systems, no solid waste product is formed. Larger quantities of liquid waste containing dissolved salts must be disposed of. Disposal practices for this waste stream include wastewater treatment, holding ponds for evaporation and deep well injection.

Favorable Impacts of Wet Scrubbing

Wet scrubbing systems achieve levels of SO_2/acid gas removal that are comparable with dry scrubbing. An advantage to wet scrubbing is that because of the low operating temperatures favoring absorption, and the ease with which reagent can be recycled, reagent/acid gas ratios approaching stoichiometric can be used. Dry scrubbing systems require more reagent, and thus incur higher reagent costs.

Because less reagent is used in wet scrubbing systems, less solid waste is produced than by spray dryer absorber/fabric filter (or ESP) systems. If treated, some of the scrubber waste solids may be saleable as by-product (e.g. gypsum).

Adverse Impacts of Wet Scrubbing

Technical concerns and numerous adverse environmental, energy and economic impacts reflect the disadvantages using wet scrubbing systems on coal-fired units.

Wastewater Treatment and Disposal - Some wet scrubbers produce acidic, high-chloride wastewater requiring treatment. Several treatments are available, including percolation of the wastewater through limestone beds, evaporation ponds, and deep well injection. More sophisticated and more costly treatment alternatives include reverse osmosis, electrodialysis, and flash evaporation/crystallization. If organics removal is required, carbon filters, UV-ozonation, or other organic treatment methods may be considered.

If a sodium reagent is used, large quantities of wastewater containing dissolved sodium salts (reaction products) must be purged to minimize the percent of dissolved solids in the system discharge.

In calcium-based systems, water losses still occur because of moisture present in the discharged solids, only the amount is less.

Disposal of Wet Sludge - Wet scrubbing alternatives produce a sludge containing the products of the SO_2 removal reactions. For calcium-based processes, including the wet limestone and wet lime scrubbing alternatives, these products consist of the salts calcium sulfate ($CaSO_4 \cdot 2H_2O$) and calcium sulfite ($CaSO_3 \cdot {}^1/_2H_2O$) which precipitate out of the scrubbing solution in the recycle tank. These solids are removed from the process by clarification and vacuum filtration, however the sludge contains from 10 to 30% water. Therefore the waste solids from wet scrubbing alternatives must be either handled wet, or dried prior to disposal.

Visible Stack Gas Plumes and Fogging - The use of wet FGD systems causes a low scrubber outlet temperature (about 120°F to 130°F). The flue gas exiting the stack at these temperatures would therefore cause visible moisture plumes. Several different techniques may be employed to minimize these effects. The flue gas can be reheated after it leaves the scrubber using a variety of heat exchangers, steam coils, or direct reheat with combustion of fossil fuel. Even after reheat, however, experience has shown that plumes are visible most of the year (Gengos, 1986). In Europe, some facilities are trying the use of subcooling, in which a heat exchanger is included downstream of the wet scrubber to condense water vapor from the saturated, cleaned flue gas. This practice reduces the visible steam plume, but also results in a cooler flue gas, which presents a separate set of concerns, as discussed below.

Increased Ground Level Concentrations - The flue gas emitted from wet scrubbing processes is generally cooler than from other control processes. This causes less plume rise, and hence, increased ground level concentrations (GLC) of all emitted pollutants. These increased concentrations cause potentially greater health risk impacts.

Corrosion, Erosion and Scaling - Significant corrosion, erosion and scaling of wet scrubber equipment, piping, pumps, fans, and valves have been reported, thus, wet scrubbers require more frequent repairs, parts replacements, and general maintenance at the expense of high costs and reduced availability. These problems can be minimized by selecting corrosion-resistant materials, better controlled recycle and blowdown rates to prevent accumulation of halide salts, better instrumentation for optimized reagent feeding, and proper equipment design to best prevent the cementing and poor dewatering tendencies of calcium sulfite sludges. Many modern FGD systems operate without these problems (Jordan, 1987; Moser and Simko, 1990).

Costs - Wet scrubbers are generally more expensive than spray dryer scrubbers to purchase and operate, regardless of whether or not the systems are designed for zero-water discharge. The capital costs are higher because corrosion-resistant materials of construction must be employed, numerous peripheral equipment must be supplied and state-of-the-art process controls must be incorporated. Operating costs are generally the highest among alternative SO_2/acid gas controls because of energy and water management requirements. Flue gas reheat and fan power associated with the high pressure drops in some wet scrubbers translate into especially large operating costs.

4.1.2.2 Spray Dryer Absorption

The other predominant SO_2/acid gas control system uses spray dryer absorbers (SDA) located upstream of particulate removal devices.

General Description

In spray dryers, an alkali reagent slurry is injected into a vessel sized for relatively long gas residence time. The SO_2 and acid gases react with the alkali solution or slurry to form liquid phase salts which are dried to about one percent free moisture by heat in the flue gas. Flue gas temperatures remain 20-30°F above the dew point, compared to wet FGD systems operating at the dew point.

Spray dryer design can be affected by the choice of the downstream particulate collection device. Fabric filters have an advantage over ESPs in that unreacted alkaline material collected in the filter cake can further react with SO_2 and acid gases. Thus, for a given SO_2/acid gas removal level, SDA/fabric filter systems require less reagent than SDA/ESP systems.

Favorable Impacts of Spray Dryer Absorber/Fabric Filter Systems

The system achieves levels of SO_2/acid gas removal that are comparable with levels achieved with wet scrubbing systems. Spray drying technology is less complex mechanically than wet scrubbing systems and does not generate a liquid waste, thus treatment and disposal problems and costs are less. Compared to wet scrubbing, the stack gas is hotter, allowing for better plume dispersion and hence lower ground level concentrations.

No flue gas reheat is required, a requirement which presents significant energy and economic penalties to wet scrubber-equipped facilities.

Adverse Impacts of Spray Dryer Absorber/Fabric Filter Systems

Reagent Requirements - Spray dryer systems require greater amounts of reagent than for wet scrubbing systems because the flue gas temperatures are higher and the absorption process is not taking place at saturated conditions.

Solid Waste Generation - Spray dryer systems generate larger quantities of solid waste than wet systems because relatively larger amounts of reagent must be injected to achieve the same removal efficiencies. This is offset, however, by the fact that the solid waste is virtually free of moisture and can thus be transported directly to disposal without further dewatering or drying. For Indiantown, the dry waste may be returned to the coal mine directly by rail.

4.1.3 Permitted Emission Control Levels

The NSPS for coal-fired boilers is both a 90% reduction in potential SO_2 emissions and a maximum emission limit of 1.2 lb/MMBtu (40 CFR Part 60 Subpart Db). Listings of the coal-fired boilers contained in the BACT/LAER Clearinghouse with limits on SO_2 and acid gas emissions are contained in Appendix A. Four types of emission controls are included in this list: wet FGD systems, spray dryer FGD systems, limestone injection, and fuel sulfur limitations. Limestone injection is employed with CFB boilers and is not technically applicable to the proposed PC boiler. Both wet and spray dryer FGD systems have more emissions reduction potential than fuel sulfur limitations, however the maximum degree of SO_2 and acid gas reduction which is possible with either type of FGD alternative is subject to many factors, including activity of reagent, contacting device design and operation, and system reliability.

4.2 BACT for SO_2 and Acid Gases - PC Boiler

4.2.1 Most Stringent Control - 0.17 lb/MMBtu

4.2.1.1 Technological Feasibility of 0.17 lb/MMBtu

An emission rate of 0.17 lb/MMBtu is considered representative of the most stringent emission rate permitted. For Indiantown, this level would be achieved utilizing a 95% efficient FGD while firing coal with a maximum sulfur content of 2%. The BACT/LAER Clearinghouse lists eleven coal-fired facilities with a permitted SO_2 control efficiency of 94% or greater. Nine of these facilities, however, are fluidized bed boilers where the control method is lime or limestone injection. The permitted emission rate of these (Pyropower, Rio Bravo Revining Co. [two listings], BMCP, Westwood Energy Properties, Cogeneration National, and American Lignite Production Co [two listings]) facilities are thus not applicable to the proposed Indiantown PC unit.

The other two facilities with permitted SO_2 control levels of 94% and greater are Deseret Generation and Transmission's Moon Lake, UT unit and Kentucky Power's Carr unit. Neither of these units were ever built. Thus 95% SO_2 control is more stringent than the highest permitted control efficiency for a non-CFB boiler.

There are a number of non-CFB coal-fired units in current operation, however, with FGD devices designed for and achieving 95% control of SO_2. Table 4-1 contains a listing of the FGD facilities in current operation on domestic utility boilers. This listing, compiled from the 1989 PEI Associates "Utility FGD Survey" (DOE 1989) covers all FGD types, including the limestone, wet

TABLE 4-1
Flue Gas Desulfurization Units in Operation

Unit	Size (MW)	% S	FGD Type	Year Start	Control Efficiency Design	Actual	System Availability
Alabama Electric							
Tombigbee 2	255	1.61	limestone	1978	59.5	85	96.9
Tombigbee 3	255	1.61	limestone	1979	59.5	85	91.2
Alamito Co							
Springerville 1	400	0.61	SD	1985	70	61	99
Applied Energy Service							
Deepwater 1	165	4.00	limestone	1986	NA	NA	92
Arizona Electric Power							
Apache 2	195	0.70	limestone	1978	85	97	85.7
Apache 3	195	0.70	limestone	1979	85	97	64
Arizona Public Service							
Cholla 1	126	0.50	limestone	1973	55	92	
Cholla 2	250	0.50	limestone	1978	75	98	99
Cholla 4	380	0.50	limestone	1981	95	95	87
Four Corners 1	186	0.75	wet lime	1979	50	67.5	
Four Corners 2	186	0.75	wet lime	1979	50	67.5	
Four Corners 3	244	0.75	wet lime	1979	50	67.5	
Four Corners 4	786	0.75	wet lime	1984	80	67.5	99.2
Four Corners 5	786	0.75	wet lime	1985	80	90	
Associated Electric							
Thomas Hill 3	670	4.80	limestone	1982	91.5	92	84
Basin Electric Power							
Antelope Valley 1	490	0.68	SD	1983	60	62	100
Antelope Valley 2	490	0.68	SD	1985	78	78	
Laramie River 1	600	0.54	limestone	1980	90	95	
Laramie River 2	600	0.54	limestone	1986	90	90	
Laramie River 3	600	0.54	SD	1982	82.5	85	
Big Rivers Electric							
D.B. Wilson 1	440	3.75	limestone	1986	NA	NA	
Green 1	250	3.91	wet lime	1979	90	90	92.5
Green 2	242	3.91	wet lime	1980	90	90	92.5
Central Illinois Light							
Duck Creek 1	396	3.40	limestone	1976	85.3	85.3	96.3
Central Illinois Public Service							
Newton 1	500	3.00	Dual Alkali	1979	90	90	100
Cincinatti Gas & Electric							
East Bend 2	643	2.60	wet lime	1981	87	87	
City Utilities of Springfield							
Southwest 1	195	3.50	limestone	1977	80	85	69.3
Colorado Ute Electric							
Craig 1	454	0.45	limestone	1980	85	85	83.5
Craig 2	454	0.45	limestone	1980	85	85	86.5
Craig 3	421	0.45	SD	1985	85	90	
Columbus & Southern Ohio Electric							
Conesville 5	405	4.50	wet lime	1977	89.5	92	87.7
Conesville 6	405	4.50	wet lime	1978	89.5	92	81.8
Cooperative Power Association							
Coal Creek 1	550	0.63	wet lime	1979	54	90	
Coal Creek 2	550	0.63	wet lime	1980	54	90	
Delmarva Power & Light							
Delaware City 1	28	7.00	Wellman-Lord	1980	90	90	81.1
Delaware City 2	28	7.00	Wellman-Lord	1980	90	90	81.6
Delaware City 3	75	7.00	Wellman-Lord	1980	90	90	90.2
Desert Gen & Trans							
Bonanza 1	430	0.50	limestone	1986	95	95	
Duquesne Light							

Source: PEI 1987 Survey of Operating Utility FGD Plants

TABLE 4-1 (Continued)

Unit	Size (MW)	% S	FGD Type	Year Start	Control Efficiency Design	Actual	System Availability
Elrama 1–4	510	2.05	wet lime	1975	83	94	
Phillips 1–6	408	2.05	wet lime	1974	83	84	
East Kentucky Power							
Spurlock 2	550	3.50	wet lime	1983	79.4	90	
Grand Haven Board of Light and Power							
J.R. Sims 3	65	2.75	wet lime	2983	90	90	100
Grand River Dam Authority							
GRDA 2	575	0.95	wet lime	1986	85	85	
Hoosier Energy							
Merom 1	490	3.60	limestone	1982	90	90	88
Merom 2	490	3.60	limestone	1982	90	90	86.5
Houston Lighting & Power							
Limestone 1	780	1.08	limestone	1986	90	90	
Limestone 2	780	1.08	limestone	1986	90	90	
W.A. Parish 8	570	0.41	limestone	1982	70	85	
napolis Power and Light							
Petersburg 3	532	3.25	limestone	1986	85	80	87
Petersburg 4	526	3.50	limestone	1986	80	90	80.4
Jacksonville Electric Authority							
St Johns River 1	612	2.50	limestone	1987	NA	90	
Kansas City Power & Light							
La Cygne 1	740	5.39	limestone	1973	80	80	
Kansas Power & Light							
Jeffrey 1	650	0.32	limestone	1978	60	60	
Jeffrey 2	650	0.32	limestone	1980	60	60	
Jeffrey 3	650	0.32	limestone	1983	60	60	
Lawrence 4	119	0.55	limestone	1977	73	73	
Lawrence 5	355	0.55	limestone	1978	52	70	
Kentucky Utilities							
Green River 1–3	60	2.23	wet lime	1976	98	80	63.8
Lakeland Utilities							
McIntosh 3	364	2.56	limestone	1982	85	85	
Los Angeles Deptartment of Water & Power							
Intermountain 1	841	0.79	limestone	1986	90	90	
Louisville Gas & Electric							
Cane Run 4	170	3.87	wet lime	1977	85	87	
Cane Run 5	181	3.80	wet lime	1978	85	85	
Cane Run 6	260	4.80	Dual Alkali	1979	95	94.2	
Mill Creek 1	321	3.75	wet lime	1981	85	86.6	
Mill Creek 2	339	3.75	wet lime	1891	85	86.6	
Mill Creek 3	412	3.87	wet lime	1979	85	85.7	83.5
Mill Creek 4	496	3.75	wet lime	1982	85	85	
Marquette Board of Light & Power							
Shiras 3	44	0.30	SD	1983	80	80	96.75
Michigan So. Central Power Agency							
Endicott 1	55	2.25	limestone	1983	90	90	96
Minnesota Power & Light							
Clay Boswell 4	554	0.94	wet lime	1980	89	89	86.56
Minnkota Power							
Milton R. Young 2	440	0.60	wet lime	1978	78	85	92.8
Monongahela Power							
Pleasants 1	684	3.00	wet lime	1980	90	90	
Pleasants 2	684	3.00	wet lime	1980	90	90	
Montana Power							
Colstrip 1	358	0.78	wet lime	1975	60	80	97.27
Colstrip 2	358	0.78	wet lime	1976	60	80	93.6

Source: PEI 1987 Survey of Operating Utility FGD Plants

TABLE 4-1 (Continued)

Unit	Size (MW)	% S	FGD Type	Year Start	Control Efficiency Design	Actual	System Availability
Colstrip 3	778	0.70	wet lime	1984	95	95.7	100
Colstrip 4	778	0.70	wet lime	1986	95	95.7	100
Montana-Dakota Utilities							
Coyote 1	427	0.87	SD	1981	70	75	100
Muscatine Power & Water							
Muscatine 9	172	3.21	limestone	1983	94	94	100
Nevada Power							
Reid Gardner 1	125	0.50	sodium	1974	90	90	99.8
Reid Gardner 2	125	0.50	sodium	1974	90	91.2	99.6
Reid Gardner 3	125	0.50	sodium	1976	85	91.2	96.9
Reid Gardner 4	285	0.75	sodium	1983	85	85	100
New York State Electric & Gas							
Somerset 1	680	2.70	limestone	1984	90	90	97
Northern Indiana Public Service							
R.M. Schahfer 17	379	3.20	Dual Alkali	1983	90	90	100
R.M. Schahfer 18	376	3.20	Dual Alkali	1986	90	90	100
Northern States Power							
Riverside 6-7	150	1.20	SD	1980	90	90	
Sherburne Co. 1	750	0.80	limestone	1976	50	50	
Sherburne Co. 2	750	0.80	limestone	1977	50	50	
Sherburne Co. 3	850	1.00	SD				
Orlando Utilities Commission							
C.H. Stanton 1	460	0.80	limestone				
Pacific Power and Light							
Jim Bridger 2	508	0.56	sodium	1986	NA	NA	96
Jim Bridger 4	508	0.56	sodium	1980	91	91	
Wyodak 1	320	0.55	SD	1986	NA	NA	
Pennsylvania Power							
Bruce Mansfield 1	835	3.50	wet lime	1976	92.1	92.1	71.4
Bruce Mansfield 2	835	3.50	wet lime	1977	92.1	92.1	82.7
Bruce Mansfield 3	835	4.30	wet lime	1980	92.2	92.5	90.4
Philadelphia Electric							
Cromby 1	188	2.00	mag.ox.	1983	92	92	
Eddystone 1	354	2.00	mag.ox.	1982	92	92	
Eddystone 2	354	2.00	mag.ox.	1982	92	92	
Plains Electric G & T							
Plains Escalante 1	233	0.80	limestone	1984	75	75	
Platte River Power Authority							
Rawhide 1	278	0.34	SD	1984	80	80	91.3
Public Service Indiana							
Gibson 5	667	3.30	limestone	1983	86	95	93.6
Public Service of New Mexico							
San Juan 1	361	0.80	Wellman-Lord	1978	90	90	97
San Juan 2	550	0.80	Wellman-Lord	1978	90	90	99.9
San Juan 3	544	0.80	Wellman-Lord	1979	90	90	96.6
San Juan 4	544	0.80	Wellman-Lord	1982	90	90	83.4
Salt River Project							
Coronado 1	400	0.56	limestone	1979	82	98	
Coronado 2	400	0.56	limestone	1981	82	98	
San Miguel Electric							
San Miguel 1	410	2.39	limestone	1981	86	86	
Seminole Electric							
Seminole 1	650	2.75	limestone	1984	86	86	
Seminole 2	650	2.75	limestone	1985	86	86	
Sierra Pacific Power							
North Valmy 2	288	0.50	SD	1985	70	70	

Source: PEI 1987 Survey of Operating Utility FGD Plants

TABLE 4-1 (Continued)

Unit	Size (MW)	% S	FGD Type	Year Start	Control Efficiency Design	Actual	System Availability
Sikeston Board of Municipal Utilities							
Sikeston 1	235	2.80	limestone	1981	80	80	
South Carolina Public Service							
Cross 2	510	1.80	limestone	1984	85.8	85.8	94.4
Winyah 2	315	1.00	limestone	1977	45	69	97.3
Winyah 3	315	1.00	limestone	1980	90	90	94.5
Winyah 4	315	1.70	limestone	1981	80	80	90.6
South Mississippi Electric Power							
R.D. Morrow, Sr. 1	215	1.64	limestone	1978	85	85	99.7
R.D. Morrow, Sr. 2	215	1.64	limestone	1979	85	85	90.4
Southern Illinois Power							
Marion 4	184	3.75	limestone	1979	89.4	89.4	97
Southern Indiana Gas & Electric							
A.B. Brown 1	265	3.35	Dual Alkali	1979	85	85	84.3
A.B. Brown 2	265	3.35	Dual Alkali	1986	90	90	71
Southwestern Electric Power							
Dolet Hills 1	720	0.70	limestone	1986	76	76	
Henry W. Pirkey 2	720	0.80	limestone	1985	85	76	
Springfield Water Light and Power							
Dallman 3	192	3.05	limestone	1981	95	95	76.3
Sunflower Electric							
Holcomb 1	319	0.34	SD	1983	80	80	100
Tampa Electric							
Big Bend 4	455	3.50	limestone	1985	90	90	
Tennesee Valley Authority							
Paradise 1	704	3.20	limestone	1983	84	84.2	100
Paradise 2	704	3.20	limestone	1983	84	84.2	100
Widows Creek 7	575	3.70	limestone	1981	80	80	
Widows Creek 8	550	3.30	limestone	1978	80	70	
Texas Municipal Power Agency							
Gibbons Creek 1	443	1.06	limestone	1983	87.3	87.3	
Texas Power & Light							
Sandow 4	595	1.60	limestone	1981	75	75	
Texas Utilities							
Martin Lake 1	793	0.90	limestone	1977	71	95	
Martin Lake 2	793	0.90	limestone	1978	71	95	
Martin Lake 3	793	0.90	limestone	1979	71	95	
Monticello 3	791	0.50	limestone	1978	74	74	
United Power Association							
Stanton 1A	60	0.77		1982	72.7	91	
Utah Power & Light							
Hunter 1	430	0.52	wet lime	1979	80	80	
Hunter 2	430	0.52	wet lime	1980	80	80	
Hunter 3	424	0.55	limestone	1983	90	90	
Huntington 1	426	0.43	wet lime	1978	80	80	77.2
Naughton 3	346	0.55	sodium	1981	70	70	95
West Penn Power							
Mitchell 3	296	2.80	wet lime	1982	95	95	
West Texas Utilities							
Oklaunion 1	720	0.34	limestone	1986	70	70	

Source: PEI 1987 Survey of Operating Utility FGD Plants

lime, sodium, magnesium oxide, Wellman-Lord and dual-alkali wet scrubbing processes as well as limestone spray drying.

The PEI listing indicates that there are nine operating units with wet limestone scrubbing systems, four units with wet lime scrubbing systems, and one unit with a dual-alkali system which average greater than 94% SO_2 control.

Therefore, even though there are no PC units with a permit limit as stringent as 95% control, this level of control is considered technologically feasible for both wet scrubbing and spray drying based on data from operating systems.

The control efficiency of acid gases (HF, H_2SO_4) associated with this level of SO_2 control will be greater than 50%. This level would be achieved using either wet scrubbing or spray drying.

4.2.1.2 Economic Analysis of 0.17 lb/MMBtu

Capital and annualized operating costs for the limestone scrubbing and spray drying control alternatives were estimated. As the most common FGD system in use currently, the limestone scrubbing process is considered to be most representative of wet scrubbing FGD processes in general capable of achieving 95% control.

For the limestone scrubbing alternative, capital equipment includes flue gas handling equipment (parallel I.D. fans, ductwork, dampers and steam coil flue gas reheat system), scrubbing equipment (three absorber towers in parallel [one spare], reagent recirculation pumps, recirculation and reaction tanks, pH control equipment and system controls), reagent feed preparation equipment (limestone storage hoppers, ball mills and slurry tanks), waste handling equipment (thickener, rotary drum vacuum filter, pug mill and sludge transportation and storage equipment), and support equipment (seal water system, instrument air compressor, makeup water system and control room).
Equipment for the spray dryer system includes two parallel absorber vessels, pebble lime receiving and storage equipment, a lime slaker, lime slurry feed and recirculation tanks, and spent reaction product storage and handling facilities.

Capital and annual costs for the alternative SO_2 and acid gas controls for the proposed 330 MW Indiantown PC unit are shown on Tables 4-2 and 4-3.

Total capital cost to achieve 0.17 lb/MMBtu is estimated at $67,828,000 and $32,271,000 for the limestone and spray drying process, respectively. Total annual costs are estimated at $31,385,-000/yr and $25,383,000/yr for the two processes.

TABLE 4-2
Costs for SO_2 /Acid Gas Control Alternatives, PC Boiler

	WET FGD	SPRAY DRYER
(1) Purchased Equipment		
(a) Basic Equipment	27,000,000	12,500,000
(b) Auxiliaries	included	included
(c) Instrumentation and Controls	2,700,000	1,250,000
(d) Structural Support	2,700,000	1,250,000
(e) Freight & Taxes	2,592,000	1,200,000
(2) Direct Installation	10,498,000	4,860,000
Total Direct Costs (TDC)	$45,490,000	$21,060,000
(3) Indirect Installation		
(a) Engineering & Supervision	4,549,000	2,106,000
(b) Construction & Field Expense	4,549,000	2,106,000
(c) Construction Fee	2,275,000	1,053,000
(d) Contingencies	9,098,000	4,212,000
(4) Other Indirect Costs		
(a) Startup & Performance Test	455,000	211,000
(b) Working Capital	1,412,000	1,523,000
Total Indirect Costs (TIC)	$22,338,000	$11,211,000
Total Capital Cost (TCC)	$67,828,000	$32,271,000
(5) Annualized Capital Recovery (ammortized over 10 years straight line @ 10% interest rate)	$11,008,000	$5,238,000

Cost Factors: 1990 OAQPS Control Cost Manual

TABLE 4-3
Annual Costs for SO_2/Acid Gas Control Alternatives, PC Boiler

	WET FGD	SPRAY DRYER
Direct Operating Costs		
(1) Labor		
(a) Operating (1)	$787,000	$524,000
(b) Supervisory	118,000	79,000
(2) Maintenance		
(a) Labor	1,180,500	786,000
(b) Supplies (50% Maint. Labor)	590,000	393,000
(3) Replacement Parts	1,350,000	625,000
(4) Utilities (1)(2)		
(a) Air	–	–
(b) Steam	–	–
(c) Electricity	2,919,000	1,249,000
(5) Raw Materials (1)(2)		
(a) Limestone	3,815,000	–
(b) Lime	–	8,726,000
(6) Solid Disposal (1)(2)	6,421,000	6,150,000
Indirect Operating Costs		
(7) Overhead	484,000	322,000
(8) Taxes	678,000	323,000
(9) Insurance	678,000	323,000
(10) Administration	1,357,000	645,000
Annual Operating Costs	$20,377,500	$20,145,000
Annual Capital and Operating Costs	$31,385,500	$25,383,000

Notes:
(1) per Bechtel Power
(2) based on 100% capacity

4.2.1.3 Environmental and Energy Analysis

Makeup Water Requirements

Based on information supplied by Bechtel Power, the dry scrubbing alternative would require 378 GPM of water makeup, while the wet scrubbing alternative would require 444 GPM. Based on the stringent water availability limitations at the site, the spray drying alternative is preferred since it requires less water.

Sludge Disposal Requirements

The primary difference between the wet scrubbing and spray drying alterntaives in terms of solids disposal is related to the moisture content of the sludge. Spray drying produces a solid material for disposal which is essentially free of moisture. Wet scrubbing, on the other hand, generates a sludge which may contain up to 30% water. For Indiantown, the dry solid material will be returned to the coal mine for disposal, whereas for this to be done with the wet scrubber sludge, it must be dried to 10% moisture or lower, which would entail increased capital and operating costs.

The quantity of material to be disposed of in either case is similarly related to the moisture. Based on information supplied by Bechtel Power, the dry scrubbing alternative will generate approximately 145,000 ton/yr of dry material for disposal; the wet scrubbing alternative would generate approximately 151,000 ton/yr of sludge.

Thus, both in terms of ease of disposal and quatity of material to be disposed, the spray drying alternative is preferred over the wet scrubbing alternative.

Facility Energy Balance

The spray dyring alternative will result in lower facility energy impacts when compared to the wet limestone process. Bechtel Power estimates that the system power requirements (to operate slurry pumps, grinders, and sludge handling equipment) are 2,150 kw and 3,470 kw for the spray dryer and wet scrubbing alternatives, respectively. Thus the spray dryer is more energy efficient than the wet scurbbing alternative.

4.2.1.4 Conclusion

The use of either wet scrubbing or dry lime spray drying is concluded to be technically feasible for the proposed Indiantown PC boiler. Annualized cost for the wet scrubbing alternative is estimated at $31,385,000/yr; cost of the dry scrubbing alternative is estimated at $25,383,000/yr, representing an annual cost reduction of $6,000,000.

The use of the wet scrubbing alternative would result in the production of large amounts of wet sludge which must be disposed of. In addition, the wet scrubbing alternatives require more makeup water than the dry scrubbing alternative, which is a significant concern given the water contstraints in the Indiantown project area. The wet scrubbing alternative also requires more energy than the dry scrubbing alternative.

Finally, there is no clear evidence that the wet scrubbing alternative would result in better control of trace metal emissions. Therefore, the spray dryer alternative, at an emission limit of 0.17lb/MMBtu, is considered representative of BACT for the PC boiler based on economic, energy and environmental considerations.

4.3 BACT for SO_2 and Acid Gases - Auxiliary Boiler

4.3.1 Control Alternatives

As with the PC boiler, the available alternatives for control of SO_2 and acid gases from the auxiliary boiler include various flue gas desulfurization techniques and limiting the fuel sulfur content.

In developing standards of performance for new oil-fired steam generating units, EPA stated that sodium scrubbing, lime spray drying and the use of low sulfur oil were all "considered demonstrated" in terms of their ability to meet the proposed 90% reduction requirement (EPA 1986b).

4.3.1.1 Flue Gas Desulfurization Alternatives

As extensively discussed in Section 4.1.2, alternative FGD processes consist of wet and dry systems. For oil-fired sources, dry scrubbing is not technically feasible due to the difficulty in dislodging oil-fired particulate matter from the bags of the fabric filter employed with this control alternative. In general, the most common FGD system applied to oil-fired boilers has been sodium scrubbing (EPA 1986b). Five oil-fired boilers are listed in the BACT/LAER Clearinghouse as utilizing sodium scrubbers for control of SO_2.

4.3.1.2 Fuel Sulfur Limitations

The alternative to FGD controls for SO_2 and acid gases for oil-fired boilers is the use of low sulfur oil. Since virtually all of the sulfur introduced in the fuel becomes oxidized in the furnace and released to the atmosphere as SO_2, the lower the fuel sulfur content, the lower the SO_2 emissions. Limiting the sulfur content also limits acid gas formation; low sulfur content fuels will have release correspondingly lower amounts of SO_3, thereby forming lower levels of sulfuric acid mist.

EPA recognized that fuel sulfur limitations were effective in limiting SO_2 emissions from oil-fired sources when proposing NSPS for fossil fuel-fired steam generators (EPA 1986b). In fact, EPA noted that "... for oil-fired steam generating units operating at low capacity utilization factors, it is generally less costly to fire a very low sulfur oil to meet [the proposed emission limit]" than to employ FGD.

4.3.1.3 Permitted Control Levels

The NSPS for #2 fuel oil-fired steam generators with heat inputs greater than 100 MMBtu/hr is 0.3 lb/MMBtu. A list of oil-fired sources in th BACT/LAER Clearinghouse with limits on SO_2 is included in Appendix A. The most stringent emission limit in the Clearinghouse is achieved at four crude oil production facilities in Kern County CA employing a wet scrubbers (0.034-0.05 lb/MMBtu). Therefore the use of sodium-based wet scrubbing to achieve 0.034 lb/MMBtu is considered demonstrated.

Oil-fired facilities employing fuel sulfur limitations (7 of 12 listed) have limits 0.5 lb/MMBtu and higher. The new NSPS for steam generating units with heat inputs greater than 100 MMBtu/hr concludes that the use of very low sulfur oil to meet an emission limit of 0.5 lb/MMBtu is technically feasible. In addition, PG&E-Bechtel Generating Company has determined that fuel suppliers are able to provide oil with a sulfur content of 0.05%, which will have a corresponding emission rate of 0.052 lb SO_2/MMBtu.

Thus the most stringent alternative is concluded to be the use of sodium-based wet scrubbing to acheive 0.034 lb/MMBtu, followed by the use of low sulfur oil to meet 0.052 lb/MMBtu.

4.3.2 Economic Analysis

4.3.2.1 Flue Gas Desulfurization Alternative

The economics of employing a sodium based wet scrubber for control of SO_2 and acid gas emissions on the Indiantown auxiliary boiler were estimated from a vendor equipment quote and are shown on Tables 4-4 and 4-5. Equipment costs are estimated at $360,000, and total installed cost and capital recovery costs are estimated at $810,000 and $131,000/yr, respectively. Operating costs consist mainly of fixed costs for capital recovery and overhead, as well as variable costs for reagent and equipment maintenance. At the proposed 1000 hours/yr of auxiliary boiler firing, the total annualized costs are $536,000, and for a cost effectiveness (compared to low sulfur oil firing) of $63,523/ton. This is not considered cost effective, and therefore unrepresentative of BACT.

4.3.2.2 Fuel Sulfur Limitations

There are no adverse economic impacts associated with firing fuel oil with 0.05% sulfur.

4.3.3 Environmental and Energy Impacts Analysis

For the wet scrubbing alternative, the most significant adverse environmental impacts are the disposal of the scrubber waste and obtaining the necessary makeup water for the system. At the proposed 1,000 hours/yr of auxiliary boiler firing, this alternative would generate approximately 34,000 lb/yr of dissolved sodium compounds.

There are no adverse environmental impacts associated with the use of low sulfur oil.

Energy impacts associated with the use of a sodium-based wet scrubber to control SO_2 and acid gas emissions from the Indiantown auxiliary boiler are related to increased fan power required to overcome scrubber pressure drop and power required to run circulation pumps. Total power requirement is estimated to be 8,500 kwhr/yr, for a energy effectiveness of 1000 kw/ton SO_2 controlled. There are no adverse energy impacts associated with the use of low sulfur oil.

4.3.4 Conclusion

Both the use of sodium-based wet scrubbers and firing very low sulfur oil are considered demonstrated alternatives for control of SO_2 and acid gases from the proposed oil-fired auxiliary boiler. The use of wet scrubbing, however, would result in significant economic and energy impacts, and is thus concluded to be unrepresentative of BACT.

TABLE 4-4
Capital Costs for SO_2 Control Alternatives, Auxiliary Boiler

	Wet FGD
(1) Purchased Equipment	
(a) Basic Equipment	360,000
(b) Auxiliaries	included
(c) Instrumentation and Controls	36,000
(d) Structural Support	36,000
(e) Freight & Taxes	35,000
(2) Direct Installation	140,000
Total Direct Costs (TDC)	$607,000
(3) Indirect Installation	
(a) Engineering & Supervision	61,000
(b) Construction & Field Expense	61,000
(c) Construction Fee	30,000
(d) Contingencies	18,000
(4) Other Indirect Costs	
(a) Startup & Performance Test	6,000
(b) Working Capital	27,000
(c) License Fee	-
Total Indirect Costs (TIC)	$203,000
Total Capital Cost (TCC)	$810,000
(5) Annualized Capital Recovery (ammortized over 10 years straight line @ 10% interest rate)	$131,000

Cost Factors: 1990 OAQPS Control Cost Manual

TABLE 4-5

Annual Costs for SO_2 Control Alternatives, Auxiliary Boiler

	Wet FGD
Direct Operating Costs	
(1) Labor	
(a) Operating	$87,600
(b) Supervisory	13,000
(2) Maintenance	
(a) Labor	107,100
(b) Supplies (50% Maint. Labor)	54,000
(3) Replacement Parts	36,000
(4) Utilities	
(a) Air	-
(b) Steam	2,900
(c) Electricity	20,200
(5) Raw Materials - Sodium Hydroxide	2,300
(6) Waste Disposal	500
Indirect Operating Costs	
(7) Overhead	50,000
(8) Taxes	8,000
(9) Insurance	8,000
(10) Administration	16,000
Annual Operating Costs	$405,600
Annual Capital and Operating Costs	$536,600
Annual Tons Removed (1)	8.4
Cost Effectiveness ($/ton)	$63,523

Notes:
(1) compared to 0.052 lb/MMBtu with 1000 annual operating hours

Therefore firing very low sulfur oil to meet an emission limitation of 0.052 lb SO_2/MMBtu is considered representative of BACT for the auxiliary boiler.

5.0 BACT DETERMINATION FOR CO AND VOC

5.1 Introduction

Emissions of carbon monoxide (CO) and volatile organic compounds (VOCs) result from the incomplete combustion of carbon and organic compounds. CO and VOC emissions are a function of oxygen availability (excess air), flame temperature, residence time at flame temperature, boiler design, and turbulence. The baseline emissions of CO and VOC from the Indiantown coal-fired boiler are estimated to be 400 ton/yr and 70 ton/yr, respectively. For the auxiliary boiler, worst-case CO and VOC emissions (assuming oil firing for CO and gas firing for VOC) are estimated at 23.7 and 0.31 ton/yr, respectively.

Control of the emissions of CO and VOCs may be effected two ways: (1) combustion modifications to minimize the formation of the pollutants, and (2) flue gas catalytic oxidation of any CO and VOCs formed in the combustion process.

Lists of coal- and oil-fired boilers with limits on CO and VOC emissions in the BACT/LAER Clearinghouse is included in Appendix A. Combustion controls are listed as the predominant control technology utilized.

5.2 Catalytic Oxidation

5.2.1 Description

Catalytic oxidation has been the control alternative used to obtain the most stringent control level for CO and VOCs from fossil fuel-fired combustion units. The use of this alternative is well established for certain fuels and firing configurations, such as combustion turbines firing natural gas. This alternative has never been applied to a coal-fired unit, however.

As with the use of SCR for the control of NO_x, catalytic oxidation is a process which employs a catalyst material containing active sites on which the reactant species (CO, VOCs and O_2) are adsorbed. This adsorption lowers the activation energy of the oxidation reaction and permits combination of the reactants species at lower gas temperatures than would be required for uncatalyzed oxidation.

The effective temperature range of the flue gas for catalytic oxidation is between 600 and 1150°F; CO oxidation occurs at any temperature above 600°F, VOC oxidation requires a higher temperature (900-1000°F).

The overall reaction rate for catalytic oxidation is subject to the following factors:

- rate of diffusion of oxygen to unoccupied active sites
- rate of diffusion of oxidizable species (CO or VOC) to oxygen-occupied sites
- rate of oxidation reaction on active sites
- rate of desorption of reaction products (CO_2 and H_2O) from active sites

The rate of diffusion of oxidizable species to active sites on the catalyst surface is the rate-controlling step; the other three steps, for low concentrations of CO and VOC in the presence of excess oxygen, are not significant contributors to the overall rate. Therefore, catalysts are designed so as to maximize active site activity and stability, number of active sites, and ease of access of oxidizable species to active sites.

The main advantage of the oxidation catalyst alternative is the high removal efficiency (up to 90% for gas-fired sources with little sulfur present in the fuel). In addition, a catalytic oxidation system occupies little space, is relatively easy to operate, and requires no reagents other than what is present in the flue gas.

For sulfur containing fuels, such as coal and fuel oil, the main disadvantage of an oxidation catalyst is the lack of catalyst selectivity; catalysts will promote oxidation of SO_2 to SO_3 in addition to CO and VOCs. The amount of SO_2 conversion is a strong function of temperature and catalyst design, however under the proper conditions, formation of SO_3 can be minimized to 20-23% of inlet SO_2. This level of conversion would result in unacceptable levels of corrosion to the air preheater and ductwork.

5.2.2 Applicability to Coal Firing

ENSR contacted an oxidation catalyst vendor to determine the technical feasibility and economic impacts of installing an oxidation catalyst on a coal-fired boiler. Due to the high particulate loading of the flue gas, trace element concentration, an SO_2 level, the vendor stated that they could not provide a catalyst system for this particular application. The vendor stated that flue gas particulate will plug the catalyst, thereby restricting gas flow, masking the active sites and corroding the catalyst. Generally, oxidation catalysts are designed for a maximum particulate landing of 50 mg/Nm^3 (Englehard, 1990). The proposed Indiantown boiler will have a particulate loading upstream of the baghouse in excess of 2,000 mg/Nm^3.

In addition, trace elements present in coal, in particular chlorine, are poisonous to oxidation catalysts.

Although the catalyst could be installed downstream of the spray dryer/fabric filter, the flue gas temperature at that point will be approximately 150°F, which is below the minimum temperature required (600°F). The flue gas would thus have to be reheated, resulting in significant unfavorable energy and economic impacts. For these reasons, as well as the generally low level of CO and VOC in coal-fired units, no PC boilers have been equipped with oxidation catalysts.

5.2.3 Applicability to Oil Firing

Catalyst vendors contacted stated that they have never supplied an oxidation catalyst system for an oil-fired boiler. Although the sulfur, ash and trace element concentrations in fuel oil are lower than the concentrations in coal, the presence of these constituents in fuel oil result in oxidation catalyst systems being technologically infeasible for the fuel oil-fired auxiliary boiler.

5.2.4 Conclusion

Use of an oxidation catalyst system in either the proposed Indiantown PC boiler or fuel oil-fired auxiliary boiler is thus considered technically infeasible. There are no catalysts developed that have or can be applied to coal- or oil-fired boilers due to the high levels of particulate matter and trace elements present in the flue gas. Thus, this alternative cannot be considered to represent BACT for control of CO and VOCs from either of the proposed boilers.

5.2.5 Combustion Controls

The next most stringent levels of control of CO and VOCs from fossil fuel-fired boilers have been achieved through the use of modifications to the boiler design and operation intended to limit the formation of these pollutants. Such controls are commonly referred to as combustion controls. In general, a combustion control system seeks to maintain the proper fuel to oxygen ratio to ensure complete combustion.

For the PC boiler, the estimated CO and VOC emission rates of 0.11 and 0.0036 lb/MMBtu, respectively, are based on the use of combustion controls. Similarly, the estimated emission rates for the auxiliary boiler (0.14 lb CO/MMBtu and 0.0018 lb VOC/MMBtu) reflect the use of combustion controls.

5.2.6 Description

In general, a combustion control system seeks to maintain the proper fuel to oxygen ratio to ensure complete combustion of the fuel. Essential requirements are sufficient excess air, thorough mixing of fuel and air, and adequate furnace residence time. Advanced combustion controls accomplish this through the use of one or more of the following operational design features:

- Low excess air
- Staged combustion
- Overfire air

5.2.7 Economic, Environmental and Energy Considerations

There are no adverse economic impacts associated with the use of combustion controls for minimization of CO and VOC emissions from either the PC boiler or the auxiliary boiler. Minimization of emissions of these pollutants represents a maximization of fuel use and therefore boiler thermal efficiency, as well as a requirement in terms of licensability and permitting. Such boiler design considerations are therefore considered standard features of modern fossil fuel combustion units.

There are no adverse environmental considerations in conjuction with the use of combustion controls in either the PC boiler or the auxiliary boiler for minimization of the formation of CO and VOC.

5.2.8 Conclusion

Combustion controls minimize the formation and emission of both CO and VOCs without adverse economic, energy or environmental impacts. Such controls are the most stringent control alternative which has been demonstrated to be applicable to PC and fuel oil-fired units, and should therefore be concluded to be representative of BACT for both the PC boiler and the auxiliary boiler.

6.0 BACT FOR STACK EMISSIONS OF PARTICULATE MATTER (PM) AND PM_{10}

6.1 Introduction

The composition and amount of particulate matter (PM) emitted from coal-fired boilers are a function of firing configuration, boiler operation and coal properties (U.S. EPA, 1985a). Particulate matter (as total suspended particulates or TSP) will be emitted from the proposed pulverized coal boiler as a result of the entrainment of uncombustible inert matter (ash), and condensible substances. Since PC systems attain almost complete combustion, very little unburned carbon should be present (U.S. EPA, 1985a).

Based on a 12% coal ash content, the uncontrolled emissions of PM will be approximately 153,000 tpy. Due to the fine nature of the coal particles combusted in the boiler, it is conservatively assumed that all particles emitted will be less than 10 microns in diameter or PM-10. Thus, the uncontrolled emissions of PM-10 would also be ~153,000 tpy.

6.1.1 Available Control Options

A review of EPA's BACT/LAER Clearinghouse was conducted to identify available control technologies, and to determine the level of particulate control which has been determined to represent BACT for pulverized coal fired boilers.

Data for coal fired boilers from the BACT/LAER Clearinghouse is presented in Appendix A and summarized in Table 6-1. As shown in Table 6-1, all of the entries for coal fired boilers for the last three years have been permitted with fabric filters (baghouses) for PM control. Twenty utility sized generating station entries are listed with ESPs; these are assumed to represent pulverized coal fired units. Only four of the baghouse equipped entries are assumed to represent PC boilers. The rest are mostly spreader stokers or fluidized bed boilers.

A review of vendor offerings and the technical literature identified several wet control techniques which have been applied to combustion sources in general. These include venturi scrubbers, tray towers, the Calvert® collision scrubber, and wet ESPs such as the Cielcote® ionizing wet scrubber. No examples of the application of wet particulate control to PC boilers are listed in Table 6-1.

The control options which were identified for the potential control of PM from PC boilers, coal fired boilers in general, and from other types of combustion sources are listed as follows:

TABLE 6-1
Coal Fired Boilers BACT/LAER Clearinghouse Listings for PM
(1980 - Present)

Name	Type	Size MMBtu/hr	Reviewing Agcy	Date of Issuance	BACT for PM
Applied Energy Services	CFB	2150	Hawaii DOH	1/25/90	32.2 lb/hr (0.007 gr/dscf) – Baghouse (99.9%) – ~0.018 lb/MMBtu
A E S Thames, Inc	FB	923	Connecticut DEP	8/9/89	0.02 lb/MMBtu – Baghouse (99.9%)
A E S Thames, Inc	FB	923	Connecticut DEP	8/9/89	0.02 lb/MMBtu – Baghouse (99.9%)
Cogentrix, Rocky Mount (4 units)	SS	375	North Carolina DEM	7/20/89	0.0200 lb/MMBtu – Fabric Filter
Cambria Cogen Inc. (2 units)	CFB	559	Pennsylvania BAQC	5/26/89	16.8 lb/hr (0.03 lb/MMBtu) – Fabric Filter (99.9% eff)
Scrubgrass Power Corp. (2 units)	CFB	599	Pennsylvania BAQC	1/18/89	0.0300 lb/MMBtu –Fabric Collector (99.96% eff)
Goodyear United Development	FB	577	New York State DEC	10/14/88	0.022 lb/MMBtu – Fabric Filter (99% eff)
North Branch Energy Partners LP	CFB	563	Pennsylvania BAQC	9/26/88	0.03 (PM) 0.028 (PM10) lb/MMBtu – FF (99% eff)
United Development Group	FB	577	New York State DEC	9/25/88	0.022 lb/MMBtu – Pulse Jet Baghouse (99.8% eff)
Fort Howard Corp.	CFBC	505	Wisconsin DNR	9/21/88	0.05 lb/MMBtu – Baghouse
Northeastern Power Co.	CFB	513	Pennsylvania BAQC	6/17/88	0.028 lb/MMBtu – Fabric Filter (99% eff)
Edensburg Power Co.	FB	617	Pennsylvania BAQC	6/6/88	0.0300 lb/MMBtu – Baghouse (99.98% eff)
TVA – Shawnee	AFBC	1579	Kentucky DAQ	5/4/88	0.03 lb/MMBtu – Baghouse (99% eff)
Panther Creek Energy	CFB	1170	Pennsylvania DER	2/17/88	0.03 lb/MMBtu – Baghouse (99% eff)
GWF Power Systems Co., Inc.	CF	202	Bay Area AQMD (CA)	2/11/88	30 lb/d Baghouse, Pulse Jet
City of Wyandotte, Dept Mun Svcs	CFBC	369	Wayne Co. APC	12/07/87	0.011 lb/MMBtu – baghouse (99.9%)
Cogentrix Michigan Leasing Corp	SS	214	Michigan DNR	7/31/87	0.03 lb/MMBtu – Baghouse (99.1% eff)
Fort Drum Heating Plant	CFB	190	New York State DEC	4/1/87	0.05 lb/MMBtu – Baghouse
Wm. H. Zimmer Generating Sta	NS	11968	Southwest. Ohio APCA	2/5/87	0.025 lb/MMBtu – ESP (99.5% eff)
Archbald Power Corp.	CFB	240	Pennsylvania DER	1/16/87	0.05 lb/MMBtu – Fabric Filter
Mt. Poso Cogeneration Co.	CFB	50 MW	EPA Region IX	1/12/87	0.01 gr/dscf – baghouse – ~0.02 lb/MMBtu
Foster Wheeler Power (2 units)	NS	283	Pennsylvania DER	12/29/86	0.03 lb/MMBtu – Baghouse (99.9% eff)
Tultex Corp.	NS	12	Virginia APCB	12/18/86	0.43 lb/MMBtu – settling chamber (35%)
Sheridan Coal Co.	NS	550	Pennsylvania DER	12/1/86	0.03 lb/MMBtu – Baghouse/Cyclone
Pyropower Corp.	CFB	640	Kern County APCD	12/1/86	0.012 lb/MMBtu – fabric filter (99.9%)
J. Pagnotti Enterprises	NS	1082	Pennsylvania DER	11/1/86	0.03 lb/MMBtu – Baghouse/Cyclone
Utah Power & Light Co.	NS	4000	Utah BAQ	10/1/86	0.1 lb/MMBtu – ESP (99% eff)
Cogentrix Carolina Leasing Corp.	NS	202	North Carolina DEM	7/7/86	0.03 lb/MMBtu – bagfilter (99.1%)
Northeastern Power Co.	NS	540	Pennsylvania DER	6/27/86	0.028 lb/MMBtu – Fabric Filter
BMCP	CFB	220	Kern County APCD	6/20/86	0.0156 gr/dscf – fabric collector (99%) – ~ 0.03 lb/MMBtu
Cogentrix Hopewell	NS	200	Virginia APCB	6/12/86	0.03 lb/MMBtu – baghouse (99.1%)
Cogentrix Carolina Leasing Corp.	NS	202	North Carolina DEM	5/28/86	0.03 lb/MMBtu – baghouse (99.1%)
TVA – Shawnee	AFBC	1430	Kentucky DAPC	4/15/86	0.03 lb/MMBtu – FF (99%)
Westwood Energy Properties	NS	425	Pennsylvania DER	1/6/86	0.03 lb/MMBtu – FF (99.92%)
Cogeneration National Corp	CFB	279.6	San Joaquin Cty APCD	12/13/85	0.036 lb/MMBtu – baghouse
TVA – Paducah	CFB	200	Kentucky DAPC	12/13/85	0.1 lb/MMBtu – baghouse (98.85%)
Signal Frackville Energy	NS	NS	Pennsylvania DER	12/2/85	0.012 lb/MMBtu – Baghouse (99.9% eff)
Corn Products	CFB	620	San Joaquin Cty APCD	10/29/85	0.016 lb/MMBtu – baghouse
White Pine Power Project	NS	750	Nevada DEP	8/6/85	0.02 lb/MMBtu – baghouse (99.6%)
Central State University	NS	66	Dayton RAPCA	7/1/85	0.1 lb/MMBtu – baghouse (99%)
Union Camp – Franklin	NS	245	Virginia APCB	7/1/85	0.05 lb/MMBtu – ESP (99%)

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker PC – pulverized coal NS–not specified

TABLE 6-1 (Continued)

Name	Type	Size MMBtu/hr		Reviewing Agcy	Date of Issuance	BACT for PM
Biogen Power Project	CFBC	212		EPA Region IX	4/26/85	0.01 gr/dscf @3%O2 (~0.03 lb/MMBtu) – baghouse (99.9%)
Wisc. Electric Power Co.	PFBC	825		Wisconsin DNR	1985	0.02 lb/MMBtu – ESP
3M Co.	NS	120		Alabama DEM	11/29/84	0.1 lb/MMBtu – baghouse (98.7%)
Amalgamaize Co	NS	179.7		Alabama DEM	11/29/84	0.05 lb/MMBtu – baghouse (98%)
Puget Sound Naval Shipyard	NS	NS		Puget Sound APCA	9/25/84	0.02 gr/scf (~0.04 lb/MMBtu) – baghouse (99.9%)
Cogentrix – Lumberton	NS	202		North Carolina DEM	9/10/84	0.03 lb/MMBtu – baghouse (99.1%)
Alabama Power Co.	NS	248		Alabama DEM	9/10/84	0.05 lb/MMBtu – baghouse (99.6%)
Virginia Power – Portsmouth	PC	1129		Virginia APCB	7/27/84	0.03 lb/MMBtu – ESP (99.3%)
Cogentrix – Kenansville	NS	202		North Carolina DEM	6/25/84	0.03 lb/MMBtu – baghouse (99.1%)
Cogentrix – Hamilton	NS	202		North Carolina DEM	4/3/84	0.03 lb/MMBtu – baghouse (99.1%)
American Lignite Products	CFB	571		EPA Region IX	1/10/84	0.013 lb/MMBtu – baghouse (99.9%)
Lower Colorado River Authority	LIG	4735		Texas ACB	12/22/83	0.03 lb/MMBtu – ESP (99.96%)
American Lignite Prod. Co.	FB	240		Amador Cty APCD	12/21/83	0.0156 gr/dscf (~0.03 lb/MMBtu) – baghouse (99.93%)
Intermountian Power Project	NS	8352		Utah BAQ	10/17/83	0.02 lb/MMBtu – FF (99.8%)
Basin Electric Power Coop.	PC	6278		North Dakota SHD	1/12/83	0.03 lb/MMBtu – baghouse (99.86%)
Eastman Kodak Co.	PC	670		New York DEC	12/20/82	0.035 lb/MMBtu – ESP (99.57%)
Washington Water Power Co.	PC	2080		EPA Region X	11/17/82	0.03 lb/MMBtu
Iowa Electric Light & Power Co.	PC	400		EPA Region VII	10/29/82	0.03 lb/MMBtu – ESP
Holyoke Water Power – Mt Tom	PC	1447		Massachusetts DEQE	10/27/82	0.08 lb/MMBtu – ESP (99.51%)
B.F.Goodrich	CFB	150		Illinois EPA	9/16/82	0.06 lb/MMBtu – cyclone & baghouse (99%)
Cincinati Gas & Elect.	PC	6313		Kentucky DAPC	5/14/82	0.7 lb/MMBtu –
West Texas Utilities Co.	NS	6.8		Texas ACB	5/20/82	0.03 lb/MMBtu – ESP (99.7%)
Kentucky Utilities	PC	6650		Kentucky DAPC	4/15/82	0.03 lb/MMBtu – ESP (99.8%)
Jacksonville Elec Auth	PC	600	MW	Florida DER	1/1/82	0.03 lb/MMBtu – ESP (99.78%)
SC Public Svc – Cross	PC	500	MW	South Carolina DHEC	12/3/81	0.03 lb/MMBtu – ESP (99.8%)
Houston Lighting & Power	PC	5729		EPA Region VI	11/12/81	0.03 lb/MMBtu – FF (99.72%)
Central Power & Light	PC	6781		EPA Region VI	10/19/81	0.03 lb/MMBtu – ESP (99.6%)
Tampa Elect Co	PC	425	MW	Florida DER	10/15/81	0.03 lb/MMBtu – ESP (99%)
Oklahoma Gas & Elect	PC	5250		EPA Region VI	10/5/81	0.03 lb/MMBtu – ESP or baghouse (99.6%)
Delmarva Power & Light	PC	5702		EPA Region III	9/30/81	0.03 lb/MMBtu – ESP (99.65%)
Panorama Enercorp, Inc	NS	37	MW	EPA Region X	9/22/81	0.007 gr/dscf (~0.018 lb/MMBtu) – ESP (99%)
SW Elect Power	PC	720	MW	EPA Region VI	9/1/81	0.1 lb/MMBtu – ESP (99.8%)
Pensylvania Elect Co	PC	6280		EPA Region III	8/18/81	0.03 lb/MMBtu – ESP (99.7%)
NY State Elect – Cyuga	PC	1750		EPA Region II	6/29/81	0.03 lb/MMBtu – ESP
Iowa-Illinois Gas & Elect	PC	7000		EPA Region VII	6/16/81	0.03 lb/MMBtu – ESP
Idaho Nat Engineering Lab	NS	82.5		EPA Region X	6/5/81	0.05 gr/dscf (~0.05 lb/MMBtu) – baghouse (99%)
Plains Elect Gen & Trans	PC	2471		EPA Region VI	5/27/81	0.03 lb/MMBtu – baghouse (99.9%)
Nevada Power Co	PC	560	MW	EPA Region IX	4/13/81	0.015 lb/MMBtu – baghouse
Big Rivers Elect – D.B. Wilson	PC	4585		Kentucky DAPC	3/11/81	0.03 lb/MMBtu – ESP (99.8%)
AL Elect Coop Inc	LIG	4805		Alabama APCD	2/24/81	0.03 lb/MMBtu – ESP
SW Elect Power	PC	6821		EPA Region VI	2/23/81	0.03 lb/MMBtu – ESP (99.8%)

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker PC – pulverized coal NS–not specified

TABLE 6-1 (Continued)

Name	Type	Size MMBtu/hr	Reviewing Agcy	Date of Issuance	BACT for PM
Container Corp of America	PC	NS	Philadelphia AMS	1/20/81	0.06 lb/MMBtu
Nebraska Public Power Dist	NS	650 MW	Nebraska DEC	12/16/80	0.03 lb/MMBtu – FF (99.9%)
New England Power – Brayton Pt	NS	10625	Massachusetts DEQE	11/1/80	0.08 lb/MMBtu – ESP (99.3%)
E.Kentucky Power	NS	6760	Kentucky DAPC	8/21/80	0.03 lb/MMBtu – ESP (99.8%)
City of Wilkes–Barre	NS	92.5	EPA REgion III	7/1/80	0.086 lb/MMBtu – baghouse/cyclone (99.7%)
Curtiss Wright Corp	NS	137	EPA Region II	6/13/80	none
Intermountian Power Project	NS	3000	EPA Region VIII	6/8/80	0.02 lb/MMBtu – ESP (99.8%)
Utah Power & Light	NS	860	EPA Region VIII	6/2/80	0.03 lb/MMBtu – FF (90%)
Deseret Gen & Trans, Moon Lake	NS	800	EPA Region VIII	2/4/80	0.03 lb/MMBtu – FF (99.8%)

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker PC – pulverized coal NS–not specified

Pulverized Coal Boilers

- Electrostatic precipitator (ESP), twenty entries in BACT/LAER clearinghouse.
- Fabric filter (FF/baghouse) eleven entries in BACT/LAER clearinghouse.

Coal Fired Boilers

- Fabric filter (FF/Baghouse) fifty-four entries in BACT/LAER clearinghouse.
- Electrostatic precipitator (ESP), twenty five in BACT/LAER clearinghouse.

Combustion Sources in General

- Electrostatic precipitator (ESP)
- Fabric filter (FF/baghouse)
- Venturi scrubber (no listings in BACT/LAER clearinghouse)
- Tray tower (no listings in BACT/LAER clearinghouse)
- Calvert® collision scrubber (no listings in BACT/LAER clearinghouse)
- wet ESPs (no listings in BACT/LAER clearinghouse)

6.1.2 Technical Feasibility Analysis

Electrostatic precipitators clearly represent a technically feasible option for the control of PM from pulverized coal fired boilers. While few installations of fabric filters are listed in the BACT/LAER clearinghouse for PC boilers, this technology is considered to be applicable due to commercial availability, and the large number of coal fired applications with similar flue gas characteristics.

The various wet control techniques are not considered to represent feasible control options for the Indiantown project due to the limited availability of additional clean water and the lack of treatment and disposal capability for wastewater at the Indiantown site. Further, wet control techniques do not represent a demonstrated control technique for large pulverized coal fired boilers, nor do they offer more stringent levels of control than do ESPs and fabric filters. Wet particulate controls will not, therefore, be considered further in this analysis.

6.1.3 Ranking of Technically Feasible Alternatives

Since fabric filters and ESPs are both capable of PM control levels in excess of 99%, performance is compared on a lb/MMBtu of PM emitted basis. This convention allows straightforward comparison with the emission levels listed in the BACT/LAER Clearinghouse.

Of the control options identified, fabric filters are capable of achieving the most stringent levels of PM control available. While other control technologies such as ESP may rival the performance of fabric filters, none were identified as being able to exceed this performance for control of PM and PM_{10}.

Fabric filters are deemed the superior fine particulate (PM-10) removal device because their performance is not as sensitive to particle size distribution as an ESP. According to Appendix C.2 of Supplement A of AP-42 (U.S. EPA, 1985a), fabric filters are more efficient than ESPs at controlling fine particulates (i.e., those with diameters less than 6 microns).

Typical Collection Efficiencies for the Following
Range of Particle Sizes

Control Device	Particle Size (μm)		
	0 - 2.5	2.5 - 6	6 - 10
ESP	95 percent	99 percent	99.5 percent
Fabric Filter	99 percent	99.5 percent	99.5 percent

Since the most stringent emission levels listed in the BACT/LAER Clearinghouse are for fabric filters, and since they are superior to ESPs for control of PM_{10}, fabric filters are considered to represent the top technology for control of PM and PM_{10} from the proposed project.

The NSPS for control of PM from coal fired steam generating units with heat inputs greater than 100 MMBtu/hr is 0.05 lb/MMBtu (40 CFR 60 Subpart Db). The most recent entry in the BACT/LAER Clearinghouse for fabric filter control of PM from a coal fired boiler lists an emission rate of .018 lb/MMBtu (Applied Energy Services). Of the remaining eighty-two listings in the BACT/LAER clearinghouse, only five are listed with emission rates less than .018 lb/MMBtu; the most recent of these is a 1987 determination for City of Wyandotte.

ENSR contacted Mr. Barry Andrews at the Florida DER to determine if any coal fired boilers were currently being permitted in the State. The only coal fired unit to obtain a permit in Florida in the last five years is a project in Jacksonville (Cedar Bay Cogeneration) which is currently awaiting federal PSD approval. This 225 MW CFB project will control PM with fabric filters, to a level of .02 lb/MMBtu.

It was therefore concluded that the most stringent method of particulate control for the Indiantown project can be achieved with fabric filters. Two levels of particulate control were considered for fabric filters - .018 lb/MMBtu which is representative of the most recent BACT/LAER clearinghouse listings, and .012 lb/MMBtu which is representative of the five most stringent listings. The .03 lb/MMBtu new source performance standard (NSPS) would equate to a stack emission of 450 tons/year. 0.18 lb/MMBtu would result in a stack emission of 270 tons/year. .012 lb/MMBtu would result in a stack emission of 180 tons/year.

6.2 Fabric Filters

6.2.1 Technical Analysis

6.2.1.1 Introduction

The basic components of a baghouse include a filter medium, in the form of cylindrical bags, a tube sheet to support the bags, a gas-tight enclosure, and a means to dislodge accumulated dust from the bags.

The particulate-laden gas stream normally enters the lower portion of the baghouse near the collection hoppers. The gas then passes upward on the outside or inside of the bags, depending on the type of device used. Particulate collection occurs through inertial impaction, diffusion, direct sieving, electrostatic attraction, and gravity settling. The first two mechanisms prevail during the early phases of filtration after the cleaning cycle, while the sieving action of the accumulated particle layer soon predominates, especially at high loadings (Roeck, 1979). The baghouse mainly serves as the support structure for the accumulated particles, or filter cake. Build-up of a porous and dry filter cake is desirable since the filter cake becomes a filter medium which exhibits an extremely fine pore structure. Eventually the pressure drop across the filter cake increases, the differential pressure sensors initiate changeover to a standby filter chamber and the off line chamber is cleaned. The accumulated filter cake is periodically removed from the bags using various cleaning methods; i.e., mechanical shaking, reverse air cleaning, or pulse-jet cleaning. The collected particulate drops by gravity to the collection hoppers and is removed for disposal.

There are three general types of fabric filter designs, categorized based on the cleaning method: reverse air, shaker, and pulse jet units. Reverse air fabric filters use low A/C ratios and collect

PM on the inside of the filter bags. The flue gas is first introduced through a manifold into the hopper section of the bag compartments. The gas then flows upward and into the inside of the filter bags to the outside. Once the collected material builds up to a point where the resistance to flow (pressure drop) is too great, the filter bags are cleaned using a low energy reverse air cleaning process. The gas flow is periodically reversed, causing the bag to collapse; this fractures the filter cake and allows the particulate to fall into the collection hoppers for disposal. A portion of the cleaned flue gas serves as the reverse air during the cleaning process.

Shaker units also use low A/C ratios and collect the PM on the inside of the bags. To clean the filter bags, a portion of the baghouse is isolated to prevent gas flow and is then mechanically shaken for about one minute to dislodge the dust cake. The shaking is accomplished by a drive linkage which vibrates and shakes the bags at an optimum frequency and amplitude to facilitate efficient dust removal. The shaking can cause increased stress on the bags and may shorten bag life because of reduced structural integrity.

Pulse jet units employ A/C ratios (4:1) which are usually about twice those of reverse air and shaker units (2:1). In contrast to reverse air and shaker units, the gas flow in a pulse jet baghouse flows from the outside of the filter bag to the inside, so that the PM is collected on the outside of the filter bags. The cleaning cycle may be initiated automatically by either a timer or pressure drop activation signal, and typically occurs when the pressure drop across the fabric filter reaches between 6 to 8 in W.C. When the cleaning process is initiated, a module is taken off line and bags are cleaned one row at a time with a high pressure burst (pulse jet) of compressed air into the open end of the bag. This action causes the bag to flex away from the supporting cage releasing the PM on the outside of the bag. The dust then falls into the collection hoppers.

6.2.1.2 Factors Which May Effect Operating Performance

A wide range of actual operating performance has been reported for fabric filters. One study reviewed a data base of over 50 operating fabric filters in an effort to examine the influence of design and operating variables on particulate emissions (Lane, 1988). One conclusion drawn from this review of operating units was "the design of a fabric filter for ultra low emissions is not a well understood science, [and is] not even a black art". Some of the differences in design and operation examined in this study which were thought to influence baghouse emissions include the following:

1. fabric leaks
2. bypass damper leakage
3. cleaning frequencies and techniques

4. fuel and combustion characteristics
5. maintenance quality
6. fabric weight and design
7. height to diameter ratio
8. air to cloth ratio
9. gas temperature, humidity, and SO_3 content
10. fabric filter vendor-specific features

Fabric leaks yield elevated emission levels by allowing a portion of dust laden flue gas to bypass the filtration process. The impact of small amounts of leakage can dominate the performance of units which attempt to achieve extremely low outlet emission levels. The control of fabric leakage becomes more difficult as the fabric filter installation becomes larger. For example, a project such as Indiantown may employ 7,200 individual bags in twenty separate baghouse modules. A small tear in one of these bags would result in elevated emissions; yet locating the source of a minor bypass would be like finding a needle in a haystack. The probability of encountering a defective bag is statistically higher when such a large number of individual bags is required.

Bypass damper leakage can similarly affect outlet emissions. Bypass dampers are required to divert flue gas around the baghouse during startup conditions, when temperatures have not yet reached the acid dew point. Dampers are also required to remove the module from service for cleaning. During normal operation, any leakage of the damper seals will allow a portion of the particulate laden flue gas to bypass the filter medium. Large units such as Indiantown require large dampers with large seal areas. It is more difficult to maintain a good perimeter seal with large dampers that it is with smaller ones.

The cleaning frequencies and techniques employed in operation of a fabric filter may also influence baghouse emissions. More frequent cleaning may result in higher average emissions since the high filtration filter cake is removed more often, exposing the inferior filtration fabric of the bag itself. The frequency of cleaning required is dependant on a number of variables which affect baghouse pressure drop. For instance, the particle size of the ash being collected, which may be finer for a PC than for a CFB, could impact pressure drop by tending to clog the open pores of the filter medium.

As stated previously, the particulate size distribution resulting from the combustion of pulverized coal, as opposed to various other types of combustion sources, may yield lower baghouse collection efficiencies. The particulate size distribution resulting from an upstream SO_2 removal process may also impact collection efficiency. For instance, the lime introduced with a spray dryer such as that proposed for Indiantown is much finer than that employed in a fluidized bed unit.

Baghouse maintenance includes carefully monitoring the performance of each module, the routine changout of bags as wear becomes a factor, and the maintenance of damper seals, etc. Such maintenance becomes more difficult for large facilities.

The particular fabric selected for a given application may influence baghouse performance. Some of the criteria which affect fabric selection are operating temperature and humidity, SO_3 content of the flue gas, particulate size distribution, and required bag life. These factors influence the material and weave selection for each individual application. Table 6-2 lists some of the commercially available bag materials and their relative properties. These materials are generally available as woven, textured, or felted materials; woven fabric is the most commonly used bag material. Highly textured fabrics minimize voids by incorporating a tighter weave and "tangled" fibers. Felts virtually eliminate weave voids with layers of randomly oriented fibers. Many case specific factors influence bag selection, which may yield differing emission rates from one installation to another. This factor is thought to contribute to the variability in reported emissions from various operating facilities.

Two other design and operational parameters which govern baghouse performance are air-to-cloth ratio and pressure drop. The air-to-cloth (A/C) ratio is the ratio of the actual volumetric flow rate of the gas stream (acfm) to the surface area of the fabric (ft^2). In general, lower air-to-cloth ratios are used in the collection of fine particles which have a tendency to become permanently entrapped in the filter media, thereby clogging or "blinding" the bag. The pressure drop across the filter media is a function of the face velocity of the gas stream through the filter and the combined resistance of the fabric and accumulated dust layer. To avoid operational problems and excessive power requirements, the maximum pressure drop across the filter media should be limited to approximately 6.0 to 8.0 in. water column (W.C.).

Other factors which may affect fabric filter performance are bag height to diameter ratio and specific features of a given product line, such as the Staclean diffuser described by Lucas et al (Lucas 1980).

TABLE 6-2

Commercially Available Fabric Filter Materials

	Temp	Acid Resistance	Fine Particulate Collection
Woven Fiberglass	550°f	Good	Very Good
Woven Fibreglass with Teflon®	450°f	Excellent	Very Good
Highly Texturized Woven Fiberglas	350°f	Good	Excellent
RYTON®	375°	Excellent	Very Good
GORE TEX®/Acrylic (Felt)	260°f	Very Good	Excellent
CORE TEX®/NOMEX (Felt)	400°f	Fair	Excellent
GORE TEX®/Fiberglas (Felt)	500°f	Good	Excellent
GORE TEX®/PTFE (Felt)	500°f	Excellent	Excellent
Polypropalene (Felt)	200°f	Excellent	Excellent
NOMEX® (Felt)	400°f	Fair	Excellent
TEFAIRE® (glas/teflon, Felt)	450°f	Excellent	Excellent
TEFLON®	425°f	Excellent	Very Good

6.2.1.3 Advantages of Fabric Filters vs ESP's

Fabric filters exhibit several advantages over electrostatic precipitators for a pulverized coal fired cogeneration project such as Indiantown.

Some of the major advantages of baghouses are as follows:

- improved SO_2 removal (lime content of filtercake)
- ability to attain high collection efficiencies,
- particle electrical resistivity has no effect on collection efficiency, and
- uniform collection efficiency over a wide range of particle sizes and particulate loadings

The use of fabric filters can enhance the capture of SO_2 in the flue gas stream due to the filtercake buildup on the baghouse bags. The Indiantown project will utilize a lime spray dryer for SO_2 control. Reacted and unreacted lime are ultimately collected in the baghouse filter. The unreacted lime which becomes part of the filter cake continues to capture SO_2 as flue gas continues to permeate the filter media. This additional desulfurization capability would not be experienced with an ESP.

The fabric filter is more effective at capturing fine particulate than an ESP, because ESPs tend to selectively collect larger particles. Large particles have a high mass to surface area ratio which allows a charged particle to be efficiently dragged through the flue gas stream for collection on a charged plate. Ultra fine particles have a low terminal velocity and cannot carry a strong enough electrical charge to result in complete collection.

6.2.2 Environmental and Energy Analysis

No negative environmental impacts have been identified for use of a fabric filter to control particulate emissions from pulverized coal boilers. There is, however, a significant energy demand for this system. Energy is required to overcome the complete system's (fabric filter and associated ductwork) 8-12 in W.C. pressure drop, and miscellaneous loads such as electric hopper heating. The total annual energy expenditure to operate a fabric filter for a 300 MW pulverized coal fired boiler is estimated to be approximately 1,250 KW (Bechtel).

6.2.2.1 Economic Analysis

A budgetary cost estimate for the total capital investment for a fabric filter system was obtained by Bechtel for a similar project. The cost factors were then used to calculate the basic equipment and total purchased equipment costs. The basic equipment and auxiliaries for a fabric filter system includes the baghouse, filter bags, dampers and ductwork. These items were estimated to be $9.5 million as presented in Table 6-3. The total equipment cost, which includes instrumentation, taxes and freight is estimated at $12.1 million. Direct installation cost (foundations, structural supports, handling and erection, piping and insulation) totals $3.7 million. Indirect costs are also summarized in Table 6-3, and are estimated at $4.7 million. Therefore, the total capital investment (TCI) of the system is approximately $20.5 million. A second economic analysis was prepared for the same system equipped with Gore-Tex bags, to achieve an emission level of .012 lb/MMBtu. Gore-Tex bags were estimated at $270 ea, for an additional equipment cost of $1,300,000.

Annual operating costs for the baghouse systems are shown in Table 6-4. Operating labor is estimated at 8 hours per shift for an annual expense of $175,000. Power is required to overcome the system's pressure drop. Approximately 10.9 x 10^6 kWh is required for this purpose annually, totalling over $657,000. Another significant expense, at roughly $216,000/yr, is bag replacement. A bag life of 3 years was assumed in this assessment. The replacement cost if Gore-Tex bags were specified, was estimated at $648,000.

The total annualized cost of the baghouse system is thus estimated at over $5,990,000. For the control of 152,730 tpy of PM this technology would have a cost effectiveness of less than $100 per ton of particulate removed. The use of Gore-Tex bags would increase the annualized cost by $832,000/yr and would control an additional 90 t/y, for an incremental cost effectiveness of $9,244/ton. The incremental cost effectiveness for Gore-Tex bags is thought to be excessive - BACT for the Indiantown project is therefore concluded to be fabric filters with conventional bags to achieve an emission level of .018 lb/MMBtu.

6.3 Conclusions

Baghouse filters are thought to represent the most stringent PM/PM-10 control technique which can be applied to PC boilers. Fabric filters at .018 lb/MMBtu were found to represent a cost effective control technology for the proposed project, with no negative environmental impacts. Although the large pressure drop incurs an annual energy expense of $657,000 MMBtu, the high PM/PM-10 removal efficiency compensates such that the overall energy effectiveness is reasonable.

TABLE 6-3

Capital Costs For Fabric Filter

	.018 lb/mm Btu	.012 lb/mm Btu
(1) Purchased Equipment		
(a) Primary and Auxiliary	$9,523,000	$9,523,000
(b) Instrumentation & Control	952,000	952,000
(c) Structural Support	952,000	952,000
(d) Freight & Taxes	762,000	762,000
(e) Adder for Gore-tex Bags	______	1,300,000
Total Purchased Equipment Cost	$12,189,000	$13,489,000
(2) Direct Installation	$3,657,000	$3,657,000
Total Direct Cost	$15,846,000	$17,146,000
(3) Indirect Installation		
(a) Engineering & Supervision	$1,585,000	1,715,000
(b) Construction & Field Expense	1,585,000	1,715,000
(c) Construction Fee	792,000	857,000
(d) contingencies	475,000	514,000
Total Indirect Installation	$4,437,000	4,801,000
(4) Other Indirect Costs		
(a) Startup & Testing	158,000	171,000
(b) Working Capital	83,000	88,000
Total Other Indirect	$241,000	$259,000
Total Indirect Cost	$4,678,000	$5,060,000
Total Capital Costs	$20,524,000	$22,206,000
Capital Recovery Factor	$3,345,000/yr	$3,620,000/yr

TABLE 6-4

Annual Costs for Fabric Filter

	.018 lb/mmBtu	.012 lb./mmBtu
Direct Operating Costs		
(1) Labor (a) Operating (b) Supervisory	 $175,000 26,000	 $175,000 26,000
(2) Maintenance	$792,000	$875,000
(3) Replacement Parts	@$90 ea 216,000	@270 ea $648,000
(4) Utilities (a) Electricity	 657,000	 657,000
(5) Raw Materials (a) Ammonia (b) Lime (c) Limestone	 0 0 0	 0 0 0
(6) Disposal Costs	NA	NA
Indirect Operating Costs		
(7) Overhead	$155,000	$163,000
(8) Property Taxes	158,000	171,000
(9) Insurance	158,000	171,000
(10) Administration	317,000	343,000
(11) Capital Recovery	$3,345,000/yr	3,620,000/yr
Total Annualized Cost	$5,999,000/yr	$6,831,000/yr
Uncontrolled Emission Rate	153,000 t/y	153,000 t/y
Controlled Emission Rate	270 t/y	180 t/y
Tons Controlled	152,730 t/y	90 t/y additional
Cost Effectiveness	$39/ton	$9,244/ton incremental

Baghouse filters are therefore considered to represent BACT for PM/PM-10 by controlling emissions to a level of 0.018 lb/MMBtu (270 tpy). This level is equivalent to that proposed as BACT for PM and PM_{10} for recently permitted coal-fired boilers listed in the BACT/LAER Clearinghouse, and is significantly lower than the NSPS emission level (.03 lb/MMBtu) for pulverized coal fired boilers.

6.4 BACT Determination for Auxiliary Boiler PM

6.4.1 Introduction

Emissions of particulate matter (PM) in oil-fired boilers result from the ash in the fuel and incomplete fuel combustion. PM emissions vary with the sulfur content of the fuel (EPA, 1982). They are also dependent on boiler load, generally decreasing with decreasing load.

In order to determine the emissions of PM_{10} (particulates with diameters less than 10 microns), the particle size distribution was estimated using data from AP-42 for oil-fired units equipped with a cyclone (EPA, 1985). As shown in Table 6-5, essentially all PM will be less then 15 microns in diameter. Emissions of PM_{10} are expected to be 95% of the total emission rate.

Several technologies are available for the control of PM and PM_{10}. Since almost all of the particulates emitted from the boilers are less than 15 microns, it is assumed that the BACT determination for PM_{10} will be the same as that for PM. Available control technologies include electrostatic precipitators (ESP) and fabric filters (FF).

6.4.2 Technical Feasibility of Control Options

Fabric Filter

The most effective PM control technology for combustion sources in general is a fabric filter, which can achieve removal efficiencies of greater than 99%, including submicron particles. Fabric filter technology has been described previously in Section 6.2. One limitation for fabric filters is potential blinding of the bags resulting from oil soot. Soot buildup can adhere to the bags preventing filter cake removal for proper operation.

ENSR contacted several fabric filter vendors for information on the technical feasibility and economic impacts of controlling PM emissions from an oil fired boiler with a fabric filter. The vendors contacted, however, said they do not provide fabric filters for oil-fired boilers (Lemaire, 1989). None of the entries for oil-fired boilers in the Clearinghouse or Supplements (EPA 1985, 1986, 1987a, 1988) deem fabric filter technology BACT for PM. Based on these factors, this

TABLE 6-5

Particle Size Distribution for Residual Oil Fired Boilers Equipped with a Cyclone

Particle Size (um)	Cumulative Mass % < Stated Size
15	100
10	95
6	72
2.5	22
1.25	21
1	21
0.625	21
Source: U.S. EPA, 1985	

technology is not considered available or technically feasible for control of PM emissions from the auxiliary boilers.

Electrostatic Precipitators (ESPs)

A particulate control device which is applicable to oil fired boilers and can remove $99^{+}\%$ of inlet particulate loadings is an electrostatic precipitator (ESP). The following discussion assumes a removal efficiency of 99%, including submicron particles, to achieve a controlled emission rate of .03 lb/MMBtu.

Electrostatic precipitators are generally used for the removal of particulate matter from gas streams which can be easily ionized. A typical ESP consists of an alternating array of negatively-charged discharge electrode wires and grounded collection plates. Particulate collection takes place in several steps. A high voltage is applied to the discharge electrodes and the collection plates which produces an electrostatic field between the two elements. In the interelectrode space, a corona is established around the negatively-charged electrode. As the particulate laden gas passes through the interelectrode space, the corona ionizes molecules of electronegative gases (i.e., oxygen, CO_2, SO_2) present in the gas stream. Particles larger than 1-2 micrometers are charged by field charging; ions are driven onto the particles by the electric fields. Submicron particles are charged by diffusion charging; ions are carried to the particles by their kinetic energy. The charged particles migrate to the collection plates, and are deposited. The strong electrostatic field and adhesive properties of the particulate inhibit re-entrainment. Particulate removal is accomplished by rappers that vibrate the collection plates and dislodge the particles, which then drop into collection hoppers.

ESPs may be designed for highly efficient performance in excess of 99 percent PM removal. The collection efficiency is a function of many factors. The most important factors are particle electrical resistivity, specific collection area of the collection electrodes, flue gas velocity, humidity, temperature, and particle size distribution.

Particulate collection efficiency of an ESP is highly dependent on fly ash electrical resistivity. Particle resistivities in the range of 10^4 to 10^{10} ohm-cm have been shown to be the most suitable for electrostatic precipitation (Oglesby, 1970). Particles with resistivities less than 10^4 ohm-cm will give up their charge too easily when they contact the collection plates and may be re-entrained in the flue gas, whereas particles with resistivities greater than 10^{10} ohm-cm will adhere to the collection plates and be difficult to dislodge. These particles may then act as an insulator, reducing the ability of the electrode to further collect particulate matter.

Two major factors influence the resistivity of the fly ash: (1) fuel characteristics, and, (2) flue gas stream characteristics (e.g., temperature and moisture) (CARB, 1984). Fuel characteristics, such as the quantity of ash, chloride and metals greatly determine the resistivity of the resultant fly ash.

Particle size distribution also affects performance. A high density of fine particles reduces the corona discharge which, if sufficiently reduced, prevents charging of flyash and reduces particulate collection efficiency. In general, reduction in ESP collection efficiency occurs in the 0.1 to 1.0 micron diameter particle size range.

The overall collection efficiency of an ESP can be estimated by the Deutsch-Anderson equation (White, 1977):

$$\text{Efficiency} = 1 - \exp(-AW/Q)^K$$

where: A is the collection plate area (ft^2),
Q is the gas flow rate (ft^3/sec), and
W is the particle migration velocity (ft/sec).
K factor equal to 0.5 - 1.0

The migration velocity is the rate at which charged fly ash particles travel towards the ESP collection plates. It is defined as the terminal velocity of a particle of a given size when the gas drag and electrical forces acting on the particle are equal, and is dependent on electric field intensity at the charging electrode and collection plate, particle size, gas viscosity, and aerodynamic slip.

The migration velocity is the parameter that most affects the design specifications of an ESP. A slow migration velocity indicates less particle capture per area of collection plate. Small particles usually have lower migration velocities than large particles. The collecting electrode surface area would therefore have to be increased for applications with larger quantities of small fly ash (CARB, 1984).

ESP performance may be evaluated by comparing the specific collection area (SCA) needed to achieve a specified collection efficiency or outlet concentration of particulate matter. SCA is defined as the surface area of the ESP where the particulates may be collected, divided by the flowrate (K acfm).

ESPs may be preferred, for some applications, over other particulate control devices such as fabric filters and high energy scrubbers for the following reasons:

- relatively low pressure drop across the system (typically <1.0 in. water column),
- ability to treat relatively humid gas streams,
- collected particles are in a dry state which reduces corrosion and freeze-up and presents lesser environmental impacts than sludge, an end product of wet scrubbing,
- oil-firing applications.

Although ESPs are accepted as efficient particulate control devices they have certain drawbacks. Disadvantages with ESPs include the following:

- changes in fuel characteristics, gas properties and particle size distribution may change collection efficiency,
- inorganic particles with low resistivities are difficult to collect, - unburnt carbon may pass through because of premature loss of charge,
- high capital cost.

Energy demand is one of the most significant impacts of ESPs. For this application, roughly 1.85×10^6 kwh of electricity would be required annually. None of the oil-fired boilers listed in the Clearinghouse, Supplements or BLIS (EPA, 1985, 1986, 1987, 1988, 1989) consider ESP's BACT for PM.

6.4.3 Economic and Energy Analysis for ESP

Basic equipment costs for an ESP were estimated from vendor data obtained from another project. Basic equipment costs of $292,000 and are shown in Table 6-6. Total capital costs for this option are estimated at $918,000.

Annual ESP costs were estimated assuming 1000 hrs/yr operation. ESPs have significant electricity requirements. Based on a pressure drop of 1 inch of water and a power requirement of 200 kWh, the annual electrical expense for this option is $131,000. Due to the complexity of this technology, 2 hours of operating labor is required per shift resulting in an annual expense of $55,000. Supervisory labor is calculated as 15% of the operating labor and totals $5,000 per year. As shown in Table 6-7, the total annualized cost for operation of an ESP is estimated at $480,000. The ESP would control 3.5 tpy of PM resulting in a cost effectiveness of $137,150/ton PM removed. Although this technique is the most efficient for PM control, it is not cost-effective. Therefore, it is not considered to represent BACT for PM from the Indiantown auxiliary boiler. No negative energy or enviornmental impacts were identified for ESPs.

TABLE 6-6

Capital Cost Components for an Electrostatic Precipitator (ESP)

Direct Costs	ESP
(1) Purchased Equipment	
(a) Basic Equipment	$292,000
(b) Auxiliaries	$102,000
(c) Instrumentation	$29,000
(d) Structural Support	$29,000
(e) Tax & Freight	$36,000
Total Purchased Equipment Cost	$488,000
(2) Direct Installation	$146,000
TOTAL DIRECT COST (TDC)	$634,000
INDIRECT COSTS	
(4) Indirect Installation	
(a) Engineering Supervision	$63,000
(b) Construction & Field Expenses	$63,000
(c) Construction Fee	$95,000
Total Indirect Installation Cost	$221,000
(5) Other Indirect Costs	
(a) Start-up & Performance Tests	$6,000
(b) Working Capital	$8,000
(c) Interest During Construction	$49,000
TOTAL INDIRECT COST (TIC)	$63,000
TOTAL CAPITAL COST (TCC)	$284,000
CRF	$159,000/yr

TABLE 6-7

Annual Cost Components for an Electrostatic Precipitator (ESP)

Direct Operating Costs	ESP
(1) Labor	
(a) Operating	$55,000
(b) Supervisory	$8,000
(2) Maintenance	$32,000
(3) Replacement Parts	$36,000
(4) Utilities	
(a) Electricity	$131,000
(b) Water	$0
(c) Steam	$0
(d) Compressed Air	$0
(e) Fuel	$0
(5) Raw Materials	
(a) Ammonia	$0
(b) Urea	$0
(c) Lime	$0
(d) Sodium hydroxide	$0
(e) Soda Ash	$0
INDIRECT OPERATING COSTS	
(7) Overhead	$23,000
(8) Property Tax	$9,000
(9) Insurance	$9,000
(10) Administration	$18,000
(11) Capital Recovery	$159,000
TOTAL ANNUALIZED OPERATING COST	$480,000
tpy removed	3.5
Cost Effectiveness $/ton removed	$137,000

6.4.4 BACT for PM Control Of Auxiliary Boiler

ESPs are highly effective PM control devices and are routinely used on coal-fired boilers and resource recovery facilities. None of the entries for oil-fired (crude, distillate or residual) boilers in the Clearinghouse, Supplements or on-line BLIS (U.S. EPA, 1985, 1986, 1987a, 1988, 1989), however, proposed an ESP as BACT for PM. The use of an ESP on the auxiliary boilers to control a maximum of 3.5 tons/year of particulate was found to be not cost effective. BACT for PM from the auxiliary boiler at the Indiantown project is therefore concluded to be the use of a high quality fuel such as natural gas or distillate oil with a maximum emission limit of .02 lb/MMBtu. This level of control will result in the emission of a maximum of 0.70 tons/yr for PM and PM_{10}.

7.0 BACT FOR FUGITIVE PM

7.1 Introduction

Fugitive emissions are generated as a result of delivery, storage and handling of coal, pebble lime and ash. These emissions can be characterized as either windblown dust from outdoor storage piles, or dust emissions released during unloading and conveying operations. The following analysis will evaluate BACT for storage of coal, pebble lime, bottom ash and flyash, and the materials handling systems for each.

7.1.1 BACT/LAER Clearinghouse

The BACT/LAER Clearinghouse contains no entries for fugitive dust emissions from coal fired boiler projects.

7.1.2 Alternative Control Technologies/Best Available Control Technology

7.1.2.1 Inactive Coal Storage Pile

Fugitive dust from the inactive coal storage pile may be controlled by enclosing the pile with a protective structure, covering the pile with turf, or coating with a crusting agent. Each of these methods is thought to be equally effective since fugitive emissions are essentially eliminated by these techniques, and are considered to represent BACT.

7.1.2.2 Active Coal Storage Pile

Fugitive dust from the active coal storage pile may be controlled by enclosing the pile within a protective structure, or by wetting the pile with water sprays, oil, or various other surfactants. Of these techniques, enclosing the pile altogether is thought to be the superior technique since fugitive emissions are essentially eliminated, and is considered to represent BACT.

7.1.2.3 Pebble Lime Storage

Pebble lime will be stored on site in an enclosed structure ventilated with fabric filters. Since fabric filters are capable of controlling outlet emissions to 0.001 gr/DSCF or less, this level of control is considered to represent BACT.

7.1.2.4 Bottom Ash Storage

Bottom ash will be stored in storage hoppers prior to rail loading for ultimate disposal. The storage of bottom ash in open top hoppers does not represent a source of fugitive emissions, since bottom ash is handled wet and since it does not contain fine particles which can become entrained due to wind conditions.

7.1.2.5 Fly Ash Storage

Fly ash is characterized by very fine particles which would yield high fugitive emissions if stored in outdoor piles. This material is therefore handled in enclosed silos, which results in essentially no emissions of fugitive dust, and is considered to represent BACT.

7.1.2.6 Coal and Lime Delivery

The generation of fugitive dust may result from rail unloading of coal and pebble lime. Fugitive emissions may be controlled with water sprays, by enclosing the unloading area within a structure, and by collecting airborne dust within the structure by use of a fabric filter. Since fabric filters for room ventilation systems can control emissions to 0.001 gr/DSCF or less, this level of control is considered to represent BACT.

7.1.2.7 Coal and Lime Conveyors

Coal and pebble lime will be handled at the Indiantown facility with various mechanical conveyors which reclaim bulk materials from storage, crush and size coal and lime, and transport the materials to silos local to the boilers. Each of these handling steps results in a potential source of fugitive emissions. Such emissions may be controlled with water sprays, or by utilizing enclosed conveyors, transfer towers, and crushing stations. Further fugitive emission control may be obtained by maintaining a slight negative pressure in these encloses so that fresh air will leak in rather than dust being able to leak out. The air evacuated from the enclosures can be cleaned by fabric filters at various points along the conveying system. Since fabric filters from the various conveying segments can control emissions to 0.001 grains/DSCF or less, this level of control is considered to represent BACT.

7.1.2.8 Flyash Conveyors

Flyash consists of very fine ash and lime particles which exhibit a high potential for fugitive dust emissions during handling. Wetting of the ash to improve handling characteristics or handling in totally enclosed conveying systems represent alternatives to control fugitive emissions. For the Indiantown project, flyash will be conveyed from the baghouse hoppers to a storage silo within a totally enclosed pneumatic conveying system. Exhaust from the pneumatic conveying system will be discharged through a fabric filter. Flyash will be loaded via dustless conveyor from the silo into dedicated fully enclosed railcars for transport and off site disposal. Since bin vent filters can control emissions to .001 grains/DSCF or less, this level of control is considered to represent BACT.

7.2 Conclusion

The Indiantown project will incorporate BACT for the control of fugitive PM emissions resulting from the storage and handling of coal, lime and ash. Inactive coal storage piles will be covered so as to prevent fugitive emissions. The active coal pile will be enclosed in a structure ventilated with bin vent filters. Coal, lime, and ash will be conveyed and handled within enclosed negative draft conveyors equipped with fabric filters. Flyash will be conveyed with a pneumatic conveying system exhausting through bin vent filters. Flyash will be transported in enclosed railcars to prevent the emission of dust during transportation. These methods of control will result in minimal emissions of fugitive dust from the Indiantown project.

8.0 BACT DETERMINATION FOR TRACE METALS

8.1 Formation of Metals Emissions

Three regulated trace metals, mercury (Hg), beryllium (Be), and arsenic (As) will potentially be emitted from the proposed Indiantown PC facility in greater than PSD significance levels. The quantity and characteristics of these trace pollutant emissions depend on the coal composition, the chemical and physical properties of the trace metals and performance of the control devices. Operational features of the combustion process do not significantly effect metal emissions.

Heavy metal emissions from fossil fuel-fired boilers are created as a result of combustion of fuels containing metals. Due to the high temperatures and turbulence in the furnace, metals are released in both a particulate and vapor phase, often as metal oxides, chlorides and sulfates. Depending on the metal compound involved and its condensation temperature, a vaporized metal begins to condense mostly on the surfaces of the fine solid particles in the flue gas (since that fraction has the greatest surface area) at normal stack temperatures (about 350°F and below) and almost totally at temperatures below 212°F (Hasselriis, 1985). Condensation occurs as the flue gases cool in the boiler and especially as condensation temperatures are achieved in a acid gas control device such as a spray dryer absorber. Many of the metal compounds emitted from coal-fired boilers, for instance lead and beryllium, condense at temperatures above 572°F. Thus the probability of removing these metals using a particulate control device is quite high (Clarke, 1986). On the other hand, mercury condenses at lower temperatures and is, therefore, more difficult to extract.

8.2 Trace Metal Control Alternatives

There are eight coal-fired facilities listed in the BACT/LAER Clearinghouse with limits for trace metal emissions; in each listing the limits are for beryllium, mercury or both. In cases where the control technology is specified (5 of 8 listings), the predominant method is concurrent with particulate control. For beryllium, emission limits listed in the Clearinghouse range from 1.0×10^{-6} to 6.5×10^{-6} lb/MMBtu. For mercury, the limits range from 1.5×10^{-6} to 7.9×10^{-5} lb/MMBtu.

Programs to assess the relative advantages and disadvantages of alternative pollution control devices on trace metal collection from coal combustion have only recently begun. However, test data is available from programs to determine the best system of trace metals control from municipal waste combustors (MWCs), in conjunction with the proposed new source performance standard for these sources; these data are currently more complete than any other data available in the published literature and as such are considered the best representation of trace metal control from combustion sources in general.

Various test data show improved trace metal collection at lower temperatures. Results from the Quebec City pilot plant incineration testing (Klicius, 1986) reported that over 99.5% of the heavy metals, excluding mercury, were removed between test temperatures of 230°F and 399°F. Removal efficiencies of mercury were reported to be greater than 90 percent at temperatures less than 284°F from tests on a dry scrubbing system (including fabric filter) and 95 percent at 284°F for a spray dryer/fabric filter system. At test temperatures of 399°F, the mercury removal efficiency was poor.

These pilot plant studies support the theory that trace metal control relies, at least in part, on sufficient particulate control and flue gas temperature.

There is currently no NSPS for control of trace metals from coal combustion. In the proposed NSPS for MWCs, however, emissions of trace metals would be regulated as a component of "MWC emissions." The background material for these standards thus reflects the most current and accurate information available for control of trace metals, and provides insight as to current Agency positions on alternative controls.

In general, EPA has concluded that efficient particulate matter control serves as a surrogate for control of MWC metal emissions (EPA, 1989b).

In the preamble to the proposed NSPS for MWCs, the EPA has basically stated that adequate PM controls are adequate for trace metal controls. The EPA endorsed use of spray dryer absorbers and fabric filters for PM and SO_2 control from MWC's.

Therefore, BACT for all trace metals is proposed to be use of the proposed particulate matter emission rate to perform better than 0.018 lb/MMBtu.

In light of the fact that mercury is more volatile and therefore more difficult to control than the then heavy metals emitted from coal combustion, mercury control is discussed in more detail below.

8.3 Mercury

8.3.1 Formation Mechanism

Trace quantities of mercury are present in coal. Most of this mercury is expected to volatilize during combustion in the furnace. Approximately two-thirds of the mercury content in the flue gas exits as solid mercuric chloride ($HgC1_2$); the other third is exhausted as elemental mercury vapor (Flakt, 1990). Volatile mercury is expected to condense upon submicron particles contained in the flue gas and exit as either condensed aerosol or solid mercuric chloride and be controlled by the fabric filter. Some of the vapor is expected to be emitted uncontrolled.

8.3.2 Available Control Technologies

Potential control alternatives for mercury include:

- Sodium sulfide injection upstream of SDA/fabric filter (or ESP)
- Activated carbon injection upstream, within, or downstream of SDA and upstream of fabric filter
- Wet scrubbing techniques
- Spray dryer followed by a fabric filter
- Flue gas cooling

At this time, it is not absolutely clear to the EPA which control alternative best reduces mercury emissions from any combustion process (Porter, 1990) or which operating variables in the combustor influence altevnative controls' performance. Recognizing this, the EPA stated in the preamble to the proposed NSPS for MWCs that a joint EPA/industry task force is being established to investigate mercury emissions and controls, and that the findings would be considered in development of the final standards (54 FR 52251).

As part of the effort of the joint task force, two meetings were held at Research Triangle Park in February 1990 to discuss both "precombustion" controls of mercury emissions and add-on control of mercury emissions. It is evident from the meetings' transcripts that there are not only numerous unknowns regarding mercury formation and control, but there are some valid side issues that must also be resolved before the subject can be understood and the MWC NSPS for Hg fairly promulgated.

Some of the key issues raised in the meetings were:

- the potential of NO_x controls by ammonia injection to reduce mercury control efficiencies of SDA/FF systems;
- inadequate emissions data to set a mercury limit;
- the relationship between the amount of carbon in the flue gas and the amount of mercury control, and whether this is more influential on mercury emissions than NO_x controls;
- whether 70 percent mercury control is typically achieved by SDA/FF systems;
- the conversion of mercuric chloride on the filter cake to mercury vapor over time;
- reliability of current test methods;
- the inconsistencies in test data between the U.S. and European facilities (which use different test methods)
- lack of data on mercury content of ash, effects of add-on mercury control to ash toxicity and possible outgassing;
- contradictory data and general variability of data;
- the overemphasis on mercury control from MWCs;
- establishing which mercury control systems are "demonstrated";
- whether an emission limit is supportable and what the limit would be; and
- how to handle all the work activities at the U.S. EPA prior to promulgation with limited resources.

The following provides more information on the controls discussed by the EPA/industry task force.

Sodium Sulfide Injection

Sodium sulfide (Na_2S) can be sprayed into the gas stream as a 10 percent water solution, either upstream of or in the spray dryer. Na_2S is a soluble crystalline industrial chemical commonly used in the leather and dye industry. The mercury vapor is converted to solid mercuric sulfide according to the following reaction:

$$Na_2S + Hg + H_2O + 1/2O_2 \rightarrow HgS + 2NaOH$$

The resulting solids are collected in the baghouse or ESP as particulate. (Buschmann, 1990).

The technology was developed (patent pending) and is marketed by Flakt, an air pollution control device vendor. The technology has been tested at several new MSW incinerators, but has not been utilized on a coal-fired facility.

The limited data available for this process suggests that Na_2S injection may reduce Hg emissions, although there are some inherent problems with the available data. For instance, mercury emissions were not reported in the literature for times during test periods when the Na_2S injection system was not operating. In fact, data for some MWC facilities equipped with SDA/FF shows considerable Hg removal without Na_2S injection. Removal efficiencies at the Linkoping facility in Sweden and the Quebec City incinerator were 94 and 95 percent, respectively, using only a spray dryer and fabric filter (EPA, 1987a).

The Na_2S injection system may present concerns. Na_2S is similar to lime or sodium hydroxide in terms of personnel protection equipment. Personnel handling sodium hydroxide require skin and eye protection; however, Na_2S is not considered to be very toxic. HgS, one of the reaction products, is toxic, but will compose less than 0.01 percent of the ash collected in the system and thus will not contribute greatly to overall toxicity (Flakt, 1990). EPA's task force on mercury also recognizes that the effects of transferring the mercury to the ash need to be studied further.

A potential disadvantage is cost, considering that no PC units have installed the control system and considering that the amount of additional Hg removal possible has yet to be fully uqantified. Flakt estimated that the cost of adding the sodium sulfide system to a typical Flakt air pollution control device train is 2 percent of the capital and operating costs. As more experience is gained with the technology, these costs will become more defined.

Activated Carbon Injection

Activated carbon or a modified activated carbon material may be injected upstream of the spray dryer or in the spray dryer to achieve mercury reductions. There are currently no PC units operating which employ activavted carbon injection.

Acitivated carbon injection systems are listed as being offered commercially by A/S Niro Atomizer of Denmark and Research Cottrell. According to the Niro patent, powdery activated carbon is continuously fed into the flue gas upstream or downstream of the spray dryer absorber. The choice of injection location is influenced to some extent by the choice of particulate controls. If an ESP is used, the benefit of added retention time and, hence, reaction potential within the filter cake (which is unique to fabric filter use), is missing. To increase overall reaction time and thus achieve high removal efficiencies, the carbon is introduced upstream of the spray dryer/ESP. If a fabric filter is employed, the preferable injection location is downstream of the spray tower, since the lower temperatures promote greater adsorptivity. Although the reaction time is less when injected upstream of the control device, the additional contact between Hg and carbon in the filter cake compensates.

Fine powdery activated carbon is preferred over coarse or granulated carbon because it has a higher adsorptive capacity and is less expensive. According to the Niro patent, fine powdery activated carbon (including any fine powdery carbonaceous material such as coal or coke) was once suspected to cause plugging in fabric filters and unacceptably high pressure drops.

Carbon injection may achieve sizeable Hg reductions, as shown by two sets of test data in the Niro patent. In three pilot-test runs, injection of 80 mg/Nm^3 in flue gas at a location between the SDA and fabric filter resulted in overall Hg reductions of 89 percent (230°F run), 95 percent (230°F run), and 91 percent (284°F run). Hg reductions with no carbon injection were still sizeable, however, at about 69 percent.

On full-size MWCs tests, 78 to 93 percent Hg reductions were achieved with carbon injection (with injection upstream of SDA/ESP). However, data from these tests indicate Hg removals of 66 to 27 percent with the carbon injection system off.

Carbon injection systems are not considered to be demonstrated on PC boilers. In addition, costs are not well defined but, as with Na_2S injection, may add about 2 percent to capital and operating costs of the SO_2/particulate control device. More importantly, a significant amount of carbon is used and discarded on a continuous basis. None of the vendor literature discusses the solid waste generated; however, if rates of 50 to 80 mg/Nm^3 are required for successful operation, then 50 to 80 mg/Nm^3 of additional waste will be generated.

Considering that (1) the reductions achieved with Na_2S or carbon injection above that achieved with the SDA/FF alone are questionable, (2) true system costs are not well defined, and (3) no one else in the U.S. has installed them, activated carbon and Na_2S injection are considered unrepresentative of BACT.

Wet Scrubbing Techniques

There is a general opinion that because of the saturated operating conditions and cooler flue gas temperatures in wet scrubbing, better mercury condensation and collection should occur than in SDA/FF systems. The NJDEP tested the efficiency of mercury removal at the small scale resource recovery facility in Ft. Dix, New Jersey, which uses a baghouse upstream of a wet scrubber. Using EPA Test Method 101A, the removal efficiency ranged over three test runs between 16.6 percent and 74.9 percent (average 42.8 percent). Not only was the variability in test results similar to that observed in SDA/FF-equipped MWC facilities, the removals were actually lower. This is only one set of test data, but it does not support use of wet scrubbers as BACT for for control of mercury from coal-fired facilities.

Flue Gas Cooling

Flue gas cooling has been considered essential for Hg removal because Hg typically enters the control equipment as a vapor. Test data available for MWCs both support and refute this theory. Env. Canada and Flakt reported Hg reduction of 40 percent when flue gas was cooled to 289°F (Env. Canada, 1987). Environment Canada also reported (1986) data that are more inconclusive. Over two test runs for each temperature, mercury reductions were 90.9% (230°F), 97.3% (257°F) and, 93.7% (284°F). The lowest flue gas temperature achieved the lowest percent mercury control. Tests conducted in June 1989 at Ogden Martin's Indianapolis Resource Recovery Facility, which uses a spray dryer/fabric filter control system, indicate that measured emissions of mercury were well below the expected levels. Mercury removal efficiency was measured at spray dryer outlet temperatures of 265 and 295°F. The Indiantown facility should exhibit correspondingly low Hg emissions since the outlet temperature of the spray dryer of the proposed facility is anticipated to be 150°F.

Conclusion

There are many issues yet to be settled with mercury emissions control. However, a well-operated and maintained spray dryer absorber/fabric filter control train (a control train providing high mercury removal efficiencies) is proposed as the BACT for Hg control since no clear evidence exists that there is a more stringent control alternative available.

9.0 BACT DETERMINATION FOR RADIONUCLIDES

Coal-fired facilities release trace amounts of radioactive elements to the atmosphere from naturally occurring radionuclides present in the fuel. These radionuclides are primarily those that have existed since primordial times and their daughter products which have not completely decayed due to their long half-lives. The primordial radionuclides that are associated with emissions from coal combustion are potassium-40 (K^{40}), uranium-235 (U^{235}) and decay products, uranium-238 (U^{238}) and decay products, and thorium-232 (Th^{232}) and decay products.

K^{40} is present as a fixed proportion of naturally occurring potassium. The U^{235} decay series contributes only a small fraction of the radioactivity of the U^{238} and Th^{232} decay series; most of the radioactive emissions from a coal-fired plant come from the U^{238} and Th^{232} series.

Only one facility, the Mt. Poso FBC cogeneration facility in Kern County CA is listed in the BACT/LAER Clearinghouse as having a limit on radionuclides. The listing denotes that BACT for radionuclides for this facility is the same as BACT for particulate matter: fabric filter.

For the proposed Indiantown boiler, it is estimated that approximately 6.6×10^{-4} curies/year of Th^{232} and 1.5×10^{-3} curies/year of U^{238} will be emitted (EPA 1989a). Since radionuclides will be emitted as particuate matter these emissions estimates are based on the projected controlled PM emissions.

A study by McBride (1973) used a 1,000 MW coal-fired plant to develop dose contributions from the ingestion, inhalation and external pathways (e.g. dermal absorption). The radiation dose due to emissions from the large coal plant was shown to be much lower than from natural background. The dose from the proposed Indiantown facility, approximately one-third the size of that used by McBride, is also expected to be less than the natural background.

On December 15, 1989, EPA released the final rule for the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for radionuclides (54 FR 51654). The emissions of radionuclides from coal-fired power plants were excluded from this ruling since they pose a risk below the assumed safe level.

Since the emissions of radionuclides from coal combustion are emitted as PM and PM10, the particulate control device (fabric filter) will also control radionuclide emissions. Use of a fabric filter to control emissions of radionuclides incurs no additional economic impact, has no adverse energy or energy or environmental impacts, and is technologically demonstrated. Fabric filtration thus can be concluded to be representative of BACT for radionuclide emissions from the Indiantown facility.

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APPENDIX A

BACT/LAER CLEARINGHOUSE LISTINGS

CO
VOC

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR PM (1980 – PRESENT)

Name	Type	Size MMBtu/hr	Reviewing Agcy	Date of Issuance	BACT for PM
Applied Energy Services	CFB	2150	Hawaii DOH	1/25/90	32.2 lb/hr (0.007 gr/dscf) – Baghouse (99.9%)
A E S Thames, Inc	FB	923	Connecticut DEP	8/9/89	0.02 lb/MMBtu – Baghouse (99.9%)
A E S Thames, Inc	FB	923	Connecticut DEP	8/9/89	0.02 lb/MMBtu – Baghouse (99.9%)
Cogentrix, Rocky Mount (4 units)	SS	375	North Carolina DEM	7/20/89	0.0200 lb/MMBtu – Fabric Filter
Cambria Cogen Inc. (2 units)	CFB	559	Pennsylvania BAQC	5/26/89	16.8 lb/hr – Fabric Filter (99.9% eff)
Scrubgrass Power Corp. (2 units)	CFB	599	Pennsylvania BAQC	1/18/89	0.0300 lb/MMBtu –Fabric Collector (99.96% eff)
Goodyear United Development	FB	577	New York State DEC	10/14/88	0.022 lb/MMBtu – Fabric Filter (99% eff)
North Branch Energy Partners LP	CFB	563	Pennsylvania BAQC	9/26/88	0.03 (PM) 0.028 (PM10) lb/MMBtu – FF (99% eff)
United Development Group	FB	577	New York State DEC	9/25/88	0.022 lb/MMBtu – Pulse Jet Baghouse (99.8% eff)
Fort Howard Corp.	CFBC	505	Wisconsin DNR	9/21/88	0.05 lb/MMBtu – Baghouse
Northeastern Power Co.	CFB	513	Pennsylvania BAQC	6/17/88	0.028 lb/MMBtu – Fabric Filter (99% eff)
Edensburg Power Co.	FB	617	Pennsylvania BAQC	6/6/88	0.0300 lb/MMBtu – Baghouse (99.98% eff)
TVA – Shawnee	AFBC	1579	Kentucky DAQ	5/4/88	0.03 lb/MMBtu – Baghouse (99% eff)
Panther Creek Energy	NS	1170	Pennsylvania DER	2/17/88	0.03 lb/MMBtu – Baghouse (99% eff)
GWF Power Systems Co., Inc.	CF	202	Bay Area AQMD (CA)	2/11/88	30 lb/d Baghouse, Pulse Jet
City of Wyandotte, Dept Mun Svcs	CFBC	369	Wayne Co. APC	12/07/87	0.011 lb/MMBtu – baghouse (99.9%)
Cogentrix Michigan Leasing Corp	SS	214	Michigan DNR	7/31/87	0.03 lb/MMBtu – Baghouse (99.1% eff)
Fort Drum Heating Plant	CFB	190	New York State DEC	4/1/87	0.05 lb/MMBtu – Baghouse
Wm. H. Zimmer Generating Sta	NS	11968	Southwest. Ohio APCA	2/5/87	0.025 lb/MMBtu – ESP (99.5% eff)
Archbald Power Corp.	NS	240	Pennsylvania DER	1/16/87	0.05 lb/MMBtu – Fabric Filter
Mt. Poso Cogeneration Co.	CFB	50 MW	EPA Region IX	1/12/87	0.01 gr/dscf – baghouse
Foster Wheeler Power (2 units)	NS	283	Pennsylvania DER	12/29/86	0.03 lb/MMBtu – Baghouse (99.9% eff)
Tultex Corp.	NS	12	Virginia APCB	12/18/86	0.43 lb/MMBtu – settling chamber (35%)
Sheridan Coal Co.	NS	550	Pennsylvania DER	12/1/86	0.03 lb/MMBtu – Baghouse/Cyclone
Pyropower Corp.	CFB	640	Kern County APCD	12/1/86	0.012 lb/MMBtu – fabric filter (99.9%)
J. Pagnotti Enterprises	NS	1082	Pennsylvania DER	11/1/86	0.03 lb/MMBtu – Baghouse/Cyclone
Utah Power & Light Co.	NS	4000	Utah BAQ	10/1/86	0.1 lb/MMBtu – ESP (99% eff)
Cogentrix Carolina Leasing Corp.	NS	202	North Carolina DEM	7/7/86	0.03 lb/MMBtu – bagfilter (99.1%)
Northeastern Power Co.	NS	540	Pennsylvania DER	6/27/86	0.028 lb/MMBtu – Fabric Filter
BMCP	CFB	220	Kern County APCD	6/20/86	0.0156 gr/dscf – fabric collector (99%)
Cogentrix Hopewell	NS	200	Virginia APCB	6/12/86	0.03 lb/MMBtu – baghouse (99.1%)
Cogentrix Carolina Leasing Corp.	NS	202	North Carolina DEM	5/28/86	0.03 lb/MMBtu – baghouse (99.1%)
TVA – Shawnee	AFBC	1430	Kentucky DAPC	4/15/86	0.03 lb/MMBtu – FF (99%)
Westwood Energy Properties	NS	425	Pennsylvania DER	1/6/86	0.03 lb/MMBtu – FF (99.92%)
Cogeneration National Corp	CFB	279.6	San Joaquin Cty APCD	12/13/85	0.036 lb/MMBtu – baghouse
TVA – Paducah	CFB	200	Kentucky DAPC	12/13/85	0.1 lb/MMBtu – baghouse (98.85%)
Signal Frackville Energy	NS	NS	Pennsylvania DER	12/2/85	0.012 lb/MMBtu – Baghouse (99.9% eff)
Corn Products	CFB	620	San Joaquin Cty APCD	10/29/85	0.016 lb/MMBtu – baghouse
White Pine Power Project	NS	750	Nevada DEP	8/6/85	0.02 lb/MMBtu – baghouse (99.6%)
Central State University	NS	66	Dayton RAPCA	7/1/85	0.1 lb/MMBtu – baghouse (99%)
Union Camp – Franklin	NS	245	Virginia APCB	7/1/85	0.05 lb/MMBtu – ESP (99%)

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker PC – pulverized coal NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR PM (1980 - PRESENT)

Name	Type	Size MMBtu/hr		Reviewing Agcy	Date of Issuance	BACT for PM
Biogen Power Project	CFBC	212		EPA Region IX	4/26/85	0.01 gr/dscf @3%O2 (4.5 lb/hr) - baghouse (99.9%)
Wisc. Electric Power Co.	PFBC	825		Wisconsin DNR	1985	0.02 lb/MMBtu - ESP
3M Co.	NS	120		Alabama DEM	11/29/84	0.1 lb/MMBtu - baghouse (98.7%)
Amalgamaize Co	NS	179.7		Alabama DEM	11/29/84	0.05 lb/MMBtu - baghouse (98%)
Puget Sound Naval Shipyard	NS	NS		Puget Sound APCA	9/25/84	0.02 gr/scf - baghouse (99.9%)
Cogentrix - Lumberton	NS	202		North Carolina DEM	9/10/84	0.03 lb/MMBtu - baghouse (99.1%)
Alabama Power Co.	NS	248		Alabama DEM	9/10/84	0.05 lb/MMBtu - baghouse (99.6%)
Virginia Power - Portsmouth	NS	1129		Virginia APCB	7/27/84	0.03 lb/MMBtu - ESP (99.3%)
Cogentrix - Kenansville	NS	202		North Carolina DEM	6/25/84	0.03 lb/MMBtu - baghouse (99.1%)
Cogentrix - Hamilton	NS	202		North Carolina DEM	4/3/84	0.03 lb/MMBtu - baghouse (99.1%)
American Lignite Products	CFB	571		EPA Region IX	1/10/84	0.013 lb/MMBtu - baghouse (99.9%)
Lower Colorado River Authority	LIG	4735		Texas ACB	12/22/83	0.03 lb/MMBtu - ESP (99.96%)
American Lignite Prod. Co.	FB	240		Amador Cty APCD	12/21/83	0.0156 gr/dscf - baghouse (99.93%)
Intermountian Power Project	NS	8352		Utah BAQ	10/17/83	0.02 lb/MMBtu - FF (99.8%)
Basin Electric Power Coop.	NS	6278		North Dakota SHD	1/12/83	0.03 lb/MMBtu - baghouse (99.86%)
Eastman Kodak Co.	NS	670		New York DEC	12/20/82	0.035 lb/MMBtu - ESP (99.57%)
Washington Water Power Co.	NS	2080		EPA Region X	11/17/82	0.03 lb/MMBtu
Iowa Electric Light & Power Co.	NS	400		EPA Region VII	10/29/82	0.03 lb/MMBtu - ESP
Holyoke Water Power - Mt Tom	NS	1447		Massachusetts DEQE	10/27/82	0.08 lb/MMBtu - ESP (99.51%)
B.F.Goodrich	CFB	150		Illinois EPA	9/16/82	0.06 lb/MMBtu - cyclone & baghouse (99%)
Cincinati Gas & Elect.	NS	6313		Kentucky DAPC	5/14/82	0.7 lb/MMBtu -
West Texas Utilities Co.	NS	6.8		Texas ACB	5/20/82	0.03 lb/MMBtu - ESP (99.7%)
Kentucky Utilities	NS	6650		Kentucky DAPC	4/15/82	0.03 lb/MMBtu - ESP (99.8%)
Jacksonville Elec Auth	NS	600	MW	Florida DER	1/1/82	0.03 lb/MMBtu - ESP (99.78%)
SC Public Svc - Cross	NS	500	MW	South Carolina DHEC	12/3/81	0.03 lb/MMBtu - ESP (99.8%)
Houston Lighting & Power	NS	5729		EPA Region VI	11/12/81	0.03 lb/MMBtu - FF (99.72%)
Central Power & Light	NS	6781		EPA Region VI	10/19/81	0.03 lb/MMBtu - ESP (99.6%)
Tampa Elect Co	NS	425	MW	Florida DER	10/15/81	0.03 lb/MMBtu - ESP (99%)
Oklahoma Gas & Elect	NS	5250		EPA Region VI	10/5/81	0.03 lb/MMBtu - ESP or baghouse (99.6%)
Delmarva Power & Light	NS	5702		EPA Region III	9/30/81	0.03 lb/MMBtu - ESP (99.65%)
Panorama Enercorp, Inc	NS	37	MW	EPA Region X	9/22/81	0.007 gr/dscf - ESP (99%)
SW Elect Power	NS	720	MW	EPA Region VI	9/1/81	0.1 lb/MMBtu - ESP (99.8%)
Pensylvania Elect Co	NS	6280		EPA Region III	8/18/81	0.03 lb/MMBtu - ESP (99.7%)
NY State Elect - Cyuga	NS	1750		EPA Region II	6/29/81	0.03 lb/MMBtu - ESP
Iowa-Illinois Gas & Elect	NS	7000		EPA Region VII	6/16/81	0.03 lb/MMBtu - ESP
Idaho Nat Engineering Lab	NS	82.5		EPA Region X	6/5/81	0.05 gr/dscf - baghoue (99%)
Plains Elect Gen & Trans	NS	2471		EPA Region VI	5/27/81	0.03 lb/MMBtu - baghouse (99.9%)
Nevada Power Co	NS	560	MW	EPA Region IX	4/13/81	0.015 lb/MMBtu - baghouse
Big Rivers Elect - D.B. Wilson	NS	4585		Kentucky DAPC	3/11/81	0.03 lb/MMBtu - ESP (99.8%)
AL Elect Coop Inc	LIG	4805		Alabama APCD	2/24/81	0.03 lb/MMBtu - ESP
SW Elect Power	NS	6821		EPA Region VI	2/23/81	0.03 lb/MMBtu - ESP (99.8%)

CFB-circulating fluidized bed FB-fluidized bed LIG-lignite SS-spreader stoker PC - pulverized coal NS-not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR PM (1980 – PRESENT)

Name	Type	Size MMBtu/hr	Reviewing Agcy	Date of Issuance	BACT for PM
Container Corp of America	PC	NS	Philadelphia AMS	1/20/81	0.06 lb/MMBtu
Nebraska Public Power Dist	NS	650 MW	Nebraska DEC	12/16/80	0.03 lb/MMBtu – FF (99.9%)
New England Power – Brayton Pt	NS	10625	Massachusetts DEQE	11/1/80	0.08 lb/MMBtu – ESP (99.3%)
E.Kentucky Power	NS	6760	Kentucky DAPC	8/21/80	0.03 lb/MMBtu – ESP (99.8%)
City of Wilkes-Barre	NS	92.5	EPA REgion III	7/1/80	0.086 lb/MMBtu – baghouse/cyclone (99.7%)
Curtiss Wright Corp	NS	137	EPA Region II	6/13/80	none
Intermountian Power Project	NS	3000	EPA Region VIII	6/8/80	0.02 lb/MMBtu – ESP (99.8%)
Utah Power & Light	NS	860	EPA Region VIII	6/2/80	0.03 lb/MMBtu – FF (90%)
Deseret Gen & Trans, Moon Lake	NS	800	EPA Region VIII	2/4/80	0.03 lb/MMBtu – FF (99.8%)

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker PC – pulverized coal NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR SO2 (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)	Reviewing Agcy	Date of Issuance	BACT for SO2
Applied Energy Services	CFB	2150	Hawaii DOH	1/25/90	645 lb/hr (48 ppm) – limestone bed (90%)
A E S Thames, Inc	FB	923	Connecticut DEP	8/9/89	0.32 lb/MMBtu – limestone injection (70%)
A E S Thames, Inc	FB	923	Connecticut DEP	8/9/89	0.32 lb/MMBtu – limestone injection (70%)
Cogentrix, Rocky Mount (4 units)	SS	375	North Carolina DEM	7/20/89	0.31 lb/MMBtu – Dry Lime FGD
Cambria Cogen Inc. (2 units)	CFB	559	Pennsylvania BAQC	5/26/89	556 lb/hr – limestone inj (2:1 Ca:S)
Scrubgrass Power Corp. (2 units)	CFB	599	Pennsylvania BAQC	1/18/89	0.45 lb/MMBtu – limestone inj
Goodyear United Development	FB	577	New York State DEC	10/14/88	0.5 lb/MMBtu – limestone bed (90%)
North Branch Energy Partners LP	CFB	563	Pennsylvania BAQC	9/26/88	0.91 lb/MMBtu – limestone inj (90%)
United Development Group	FB	577	New York State DEC	9/25/88	0.5 lb/MMBtu – limestone inj
Fort Howard	CFB	505	Wisconsin DNR	9/21/88	0.7 lb/MMBtu – limestone inj (90%)
Northeastern Power Co.	CFB	513	Pennsylvania BAQC	6/17/88	0.32 lb/MMBtu – limestone inj
Edensburg Power Co.	FB	617	Pennsylvania BAQC	6/06/88	1 lb/MMBtu – limestone inj (90%)
Tennessee Valley Authority	FB	1579	Kentucky DAQ	5/04/88	1.2 lb/MMBtu – limestone inj (90%)
Panther Creek Energy	CFB	1170	Pennsylvania DER	2/17/88	0.33 lb/MMBtu –
GWF Power Systems Co., Inc.	CFB	202	Bay Area AQMD (CA)	2/11/88	0.109 lb/MMBtu – limestone inj
City of Wyandotte, Dept Mun Svce	CFB	369	Wayne Co. APC (MI)	12/07/87	0.496 lb/MMBtu – limestone inj
Cogentrix Michigan Leasing Corp.	SS	214	Michigan DNR	7/31/87	1.67 lb/MMBtu –lime spray dryer (90%)
Fort Drum Heating Plant	CFB	190	New York State DEC	4/01/87	1.2 lb/MMBtu – limestone inj (90%)
Wm. H. Zimmer Generating Station	CFB	11968	Southwest. Ohio APCA	2/5/87	0.548 lb/MMBtu – Mg enhanced lime FGD
GWF Power Systems Co.	FB	274	EPA Region IX	1/28/87	20 ppm – limestone inj
Archbald Power Corp	NS	240	Pennsylvania DER	1/16/87	0.15 lb/MMBtu – limestone inj (90%)
Mt Poso Cogeneratoin Co.	CFB	50 MW	EPA Region IX	1/12/87	0.04 lb/MMBtu – limestone inj (90%)
Foster Wheeler Power (2 units)	CFB	283	Pennsylvania DER	12/29/86	0.24 lb/MMBtu – limestone inj
Sheridan Coal Co.	CFB	550	Pennsylvania DER	12/1/86	0.25 lb/MMBtu – limestone inj
Pyropower Corp.	CFB	640	Kern County APCD	12/1/86	0.039 lb/MMBtu – limestone inj (96.2%)
J. Pagnotti Enterprises	CFB	1082	Pennsylvania DER	11/1/86	0.22 lb/MMBtu – limestone inj
Rio Bravo Refining Co.	FB	389	EPA Region IX	10/22/86	0.036 lb/MMBtu – limestone inj (95%)
Utah Power & Light Co. (#2 unit)	NS	4000	Utah BAQ	10/1/86	1.2 lb/MMBtu –(80%)
Rio Bravo Refining Co	FB	36 MW	EPA Region IX	8/19/86	0.036 lb/MMBtu – limestone inj (95%)
Cogentrix Carolina Leasing Co.	NS	202	North Carolina DEM	7/7/86	1.64 lb/MMBtu – low S coal
Northeastern Power Co.	NS	540	Pennsylvania DER	6/27/86	0.32 lb/MMBtu –
BMCP	CFB	230	Kern County APCD	6/20/86	0.039 lb/MMBtu – limestone inj (96%)
Cogentrix of Virginia, Inc	NS	200	Virginia APCB	6/12/86	1.52 lb/MMBtu –
TVA – Shawnee Steam Plant	FB	1430	Kentucky DAPC	4/15/86	0.86 lb/MMBtu – limestone inj (90%)
Westwood Energy Properties	NS	425	Pennsylvania DER	1/06/86	0.2 lb/MMBtu – limestone inj (93.6%)
Wisc. Electric Power Co.	FB	825	Wisconsin DNR	1985	1.2 lb/MMBtu – limestone inj (90%)
Cogeneration National Corp	FB	300	EPA Region IX	12/31/85	0.087 lb/MMBtu – lime inj (95%)
Corn Products	FB	49.9 MW	EPA Region IX	12/16/85	59 lb/hr – limestone inj (90%)
Cogeneration National Corp	NS	279.6	San Joaquin Cty APCD	12/13/85	0.046 lb/MMBtu – limestone inj (95%)
Tennesee Valley Authority	FB	200	Kentucky DAPC	12/13/85	1.2 lb/MMBtu – limestone inj (83.9%)
Signal Frackville Energy	NS	NS	Pennsylvania DER	12/2/85	0.21 lb/MMBtu – limestone inj

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR SO2 (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)	Reviewing Agcy	Date of Issuance	BACT for SO2
Corn Products	CFB	620	San Joaquin Cty APCD	10/29/85	0.01 lb/MMBtu – limestone inj (90%)
White Pine Power	NS	750 MW	Nevada DEP	8/6/85	0.19 lb/MMBtu – lime spray drying (84%)
Central State University	NS	66	Dayton RAPCA	7/1/85	1.6 lb/MMBtu – low S coal
Union Camp Franklin	NS	245	Virginia APCB	7/1/85	1.5 lb/MMBtu – 1% S coal
SCE – Biogen Power Project	CFB	212	EPA Region IX	4/26/85	0.44 lb/MMBtu – limestone inj (92%)
3M Co.	NS	120	Alabama DEM	11/29/84	1.5 lb/MMBtu – low S coal
Amalgamaize Co.	NS	180	Alabama DEM	11/29/84	2.27 lb/MMBtu – low S coal
Puget Sound Naval Shipyard	NS	NS	PUget Sound APCA	9/25/84	0.23 lb/MMBtu – spray dryer
Cogentrix of NC, Lumberton	NS	202	North Carolina DEM	9/10/84	1.6 lb/MMBtu – low S coal
Alabama Power Co.	NS	248	Jefferson Cty HD	9/10/84	1.17 lb/MMBtu – low S coal
Virgina Power – Portsmouth	NS	1129	Virginia APCB	7/27/84	1.52 lb/MMBtu – low S coal
Cogentrix of NC, Kenansville	NS	202	North Carolina DEM	9/10/84	1.6 lb/MMBtu – low S coal
Cogentrix of NC, Hamilton	NS	202	North Carolina DEM	9/10/84	1.6 lb/MMBtu – low S coal
American Lignite Products	FB	590	EPA Region IX	1/10/84	65 lb/hr – limestone inj (94.3%)
Lower Colorado River Auth.	LIG	4735	Texas ACB	12/22/83	1 lb/MMBtu – limestone scrubber (90%)
American Lignite Prod Co	FB	240	Amador Cty APCD	12/21/83	115 ppm – limestone inj (94.25%)
Intermountian Power Project	NS	6352	Utah BAQ	10/17/83	0.015 lb/MMBtu – limestone scrubber (90%)
Basin Electric Power Coop.	NS	6278	North Dakota SHD	1/12/83	0.6 lb/MMBtu – spray dryer
Eastman Kodak	NS	670	New York DEC	12/20/82	1.2 lb/MMBtu – low S coal
Washington Water Power Co.	NS	2080 MW	EPA Region X	11/17/82	0.22 lb/MMBtu – limestone scrubber
Iowa Electric Light & Power	NS	10000	EPA Region VII	10/29/82	0.6 lb/MMBtu – limestone scrubber
B.F.Goodrich	CFB	150	Illinois EPA	9/16/82	1.2 lb/MMBtu – limestone inj (85%)
Cincinatti Gas & Electric	NS	6313	Kentucky DAPC	5/14/82	1.2 lb/MMBtu – wet scrubber (81.5%)
West Texas Utilities Co.	NS	6.8	Texas ACB	5/20/82	0.5 lb/MMBtu – limestone scrubber (70%)
Tacoma City Light	NS	1600	EPA Region X	5/11/82	0.23 lb/MMBtu – dry scrubber (85%)
Kentucky Utilities – Hancock	NS	6650	Kentucky DAPC	5/15/82	1.2 lb/MMBtu – wet scrubber (91.8%)
Jacksonville Elec Auth	NS	600	Florida DER	1/1/82	0.76 lb/MMBtu – lime/limestone FGD
SC Pub Svc – Cross Site	NS	500 MW	South Carolina DHEC	2/3/82	0.41 lb/MMBtu – low S coal
Houston Lighting & Power	NS	5729	EPA Region VI	11/12/81	0.36 lb/MMBtu – limestone scrubber (70%)
Holyoke Water Power – Mt Tom	NS	1447	Massachusetts DEQE	10/27/81	1.6 lb/MMBtu –
Central Power & Light	NS	6781	EPA Region VI	10/19/81	0.39 lb/MMBtu – FGD
Tampa Elect. Co.	NS	425 MW	Florida DER	10/15/81	0.82 lb/MMBtu – limestone scrubber
Oklahoma Gas & Elect	NS	5250	EPA Region VI	10/5/81	0.46 lb/MMBtu – FGD
Delmarva Power & Light	NS	5702	EPA Region III	9/30/81	0.6 lb/MMBtu – scrubber (70%)
SW Elect Power	NS	720 MW	EPA Region VI	9/1/81	1.2 lb/MMBtu – FGD
Pennsylvania Elect. Co.	NS	6280	EPA Region III	8/18/81	0.62 lb/MMBtu – lime scrubbing (77%)
NYS Elect & Gas – Cyuga Stat.	NS	1750	EPA Region II	6/29/81	0.6 lb/MMBtu – FGD
Iowa-Illinois Gas & Elect	NS	7000	EPA Region VII	6/16/81	0.86 lb/MMBtu – low S coal
Idaho Nat Engineering Lab	NS	82.5	EPA Region X	6/5/81	1.2 lb/MMBtu – fluidized bed
Plains Elect Gen & Trans	NS	2471	EPA Region VI	5/27/81	0.2 lb/MMBtu – FGD (90%)
Nevada Power Co	NS	560 MW	EPA Region IX	4/13/81	0.1 lb/MMBtu – wet lime scrubber

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR SO2 (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)		Reviewing Agcy	Date of Issuance	BACT for SO2
Big Rivers Elect – D.B.Wilson	NS	4585		Kentucky DAPC	3/11/81	1.2 lb/MMBtu – wet scrubber
AL Elect Coop, Inc	LIG	4805		Alabama APCD	2/24/81	0.8 lb/MMBtu – FGD (90%)
SW Elect Power	NS	6821		EPA Region VI	2/23/81	0.9 lb/MMBtu – wet limestone FGD (87.4%)
Container Corp of America	PC	NS		Philadelphia AMS	1/20/81	0.5 lb/MMBtu – spray dryer
Nebraska Public Power Dist	NS	650	MW	Nebraska DEC	12/16/80	0.38 lb/MMBtu – dry scrubber (70%)
New England Power – Brayton Pt	NS	10625		Massachusetts DEQE	11/1/80	1.21 lb/MMBtu –
E. Kentucky Power – J.K.Smith	NS	6760		Kentucky DAPC	8/21/80	1.2 lb/MMBtu – wet scrubber (90%)
City of Wilkes-Barre	NS	92.5		EPA Region III	7/1/80	1.5 lb/MMBtu – low S coal
Curtiss-Wright Corp	FB	137		EPA Region II	6/13/80	0.3 lb/MMBtu – limestone inj (93%)
Intermountian Power Project	NS	750	MW	EPA Region VIII	6/8/80	0.15 lb/MMBtu – scrubber
Utah Power & Light – Hunter	NS	860	MW	EPA Region VIII	6/2/80	0.12 lb/MMBtu – scrubber (90%)
Platte River Pwr – Rawhide	NS	250	MW	EPA Region VIII	5/22/80	0.13 lb/MMBtu – dry scrubber (80%)
Sunflower Elect Coop – Holcomb	NS	3389		EPA Region VII	5/19/80	0.48 lb/MMBtu – dry scrubber (80%)
Michigan S.Central Pwr Agcy	NS	NS		Michigan DNR	5/16/80	limestone scrubber (90%)
Kentucky Power – Carr's Fac	NS	11943		Kentucky DAPC	4/18/80	0.6 lb/MMBtu – FGD (95%)
TVA Shawnee Pilot Plant	FB	200		Kentucky DAPC	4/14/80	1.2 lb/MMBtu – fluidized bed
Tucson Elec Power Co	NS	350	MW	EPA Region IX	4/11/80	0.218 lb/MMBtu – dry scrubber (85%)
Marquette Lt & Pwr – Shiras	NS	517.6		Michigan DNR	4/1/80	0.4 lb/MMBtu – spray lime FGD (70%)
N.Indiana Public Service	NS	3967		EPA Region V	3/31/80	0.62 lb/MMBtu – scrubber (90%)
Colorado Ute-Craig	NS	5350		EPA Region VIII	3/27/80	0.2 lb/MMBtu – dry scrubber (90%)
Cajun Elec. Power Coop	LIG	6507		EPA Region VI	3/25/80	1.08 lb/MMBtu – lime/limestone scrubber (80%)
Grand Haven Lt & Pwr	NS	710		Michigan DNR	3/18/80	0.8 lb/MMBtu – lime slurry scrubber (90%)
Deseret Gen & Trans, Moon Lake	NS	400	MW	EPA Region VIII	2/4/80	0.055 lb/MMBtu – wet scrubber (94%)
Muscatine Power & Water	NS	166	MW	EPA Region VII	1/24/80	0.45 lb/MMBtu – wet limestone scrubber

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR SULFURIC ACID (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)		Reviewing Agcy	Date of Issuance	BACT for H2SO4
Applied Energy Services	CFB	2150		Hawaii DOH	1/25/90	49.5 lb/hr (0.023 lb/MMBtu) –
Cogentrix, Rocky Mount	SS	375		North Carolina DEM	7/20/89	0.0021 lb/MMBtu – Dry Lime FGD
Cogentrix, Southport	NS	202		North Carolina DEM	7/7/86	0.021 lb/MMBtu – low S coal
Cogentrix, Roxboro	NS	202		North Carolina DEM	5/28/86	0.021 lb/MMBtu – no controls
White Pine Power Project	NS	750	MW	Nevada DEP	8/6/85	35.6 lb/hr – boiler operation
Lower Colorado River Authority	LIG	4735		Texas ACB	12/22/83	0.046 lb/MMBtu
Wasington Water Power Co.	NS	2080	MW	EPA Region IX	11/17/82	80.9 lb/hr

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR NOx (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)		Reviewing Agency	Date of Issuance	BACT for NOx
Applied Energy Services	CFB	2150		Hawaii DOH	1/25/90	236 lb/hr (25 ppm) – SNCR (62%)
A E S Thames, Inc	FB	923		Connecticut DEP	8/9/89	0.36 lb/MMBtu – fluidized bed combustion
A E S Thames, Inc	FB	923		Connecticut DEP	8/9/89	0.36 lb/MMBtu – fluidized bed combustion
Cogentrix, Rocky Mount (4 units)	SS	375		North Carolina DEM	7/20/89	0.6000 lb/MMBtu – Control of Excess Air
Scrubgrass Power Corp. (2 units)	CFB	599		Pennsylvania BAQC	1/18/89	0.3000 lb/MMBtu – Combustion Control
Cambria Cogen Inc. (2 units)	CFB	559		Pennsylvania BAQC	5/26/89	335.5 lb/hr – Combustion Control
Goodyear United Development	FB	577		New York State DEC	10/14/88	0.5 lb/MMBtu – Combusiton Control (90% eff)
North Branch Energy Partners LP	CFB	563		Pennsylvania BAQC	9/26/88	0.6 lb/MMBtu
United Development Group	FB	577		New York State DEC	9/25/88	0.5 lb/MMBtu – Combustion Control (65% eff)
Fort Howard	CFB	505		Wisconsin DNR	9/21/88	0.49 lb/MMBtu – Proper Bed Operation
Northeastern Power Co.	CFB	513		Pennsylvania BAQC	6/17/88	0.6 lb/MMBtu
Edensburg Power Co.	FB	617		Pennsylvania BAQC	6/06/88	0.6 lb/MMBtu
Tennessee Valley Authority	FB	1579		Kentucky DAQ	5/04/88	0.6 lb/MMBtu
Panther Creek Energy	CFB	1170		Pennsylvania DER	2/17/88	0.42 lb/MMBtu
GWF Power Systems Co., Inc.	CFB	202		Bay Area AQMD (CA)	2/11/88	0.074 lb/MMBtu – Ammonia Inj System
City of Wyandotte, Dept Mun Svcs	CFB	369		Wayne Co. APC (MI)	12/07/87	0.4 lb/MMBtu – temp 1450–1650 F – Equip Design
Cogentrix Michigan Leasing Corp.	SS	214		Michigan DNR	7/31/87	0.6 lb/MMBtu – design and operating practices
Fort Drum Heating Plant	CFB	190		New York State DEC	4/01/87	0.6 lb/MMBtu – Combustion Control
Wm. H. Zimmer Generating Station	CFB	11968		Southwest. Ohio APCA	2/5/87	0.6 lb/MMBtu – Low NOx Burners (35% eff (est))
GWF Power Systems Co.	FB	274		EPA Region IX	1/28/87	28 ppm – staged combustion, ammonia inj
Archbald Power Corp	NS	240		Pennsylvania DER	1/16/87	0.25 lb/MMBtu
Mt Poso Cogeneratoin Co.	CFB	50	MW	EPA Region IX	1/12/87	0.1 lb/MMBtu – SNCR
Foster Wheeler Power (2 units)	CFB	283		Pennsylvania DER	12/29/86	0.6 lb/MMBtu
Sheridan Coal Co.	CFB	550		Pennsylvania DER	12/1/86	0.6 lb/MMBtu
Pyropower Corp.	CFB	640		Kern County APCD	12/1/86	0.092 lb/MMBtu (LAER) – SNCR
J. Pagnotti Enterprises	CFB	1082		Pennsylvania DER	11/1/86	0.4 lb/MMBtu
Rio Bravo Refining Co.	FB	389		EPA Region IX	10/22/86	0.1 lb/MMBtu – SNCR
Utah Power & Light Co. (#2 unit)	NS	4000		Utah BAQ	10/1/86	0.49 lb/MMBtu – Low NOx Burn (35% eff)
Rio Bravo Refining Co	FB	36	MW	EPA Region IX	8/19/86	78 ppm – SNCR
Cogentrix Carolina Leasing Co.	NS	202		North Carolina DEM	7/7/86	0.6 lb/MMBtu – control of excess air
Northeastern Power Co.	NS	540		Pennsylvania DER	6/27/86	0.6 lb/MMBtu
BMCP	CFB	230		Kern County APCD	6/20/86	0.039 lb/MMBtu – SNCR (80%)
Cogentrix of Virginia, Inc	NS	200		Virginia APCB	6/12/86	0.6 lb/MMBtu
TVA – Shawnee Steam Plant	FB	1430		Kentucky DAPC	4/15/86	0.6 lb/MMBtu
Westwood Energy Properties	NS	425		Pennsylvania DER	1/06/86	0.6 lb/MMBtu
Wisc. Electric Power Co.	FB	825		Wisconsin DNR	1985	0.5 lb/MMBtu – Proper Combustion
Cogeneration National Corp	FB	300		EPA Region IX	12/31/85	30 ppm – (LAER) SNCR
Corn Products	FB	49.9	MW	EPA Region IX	12/16/85	50 ppm – SNCR (60%)
Cogeneration National Corp	NS	279.6		San Joaquin Cty APCD	12/13/85	30 ppm – SNCR
Tennesee Valley Authority	FB	200		Kentucky DAPC	12/13/85	0.56 lb/MMBtu
Signal Frackville Energy	NS	NS		Pennsylvania DER	12/2/85	0.6 lb/MMBtu

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR NOx (1980 - PRESENT)

Name	Type	Size (MMBtu/hr)		Reviewing Agency	Date of Issuance	BACT for NOx
Corn Products	CFB	620		San Joaquin Cty APCD	10/29/85	30 ppm - SNCR
White Pine Power	NS	750	MW	Nevada DEP	8/6/85	0.45 lb/MMBtu - design & combustion
Central State University	NS	66		Dayton RAPCA	7/1/85	0.6 lb/MMBtu
Union Camp Franklin	NS	245		Virginia APCB	7/1/85	643.86 ton/yr - engineering design
SCE - Biogen Power Project	CFB	212		EPA Region IX	4/26/85	34 ppm (0.043 lb/MMBtu) - SNCR (80%)
Rio Bravo Refining Co.	CFB	37.5	MW	Kern County APCD	2/28/85	0.2 lb/MMBtu (LAER) - CFB combustion
3M Co.	NS	120		Alabama DEM	11/29/84	0.7 lb/MMBtu
Amalgamaize Co.	NS	180		Alabama DEM	11/29/84	0.57 lb/MMBtu
Cogentrix of NC, Lumberton	NS	202		North Carolina DEM	9/10/84	0.7 lb/MMBtu - control of excess air
Alabama Power Co.	NS	248		Jefferson Cty HD	9/10/84	0.6 lb/MMBtu - operating practices
Virgina Power - Portsmouth	NS	1129		Virginia APCB	7/27/84	0.6 lb/MMBtu - combustion design
Cogentrix of NC, Kenansville	NS	202		North Carolina DEM	9/10/84	0.7 lb/MMBtu - control of excess air
Cogentrix of NC, Hamilton	NS	202		North Carolina DEM	9/10/84	0.7 lb/MMBtu - control of excess air
American Lignite Products	FB	590		EPA Region IX	1/10/84	61.5 lb/hr - cfb
Lower Colorado River Auth.	LIG	4735		Texas ACB	12/22/83	0.6 lb/MMBtu - burner design
American Lignite Products	FB	240		Amador Cty APCD	12/21/83	150 ppm - staged combustion
Intermountian Power Project	NS	6352		Utah BAQ	10/17/83	0.55 lb/MMBtu - combustion control
Basin Electric Power Coop.	NS	6278		North Dakota SHD	1/12/83	0.45 lb/MMBtu - combustion controls
Eastman Kodak	NS	670		New York DEC	12/20/82	0.7 lb/MMBtu - combustion control
Washington Water Power Co.	NS	2080	MW	EPA Region X	11/17/82	0.5 lb/MMBtu
Iowa Electric Light & Power	NS	10000		EPA Region VII	10/29/82	0.5 lb/MMBtu - combustion design
B.F.Goodrich	CFB	150		Illinois EPA	9/16/82	0.6 lb/MMBtu - equipment design
Cincinatti Gas & Electric	NS	6313		Kentucky DAPC	5/14/82	0.7 lb/MMBtu
West Texas Utilities Co.	NS	6.8		Texas ACB	5/20/82	0.5 lb/MMBtu
Tacoma City Light	NS	1600		EPA Region X	5/11/82	0.5 lb/MMBtu
Kentucky Utilities - Hancock	NS	6650		Kentucky DAPC	5/15/82	0.6 lb/MMBtu
Jacksonville Elec Auth	NS	600		Florida DER	1/1/82	0.6 lb/MMBtu
SC Pub Svc - Cross Site	NS	500	MW	South Carolina DHEC	2/3/82	0.6 lb/MMBtu - equip design
Houston Lighting & Power	NS	5729		EPA Region VI	11/12/81	0.5 lb/MMBtu - O2 controls
Holyoke Water Power - Mt Tom	NS	1447		Massachusetts DEQE	10/27/81	not specified
Central Power & Light	NS	6781		EPA Region VI	10/19/81	0.5 lb/MMBtu - fire box design
Tampa Elect. Co.	NS	425	MW	Florida DER	10/15/81	0.6 lb/MMBtu - equip design
Oklahoma Gas & Elect	NS	5250		EPA Region VI	10/5/81	0.5 lb/MMBtu - excess air
Delmarva Power & Light	NS	5702		EPA Region III	9/30/81	0.6 lb/MMBtu - burner design
Panorama Enercorp, Inc	NS	37	MW	EPA Region X	9/22/81	0.17 lb/MMBtu
SW Elect Power	NS	720	MW	EPA Region VI	9/1/81	0.6 lb/MMBtu - low NOx burners
Pennsylvania Elect. Co.	NS	6280		EPA Region III	8/18/81	0.6 lb/MMBtu
NYS Elect & Gas - Cyuga Stat.	NS	1750		EPA Region II	6/29/81	0.6 lb/MMBtu - good design
Iowa-Illinois Gas & Elect	NS	7000		EPA Region VII	6/16/81	0.6 lb/MMBtu - boiler design
Idaho Nat Engineering Lab	NS	82.5		EPA Region X	6/5/81	0.5 lb/MMBtu - combustion controls
Plains Elect Gen & Trans	NS	2471		EPA Region VI	5/27/81	0.45 lb/MMBtu - fire box design

CFB-circulating fluidized bed FB-fluidized bed LIG-lignite SS-spreader stoker NS-not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR NOx (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)		Reviewing Agency	Date of Issuance	BACT for NOx
Nevada Power Co	NS	560	MW	EPA Region IX	4/13/81	0.44 lb/MMBtu – design
Big Rivers Elect – D.B.Wilson	NS	4585		Kentucky DAPC	3/11/81	0.6 lb/MMBtu – boiler design & oper
AL Elect Coop, Inc	LIG	4805		Alabama APCD	2/24/81	0.6 lb/MMBtu – boiler design & operation
SW Elect Power	NS	6821		EPA Region VI	2/23/81	0.6 lb/MMBtu – LNB & FGR
Nebraska Public Power Dist	NS	650	MW	Nebraska DEC	12/16/80	0.5 lb/MMBtu
New England Power – Brayton Pt	NS	10625		Massachusetts DEQE	11/1/80	not specified
E. Kentucky Power – J.K.Smith	NS	6760		Kentucky DAPC	8/21/80	0.6 lb/MMBtu – boiler design
Curtiss-Wright Corp	FB	137		EPA Region II	6/13/80	none
Intermountian Power Project	NS	750	MW	EPA Region VIII	6/8/80	0.55 lb/MMBtu – design
Utah Power & Light – Hunter	NS	860	MW	EPA Region VIII	6/2/80	0.55 lb/MMBtu – boiler design
Platte River Pwr – Rawhide	NS	250	MW	EPA Region VIII	5/22/80	0.5 lb/MMBtu – design
Sunflower Elect Coop – Holcomb	NS	3389		EPA Region VII	5/19/80	0.6 lb/MMBtu – staged comb, LEA
Michigan S.Central Pwr Agcy	NS	NS		Michigan DNR	5/16/80	0.6 lb/MMBtu – control excess air
Kentucky Power – Carr's Fac	NS	11943		Kentucky DAPC	4/18/80	0.6 lb.MMBtu – boiler design
Tucson Elec Power Co	NS	350	MW	EPA Region IX	4/11/80	0.44 lb/MMBtu – combustion modifications
Marquette Lt & Pwr – Shiras	NS	517.6		Michigan DNR	4/1/80	0.5 lb/MMBtu
N.Indiana Public Service	NS	3967		EPA Region V	3/31/80	0.6 lb/MMBtu
Colorado Ute–Craig	NS	5350		EPA Region VIII	3/27/80	0.5 lb/MMBtu
Cajun Elec. Power Coop	LIG	6507		EPA Region VI	3/25/80	0.6 lb/MMBtu – O2 Control
Grand Haven Lt & Pwr	NS	710		Michigan DNR	3/18/80	0.6 lb/MMBtu
Deseret Gen & Trans, Moon Lake	NS	400	MW	EPA Region VIII	2/4/80	0.55 lb/MMBtu
Muscatine Power & Water	NS	166	MW	EPA Region VII	1/24/80	0.6 lb/MMBtu

CFB–circulating fluidized bed   FB–fluidized bed   LIG–lignite   SS–spreader stoker   NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR CO (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)		Reviewing Agcy	Date of Issuance	BACT for CO
Applied Energy Services	CFB	2150		Hawaii DOH	1/25/90	408 lb/hr (70 ppm) –
Cogentrix, Rocky Mount (4 units)	SS	375		North Carolina DEM	7/20/89	0.0200 lb/MMBtu – Combustion Control
A E S Thames, Inc	FB	923		Connecticut DEP	8/9/89	0.11 lb/MMBtu
A E S Thames, Inc	FB	923		Connecticut DEP	8/9/89	0.11 lb/MMBtu
Cambria Cogen Inc. (2 units)	CFB	559		Pennsylvania BAQC	5/26/89	83.9 lb/hr – Combustion Control
Scrubgrass Power Corp. (2 units)	CFB	599		Pennsylvania BAQC	1/18/89	0.1000 lb/MMBtu
Goodyear United Development Group	FB	577		New York DEC	10/14/88	0.2 lb/MMBtu – Combustion Controls
North Branch Energy Partners LP	CFB	563		Pennsylvania BAQC	9/26/88	0.15 lb/MMBtu
United Development Group	FB	577		New York State DEC	9/25/88	0.2 lb/MMBtu – Combustion Control
Fort Howard Corp.	CFBC	505		Wisconsin DNR	9/21/88	0.2 lb/MMBtu – Proper Bed Operation
Edensburg Power Co.	FB	617		Pennsylvania BAQC	6/6/88	0.18 lb/MMBtu
TVA – Shawnee Steam Plant	AFBC	1579		Kentucky DAQ	5/4/88	0.4 lb/MMBtu
GWF Power Systems Co., Inc.	CF	202		Bay Area AQMD (CA)	2/11/88	0.09 lb/MMBtu – Best Engineering Practices
City of Wyandotte, Dept Mun Svcs	CFBC	369		Wyane Co. APC (MI)	12/7/87	0.14 lb/MMBtu – Temp. 1450–1650 F – equip design
Cogentrix Michigan Leasing Corp.	SS	214		Michigan DNR	7/31/87	0.2 lb/MMBtu – design and operation
Fort Drum Heating Plant	CFB	190		New York State DEC	4/1/87	0.25 lb/MMBtu – Combustion Control
GWF Power Systems Co.	FB	274		EPA Region IX	1/28/87	200 ppm – AFBC
Mt Poso Cogeneration Co.	CFB	50	MW	EPA Region IX	1/12/87	50 lb/hr – control of overfire air
Foster Wheeler Power (2 units)	NS	283		Pennsylvania DER	12/29/86	0.5 lb/MMBtu
Rio Bravo Refining Co.	FB	389		EPA Region IX	10/22/86	0.27 lb/MMBtu – combustion controls
Rio Bravo Refining Co	FB	36	MW	EPA Region IX	8/19/86	0.27 lb/MMBtu – combustion controls
Cogentrix Carolina Leasing Co.	NS	202		North Carolina DEM	7/7/86	0.6 lb/MMBtu – control of excess air
Cogentrix of Virginia, Inc	NS	200		Virginia APCB	6/12/86	0.6 lb/MMBtu
TVA – Shawnee Steam Plant	FB	1430		Kentucky DAPC	4/15/86	0.4 lb/MMBtu
Nortern Energy Group	WF	250		New York State DEC	12/11/85	0.35 lb/MMBtu – Combustion Control
Cogeneration National Corp	NS	279.6		San Joaquin Cty APCD	12/13/85	limit to be set – staged combustion
Tennesee Valley Authority	FB	200		Kentucky DAPC	12/13/85	none
Corn Products	CFB	620		San Joaquin Cty APCD	10/29/85	none listed
White Pine Power	NS	750	MW	Nevada DEP	8/6/85	383 lb/hr
SCE – Biogen Power Project	CFB	212		EPA Region IX	4/26/85	0.12 lb/MMBtu – boiler combustion controls
Rio Bravo Refining Co.	CFB	37.5	MW	Kern County APCD	2/28/85	0.27 lb/MMBtu – circulating bed combustion
Wisconsin Electric Power Co.	PFBC	825		Wisconsin DNR	1985	0.09 lb/MMBtu – Proper Combustion
3M Co.	NS	120		Alabama DEM	11/29/84	0.2 lb/MMBtu – boiler design & operating practices
Amalgamaize Co.	NS	180		Alabama DEM	11/29/84	0.2 lb/MMBtu – boiler design & operating practices
Cogentrix of NC, Lumberton	NS	202		North Carolina DEM	9/10/84	0.6 lb/MMBtu – control of excess air
Virgina Power – Portsmouth	NS	1129		Virginia APCB	7/27/84	0.02 lb/MMBtu – combustion design parameters
Cogentrix of NC, Kenansville	NS	202		North Carolina DEM	9/10/84	0.6 lb/MMBtu – control of excess air
Cogentrix of NC, Hamilton	NS	202		North Carolina DEM	9/10/84	0.6 lb/MMBtu – control of excess air
American Lignite Products	FB	590		EPA Region IX	1/10/84	24.2 lb/hr – circulating fluid bed
Lower Colorado River Auth.	LIG	4735		Texas ACB	12/22/83	0.12 lb/MMBtu –
American Lignite Products	FB	240		Amador Cty APCD	12/21/83	138 ppm – staged combustion

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR CO (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)	Reviewing Agcy	Date of Issuance	BACT for CO
Eastman Kodak	NS	670	New York DEC	12/20/82	0.045 lb/MMBtu – combustion control
Washington Water Power Co.	NS	2080 MW	EPA Region X	11/17/82	332 lb/hr
B.F.Goodrich	CFB	150	Illinois EPA	9/16/82	400 ppm – equipmpent design
Kentucky Utilities – Hancock	NS	6650	Kentucky DAPC	4/15/82	0.048 lb/MMBtu
SC Pub Svc – Cross Site	NS	500 MW	South Carolina DHEC	12/3/81	0.04 lb/MMBtu – equipment design and operation
Houston Lighting & Power	NS	5729	EPA Region VI	11/12/81	0.059 lb/MMBtu – O2 controls
Central Power & Light	NS	6781	EPA Region VI	10/19/81	0.06 lb/MMBtu – O2 control optimal with NOx
Tampa Elect. Co.	NS	425 MW	Florida DER	10/15/81	0.014 lb/MMBtu – equipment design & operation
Oklahoma Gas & Elect	NS	5250	EPA Region VI	10/5/81	0.64 lb/MMBtu – com. controls & proper operation
Delmarva Power & Light	NS	5702	EPA Region III	9/30/81	0.04 lb/MMBtu – burner design
Panorama Enercorp, Inc	NS	37 MW	EPA Region X	9/22/81	107.3 lb/hr
SW Elect Power	NS	720 MW	EPA Region VI	9/1/81	0.08 lb/MMBtu – efficient combustion
Pennsylvania Elect. Co.	NS	6280	EPA Region III	8/18/81	0.04 lb/MMBtu
NYS Elect & Gas – Cyuga Stat.	NS	1750	EPA Region II	6/29/81	– good combustion practices
Plains Elect Gen & Trans	NS	2471	EPA Region VI	5/27/81	0.063 lb/MMBtu – fire box design & com control
Nevada Power Co	NS	560 MW	EPA Region IX	4/13/81	50 ppm – design & excess air control
AL Elec Coop Inc	LIG	4805	Alabama APCD	2/24/81	0.098 lb/MMBtu – boiler design & operation
SW Elect Power	NS	6821	EPA Region VI	2/23/81	0.1 lb.MMBtu – low excess air
Nebraska Public Power Dist	NS	650 MW	Nebraska DEC	12/16/80	50 ppm
Curtiss–Wright Corp	FB	137	EPA Region II	6/13/80	none
Intermountian Power Project	NS	750 MW	EPA Region VIII	6/8/80	1248 lb/hr
Sunflower Elect Coop – Holcomb	NS	3389	EPA Region VII	5/19/80	0.064 lb/MMBtu –
Colorado Ute–Craig	NS	5350	EPA Region VIII	3/27/80	no control
Cajun Elec. Power Coop	LIG	6507	EPA Region VI	3/25/80	0.09 lb/MMBtu – O2 control
Deseret Gen & Trans, Moon Lake	NS	400 MW	EPA Region VIII	2/4/80	no control

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR VOC (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)		Reviewing Agcy	Date of Issuance	BACT for VOC
Applied Energy Services	CFB	2150		Hawaii DOH	1/25/90	32.2 lb/hr (3.5 ppm) –
A E S Thames, Inc	FB	923		Connecticut DEP	8/9/89	0.02 lb/MMBtu
A E S Thames, Inc	FB	923		Connecticut DEP	8/9/89	0.02 lb/MMBtu
Cambria Cogen Inc. (2 units)	CFB	559		Pennsylvania BAQC	5/26/89	Combustion Control
Scrubgrass Power Corp. (2 units)	CFB	599		Pennsylvania BAQC	1/18/89	0.0050 lb/MMBtu
Fort Howard Corp.	CFBC	505		Wisconsin DNR	9/21/88	2.21 lb/h
North Branch Energy Partners LP	CFB	563		Pennsylvania BAQC	9/26/88	0.02 lb/MMBtu
City of Wyandotte, Dept Mun Svcs	CFBC	369		Wyane Co. APC (MI)	12/7/87	8.86 lb/h
Cogentrix of Virginia, Inc	NS	200		Virginia APCB	6/12/86	0.003 lb/MMBtu
TVA – Shawnee Steam Plant	FB	1430		Kentucky DAPC	4/15/86	none
Tennessee Valley Authority	FB	200		Kentucky DAPC	12/13/85	none
Virgina Power – Portsmouth	NS	1129		Virginia APCB	7/27/84	0.004 lb/MMBtu – combustion design parameters
Lower Colorado River Auth.	LIG	4735		Texas ACB	12/22/83	0.0081 lb/MMBtu
Washington Water Power Co.	NS	2080	MW	EPA Region X	11/17/82	3.32 lb/hr
Delmarva Power & Light	NS	5702		EPA Region III	9/30/81	0.001 lb/MMBtu – burner design
Panorama Enercorp, Inc	NS	37	MW	EPA Region X	9/22/81	36.5 lb/hr
Nevada Power Co	NS	560	MW	EPA Region IX	4/13/81	– proper boiler design
Intermountian Power Project	NS	750	MW	EPA Region VIII	6/8/80	375 lb/hr –
Colorado Ute–Craig	NS	5350		EPA Region VIII	3/27/80	no control
Deseret Gen & Trans, Moon Lake	NS	400	MW	EPA Region VIII	2/4/80	no control

CFB–circulating fluidized bed FB–fluidized bed LIG–lignite SS–spreader stoker NS–not specified

COAL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR TRACE METALS (1980 – PRESENT)

Name	Type	Size (MMBtu/hr)		Reviewing Agcy	Date of Issuance	BACT Limits
Applied Energy Services	CFB	2150		Hawaii DOH	1/25/90	Pb – 0.003 lb/MMBtu
Port Washington Power Plant	NS	825		Wisconsin DNR	1988	Be – 6.5e–6 lb/MMBtu – ESP
						Hg – 1 ug/m3
						Pb – 1.9e–4 lb/MMBtu – ESP
Fort Howard	CFB	505		Wisconsin DNR	9/21/88	Be – 9e–4 lb/hr
						Hg – 0.04 lb/hr
						Pb – 0.03 lb/hr
White Pine Power	NS	750	MW	Neveda DEP	8/6/85	Hg – 0.05 lb/hr – proper boiler operation
Lower Colorado River Authority	NS	4735		Texas ACB	12/22/83	Hg – 0.13 tpy
Washington Water Power Co.	NS	2080	MW	EPA Region IX	11/17/82	Be – 0.02 lb/hr
						Hg – 0.03 lb/hr
						Pb – 0.27 lb/hr
Eastman Kodak Co	NS	670		New York DEC	12/20/82	Be – 0.001 lb/hr – ESP
NY State E&G – Cyuga	NS	1750		EPA Region II	6/29/81	Be – no limit – ESP/FGD
						Hg – no limit – ESP/FGD
						Pb – no limit – ESP/FGD
Nevada Power Co	NS	560	MW	EPA Region IX	4/13/81	Be – no limit
						Hg – no limit – PM controls
						Pb – no limit

CFBC – circulating fluidized bed NS – not specified

OIL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR NOx

Name	Size (MMBtu/hr)	Reviewing Agency	Date of Issuance	BACT for NOx
Wisconsin Tissue Mills, Inc	146.4	Wisconsin DNR	10/10/88	0.38 lb/MMBtu – low excess air
Georgia Pacific Corp	118	Southwest OH APCA	1986	0.3 lb/MMBtu – low excess air
Owens-Illinois Inc	10.3	Toledo Env Svcs	11/26/86	0.145 lb/MMBtu – gas/oil firing
Berry Holding Co	62.5	Kern County APCD	10/2/85	0.12 lb/MMBtu – LNB & FGR
Petro-Lewis Corp	50	EPA Region IX	8/7/84	0.12 lb/MMBtu – LNB
Hopco	62.5	Kern County APCD	12/4/84	0.12 lb/MMBtu – SNCR
Angus Petroleum	62.5	Kern County APCD	11/29/83	0.13 lb/MMBtu – LNB
Houston Lighting & Power	185	EPA Region IV	1/16/80	0.3 lb/MMBtu

OIL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR SO2

Name	Size (MMBtu/hr)	Reviewing Agency	Date of Issuance	BACT for SO2
Wisconsin Tissue Mills, Inc	146.4	Wisconsin DNR	10/10/88	1.1 lb/MMBtu – 1% S oil
Georgia Pacific Corp	118	Southwest OH APCA	1986	1.06 lb/MMBtu – 1% S oil
GMC–CPC Hamilton–Fairfield	27	Southwest OH APCA	12/31/86	1.1 lb/MMBtu – limit S content
Owens–Illinois Inc	10.3	Toledo Env Svcs	11/26/86	0.52 lb/MMBtu – gas/oil firing
Unical	62.5	Kern County APCD	12/27/85	0.0365 lb/MMBtu – flue gas scrubber
Berry Holding Co	62.5	Kern County APCD	10/2/85	0.07 lb/MMBtu – caustic scrubber
Delco Moraine Div, GMC	144	Dayton RAPCA	7/1/85	1.3 lb/MMBtu
Petro–Lewis Corp	50	EPA Region IX	8/7/84	0.052 lb/MMBtu – scrubber
Hopco	62.5	Kern County APCD	12/4/84	0.034 lb/MMBtu – scrubber
Angus Petroleum	62.5	Kern County APCD	11/29/83	0.04 lb/MMBtu – scrubber
Houston Lighting & Power	185	EPA Region IV	1/16/80	0.5 lb/MMBtu – low S oil
Hooker Chemical & Plastics Corp	81.9	EPA Region III	7/3/79	4.33 lb/MMBtu – 1/3% S oil

OIL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR CO

Name	Size (MMBtu/hr)	Reviewing Agency	Date of Issuance	BACT for CO
Owens-Illinois Inc	10.3	Toledo Env Svcs	11/26/86	0.04 lb/MMBtu – gas/oil firing

OIL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR VOC

Name	Size (MMBtu/hr)	Reviewing Agency	Date of Issuance	BACT for VOC
Owens-Illinois Inc	10.3	Toledo Env Svcs	11/26/86	0.003 lb/MMBtu – gas/oil firing
Hopco	62.5	Kern County APCD	12/4/84	0.000 lb/hr – vapor collection and incineration

OIL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR PM

Name	Size (MMBtu/hr)	Reviewing Agency	Date of Issuance	BACT for PM
Wisconsin Tissue Mills, Inc	146.4	Wisconsin DNR	10/10/88	0.09 lb/MMBtu – 1% S oil
Georgia Pacific Corp	118	Southwest OH APCA	1986	0.09 lb/MMBtu – 1% S oil
Owens-Illinois Inc	10.3	Toledo Env Svcs	11/26/86	0.02 lb/MMBtu – gas/oil firing
Delco Moraine Div, GMC	144	Dayton RAPCA	7/1/85	0.08 lb/MMBtu
Hopco	62.5	Kern County APCD	12/4/84	0.0272 lb/MMBtu – wet scrubber
Houston Lighting & Power	185	EPA Region IV	1/16/80	0.1 lb/MMBtu

OIL FIRED BOILERS
BACT/LAER CLEARINGHOUSE
LISTINGS FOR TRACE METALS

Name	Size (MMBtu/hr)	Reviewing Agency	Date of Issuance	BACT for Trace Metals
Wisconsin Tissue Mills, Inc	146.4	Wisconsin DNR	10/10/88	Be – no limit – 1% S oil
GMC–CPC Hamilton–Fairfield	27	Southwest OH APCA	12/31/86	As – 5 ppm in oil Cd – 2 ppm in oil Cr – 10 ppm in oil Pb – 100 ppm in oil

APPENDIX B

CALCULATIONS

Title	Date	Dwg. 1 of	Project	Proposal

PG+E – BECHTEL / INDIANTOWN

AMMONIUM BISULFITE CALCULATION

PLANT DATA:

COAL SULFUR : 2%
COAL HEAT : 11,800 BTU/lb
PC HEAT INPUT : 3430 MMBTU/hr

COAL FIRING RATE:

$$\frac{(3430 \times 10^6 \text{ BTU/HR})}{(11800 \text{ BTU/lb})} = 290,700 \text{ lb/hr}$$

SULFUR RELEASE RATE:

$$\left(290,700 \frac{\text{lb COAL}}{\text{hr}}\right)\left(\frac{0.02 \text{ lb S}}{\text{lb COAL}}\right) = 5814 \text{ lb/hr}$$

STACK RATE 100 FT/SEC @ 16 FT DIA

$$\left(100 \frac{\text{FT}}{\text{SEC}}\right)\left(\frac{60 \text{ SEC}}{\text{MIN}}\right)\frac{\pi}{4}(16 \text{ FT})^2 = 1,206,300 \text{ ACFM}$$

EXIT TEMP = 140 °F

$$\left(1,206,300 \frac{\text{FT}^3}{\text{MIN}}\right)\left(\frac{528 \text{ °R}}{140+460 \text{ °R}}\right)\left(\frac{\text{lb mol}}{385 \text{ FT}^3}\right)\left(\frac{30 \text{ lb}}{\text{lb mol}}\right)\left(\frac{60 \text{ MIN}}{\text{HR}}\right)$$

$$= 4,963,000 \text{ lb/HR}$$

AMMONIA SLIP RATE @ 5 ppm

$$\frac{(4,963,000 \text{ lb/HR})}{(30 \text{ lb/lbmol})}\frac{(5 \text{ ppm})}{(10^6)}\left(\frac{17 \text{ lb } NH_3}{\text{lbmol}}\right) = 14 \text{ lb } NH_3\text{/HR}$$

Title	Date	Dwg. 2 of 2	Project	Proposal

AMMONIUM BISULFATE EMISSIONS

- IF NH_3 IS RATE LIMITING

$$\left(14\ lb/hr\right)\left(\frac{115\ lb\ NH_4HSO_4}{17\ lb\ NH_3}\right) = \underline{\underline{95\ lb/hr}}$$

- IF SO_3 IS RATE LIMITING

SCR: 1% $SO_2 \rightarrow SO_3$ IN BOILER
1% $SO_2 \rightarrow SO_3$ IN CATALYST

$\Rightarrow$ 2% $SO_2 \rightarrow SO_3$

$$\left(5314\ \frac{lb\ S}{hr}\right)\left(0.02\ \frac{lb\ S\ in\ SO_3}{TOTAL\ S}\right)\left(\frac{80\ lb\ SO_3}{32\ lb\ S}\right) = 290.7\ \frac{lb\ SO_3}{hr}$$

$$\left(290.7\ \frac{lb\ SO_3}{hr}\right)\left(\frac{115\ lb\ NH_4HSO_4}{80\ lb\ SO_3}\right) = \underline{\underline{418\ \frac{lb\ NH_4HSO_4}{hr}}}$$

SNCR 1% $SO_2 \rightarrow SO_3$ CONVERSION

$$\left(5314\ \frac{lb\ S}{hr}\right)\left(0.01\ \frac{lb\ S\ in\ SO_3}{TOTAL\ S}\right)\left(\frac{115\ lb\ NH_4HSO_4}{32\ lb\ S}\right) = \underline{\underline{209\ \frac{lb}{hr}}}$$

B. Air Quality Impact Analysis

AIR QUALITY IMPACT ANALYSIS
IN SUPPORT OF A
PREVENTION OF SIGNIFICANT DETERIORATION (PSD) PERMIT APPLICATION
FOR THE PROPOSED
INDIANTOWN COGENERATION PROJECT

Prepared by
Bechtel Corporation
Gaithersburg, Maryland

Prepared for
Florida Department of Environmental Regulation
Tallahassee, Florida

December 1990

1.0 INTRODUCTION

The Indiantown Cogeneration L.P. (ICL) Project is proposed to be constructed at a site along Highway 710 approximately 3 miles northwest of the community of Indiantown and 9 miles east of Lake Okeechobee, Florida. The proposed site is southwest of and abuts the Caulkins Citrus Processing facility and the Florida Steel Corporation Indiantown steel mill property. The site occupies the central portion of Section 35, Township 39 South, Range 38 East, Martin County, Florida.

The U.S. Environmental Protection Agency (EPA) has promulgated Prevention of Significant Deterioration (PSD) regulations (40 CFR 52.21) which require a permit review and approval for new or modified existing sources which emitted criteria pollutants in amount greater than the significant emission levels. Since the proposed source will have emissions which exceed the significant levels, the proposed ICL plant is subject to PSD review. Based on the Florida Administration Code (FAC, 17-2.510), the State of Florida has the PSD authority through the Florida Department of Environmental Regulation (FDER). A completed FDER Form 17-1.202(1) for Application to Operate/Construct Air Pollution Sources is attached.

Although part of the SCA process, this document is prepared as a complete PSD permit application. Therefore, design information and analysis required by the federal and state regulations are included in this document. The following sections include:

- A discussion of the regulatory rationale as it applies to the project (Section 2.0)
- A description of the technical approaches used for the various air quality impact analyses (Section 3.0)
- A description of the development of dispersion model input parameters, including model options, emission data, meteorological data, and other relevant parameters (Section 4.0)
- Results of the dispersion modeling (Section 5.0)
- A summary of the visibility impact analysis (Section 6.0)
- The analyses of other air quality related effects, including effects on soil and vegetation, cooling tower impacts, and a health effects evaluation for the state regulated air toxics (Section 7.0)

2.0 REGULATORY RATIONALE

This section provides an overview of the project and summarizes the basis for identifying the air quality regulations with which the project must comply.

2.1 PROJECT DESCRIPTION

The proposed plant will be a 330 MW net pulverized-coal-fired facility. The facility includes one boiler and one steam generator. Lightoff and startup will be with natural gas or No. 2 fuel oil. Extracting steam will be supplied to the adjacent Caulkins Citrus Processing Plant. The flue gas desulfurization (FGD) system for sulfur dioxide (SO_2) removal is proposed to be a dry scrubber. Particulate emissions will be removed from the flue gas by means of multi-compartment fabric filter (baghouse) before discharging from the plant stack. The stack will meet good engineering practice (GEP) stack height specifications.

Solid waste will be removed by rail or truck for off-site disposal. Cooling at the plant will be achieved by means of a mechanical draft cooling tower.

2.1.1 FUEL

The proposed primary fuel will be eastern bituminous coal having a sulfur content of 2.0 percent. Natural gas and No. 2 fuel oil will be used for lightoff and startup. A representative fuel analysis for these fuels is presented in Table 2-1.

Coal will be delivered by rail, unloaded, and stored in an enclosed storage facility on site. A grassed inactive coal pile, sized for 30 days storage at full load, is also provided. Lime used for sulfur capture in the flue gas cleanup system will be delivered by train or in enclosed, self-unloading trucks and stored in an enclosed structure.

Fuel oil is stored in aboveground tanks located within a diked area. No. 2 fuel oil will be delivered by truck or rail.

An emission inventory for the proposed ICL plant has been developed based on applicable New Source Performance Standards (NSPS) as well as vendor-supplied data or appropriate EPA AP-42 emission factors. The total plant flue gas discharge will be based on the following:

	Main Boiler, Coal		Aux. Boiler, Oil	
Pollutant	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu
SO_2	582.6	0.17	17.73	0.05
NO_X	582.6	0.17	68.2	0.20

	Main Boiler, Coal		Aux. Boiler, Oil	
Pollutant	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu
CO	377	0.11	150(a)	47.3
Particulate	61.7	0.018	1.4	-
VOC	12.3	0.0036	0.63	-
Pb	0.035	0.00003	0.00083	-

Note: (a) Unit is ppm.

The ICL emissions with respect to regulated criteria and non-criteria air pollutants for full load (100 percent) and partial loads (75 percent and 50 percent) are presented in Section 4.0. Fugitive emissions resulting from coal handling, storage and ash handling are presented in Section 4.0.

Five scenarios were examined to determine the worst-case air quality impacts based on the emissions and the associated stack parameters. Scenarios considered are:

Case	Fuel	Load (%)
1	Coal	100
2	Coal	75
3	Coal	50
4	Gas	100
5	Oil	100

Cases 4 and 5 involve an auxiliary boiler, usually during lightoff and startup stages. However, the auxiliary boiler may be operated continuously for several months if necessary. Thus, long-term impact analysis is also performed for these two cases.

2.1.2 EMISSION CONTROL

The flue gas cleanup system consists of an FGD system and a baghouse for particulate control. The proposed FGD system for SO_2 removal will consist of a spray dryer absorber using lime slurry as the reagent. The system is designed to have a sulfur removal efficiency of 95 percent for coal with a sulfur content of 2.0 percent. Particulate emissions are removed from the flue gas by means of a multi-compartment bag filter before discharging from the plant stack. NO_X emissions from the stack are controlled by advanced combustion controls and a selective noncatalytic reduction (SNCR) technology. The emission control system proposed for the ICL plant represents the best available control technology (BACT). The BACT analysis, which is based on the "top-down" approach, is also presented.

Fugitive emissions from coal storage and material handling are controlled by enclosing most of these operations and venting through fabric filters. A summary description of emission controls for these fugitive dust sources is presented in Section 4.2.1.

2.1.4 PROJECTED CONSTRUCTION SCHEDULE

The construction schedule is preliminary, based on information available at this time. Construction is projected to take place in a single phase. Site preparation work could be initiated as early as July 1992. It is anticipated that commercial operation of the facility will begin in December 1995.

2.2 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABLE REGULATIONS

The applicability of three federal regulations promulgated as a result of passage of the Clean Air Act amendments of 1977 must be considered in the evaluation of the regulatory requirements and their applicability to the proposed ICL plant.

2.2.1 PREVENTION OF SIGNIFICANT DETERIORATION

Sources that are "major stationary sources" and "major modifications" located in areas designated as attainment or unclassifiable for National Ambient Air Quality Standards (NAAQS) are subject to the PSD regulations. Since Martin County and the surrounding counties are designated as "in attainment or cannot be classified" for all criteria pollutants (40 CFR 81.310), the task at hand is to determine whether the proposed facility would be classified as a major source under the PSD regulations. A "major stationary source" is defined as any one of 28 specified sources which has a potential to emit 100 tons per year or more, or any other stationary source which has the potential to emit 250 tons per year or more of any regulated pollutant (40 CFR 52.21).

The proposed facility is listed as a 100-ton per year source (fossil-fuel-fired steam electric plants of more than 250 million Btu/hr heat input) and has the potential to emit more than 100 tons of a criteria pollutant (see Section 2.1.2). Therefore, the proposed facility is subject to PSD review.

Under PSD, each pollutant emitted from a major source in significant quantities, as defined in Table 2-2, and for which the area is designated as "in attainment" for the pollutant, must undergo a PSD analysis. The PSD analysis involves the following:

- BACT analysis
- PSD Increment Consumption Analysis, including other increment-consuming sources in the area (if applicable)
- NAAQS impact analysis, including other significant sources in the area (if applicable)

- o Nonattainment area impact analysis
- o Class I PSD area impact analysis
- o Other air quality-related impact analyses

Each of these is briefly described in the following paragraphs.

<u>BACT Analysis</u>. For all pollutants emitted at significant levels (see Table 2-2), a control technology must be selected and defended that will result in the maximum reduction in pollutant emissions considered achievable for the source using current technology. Energy requirements, environmental impacts, and economic impacts must be considered in the BACT analysis.

<u>PSD Increment Consumption</u>. An ambient air quality analysis must be conducted for total suspended particulate matter (TSP), SO_2, and nitrogen dioxide (NO_2) for those pollutants with a resultant significant impact due to the proposed facility. If required, the analysis must demonstrate that the PSD ambient air quality increments, shown in Table 2-3, are not exceeded by the proposed project. Since the facility will be located in a Class II area, only those increments apply to this project. Finally, since there are a number of other known increment-consuming sources in the site area, the increment consumption analysis for the proposed facility must include these other sources if they produce overlapping significant air quality impacts.

<u>National and Florida Ambient Air Quality Standards</u>. The ambient air quality analysis must also demonstrate that the project's air quality impact, plus applicable background levels, does not exceed the NAAQS and Florida Ambient Air Quality Standards (FAAQS) shown in Table 2-4. As before, the analysis is required only for those pollutants emitted in significant quantities (see Table 2-2) with a resultant significant impact due to the facility. Other major sources of the applicable pollutants (i.e., with emissions greater than 100 tons per year) must also be included if those sources produce overlapping significant impacts.

<u>Nonattainment Area Impact Analysis</u>. A demonstration that the proposed source will not significantly impact designated nonattainment areas must be included in the ambient air quality analysis.

Palm Beach County, about 9 kilometers south of the site, is the only nonattainment area (for ozone) in the vicinity of the proposed facility. The proposed source has VOC emissions that are greater than the PSD significant emission rate. However, as stated in the air quality modeling protocol for the proposed ICL plant submitted to FDER in July 1990, the U.S. EPA Guideline on Air Quality Models (EPA, 1986a) indicates that "the use of models incorporating complex chemical mechanisms should be considered only in a case-by-case basis with proper demonstration of applicability. These are generally regional models not designed for the evaluation of individual sources but used primarily for region-wide evaluations." This statement and the fact that the proposed facility is not located in an ozone nonattainment area preclude subjecting the proposed ICL plant to a VOC emissions impact assessment.

Impacts on Class I PSD Areas. Any source within 100 kilometers of a Class I area must also demonstrate insignificant levels for air quality impacts at that area. Since the proposed facility is approximately 145 kilometers north of the Everglades National Park (a Class I area), the proposed facility is not subject to this provision of the PSD review process.

Additional Impacts Analysis. Any source subject to the PSD regulations must also provide an analysis of any adverse air quality-related impacts to:

- o Visibility
- o Soils
- o Vegetation
- o Commercial, residential, and industrial growth that the project might cause

2.2.2 NEW SOURCE PERFORMANCE STANDARDS

The NSPS apply to new, modified, and reconstructed sources of emissions for which the U.S. EPA has promulgated standards. The EPA promulgated NSPS for fossil-fuel-fired steam generators (40 CFR 60, Subpart D) with a heat input greater than 250 MMBtu per hour in 1971. Since its promulgation, the EPA has proposed revisions and amendments to Subpart D a number of times. One of the amendments, Subpart Da, would apply to the proposed ICL plant. Subpart Da was proposed in 1978 and promulgated in 1979 and specifically applies to electric utility steam generating units.

Electric utility steam generating units are subject to NSPS Subpart Da provided they meet all three of the following criteria. If the plant does not meet any one of the criteria, it may still be subject to NSPS (e.g., the promulgated and proposed emission limits in Subpart Db). Subpart Da is applicable to electric steam generating units that:

- o Are capable of combusting more than 73 MW (250 MMBtu/hr) heat input of fossil fuel either alone or in combination with any other fuel
- o Supply more than 25 MW electricity to any utility power distribution system for sale
- o Supply more than one-third of their potential electric output capacity to any utility power distribution system for sale

The proposed project meets these three criteria and thus is subject to the NSPS requirements set forth in Subpart Da. These requirements are summarized specifically for coal-fired boilers in Table 2-5.

Section 60.46a(c), Compliance Provisions, provides that the standards for particulate matter, nitrogen oxides (NO_X), and SO_2 apply at all times, except during periods of startup, shutdown, or malfunction, or when emergency conditions exist.

2.2.3 FLORIDA AIR TOXICS NO-THREAT LEVELS

The Florida air toxics "no-threat" levels were developed by the Florida Air Toxics Working Group for controlling toxic emissions from stationary sources to levels which will not endanger public health. The impact of all toxic air contaminants emitted by new sources must be evaluated based on the air toxics permitting guidelines (Florida Air Toxics Permitting Strategy, draft, 1990). Air toxics emitted by the proposed ICL plant will be evaluated and compared with the appropriate "no-threat" levels regulated by the FDER.

Table 2-1
FUEL ANALYSIS

Ultimate Analysis

Element	Coal[a]	No. 2 Oil	Natural Gas
	Gravimetric Breakdown (%)		
Carbon	65.37	87.26	73.913
Hydrogen	4.63	12.67	24.047
Oxygen	4.69	0.00	1.249
Nitrogen	1.16	0.02	0.773
Sulfur	2.00	0.05	0.018
Chlorine	0.15	--	--
Ash	12.00	--	--
Water	10.00	--	--
Total	100.00	100.00	100.00

Proximate Analysis

Component	No. 2 Oil	Natural Gas
Volatile Matter	99.395	99.92
Fixed Carbon	0.425	0.00
Moisture	0.05	0.00138
Ash	0.05	0.00
Sulfur	0.05	0.018
Total	100.00	100.00

The heat of combustion of coal, No. 2 fuel oil, and natural gas are estimated to be 11,800 Btu/lb, 19,130 Btu/lb, and 950 Btu/ft^3, respectively.

a - Worst case fuel.

Table 2-2
PSD SIGNIFICANT EMISSION RATES AND MAXIMUM TOTAL EMISSION RATES FOR THE PROPOSED INDIANTOWN COGENERATION PROJECT

Pollutant	Significant Emission Rate (tons/yr)[a]	Maximum Total Emission Rate (tons/yr)[b]	Air Quality Analysis Required?
Particulate Matter (TSP)	25	306.1[c]	Yes
PM-10	15	276.2[c]	Yes
Sulfur Dioxide	40	2629.4	Yes
Nitrogen Oxides	40	2850.5	Yes
Volatile Organic Compounds	40	56.6	Yes
Carbon Monoxide	100	1858.4	Yes
Lead	0.6	0.152	No
Mercury	0.1	0.172	Yes
Beryllium	0.0004	0.041	Yes
Fluorides	3	22.26	Yes
Asbestos	0.007	0	No
Vinyl Chloride	1	0	No
Total Reduced Sulfur	10	0	No
Hydrogen Sulfide	10	0	No
Reduced Sulfur Compounds	10	0	No
Sulfuric Acid Mist	7	6.51	No
Any other pollutant regulated under Clean Air Act	Any rate	---	---
Benzene		0	No
Inorganic Arsenic		0.766	Yes
Each regulated pollutant	Any rate causing an impact of 1 $\mu g/m^3$ (24-hr average) or greater in any Class I area within 10 km of source.		No[d]

a - Source: 40 CFR 52.21(b).
b - Maximum total emissions are based on the maximum hourly emission rate; 8,760 hrs/yr and 1,000 hrs/yr of operation for the main and auxiliary boilers, respectively, with an annual load factor of 100 percent for both boilers.
c - Maximum total TSP and PM-10 emissions are conservatively assumed to be the same and include fugitive emission sources listed in Table 4-2.
d - The closest Class I PSD area is the Everglades National Park, located about 145 km south of the proposed ICL. Therefore, air quality analyses are not required on this basis.

Table 2-3
MAXIMUM ALLOWABLE PSD INCREMENTS
($\mu g/m^3$)

	Class I	Class II	Class III
Sulfur Dioxide			
Annual	2	20	40
24-hour	5	91	182
3-hour	25	512	700
Total Suspended Particulate Matter			
Annual	5	19	37
24-hour	10	37	75
Nitrogen Dioxide			
Annual	2.5	25	50

Source: 40 CFR 52.21(c).

Table 2-4
STATE OF FLORIDA AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Federal NAAQS ($\mu g/m^3$)	Florida AAQS ($\mu g/m^3$)
PM[1]	24-Hour	150	150
	Annual	50	50
SO_2	3-Hour	1,300[2]	1,300[2]
	24-Hour	365	260
	Annual	80	60
NO_2	Annual	100	100
CO	1-Hour	40,000	40,000
	8-Hour	10,000	10,000
Ozone	1-Hour	235	235
Lead	Calendar Quarter	1.5	1.5

[1]Ambient air quality standards are based on PM_{10}, and PSD increments are based on TSP until such time as EPA promulgates PSD increments for PM_{10}. Compliance with PM_{10} ambient standard and PSD increments for TSP were evaluated based on TSP modeled impacts.

[2]The 3-hour average SO_2 ambient air quality standard is a secondary (welfare-related) standard. All of the other Federal and Florida ambient air quality standards are primary (health-related) standards.

Sources: 40 CFR 50.
FDER, Title 17, Part III, Chapter 17-2.300.

Table 2-5
NSPS FOR ELECTRIC UTILITY STEAM GENERATING UNITS

Affected Facility	Pollutant	Emission Level	Requirement
Coal-fired boilers (and coal-derived fuels)	Particulate Opacity	0.03 lb/million Btu 20% (27% for 6 min/hr)	Continuous Compliance
	SO_2	1.20 lb/million Btu and 90% reduction except 70% reduction when emissions are less than 0.6 lb/million Btu	Continuous
	NO_x		Continuous Compliance
	Anthracite, bituminous, and specified lignites.	0.60 lb/million Btu	
	Subbituminous coal, coal-derived fuels, and shale oil.	0.50 lb/million Btu	
	More than 25% (wt.) coal refuse.	Exempt	

Source: 40 CFR 60, Subpart Da. Proposed 19 September 1987 (43FR 42154), promulgated 11 June 1979 (44FR 33613).

3.0 TECHNICAL APPROACH

The purpose of this section is to present the technical approach for addressing the key elements of the various air quality impact analyses discussed in this report. These key elements include: (1) determining GEP stack height; (2) defining air quality impact areas; (3) establishing the emission inventories to be analyzed; (4) estimating background air quality conditions; (5) describing the dispersion modeling methodologies to be used to estimate PSD increment consumption and compliance with ambient standards; and (6) evaluating other air quality-related impacts (e.g., visibility impairment, source growth, effects on soils and vegetation, cooling tower impacts, and the potential for adverse health effects).

3.1 GOOD ENGINEERING PRACTICE STACK DETERMINATION

A stack built to GEP height will avoid atmospheric downwash effects and eliminate this from having to be considered for dispersion modeling.

The GEP stack height (H_g) is defined by the following equation (EPA, 1985):

$$H_g = H_b + 1.5\,(L)$$

where: H_b = the height of nearby structures
L = the lesser dimension of the height or projected width of nearby structures

The length, width, and height dimensions of the adjacent boiler building and coal storage-silo bay, which are the tallest buildings on the site, and other nearby structures with the potential to cause building downwash have been considered in this evaluation. The downwind distance to which a nearby structure is presumed to have a significant influence on the stack emissions is limited to 5(L).

For the proposed ICL plant, a GEP stack height of 500 feet was determined from the above formula. This GEP stack height was calculated based on the height of the boiler building (200 feet) and the maximum projected width of the boiler building (209.3 feet). Since ICL intends to use a sub-GEP stack height of 495 feet (above grade), the dispersion modeling analyses were based on this sub-GEP stack height.

3.2 DEFINING THE IMPACT AREAS

As a conservative approach, the impact areas for each criteria pollutant, (i.e., SO_2, TSP, PM-10, NO_2 and CO) are defined as a circular area whose radius is equal to the greatest distance to which dispersion modeling shows that the proposed emissions will have a significant impact. These significant ambient air quality impact levels are given in Table 3-1 (EPA, 1987a).

Impact area determinations for each averaging period applicable to these pollutants were made using the dispersion modeling approach discussed in Section 3.5. The circle enclosing the farthest radial distance to which significant impacts are predicted defines the "modeling area" for a specific pollutant and averaging time. If there is no significant impact area for a given pollutant emitted by the proposed facility, no further modeling is needed for that pollutant. Based on the modeling results in Section 5.1, significant impact areas for the criteria pollutants subject to PSD review for the proposed ICL plant are summarized in Table 3-2. Impact areas extend to 4.25 km and 4.5 km for SO_2 (24-hour average) and NO_2 (annual average), respectively. Other pollutants have no significant impact areas calculated. The following section addresses the development of the modeled emission inventory on the basis of these results.

3.3 ESTABLISHING THE EMISSION INVENTORY

The emission inventory for the proposed ICL plant is presented in Section 2.1.2. Generally, when a proposed facility has a significant air quality impact for one or more criteria pollutants, it is necessary to identify those other sources in the area that emit those pollutants in significant amounts (i.e., 100 tons per year) or that consume available PSD increment levels. The procedure for developing these interactive and PSD increment consuming emission inventories is to identify any sources of these two types that are located in or have a significant impact on the impact area of the proposed source.

The modeling results show that there are significant SO_2 and NO_2 impacts; therefore, other sources of these pollutants need to be identified.

Emission parameters for the proposed ICL plant under different operating loads are presented in Section 4.2.

3.4 BACKGROUND AIR QUALITY DETERMINATION

Representative air quality monitoring data are needed to determine background levels for those pollutants with estimated significant impacts. EPA guidance specifies that generally 1 year of onsite air quality and meteorological monitoring data is required to support the PSD permit application (EPA, 1987a). However, the use of existing, representative data is acceptable if the impacts of the applicable pollutants: (1) are below the monitoring de minimis levels (see Table 3-3); (2) do not threaten the PSD increment or the NAAQS; or (3) do not significantly impact the nearest Class I PSD area.

The impacts of all criteria pollutants are well below the de minimis monitoring levels and do not pose a threat to either the PSD increments or the NAAQS (see Section 5.2 and 5.3). Therefore, an onsite monitoring program is not required, and existing air quality data collected adjacent to the ICL site will be used to demonstrate compliance with the air quality standards (FDER letter, July 23, 1990, see Attachment A).

Existing air quality data are available from monitoring stations operated by Florida (FDER, 1987-1989) for the criteria pollutants and by Florida Power & Light (FPL) (October 1988 - October 1989) for SO_2, NO_2, PM-10, and ozone for the Martin Coal Gasification/Combined Cycle (CG/CC) project in the immediate vicinity (within about 3 miles) of the proposed ICL plant. The criteria for determining data representativeness consider monitor location, data quality, and how current the data are (EPA, 1987a). Section 5.3.1 discusses the evaluation of data representativeness and identifies the background levels to be used.

Since recent monitoring data are available, the FDER considers it appropriate to define 3- and 24-hour average background levels based on the highest of the second-highest concentrations over the most recent 3-year measurement period. Annual average background levels are determined from the highest of the annual average values measured over the 3-year period. Total impacts are calculated as the sum of the incremental modeled concentration (see Section 3.5) and the corresponding background level. This is a conservative approach because: (1) the day associated with the incremental modeled concentration does not coincide with the day of maximum background measurement; (2) the greater of the background values, determined as above from among the regional stations considered, was used, and (3) for PM-10, incremental TSP concentrations were used.

3.5 DISPERSION MODELING ANALYSIS

3.5.1 PSD INCREMENT CONSUMPTION

TSP impacts (see Section 5.1.2) due to emissions from the ICL stacks and fugitive sources are less than the significant levels specified for annual and 24-hour averging periods and are, therefore, not considered in the PSD incremental analysis.

As indicated in Section 3.2, significant impact areas were identified for SO_2 and NO_2. Therefore, PSD increment consuming sources which emit SO_2 and NO_2 and are located in or have significant impacts on the significant impact area of the proposed source are included in the PSD incremental analysis.

3.5.2 AMBIENT AIR QUALITY STANDARD COMPLIANCE

Compliance with the applicable federal and state ambient air quality standards listed in Table 2-5 will be demonstrated through the dispersion modeling results presented in Section 5.1. These modeled concentrations were combined with representative background air quality levels determined in accordance with the technical approach outlined in Section 3.4 to determine the total impact. Again, because SO_2 and NO_2 emissions from the proposed ICL plant have their significant impact areas established, other major SO_2 interactive sources located in or having a significant impact on the impact areas of the proposed source are considered in evaluating the total combined impacts to the ambient air quality. TSP and PM-10 impacts were based on emissions only from the proposed facility for the reasons given above. Results from the separate analyses of fugitive and stack emissions were included. Lead and other pollutants that have health-related no-threat levels established by the FDER are also addressed.

SO_2 is the primary pollutant of concern for this project. Short-term impacts for other pollutants were scaled from SO_2 modeling results in proportion to their respective emission rates. Annual average NO_2, TSP, and PM-10 impacts were scaled directly from the SO_2 modeling output.

The ratios between CO and SO_2 emissions are 0.65 and 2.67 for the main boiler and the auxiliary boiler stacks, respectively. Thus, the maximum CO 1- and 8-hour impact locations do not necessarily occur at the same locations as those based on the SO_2 emissions. Consequently, 1- and 8-hour average CO impacts were modeled independently.

According to EPA modeling guidance (EPA, 1986a), it is appropriate to use the highest second-highest modeled concentration for short-term averaging periods (i.e., 1-, 3-, 8-, and 24-hour) when the analysis is based on the use of 5 years of offsite meteorological data (see Section 4.3). Annual average impacts are to be based on the maximum modeled value over the 5-year period. This guidance was followed in presenting the results given in Section 5.1.

3.5.3 MODEL SELECTION

The air quality dispersion modeling analyses required to support this PSD permit application are identified in the sections above and are described in more detail in Section 4.0. The EPA Industrial Source Complex - Short Term (ISCST) dispersion model (EPA, 1987b) was selected for these analyses because of its ability to simulate the dispersion of emissions from multiple point and area sources. In addition, the model is capable of accounting for building wake effects on dispersion, allowing for variable emission rates with time and with meteorological conditions (e.g., wind erosion), and considering the effects of particle deposition by gravitational settling. This latter phenomenon occurs with a significant fraction of the relatively large particle sizes found in fugitive dust emissions. These capabilities have resulted in EPA's designation of ISC as the preferred model for estimating concentrations from sources with these characteristics (EPA, 1986a).

The current version of the ISCST model (dated 88348) was used. This version incorporates the Schulman-Scire direction-dependent building wake algorithm and other enhancements. Current EPA guidance suggests that the ISCLT (Long Term) model not be used because of several inaccuracies in the code. As a result, annual average concentrations in these analyses were based on the "N-Days" averaging option in the ISCST model.

Output results for these dispersion modeling analyses are presented in Section 5.1.

3.6 VISIBILITY IMPACT ANALYSIS

A visibility impact analysis is one of three additional analyses required to be made in support of the air quality portion of a PSD permit application.

There are no Federal PSD Class I areas within 100 km of the proposed site. The closest PSD Class I area is the Everglades National Park located about 145 km south of the proposed site. A visibility screening analysis was performed to determine the potential visibility impairment. The FDER-suggested VISCREEN model (EPA, 1988c) was used to perform this analysis.

3.7 OTHER AIR QUALITY RELATED IMPACTS

Besides the visibility impact analysis discussed in the previous section, two additional impact analyses are required to support this PSD permit application. They are a soils and a vegetation impact analysis. In addition, two other analyses were performed. The first of these analyses addresses the potential for enhanced fogging and icing conditions resulting from the operation of the heat dissipation system (cooling tower) at the plant. The second analysis addresses the potential for adverse health effects due to the emission of air toxics from the facility.

3.7.1 GROWTH ANALYSIS

The typical elements of the growth analysis include: 1) a projection of the associated industrial, commercial, and residential growth that will occur in the area; 2) an estimate of the air pollution emissions generated by associated permanent growth; and 3) an air quality analysis which includes these estimates.

The availability of residential, commercial, and industrial services in the area was assessed first. Next, new growth which must occur to support the proposed source was predicted. The amount of residential growth depends on the size of the available work force, the number of new employees, and the availability of housing in the area. Industrial growth is growth in those industries providing goods and services, maintenance facilities, and other large industries necessary for the operation of the proposed facility. Based on the predicted growth, an estimate of the air pollution which likely would evolve from permanent residential, commercial, and industrial growth was developed. Excluded from consideration were emissions from temporary sources associated with construction activities at the ICL plant and mobile sources. Using the developed air pollution estimates for the area, a qualitative air quality impact assessment for these minor sources was performed. Section 7.1 presents the results of this analysis.

3.7.2 EFFECTS ON SOILS AND VEGETATION

For most soil classifications and vegetation found in the area, ambient air concentrations of criteria pollutants below the NAAQS and FAAQS will not result in detrimental effects. As discussed in Section 3.2, maximum ground-level concentrations of all the criteria pollutants emitted from the facility are insignificant and well below the aforementioned standards. Section 7.2 outlines potential impacts associated with the major criteria pollutants. These impacts are based on published sensitivity levels compared to the modeled impacts discussed in Section 5.1.

3.7.3 COOLING TOWER IMPACTS

A linear, mechanical draft, counter-flow cooling tower (with a bank of 10 cells) is proposed to meet the closed-loop cooling requirements of the ICL plant. The cooling tower is designed to handle a heat load of 1,655 MMBtu per hour, with a circulating water flow rate of 265,000 gallons per minute (gpm) and an air flow rate of 1,575,400 cubic feet per minute (cfm) per cell at the design condition of 80 °F ambient wet bulb temperature, a cold water temperature of 90 °F, and a hot water temperature of 103 °F.

The operation of the cooling tower could affect the vegetation in terms of salt deposition and the local climatology in terms of visible plumes, icing, and fogging in the immediate vicinity of the proposed facility.

Cooling Tower Impact Model. The environmental impacts due to operation of the proposed cooling tower were evaluated using the Seasonal/Annual Cooling Tower Plume Impact model (SACTI), which is sponsored by Electric Power Research Institute (EPRI, 1984). This numerical model is an extension of an earlier model evaluation study carried out by Argonne National Laboratory. The SACTI model uses the cooling tower effluent release parameters to determine a series of combinations of the meteorological variables that represents the full range of atmospheric conditions affecting plume dispersion and deposition. The model calculates: salt deposition rate from the plume drift; visible plume length/height; and fogging/icing for the determined meteorological conditions.

3.7.4 HEALTH EFFECTS EVALUATION FOR AIR TOXICS

The health effect evaluation for releases of air toxics to the atmosphere from this facility follows that described in the "Florida Air Toxics Permitting Strategy" (FDER, draft 1990). Only pollutants that do not have an NAAQS have been examined, since the primary NAAQS is a health-based standard. A demonstration of compliance with the primary NAAQS (i.e., for lead) is considered to adequately provide the health risk assessment. For each emitted toxic air contaminant, the model-predicted concentrations are compared to the "no-threat" levels which may be associated with various (i.e., 8-hour, 24-hour, or annual) averaging times. A set of the "no-threat" levels has been provided by the FDER. If a source does not meet the no-threat levels for each toxic air contaminant, a number of measures suggested by the FDER may be used for reevaluation.

Table 3-1
PSD SIGNIFICANT AMBIENT AIR QUALITY IMPACT LEVELS

	Averaging Time				
Pollutant	Annual	24-Hour	8-Hour	3-Hour	1-Hour
SO_2	1 $\mu g/m^3$	5 $\mu g/m^3$	--	25 $\mu g/m^3$	--
TSP/PM_{10}	1 $\mu g/m^3$	5 $\mu g/m^3$	--	--	--
NO_2	1 $\mu g/m^3$	--	--	--	--
CO	--	--	0.5 $\mu g/m^3$	--	2 mg/m^3

Source: EPA, 1987a

Note: This table does not apply to Class I areas. A significant impact for Class I areas is 1 $\mu g/m^3$ on a 24-hour basis for PM_{10} and SO_2.

Table 3-2
SIGNIFICANT IMPACT RADII FOR THE ICL SOURCES

Pollutant	Radii (km)	Averaging Time
SO_2	0.5	Annual
	4.25	24-hr
	0	3-hr
NO_2	4.5	Annual
TSP/PM-10	0	Annual
	0	24-hr
CO	0	8-hr
	0	1-hr

Source: Bechtel, 1990

Note: Stack emissions from the main boiler and the oil-fired auxiliary boiler are both considered in the impact radii determination.

Table 3-3
PSD SIGNIFICANT MONITORING CONCENTRATIONS

Pollutant	Air Quality Concentration ($\mu g/m^3$) and Averaging Time
Carbon monoxide	575 (8-hour)
Nitrogen dioxide	14 (Annual)
Sulfur dioxide	13 (24-hour)
Particulate matter (TSP)	10 (24-hour)
Particulate matter (PM-10)	10 (24-hour)
Ozone	a
Lead	0.1 (3-month)
Asbestos	b
Beryllium	0.001 (24-hour)
Mercury	0.25 (24-hour)
Vinyl chloride	15 (24-hour)
Fluorides	0.25 (24-hour)
Sulfuric acid mist	b
Total reduced sulfur (including H_2S)	c
Reduced sulfur (including H_2S)	c
Hydrogen sulfide	0.2 (1-hour)

Source: EPA, 1987a.

a No specific air quality concentration for ozone is prescribed. Exemptions are granted when a source's VOC emissions are 100 tons/year.

[b] No acceptable monitoring techniques available at this time. Therefore, monitoring is not required until acceptable techniques are available.

[c] No acceptable monitoring techniques available at this time. However, techniques are expected to be available shortly.

4.0 DISPERSION MODEL INPUTS

Various features of the ISCST dispersion model were used to estimate air quality impacts from the proposed facility in two distinct analyses. The model was run:

- o With constant emission rates to evaluate ambient concentrations for all the receptors
- o With variable emission rates and particle settling characteristics to simulate dispersion of fugitive particulate emissions.

The purpose of this section is to describe the various model inputs required for these analyses, including model options, emissions data, meteorological data, receptor grids, and other relevant information. Since SO_2 is the primary pollutant of interest for this project, the model was run using SO_2 emission rates. Concentration values for other pollutants were scaled from these results in proportion to the respective emission rates for each pollutant.

Model input information for the visibility impact assessment is presented separately in Section 6.1. Likewise, the analysis of cooling tower impacts, which includes the dispersion of particulate material in the cooling tower drift, is discussed in Section 7.3.

4.1 MODEL OPTIONS

Each of the two modeling analyses identified above used different features of the ISCST model to estimate air quality impacts at various receptor locations. Model options were selected to meet applicable EPA criteria, to account for different pollutant dispersion characteristics, and to provide results based on different averaging durations, as required.

Model options that were selected include: 1-, 3-, 8-, and 24-hour and annual averages and rural mode (see Section 4.5). Buoyancy-induced dispersion was used because the proposed sources involve fuel combustion (EPA, 1986a). Since sub-GEP stack heights were used for the proposed sources, the gradual plume rise option was selected in conjunction with the building downwash option (EPA, 1986a). The stack tip downwash option was not used because the building downwash option was already selected (PDER, 1983; MDAQC, 1984); and the calm processing routine was used to calculate concentrations during calm periods (EPA, 1986a). The equivalent regulatory default options associated with the meteorological input data are discussed in Section 4.3.

The resultant SO_2 concentration values were used to scale 24-hour and annual average TSP and PM-10 impacts, annual average NO_2 concentrations, 1-hour and 8-hour CO concentrations, and quarterly average lead impacts.

There are numerous sources of fugitive particulate emissions within the proposed facility. They include among others: storage silos, coal unloading and reclaim hoppers, coal conveyors, crusher tower, and an inactive storage pile. Section 4.2.1 describes the emission rate characteristics of these sources in more detail. From a modeling standpoint, vent emissions were treated as point sources. Furthermore, emissions from certain sources were variable as a function of operating schedule. The physical characteristics of the emissions were also considered for some of the sources in order to account for the effects of gravitational particle settling. These aspects of the analysis, as well as the selection of other options, are discussed further in this section.

For fugitive particulate emissions, two of the more general options selected include flat terrain (see Section 4.4) and rural mode (see Section 4.5). The regulatory default option was not chosen because several of the default values were not applicable. Specifically, stack tip downwash does not apply since, by definition, fugitive emissions are those which do not pass through a stack. Likewise, since these emissions are released at ambient temperatures, buoyancy induced dispersion did not have to be accounted for. The arbitrary selection of final plume rise has essentially no effect on the dispersion calculations since all of the emissions are at ambient conditions with virtually no exit velocity. The release height of the fugitive source was used as the point source stack height. To simulate fugitive emissions without plume rise, the stack exit velocity, diameter, and temperature were assumed to be 0.001 m/s, 1 m, and 0 °C (273 °K), respectively (TACB, 1988). In the ISCST model, a stack temperature of 0 °C is a default value which sets the stack and ambient temperature (read from the sequential hourly data) to the same value for model calculations if the ambient temperature is greater than 0 °C. Since it is rare for the ambient temperature to be lower than 0 °C at West Palm Beach, the selection of 0 °C as the stack temperature will ensure that no thermal plume rise is permitted for modeling fugitive particulate sources. Processing of concentrations under calm wind conditions was also accounted for.

The inactive coal storage pile, which is covered with soil and seeded to minimize emission, has a capacity to store a 30-day supply. It will be used only if there is an interruption of supply; thus, no normal operational schedule is planned. Since the pile will not be disturbed under normal operational conditions, fugitive emissions from the inactive coal storage pile were not included in the modeling.

Emissions for the remaining fugitive sources were assumed to vary as a function of time of day. Schedules were based on typical operating experience at maximum material handling rates. An operational day of 8 hours was assumed to extend from 7 A.M. through 3 P.M., represented in the model by hours 7 through 14. This is a conservative approach from a dispersion standpoint, since relatively more stable conditions occur earlier in the day.

Finally, gravitational settling of particulate emissions was accounted for by distinguishing the amount of material in the 30- and 10-micron size ranges (i.e., the nominal TSP and PM-10 size categories, respectively). Size categories were defined based on information in the technical literature. Other settling parameters (i.e., settling velocity and reflection coefficients) were developed in accordance with ISC model users guidance (EPA, 1987b).

4.2 EMISSIONS INVENTORIES

The purpose of this section is to identify the emission characteristics of the sources included in the various modeling analyses described above. For the proposed ICL plant, both stack and fugitive emission sources are described. Characteristics of the particulate emissions resulting from operation of the plant cooling tower are discussed in Section 7.3.2.

4.2.1 PROPOSED SOURCE

Air pollutants will be emitted from a single stack at the proposed facility. Fugitive particulate emissions from a variety of material handling and storage sources will also occur. The following subsections describe these sources in more detail.

Stack Emissions. For the purpose of the modeling analyses described in this section and in Section 5.0, emissions from the ICL main stack are based on coal-firing. Emission rates and characteristics at three operating loads were considered (i.e., full or 100 percent load, 75 percent, and 50 percent). Operating parameters are presented in Table 4-1, as well as emission rates for SO_2, NO_x, particulates, lead, and CO. To be conservative, PM-10 emissions, which are a subset of TSP emissions from the stack, are assumed to be the same in these analyses. Emission rates and stack parameters for the oil/gas-fired auxiliary boiler are presented in Table 4-2. Figure 4-1 identifies the ICL plant main and auxiliary boiler stacks as Items 12 and 11, respectively.

Fugitive Emissions. Fugitive particulate emissions will occur at the proposed plant from various material (i.e., coal and lime) handling and storage (coal) operations. Figure 4-2 depicts a flow diagram for these coal operations. Emission parameters for these sources are listed in Table 4-3. Emission rates based on maximum material throughput were input to the model.

A brief description of these sources follows. Plot plan identification numbers corresponding to Figure 4-1 are also given.

- Coal Unloading Hopper and Feeder (1). Coal arrives on site via bottom-dump rail cars. The unloading facility will be enclosed with dust collection and suppression equipment and includes a side-mounted car shaker. The hopper is located below ground level.

- Coal Unloading Conveyor (2). A belt conveyor, enclosed in a tubular gallery, is provided between the unloading structure and tripper conveyor. A belt scale is also provided. The unloading conveyor will have a dust collector.

- o Stacking Tripper Conveyor (3). A tripper conveyor is provided in the coal storage building. The conveyor is equipped with a traveling carriage and discharge chute in order to form a longitudinal coal pile.

- o Active Coal Storage Pile (3). The active coal pile is rectangular in shape, about 35 feet high. It is enclosed by an A-frame building, with the stacking conveyor entering at one end. Dust collection equipment is provided for transfer points in the enclosure.

- o Inactive Coal Storage Pile. The inactive storage pile (coal storage yard) is about 45 feet high, with a 30 degree slope. The inactive pile is built up in compacted layers. The pile will be covered with soil and seeded to minimize fugitive dust.

- o Emergency Reclaim Hopper (3). The emergency reclaim hopper, located inside the coal storage building, will be used to reclaim coal from the inactive coal pile via mobile equipment.

- o Reclaim Conveyor (3). Normal reclaim is by a portal scraper reclaimer which removes coal from the side of the active pile and deposits it in the reclaim conveyor, located inside the coal storage building.

- o Emergency Reclaim Pile (4). This is an outdoor "come-and-go" type of pile sized to accommodate up to 30 carloads of incoming coal.

- o Emergency Stackout Conveyor (4). A dust collector and "lowering well" will be provided at the discharge end.

- o Crusher Feed Conveyor (Transfer Conveyor) (3,5). This conveyor, enclosed in a tubular gallery, transfers coal from the coal storage building to the crusher tower.

- o Crusher and Transfer Building (5). The crusher transfer building houses equipment to reduce the coal in size and transfer it to a conveyor system leading to the day storage silos. The building is enclosed with dust collection systems at the crusher and all transfer points.

- o Plant Feed Conveyor (5,6). This conveyor transports the crushed coal to the storage silo feed tripper. The conveyor is enclosed in a tubular gallery.

- o Silo Distribution Tripper (6). Located inside the boiler building, this system directs the crushed coal to four operating storage silos and one spare silo serving the boiler unit at the plant. A dust collection system covers all silos and coal transfer points between conveyors.

- o Coal Silos (6). These silos hold coal prior to feeding it to the boiler burner system. The silos are covered except for the opening to receive coal from the silo distribution tripper.

- o Ash Storage Silo (7). Fly ash collected from the baghouse hoppers is stored in an elevated silo. The silo has filters to collect dust as ash is loaded into the silo and from dust collected in the silo cyclone separator baghouse.

- o Recycle Ash Silo (8). Fly ash collected from the baghouse hoppers is conveyed to the recycle ash silo for use in the lime slurry plant. The silo has a vent filter. The recycle ash slurry plant below the silo is enclosed.

- o Lime Silo (9) and Lime Slurry Plant (10). Lime is pneumatically transferred from rail car or truck to silo. The silo is equipped with a filter and dust collector. The dust collector is also used for the lime feed system. The reagent pre-operation area is enclosed.

- o Soda Ash Silo (13). Soda ash for use in the circulating water system sidestream softener is stored in the soda ash silo. The silo is equipped with a vent filter. The reagent preparation area below the silo is enclosed.

4.2.2 PSD INCREMENT CONSUMING SOURCES

Sections 3.3 and 3.5.1 relate the fact that because there are significant SO_2 and NO_2 impacts due to stack emissions from the proposed ICL, a PSD increment consumption analysis is necessary. PSD sources are those sources which commenced construction after the base line date for a specific pollutant. The base line establishes which sources in the area of the proposed ICL plant will consume PSD increments. Based on the FPL Martin CG/CC Project Site Certification Application (1989), it was indicated that the base line dates established by the FDER for SO_2 are January 6, 1975 for sources greater than 100 tons/year and December 27, 1977 for sources less than 100 tons/year. For NO_2, the base line date is February 8, 1988.

A summary of the increment-consuming sources within and/or affecting the ICL plant's significant impact areas has been extracted from the SCA for the Martin CG\CC project. The Martin CG/CC project has an SO_2 significant impact area at a distance of 50 km from the Martin site. Thus, the emission inventories provided by the FDER to that project approximately covered a 50 km radius of the Martin site. The Martin CG/CC project in its SCA also applied the "Screening Threshold" method (North Carolina DNR, 1985), which is approved by both EPA and FDER, to objectively eliminate those sources in the emission inventory which are not likely to have a significant interaction with the source undergoing evaluation. The source screening procedure was applied such that sources emitting more than 25 tons/year of an applicable pollutant and located within 15 km of the Martin site and sources emitting more than 100 tons/year and located between 15 and 50 km from the Martin site were included both in the PSD increment impact and ambient background analyses. Since the proposed ICL plant is located only about 3 miles from the Martin site, the PSD-consuming sources that have been identified by the Martin CG/CC project are considered to be applicable for the ICL plant as well. Additionally, the SO_2 and NO_2 significant impact areas of the ICL plant are within distances of 4.25 km and 4.5 km, respectively from the stack; however, the significant impact areas for the Martin CG/CC project cover radii of 50 km and 7.5 km from the Martin site. Because of the short distance between the proposed ICL site and the Martin CG/CC site, it is conservative to include source inventories identified in the Martin CG/CC project in the ICL plant's impact analysis.

Furthermore, the FDER indicated in July 1990 that there are no other new PSD-increment-consuming sources in the vicinity of the ICL plant site since the submittal of Martin's SCA in 1989. Multiple-stack background facility emissions were combined and assumed to be emitted from the stack with the highest emission rate using that stack's emission parameters. A summary of the PSD increment-consuming sources for the proposed ICL impact analysis is presented in Table 4-4.

4.2.3 BACKGROUND SOURCES

A background interactive source analysis is required based on the same reason stated above. Similarly, a summary of the base line interactive sources within and/or affecting the ICL plant's significant impact area has been extracted from the SCA for the Martin CG/CC project. In the Martin CG/CC project, the screening threshold method was applied in identifying the background sources within a radius about 50 km of the Martin site (see Table 4-5). Again, since this set of base line interactive sources covers a radius of about 50 km, the use of these data is conservative for the proposed ICL plant.

4.3 METEOROLOGICAL DATA

Onsite meteorological data are not required for the proposed ICL plant. In this case, EPA modeling guidance requires modeling analyses to be based on the use of 5 years of meteorological data from the nearest monitoring location with conditions representative of the site area (EPA, 1986a).

The closest first-order National Weather Service (NWS) station is located in West Palm Beach, Florida, about 26 miles east-northeast of the proposed facility. Sequential, hourly meteorological data and twice-daily upper air soundings collected at West Palm Beach for the years 1982-1986 were provided by the FDER for use in the air quality analysis. Joint frequency distributions of wind speed, wind direction and stability are presented in Table 4-6. Five-year composite seasonal and annual wind roses are presented in Figures 4-3(a) through 4-3(e).

Default wind speed profile exponents and vertical potential temperature gradients, equivalent to those selected under the regulatory default option of ISCST, were also chosen.

4.4 RECEPTOR GRIDS

This section describes each of the receptor grids used for the two phases involved in the air quality impact analysis made with the ISCST model.

The significant impact area and the screening analyses used a polar receptor grid centered on the plant stack. The grid system consists of 36 direction radials, each separated by 10° increments. As suggested by the FDER, receptors were placed at ground level at successive 250-meter intervals. The coarse-mesh receptor grid provides sufficient resolution and downwind coverage to determine the extent of the significant impact area for each pollutant and the locations of all critical receptors to be evaluated in the refined phase of the analysis.

The refined phase of the air quality impact analysis used a fine-grid (100 m grid resolution) centered over each critical receptor identified in the screening phase analysis, such that two rings were added to either side of the critical receptor.

Impacts due to fugitive particulate emissions were estimated using Cartesian coordinate receptor grids. Fugitive dust tends to be released near ground level with insignificant plume rise. As a result, higher particulate concentrations are expected to occur at the plant property line. Therefore, discrete receptors were placed along the irregularly shaped ICL property line at each 10° azimuth direction using the main stack as the origin. In order to evaluate the expected decrease in particulate concentrations with increasing downwind distance, one downwind ring distance (100 m) was placed beyond the ICL property line. The closest site boundary is to the east-southeast of the main stack. Receptors near this section of the site boundary were selected in the same manner as in modeling TSP impact from the ICL stacks in order to assess the maximum combined impact. All receptors in the fence line and other grid points were assumed to be at ground level. Figure 4-4 shows the locations of the discrete receptors input to the model, as well as the plant stacks. Receptor identifications are shown in Figure 4-4, and their corresponding coordinates are presented in Table 4-7.

4.5 LAND USE CLASSIFICATION

An evaluation to determine whether the area is considered to be urban or rural, for the purposes of atmospheric dispersion modeling, was made based on land use characteristics and topographic features in the site area. The evaluation considers the Auer land use classification method (Auer, 1978) referenced in Section 8.2.8 of the Guideline on Air Quality Models (EPA, 1986a).

Approximately 95 percent of the area within a 3-km radius of the proposed facility has land use characteristics ascribed to a rural setting. Marshlands (Type A3) take up about 45 percent of the area. From the south of these Type A3 areas to the west of the Indiantown township, the land use is predominantly orchard (Type A2, agricultural rural). This accounts for about 35 percent of the total area evaluated. Interspersed within these two areas are woodlands, classified as A4 (undeveloped rural) and characterized as heavily wooded and having greater than 95 percent vegetation. These Type A4 areas make up about 15 percent of the entire area evaluated.

The only substantial area considered to be characteristic of an urban environment is located on the north and east-northeast of the ICL plant. The Caulkins Citrus Processing Plant and Florida Steel Corporation located here can be classified as Type I1 (heavy industrial), but make up only about 4 percent of the total area. Part of the Indiantown residential area is located about 3 km to the east-southeast of the ICL. The land use type may be classified as R2 (compact residential). However, this residential area accounts for a minimal portion (less than 1 percent) of the total area. Thus, for air quality impact modeling, the overall area is considered as rural.

Table 4-1
MAIN STACK EMISSION PARAMETERS INPUT TO ISCST

Parameter	Coal-Firing 100%	75%	50%
Stack Height (ft)	495	495	495
Stack Diameter (ft)	16	16	16
Flow Rate (acfm)	1,206,400	892,700	615,250
Exit Temperature (°F)	140	140	140
Exit Velocity (ft/sec)	100	74	51
Stack Base Elevation (ft)	12	12	12
Emission Rates (lb/hr)			
SO_2	582.6	461.5	310.2
NO_x	582.6	461.5	310.2
Particulate[a]	61.7	48.9	32.8
CO	377.0	298.6	200.7
Lead	0.034	0.027	0.018

<u>NOTE</u>:

a - TSP and PM-10 particulate emission rates are assumed to be the same for this analysis.

Table 4-2
AUXILIARY BOILER STACK PARAMETERS INPUT TO ISCST

Parameter	No. 2 Fuel Oil	Natural Gas
Stack Height (ft)	90	90
Stack Diameter (ft)	5.5	5.5
Exit Temperature (°F)	500	480
Exit Velocity (ft/sec)	103	102
Emission Rates (lb/hr)		
SO_2	17.7	0.61
NO_x	68.2	35.8
Particulate[a]	1.4	0.5
CO	47.3	33.6
VOC	0.63	1.35
Lead	4.155×10^{-3}	*

NOTES:

a - TSP and PM-10 particulate emission rates are assumed to be the same for this analysis.
* - Not applicable

Table 4-3
FUGITIVE EMISSIONS

Source Point	Emission Point	Discharge Height (ft)	Control Eff. (%)	Maximum Emission (lb/hr)	Hours at Max. Rate (per day)
	<u>Coal Handling</u>				
1	Coal Unloading Area				
	Unloading Hopper[C]	25	99	0.34	4
	Unloading Hopper Pit[D]	25	99.8	0.00098	4
2	Storage/Trans. Tower Area				
	Stackout Conveyor[D]	75	75	0.695	4
		75	99.8	0.00112	4
	Transfer Conveyor[D]	75	99.8	0.00088	4
3	Coal Reclaim Area[D]	75	99.8	0.000704	8
4	Emergency Reclaim Area	25	-	-	-
5	Crusher Tower Area				
	Crusher[E]	75	99.8	0.288	8
	Transfer Conveyor[D]	75	99.8	0.000704	8
6	Silo Bay Area				
	Coal Silo[F]	180	99.8	0.00032	8
	Transfer Conveyor[D]	180	99.8	0.000710	8
	<u>Ash Handling</u>				
7	Ash Silo Area				
	Discharge[B]	120	99.8	0.0648	12
	Unloading[B]	120	99.8	0.144	8
8	Ash Recycle Silo[B]	75	99.8	0.0588	12
	<u>Lime Handling</u>				
9	Lime Silo Area[A]	120	99.8	0.012	16
10	Lime Slurry Plant[A]	60	99.8	0.0012	12
13	Soda Ash Silo[A]	75	99.8	0.0024	12

References: A = EPRI, 3-59; B = UARG, 3-69; C = EPRI, 3-13; D = AP-42, 11.2.3
E = EPRI, 3-78; F = EPRI, 3-45
EPRI = EPRI, 1984; AP-42 = EPA, 1986; UARG = UARG, 1981

Table 4-4
BACKGROUND SOURCE EMISSIONS INVENTORY - PSD SOURCES

Source No. & ID	UTM Coords (km) East	UTM Coords (km) North	Stack Parameters H_s (m)	T_s (K)	V_s (m/s)	D_s (m)	Emission Rates (g/s) SO_2	PM	NO_2	Distance From Indiantown (km)
1 - Power Ventures	569.4	2975.9	19.2	422	22.6	0.9	6.8	(1)	88.1	25.8
2 - Fort Pierce Util.	566.8	3036.3	45.7	408	12.5	2.4	77.9	(1)	(1)	49.2
3 - U.S. Sugar Corp.	506.1	2956.9	45.7	340	25.2	2.2	85.7	14.7	(1)	54.0
4 - Atlantic Sugar	552.9	2945.2	27.4	339	9.7	2.0	11.8	4.8	(1)	45.7
5 - Osceola Farms	544.2	2968.0	27.4	341	16.9	1.9	33.4	7.2	(1)	23.1
6 - Sugar Cane Growers	534.9	2953.3	47.2	344	10.6	3.0	71.2	12.0	15.5	39.7
7 - U.S. Sugar Bryant Plant	538.8	2968.1	30.5	344	22.4	2.1	32.5	11.0	17.5	24.5
8 - Pratt & Whitney	558.1	2979.1	4.6	644	13.4	3.4	23.4	(1)	(1)	15.2
9 - Palm Beach	585.8	2960.2	76.2	505	24.9	2.0	44.1	(1)	(1)	48.4
10- FPL Martin CT (2)	542.9	2992.4	65.0	411	18.8	6.1	463.6	30.4	232.4	5.6
11- FPL Martin CT (2)	543.2	2992.4	65.0	411	18.8	6.1	463.6	30.4	232.4	5.3
12- FPL Martin AB (3)	543.0	2992.5	18.3	535	15.2	1.1	6.5	0.2	1.4	5.5
13- FPL Martin AB (3)	543.2	2992.5	18.3	535	15.2	1.1	6.5	0.2	1.4	5.5
14- FPL Martin DG (4)	543.0	2992.5	7.6	786	39.6	0.3	0.3	0.3	3.9	5.4
15- FPL Martin DG (4)	543.2	2992.5	7.6	786	39.6	0.3	0.3	0.3	3.9	5.4

H_s = Stack Height; T_s = Stack Exit Temperature; V_s = Stack Exit Velocity; D_s = Stack Exit Diameter
(1) No emissions data are available from FDER.
(2) Each source contains 4 units; emissions shown are the total amount (No. 2 oil @ 40 °F).
(3) Auxiliary boiler.
(4) Diesel generator.
Source: FPL Martin PSD, 1989.

Table 4-5
BACKGROUND SOURCE EMISSIONS INVENTORY - BACKGROUND SOURCES

Source No. & ID	UTM Coords (km) East	North	Stack Parameters H_s (m)	T_s (K)	V_s (m/s)	D_s (m)	Emission Rates (g/s) SO_2	PM	NO_2	Distance From Indiantown (km)
14- FPL Martin 1&2	543.1	2992.9	152.1	421	21.1	8.0	1743.8	218.0	654.0	5.64
15- Everglades Sugar	509.6	2954.2	21.9	477	10.1	1.1	40.5	(1)	(1)	53.16
16- U.S. Sugar Corp.	506.1	2956.9	22.9	344	25.3	1.9	68.3	51.6	(1)	54.0
17- Atlantic Sugar	552.9	2945.2	27.4	342	13.0	1.9	30.9	32.8	(1)	45.7
18- Osceola Farms	544.2	2968.0	27.4	341	23.6	1.9	56.4	30.1	(1)	23.1
19- Sugar Cane Growers	534.9	2953.3	24.4	336	14.4	1.6	51.6	52.8	17.1	39.7
20- U.S. Sugar Bryant Plant	538.8	2968.1	19.8	342	36.4	1.6	35.5	47.0	(1)	24.5
21- Pratt & Whitney	559.2	2978.3	15.2	533	40.2	0.9	74.0	(1)	60.5	16.5
22- FPL Riviere Plant	594.2	2960.6	90.8	408	18.9	4.9	2238.5	(1)	454.6	54.9
23- Caulkins Citrus Co.	548.1	2911.5	28.7	343	11.9	1.0	(1)	3.5	(1)	0.8

H_s = Stack Height; T_s = Stack Exit Temperature; V_s = Stack Exit Velocity; D_s = Stack Exit Diameter
(1) No emissions data are available from FDER.
Source: FPL Martin PSD, 1989.

Table 4-6
WEST PALM BEACH 1982-86 JOINT FREQUENCY TABLES

Frequency (%) of Wind Speed & Direction for Stability Class A

Surface Station No. 12844 Time Period: ANNUAL

Direction	Speed (m/s) 1.5	2.5	4.5	7.0	9.5	>11	Total
N	.0023	.0160	.0000	.0000	.0000	.0000	.0183
NNE	.0023	.0091	.0000	.0000	.0000	.0000	.0114
NE	.0023	.0114	.0000	.0000	.0000	.0000	.0137
ENE	.0000	.0114	.0000	.0000	.0000	.0000	.0114
E	.0000	.0251	.0000	.0000	.0000	.0000	.0251
ESE	.0068	.0137	.0000	.0000	.0000	.0000	.0205
SE	.0091	.0205	.0000	.0000	.0000	.0000	.0297
SSE	.0046	.0114	.0000	.0000	.0000	.0000	.0160
S	.0046	.0205	.0000	.0000	.0000	.0000	.0251
SSW	.0046	.0205	.0000	.0000	.0000	.0000	.0251
SW	.0114	.0205	.0000	.0000	.0000	.0000	.0319
WSW	.0023	.0114	.0000	.0000	.0000	.0000	.0137
W	.0023	.0228	.0000	.0000	.0000	.0000	.0251
WNW	.0000	.0023	.0000	.0000	.0000	.0000	.0023
NW	.0000	.0114	.0000	.0000	.0000	.0000	.0114
NNW	.0023	.0183	.0000	.0000	.0000	.0000	.0205
Total	.0548	.2464	.0000	.0000	.0000	.0000	

Calms = 15. hours Total Class Obs = .30%

Frequency (%) of Wind Speed & Direction for Stability Class B

Surface Station No. 12844 Time Period: ANNUAL

Direction	Speed (m/s) 1.5	2.5	4.5	7.0	9.5	>11	Total
N	.0228	.1141	.0593	.0000	.0000	.0000	.1962
NNE	.0091	.0776	.0639	.0000	.0000	.0000	.1506
NE	.0137	.0730	.1871	.0023	.0000	.0000	.2761
ENE	.0183	.0685	.1666	.0023	.0000	.0000	.2556
E	.0068	.1255	.3081	.0023	.0000	.0000	.4427
ESE	.0114	.1438	.3354	.0023	.0000	.0000	.4929
SE	.0228	.1346	.4290	.0046	.0000	.0000	.5910
SSE	.0137	.0867	.1438	.0023	.0000	.0000	.2464
S	.0342	.0844	.0730	.0000	.0000	.0000	.1917
SSW	.0160	.0844	.0753	.0000	.0000	.0000	.1757
SW	.0160	.1187	.0753	.0000	.0000	.0000	.2099
WSW	.0274	.0707	.1141	.0000	.0000	.0000	.2122
W	.0137	.0776	.0913	.0000	.0000	.0000	.1825
WNW	.0205	.0981	.0616	.0000	.0000	.0000	.1803
NW	.0205	.0867	.0639	.0000	.0000	.0000	.1711
NNW	.0114	.0936	.0776	.0000	.0000	.0000	.1825
Total	.2784	1.5380	2.3252	.0160	.0000	.0000	

Calms = 35. hours Total Class Obs = 4.16%

Table 4-6 (Contd.)

Frequency (%) of Wind Speed & Direction for Stability Class C

Surface Station No. 12844 Time Period: ANNUAL

Direction	1.5	2.5	4.5	7.0	9.5	>11	Total
			Speed (m/s)				
N	.0388	.1506	.3400	.0867	.0023	.0023	.6207
NNE	.0137	.0593	.2350	.1095	.0023	.0000	.4199
NE	.0228	.0685	.5796	.3103	.0205	.0000	1.0017
ENE	.0114	.0958	.6914	.4404	.0319	.0023	1.2733
E	.0091	.1209	1.0382	.6663	.0183	.0000	1.8529
ESE	.0183	.1050	1.2254	.7211	.0068	.0000	2.0765
SE	.0251	.1460	1.5152	.6458	.0114	.0000	2.3435
SSE	.0228	.1187	.6366	.2464	.0114	.0000	1.0360
S	.0730	.2191	.4153	.1118	.0068	.0000	.8260
SSW	.0502	.1004	.3126	.0776	.0000	.0000	.5408
SW	.0388	.1483	.2989	.0936	.0046	.0000	.5842
WSW	.0205	.0958	.2487	.0753	.0068	.0000	.4472
W	.0228	.0936	.2099	.0844	.0114	.0068	.4290
WNW	.0297	.0776	.2556	.0821	.0000	.0000	.4450
NW	.0297	.1164	.3537	.0730	.0091	.0000	.5819
NNW	.0365	.1346	.3423	.0753	.0000	.0000	.5887
Total	.4632	1.8506	8.6984	3.8997	.1438	.0114	

Calms = 99. hours Total Class Obs = 15.07%

Frequency (%) of Wind Speed & Direction for Stability Class D

Surface Station No. 12844 Time Period: ANNUAL

Direction	1.5	2.5	4.5	7.0	9.5	>11	Total
			Speed (m/s)				
N	.0548	.3674	.6846	.7142	.0662	.0023	1.8894
NNE	.0388	.1643	.3491	.8397	.0936	.0091	1.4946
NE	.0137	.1506	.6777	1.8985	.3126	.0251	3.0782
ENE	.0114	.1438	1.1615	3.4798	.5066	.0707	5.3738
E	.0274	.2168	1.7114	4.0206	.5454	.0799	6.6014
ESE	.0183	.2738	1.4718	2.0765	.0936	.0000	3.9339
SE	.0297	.4472	1.7251	1.9784	.0913	.0160	4.2876
SSE	.0365	.3217	.9675	1.1409	.0730	.0023	2.5420
S	.0388	.4267	.7918	.6731	.0479	.0000	1.9784
SSW	.0434	.2966	.4404	.2784	.0297	.0023	1.0907
SW	.0548	.3423	.4587	.3834	.0479	.0046	1.2915
WSW	.0411	.2373	.3628	.2715	.0342	.0091	.9561
W	.0411	.2350	.2921	.4039	.0844	.0228	1.0793
WNW	.0342	.2761	.3309	.5089	.1027	.0319	1.2847
NW	.0821	.3605	.7005	.8466	.0639	.0046	2.0582
NNW	.0479	.3377	.8329	.7667	.0274	.0046	2.0172
Total	.6138	4.5979	12.9587	20.2811	2.2202	.2852	

Calms = 161. hours Total Class Obs = 40.96%

Table 4-6 (Contd.)

Frequency (%) of Wind Speed & Direction for Stability Class E

Surface Station No. 12844 Time Period: ANNUAL

Direction	1.5	2.5	4.5	7.0	9.5	>11	Total
			Speed (m/s)				
N	.0525	.3286	.2510	.0023	.0000	.0000	.6344
NNE	.0251	.1232	.1689	.0000	.0000	.0000	.3172
NE	.0114	.1415	.5203	.0023	.0000	.0000	.6754
ENE	.0091	.1574	1.0976	.0137	.0000	.0000	1.2778
E	.0183	.3286	1.5243	.0160	.0000	.0000	1.8871
ESE	.0342	.4632	1.2345	.0114	.0000	.0000	1.7433
SE	.0844	.6982	1.1341	.0137	.0000	.0000	1.9304
SSE	.0434	.4678	.5568	.0046	.0000	.0000	1.0725
S	.0799	.7142	.4381	.0000	.0000	.0000	1.2322
SSW	.0616	.4427	.1734	.0023	.0000	.0000	.6800
SW	.0730	.4472	.2350	.0023	.0000	.0000	.7576
WSW	.0593	.3286	.2282	.0000	.0023	.0000	.6184
W	.0548	.3834	.2829	.0023	.0000	.0000	.7233
WNW	.0776	.4199	.2875	.0046	.0000	.0000	.7895
NW	.0685	.4723	.7553	.0000	.0000	.0000	1.2961
NNW	.0753	.5317	.5636	.0023	.0023	.0000	1.1752
Total	.8283	6.4485	9.4514	.0776	.0046	.0000	

Calms = 288. hours Total Class Obs = 16.81%

Frequency (%) of Wind Speed & Direction for Stability Class F

Surface Station No. 12844 Time Period: ANNUAL

Direction	1.5	2.5	4.5	7.0	9.5	>11	Total
			Speed (m/s)				
N	.2213	.3834	.0091	.0000	.0000	.0000	.6138
NNE	.0844	.1232	.0000	.0000	.0000	.0000	.2076
NE	.0502	.1757	.0023	.0000	.0000	.0000	.2282
ENE	.0593	.2829	.0068	.0023	.0000	.0000	.3514
E	.1050	.5317	.0068	.0023	.0000	.0000	.6458
ESE	.1666	.9949	.0137	.0000	.0000	.0000	1.1752
SE	.3012	1.2162	.0137	.0000	.0000	.0000	1.5311
SSE	.3788	.6800	.0091	.0000	.0000	.0000	1.0679
S	.4199	1.1318	.0000	.0000	.0000	.0000	1.5517
SSW	.4381	.7986	.0068	.0000	.0000	.0000	1.2436
SW	.4450	.9264	.0023	.0000	.0000	.0000	1.3737
WSW	.3719	.6777	.0205	.0000	.0000	.0000	1.0702
W	.4336	.8443	.0000	.0000	.0000	.0000	1.2778
WNW	.3742	.8123	.0023	.0000	.0000	.0000	1.1888
NW	.5043	.9858	.0068	.0000	.0000	.0000	1.4969
NNW	.3537	.7576	.0114	.0000	.0000	.0000	1.1227
Total	4.7075	11.3226	.1118	.0046	.0000	.0000	

Calms = 2277. hours Total Class Obs = 16.15%

Table 4-6 (Contd.)

Frequency (%) of Wind Speed & Direction for Stability Classes

Surface Station No. 12844 Time Period: ANNUAL

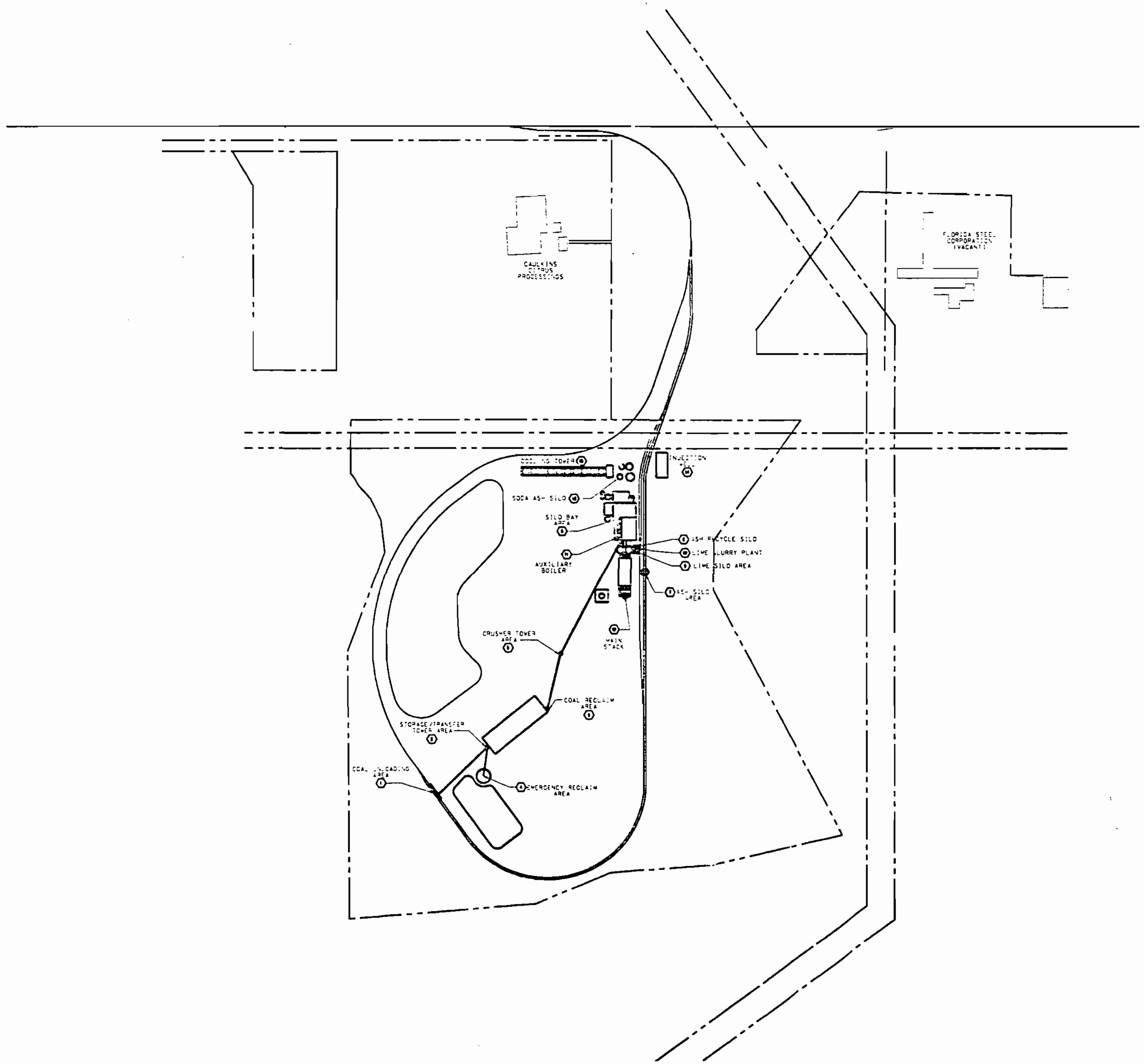
Direction	Speed (m/s) 1.5	2.5	4.5	7.0	9.5	>11	Total
N	.3925	1.3600	1.3440	.8032	.0685	.0046	3.9727
NNE	.1734	.5568	.8169	.9493	.0958	.0091	2.6013
NE	.1141	.6207	1.9670	2.2134	.3332	.0251	5.2734
ENE	.1095	.7599	3.1239	3.9385	.5385	.0730	8.5433
E	.1666	1.3486	4.5888	4.7075	.5636	.0799	11.4549
ESE	.2556	1.9943	4.2808	2.8112	.1004	.0000	9.4423
SE	.4723	2.6629	4.8170	2.6424	.1027	.0160	10.7133
SSE	.4997	1.6863	2.3138	1.3942	.0844	.0023	5.9807
S	.6503	2.5968	1.7182	.7850	.0548	.0000	5.8050
SSW	.6138	1.7433	1.0086	.3583	.0297	.0023	3.7559
SW	.6389	2.0035	1.0702	.4792	.0525	.0046	4.2488
WSW	.5225	1.4216	.9744	.3468	.0434	.0091	3.3178
W	.5682	1.6566	.8762	.4906	.0958	.0297	3.7171
WNW	.5362	1.6863	.9378	.5956	.1027	.0319	3.8906
NW	.7051	2.0331	1.8802	.9196	.0730	.0046	5.6156
NNW	.5271	1.8734	1.8278	.8443	.0297	.0046	5.1068
Total	6.9460	26.0040	33.5455	24.2789	2.3686	.2966	

Calms = 2875. hours
Missed Obs = 0 hours Total Obs = 43824. hours
Total No. of Days Counted = 1826

Notes: 1. Total observation includes calms.
2. The total days counted are for the entire data set.
3. NCC wind speed ranges (m/s): 1.5 (0-1.8); 2.5 (1.8-3.3); 4.5 (3.3-5.4); 7.0 (5.4-8.5); 9.5 (8.5-11)
4. Calm is defined as wind speed at 1 m/s or less (for dispersion modeling purpose only).

Table 4-7
DISCRETE RECEPTORS FOR FUGITIVE PARTICULATE ANALYSIS

ID	X (m)	Y (m)	ID	X (m)	Y (m)
1	74.3	388.6	40	251.5	-34.3
2	182.9	384.0	41	236.8	-77.1
3	201.2	342.9	42	223.1	-117.0
4	256.0	297.2	43	200.3	-154.4
5	310.9	256.9	44	165.5	-188.4
6	374.9	217.2	51	91.4	588.9
7	451.7	160.0	52	177.4	477.3
8	540.4	100.6	53	248.7	422.9
9	279.8	0.0	54	320.0	377.2
10	220.4	-28.6	55	388.9	320.0
11	194.3	-40.1	56	457.2	268.8
12	171.5	-96.9	57	548.6	188.4
13	160.0	-125.7	58	640.1	111.6
14	154.4	-177.4	59	383.1	0.0
15	142.9	-245.1	65	197.5	-331.5
16	131.5	-342.9	66	168.2	-434.3
17	102.9	-539.5	67	119.8	-640.1
18	0.0	-674.4	68	0.0	-777.2
19	-108.6	-634.6	69	-125.7	-731.5
20	-214.0	-582.9	70	-251.5	-680.3
21	-308.6	-531.3	71	-354.3	-617.2
22	-406.0	-474.4	72	-468.6	-554.1
23	-530.4	-449.0	73	-605.8	-511.1
24	-668.4	-377.2	74	-754.4	-426.1
25	-820.2	-285.8	75	-919.0	-320.0
26	-863.2	-137.2	76	-960.1	-157.3
27	-760.1	0.0	77	-857.3	0.0
28	-674.4	114.3	78	-777.2	131.7
29	-605.8	211.2	79	-697.2	240.0
30	-514.4	297.2	80	-599.8	342.9
31	-422.9	320.0	81	-497.4	417.0
32	-354.3	422.9	82	-411.5	497.4
33	-325.5	565.8	83	-371.2	651.5
34	-223.1	645.6	84	-256.9	743.0
35	-91.4	548.6	85	-102.9	645.6
36	0.0	485.5	86	0.0	582.9



SOURCE NUMBER	EMISSION POINT	DISCH. ELEV. ABOVE GRADE (FT.)
1	COAL UNLOAD AREA	25
2	STORAGE/TRANSFER TOWER AREA	75
3	COAL RECLAIM AREA	75
4	EMERGENCY RECLAIM AREA	25
5	CRUSHER TOWER AREA	75
6	SILO BAY AREA	180
7	ASH SILO AREA	120
8	ASH RECYCLE SILO	75
9	LIME SILO AREA	120
10	LIME SLURRY PLANT	60
11	AUX BOILER STACK	90
12	MAIN STACK	500
13	SODA ASH SILO	75
14	INJECTION WELL	0
15	COOLING TOWER	56

Figure 4-1.

EMISSION POINT DIAGRAM

INDIANTOWN
COGENERATION
PROJECT

Indiantown Cogeneration, L.P.

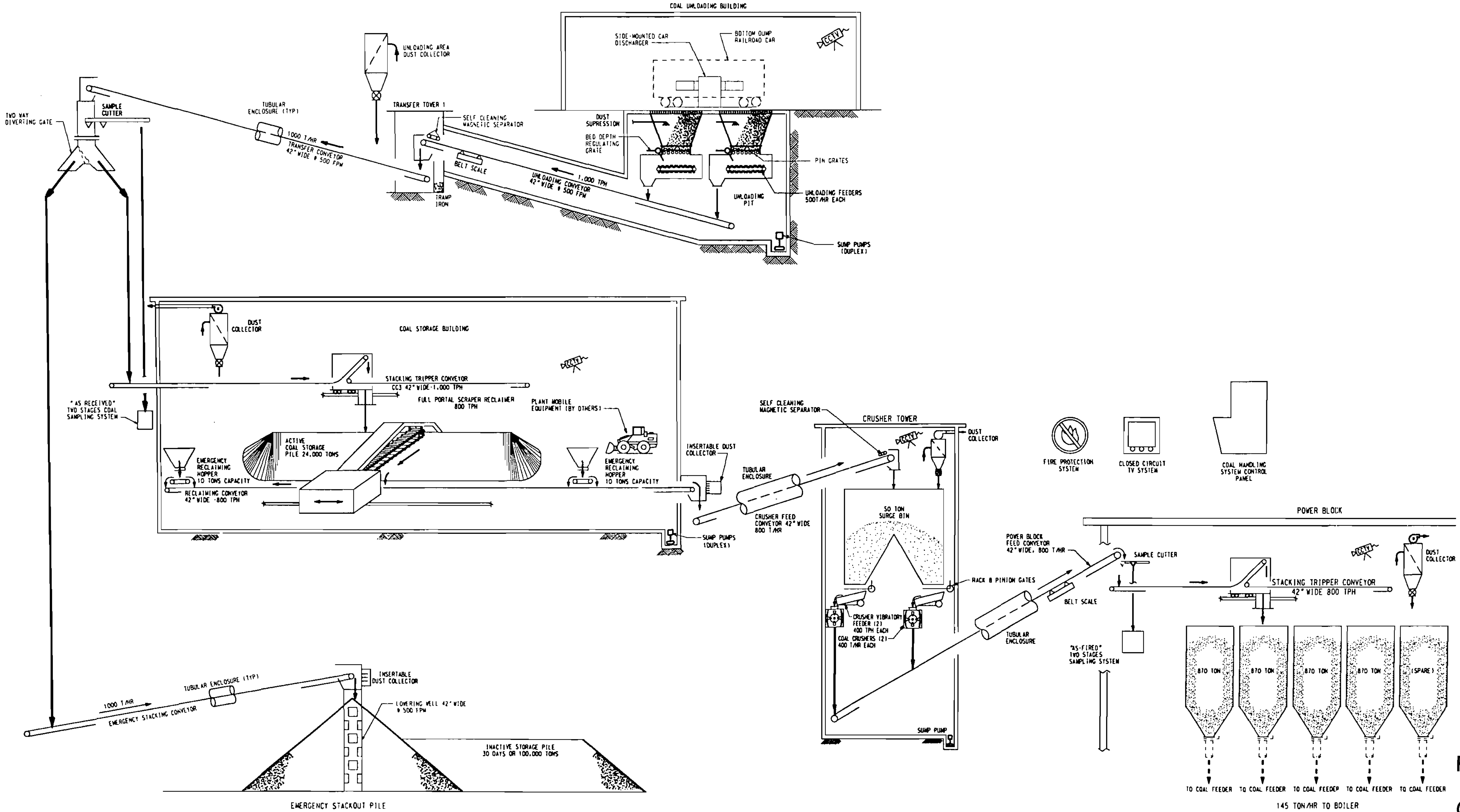
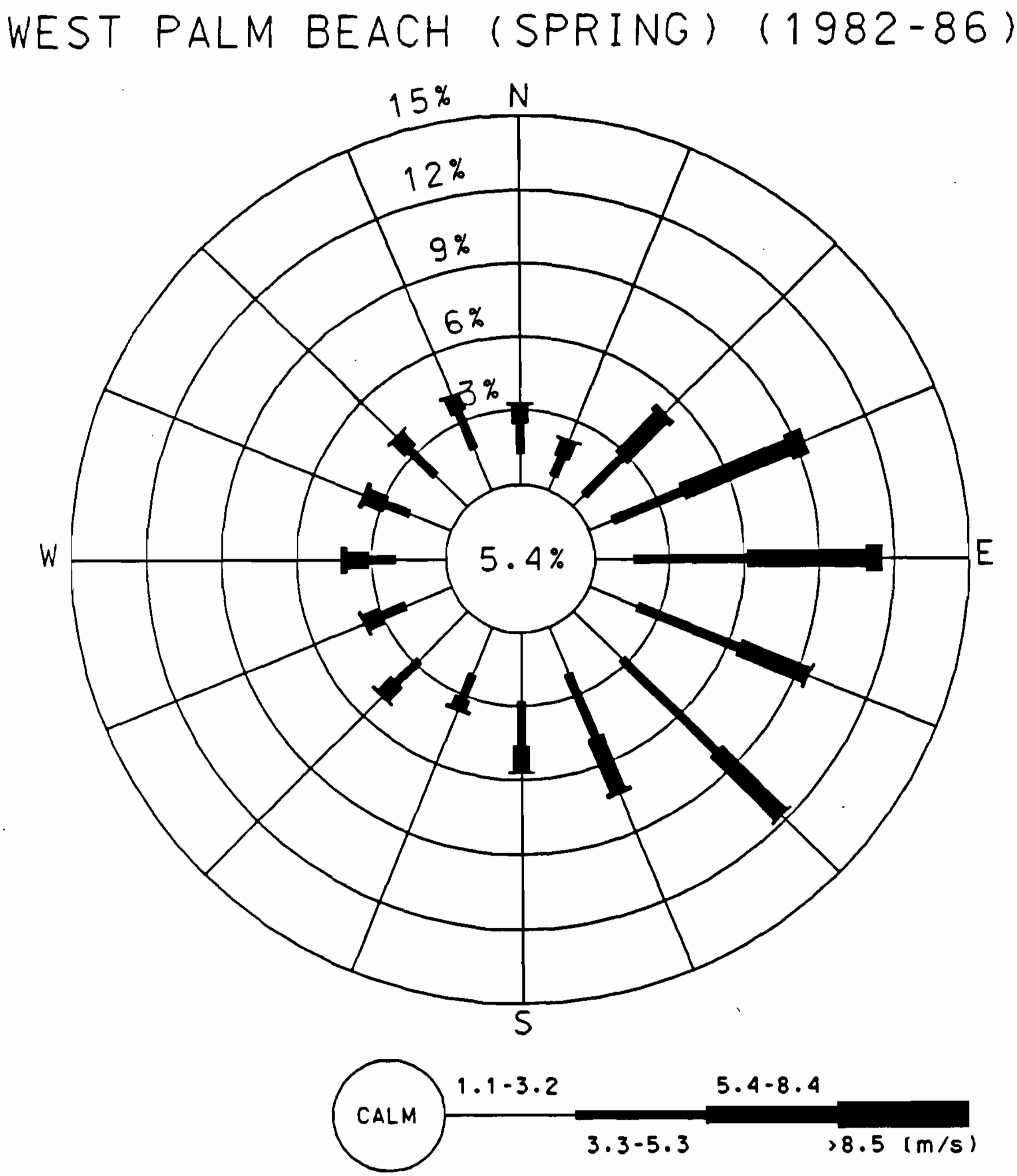


Figure 4-2.

COAL AND LIME HANDLING AND STORAGE OPERATIONS

INDIANTOWN COGENERATION PROJECT

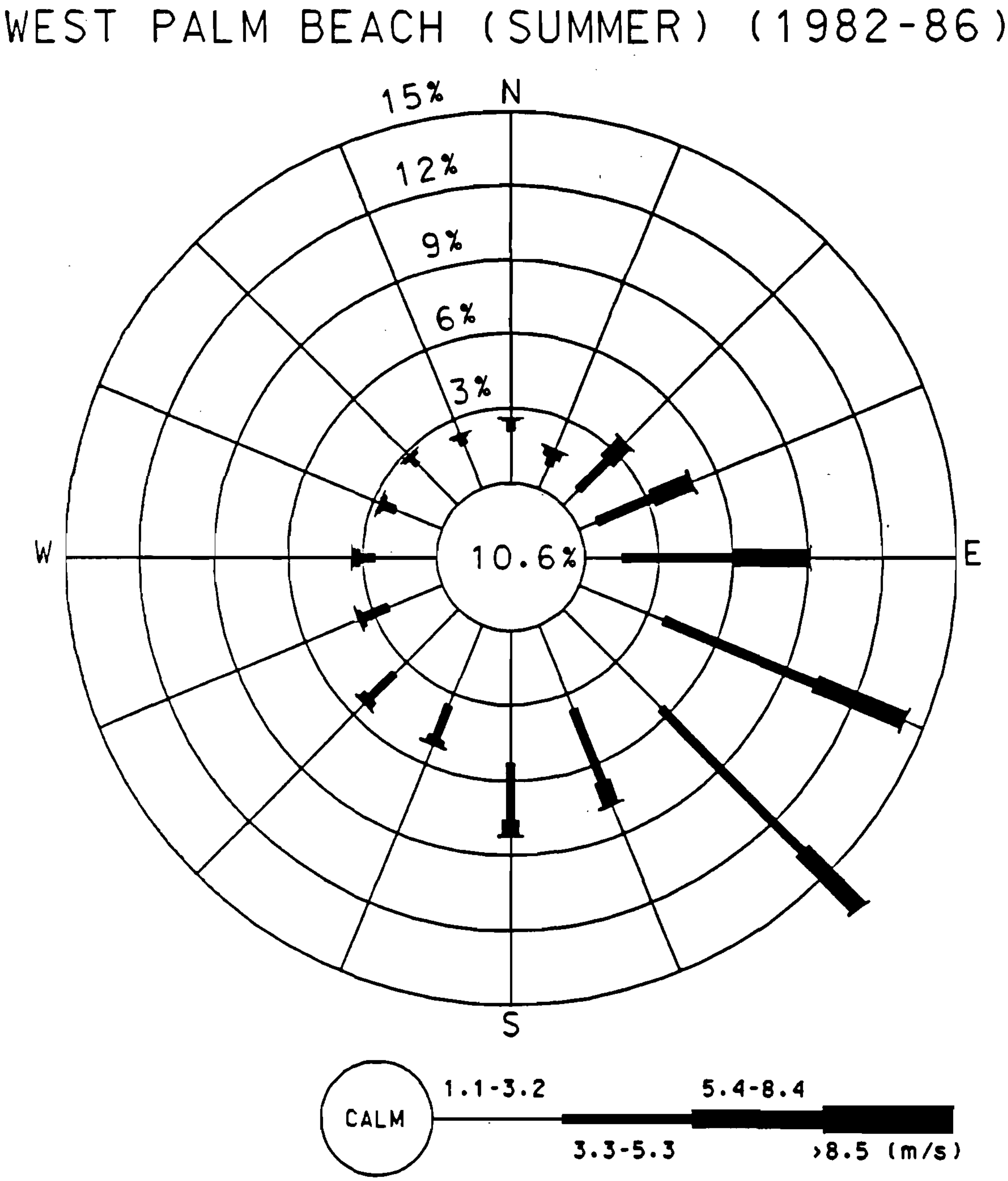
Indiantown Cogeneration, L.P.



INDIANTOWN COGENERATION PROJECT

Figure 4-3(a)

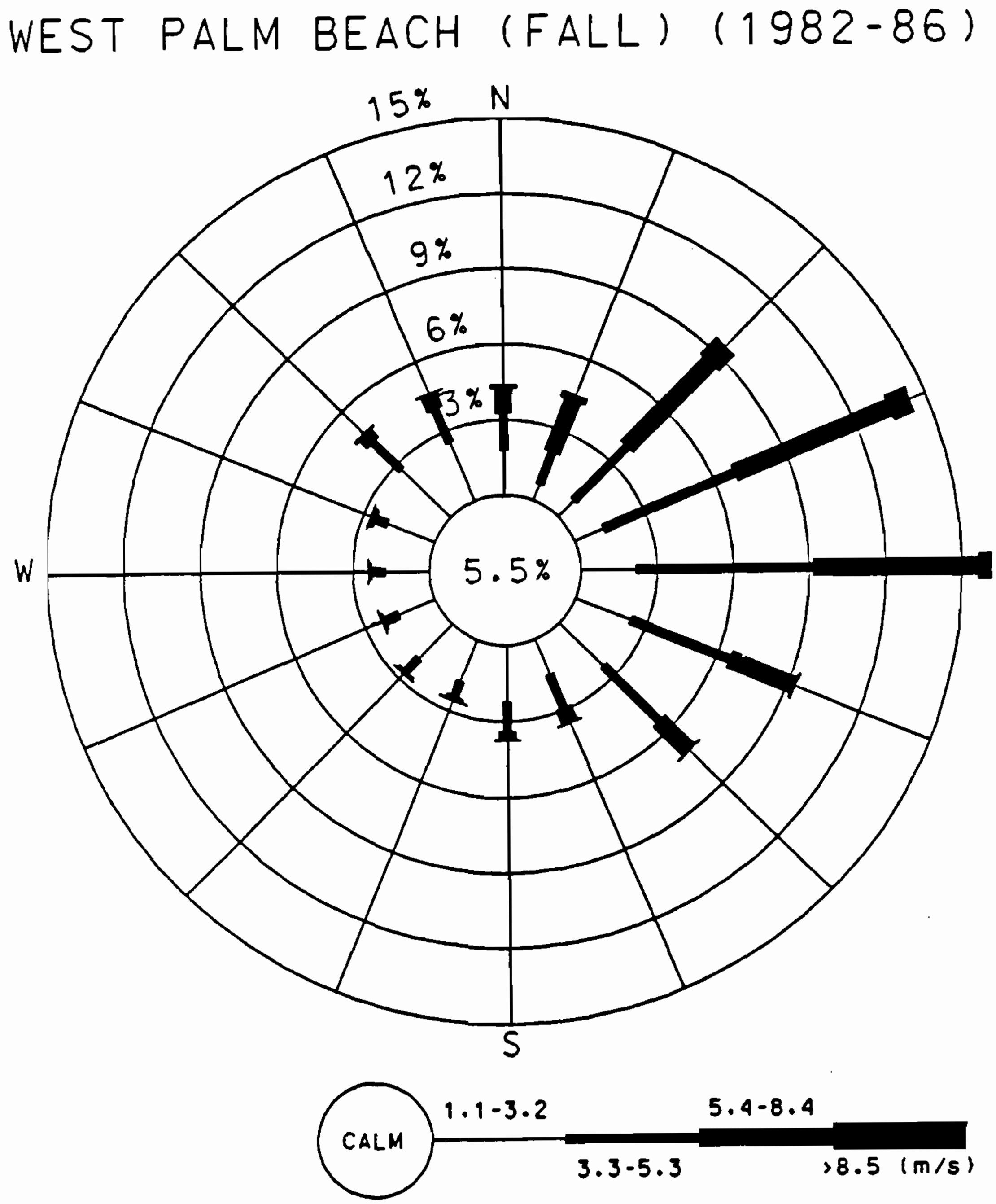
SPRING WIND ROSE



INDIANTOWN COGENERATION PROJECT

Figure 4-3(b)

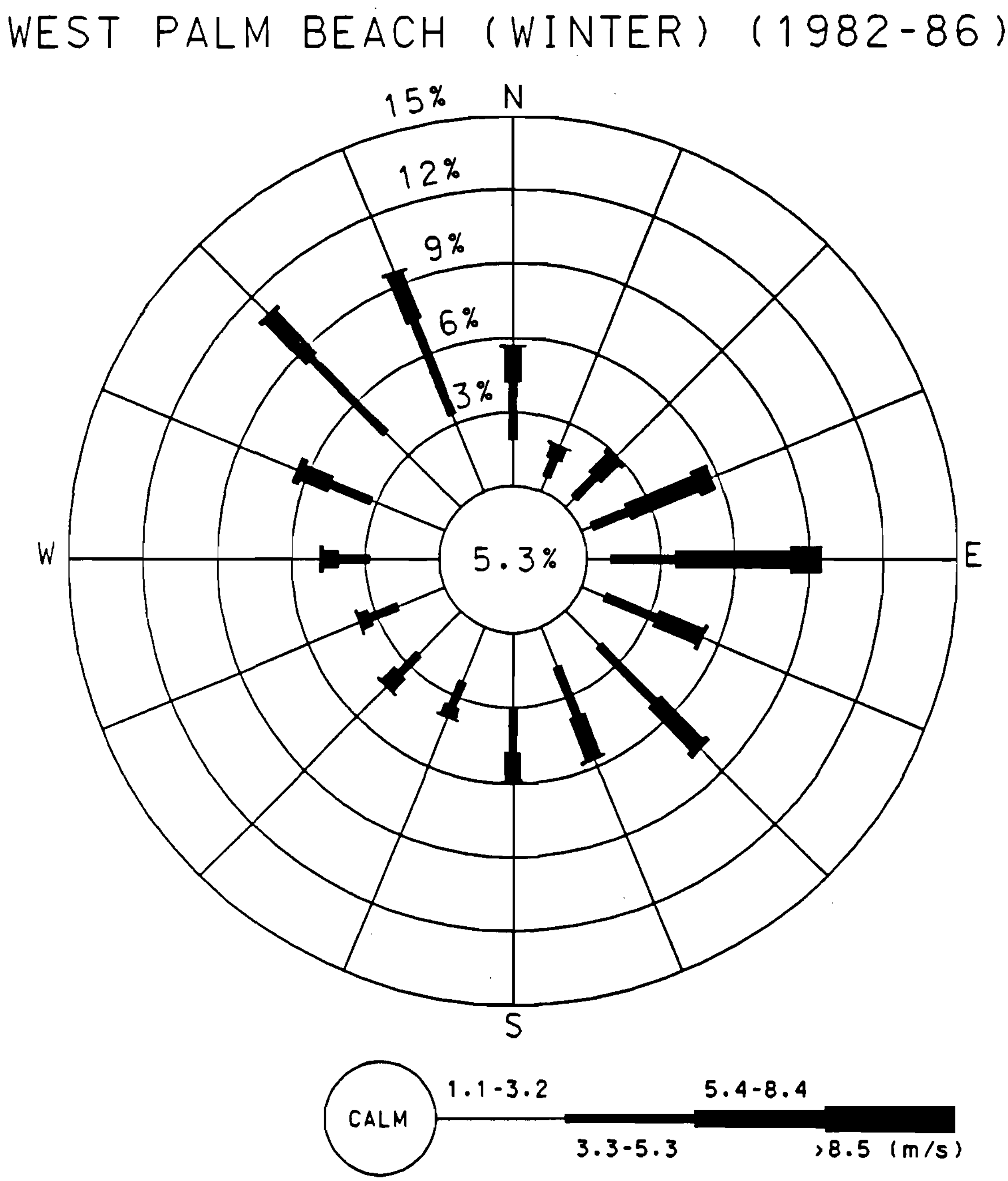
SUMMER WIND ROSE



INDIANTOWN COGENERATION PROJECT

Figure 4-3(c)

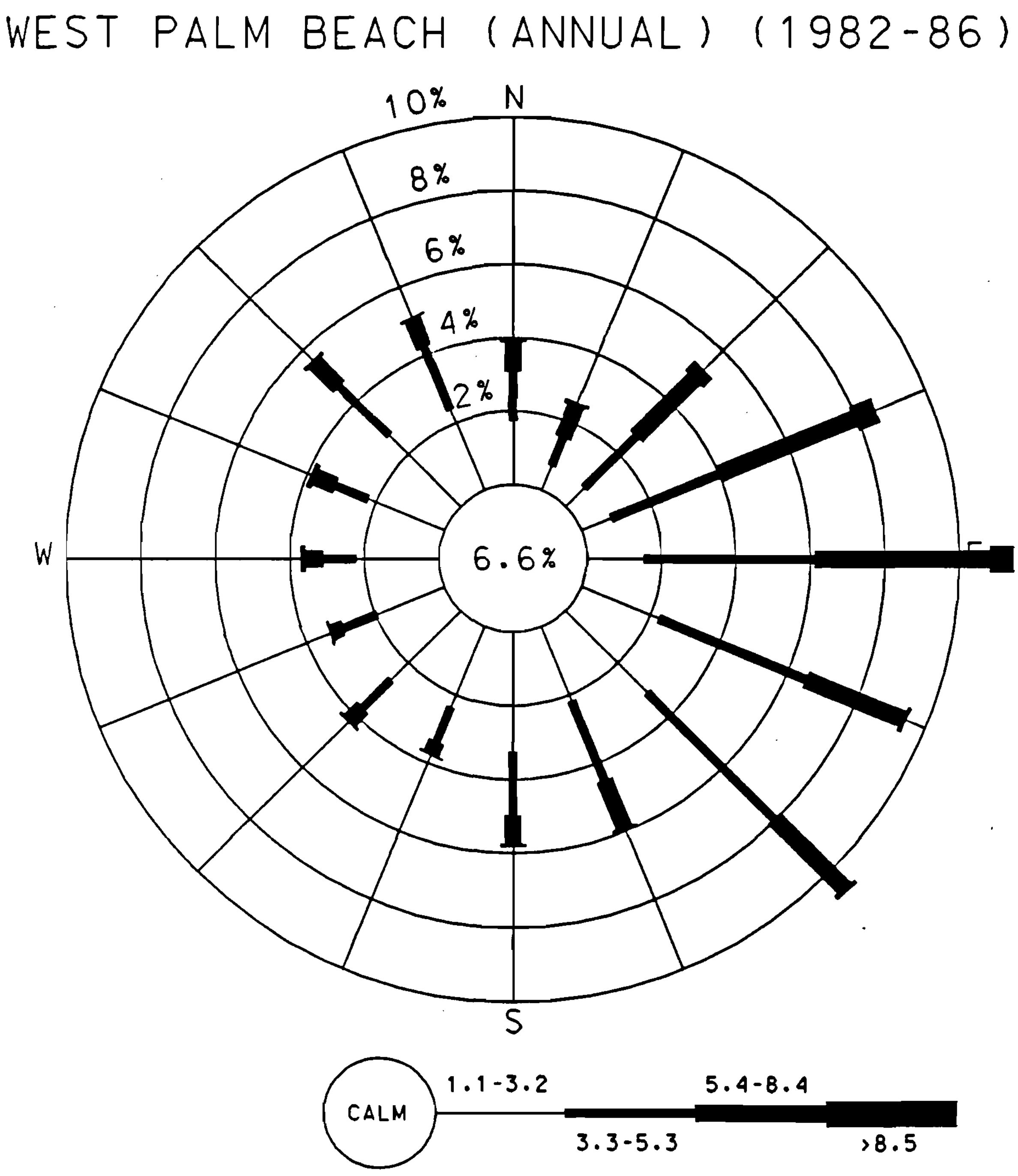
FALL WIND ROSE



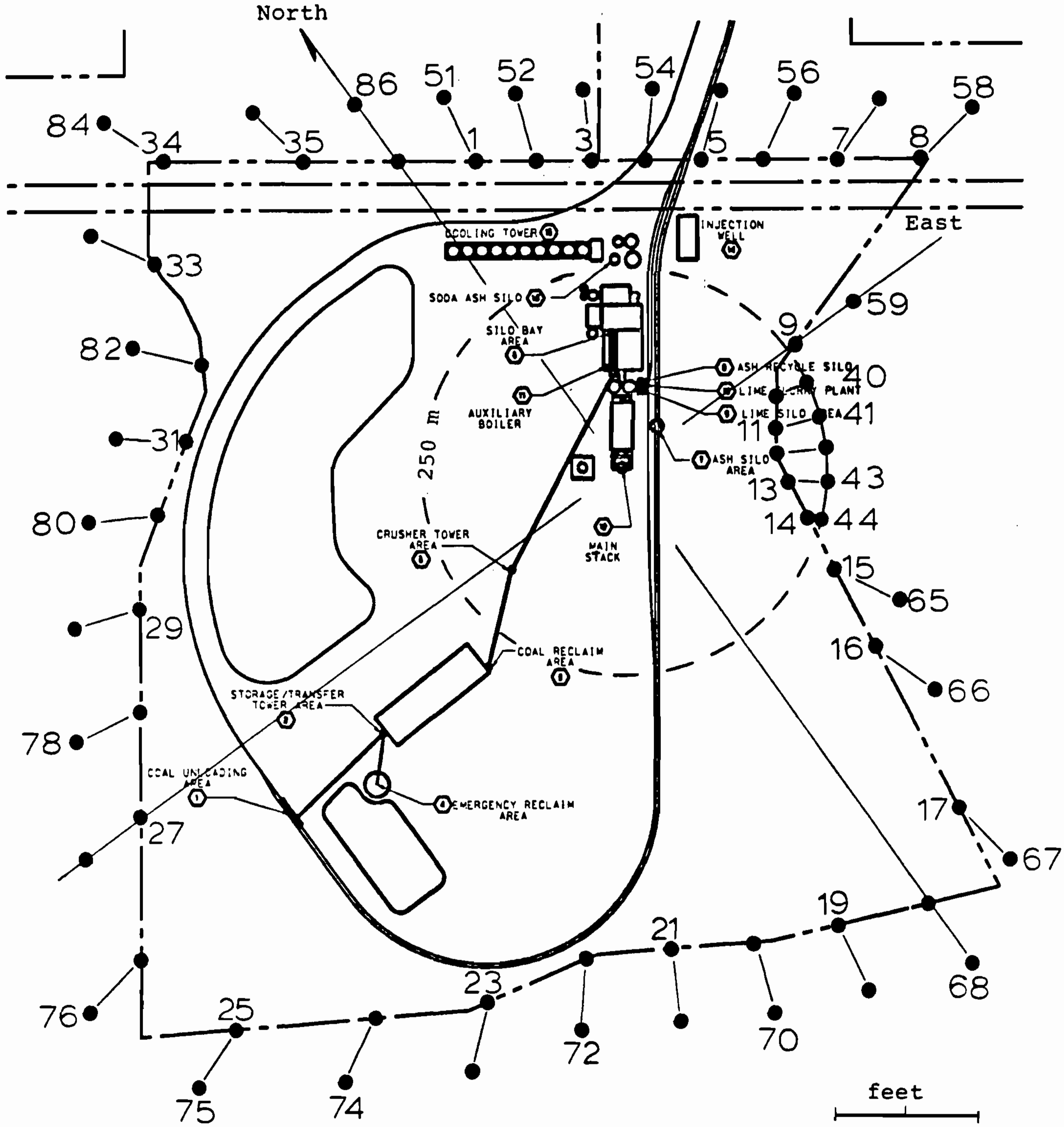
INDIANTOWN COGENERATION PROJECT

Figure 4-3(d)

WINTER WIND ROSE



INDIANTOWN COGENERATION PROJECT
Figure 4-3(e)
ANNUAL WIND ROSE



INDIANTOWN COGENERATION PROJECT

Figure 4-4
ISCST Receptor Grids for Fugitive Particulate Impact Analysis

5.0 DISPERSION MODEL RESULTS

The purpose of this section is to present the results of the ISCST dispersion modeling analyses described in Sections 3.0 and 4.0. These analyses are used to demonstrate impacts: (1) within significant impact areas of the proposed facility due to stack emissions from the ICL plant (for all criteria and certain noncriteria pollutants) and (2) adjacent to the proposed facility due to sources of fugitive particulate emissions from material handling and storage activities. The results of a modeling analysis to evaluate particulate impacts due to cooling tower drift from the plant's cooling system are presented in Section 7.3.

5.1 IMPACTS DUE TO PROPOSED FACILITY

This section discusses the air quality impacts due to stack and fugitive emission sources at the ICL plant. The analyses consider facility operation (stack emissions) at full (100 percent) load and at partial loads of 75 and 50 percent for receptors within a 5-km radius of the facility. Results are based on the use of 5 years of meteorological data collected from the West Palm Beach NWS station (see Section 4.3), as required by the FDER.

SO_2 is the primary pollutant of concern for this project. Impacts presented for NO_2, TSP, PM-10, and lead were scaled from the modeled SO_2 concentrations in proportion to their respective emission rates. Likewise, concentrations of noncriteria pollutants released in amounts above threshold significant emission levels (i.e., beryllium and fluorides) were scaled from the SO_2 modeling results.

5.1.1 SO_2 IMPACTS

Impacts from SO_2 emissions were analyzed by the ISCST model. For short-term impacts, the highest second-highest concentrations are reported because the analyses were based on the use of 5 years of representative meteorological data. For long-term (annual) impact, the maximum concentration estimated for each year was used.

Table 5-1 presents annual, 24-hour, and 3-hour average SO_2 impacts due to the proposed ICL main boiler operating at full (100 percent) and partial (75 and 50 percent) loads. These results are based on the screening modeling for receptors within 5 km of the facility. The purpose of these screening modeling studies is to determine the worst-load case. Results indicate that impacts at partial loads are less than that at full load. The tradeoff between dispersion due to a lower exit flow rate and lower emissions at these reduced loads was apparently dominated by the latter.

Impacts from the oil/gas-fired auxiliary boiler were also analyzed to determine which fuel would have more impact to the ambient air. Table 5-2 shows that oil firing resulted in higher concentrations than gas firing for all the averaging periods considered. Therefore, the oil-firing auxiliary boiler was considered together with the coal-firing main boiler to estimate the maximum combined impacts from the proposed ICL stacks. This approach is conservative because the auxiliary boiler is only planned to be operated on a part-time basis in support of the main boiler.

Screening analyses were made using a coarse-grid (250-m interval) within 4.25 km of the facility. The screening analyses revealed that due to the relatively short auxiliary boiler stack, building downwash effects induced by the boiler building were evident near the proposed plant. Therefore, for the refined-grid (100-m interval) analyses, the receptors were placed much closer to the site. In the refined-grid analyses, the receptors were placed around the maximum impact locations predicted by the screening modeling. The closest site boundary is located to the east of the main stack, slightly more than 200 m away. In order to identify the maximum concentrations induced by building downwash, instead of 100 m, an interval of 50 m was used between the first and the second rings of the polar receptor network. Thus, the first ring distance was set at 250 m, instead of 300 m. The ICL site boundary has an irregular shape. Concentrations predicted at the receptors located on-site were excluded in the analyses. Table 5-3 presents the refined-grid modeling results for annual 1-, 3-, 8-, and 24-hour average SO_2 concentrations due to the combined impacts from the main boiler stack and the auxiliary boiler stack.

Of the 5 years modeled, the maximum annual average concentration is 1.15 $\mu g/m^3$ (occurring in 1985), only slightly more than the significance level of 1 $\mu g/m^3$. This value occurs to the east-southeast of the proposed facility (100° radial) at a distance of 250 m. The maximum 24-hour average SO_2 value (11.6 $\mu g/m^3$) also occurs at this receptor and in the same year. It should be noted that this 24-hour average value is less than the monitoring exemption level (13 $\mu g/m^3$). The maximum 3-hour average is 24.7 $\mu g/m^3$ and occurs on the 310° radial at a distance of 2 km. The maximum 8-hour and 1-hour concentrations are 19 and 61.2 $\mu g/m^3$, respectively.

As mentioned in Section 3.5.2 and elsewhere, SO_2 concentration values will be used to scale NO_2, TSP, PM-10, and lead impacts due to stack emissions and for selected non-criteria pollutants as presented in the following subsections. The ISCST-modeled results also indicated that the main boiler stack has no impacts at 250 m downwind for 3-, 8-, and 24-hour and annual averaging periods (see Table 5-4). For these averaging periods, all the impacts at this distance are due to the building downwash affecting the auxiliary boiler plume. Thus, the auxiliary boiler SO_2 emission rate was used to scale impacts of other pollutants at this distance. For the 1-hour averaging time, the main boiler and the auxiliary boiler contribute 94 percent and 6 percent to the maximum impact location (800 m downwind), respectively.

5.1.2 PARTICULATE IMPACTS

As stated in Section 5.1.1, the maximum impacts for 24-hour and annual averaging periods were contributed by the auxiliary boiler stack alone. The ratio of the hourly auxiliary stack particulate emission (1.4 lb/hr) to SO_2 emissions (17.73 lb/hr) is about 0.079. Scaling the highest annual average SO_2 concentration reported above (1.15 $\mu g/m^3$, within 4.25 km) by this ratio yields a maximum incremental annual particulate concentration of only 0.09 $\mu g/m^3$. Likewise, scaling the highest 24-hour average SO_2 concentration (11.6 $\mu g/m^3$) yields a maximum incremental 24-hour particulate concentration of only 0.92 $\mu g/m^3$. Clearly, the incremental impacts of stack-emitted particulates are well below the corresponding significance levels (1 $\mu g/m^3$ - annual; 5 $\mu g/m^3$ - 24 hour).

The highest particulate impacts due to the proposed ICL plant are a result of fugitive dust emissions from material handling and storage activities. The highest annual and 24-hour average incremental concentrations are 0.17 and 3.3 $\mu g/m^3$, respectively (see Table 5-5). The maximum 24-hour fugitive particulate impact is less then the significant impact level (5 $\mu g/m^3$). This value occurs at the ICL property line, 600 feet from the coal unloading area, and decreases farther downwind of the boundary.

As stated in Section 5.1.1, the main boiler stack has no contribution to receptors located at the property line for 24-hour or annual averaging periods. Therefore, the combined impacts of fugitive and auxiliary boiler stack emissions were analyzed. The maximum 24-hour particulate impact from these stack emissions is 0.92 $\mu g/m^3$, which occurred on Julian day 10 in 1982 (see Table 5-4). The impact of fugitive emissions on this date and at the same location was estimated by the ISCST model to be only 0.075 $\mu g/m^3$. Similarly, based on the maximum 24-hour particulate impact produced by the fugitive emissions, the stack impact at the same location and date was also analyzed. The resultant combined impacts are presented below.

Year	Julian Day	Fugitive ($\mu g/m^3$)	Aux. Boiler ($\mu g/m^3$)	Total ($\mu g/m^3$)
1982	10	0.075	0.916	0.991
1986	164	3.33	0.014	3.347

The results show that the maximum combined 24-hour impact (3.3 $\mu g/m^3$) is below the significant level of 5 $\mu g/m^3$. It is also less than the monitoring exemption level of 10 $\mu g/m^3$. For annual particulate impacts, the highest values for stack and fugitive sources are 0.09 (see Table 5-4) and 0.17 $\mu g/m^3$ (see Table 5-5), respectively. These two maximum impacts do not overlap. However, since they are relatively small, it is conservative to use their sum (0.26 $\mu g/m^3$) as the total maximum annual incremental impact. This sum is less than the significant level of 1 $\mu g/m^3$.

5.1.3 NO_2, CO, AND LEAD IMPACTS

As stated above, the main boiler stack has no contribution to the maximum 8-hour, 24-hour, and annual impact locations. The ratio of maximum hourly auxiliary boiler stack emissions of NO_2 (68.2 lb/hr) to SO_2 (17.73 lb/hr) is about 3.847. Scaling the highest annual average SO_2 concentration reported above (1.15 $\mu g/m^3$) by this ratio yields a maximum incremental annual NO_2 concentration of 4.42 $\mu g/m^3$. This value is below the corresponding monitoring exemption level (14 $\mu g/m^3$) for NO_2.

As stated in Section 3.5.2, for the auxiliary boiler stack, the CO emission rate is about 2.7 times of the SO_2 emission. However, for the main boiler stack, the CO emission rate is only about 0.65 times the SO_2 emission. Therefore, the maximum 1- and 8-hour CO impacts do not necessarily occur at the same locations as those predicted by the SO_2 emissions. As a result, ISCST modeling was independently made for 1-hour and 8-hour CO impact analyses. The modeling results showed that the maximum 1-hour CO impact is 78.2 $\mu g/m^3$, which occurred on Julian day 11, 1983. The maximum 8-hour CO impact is 50.9 $\mu g/m^3$, which occurred on Julian day 21, 1985. Both of these maximum impacts occurred at 250 m downwind from the main boiler stack. It is evident that these values are contributed by the auxiliary boiler stack due to plume downwash. The maximum 1-hour value is about 25 times less than the 1-hour significant impact level (2,000 $\mu g/m^3$). The maximum 8-hour value is about 10 times less than the 8-hour significant impact level (500 $\mu g/m^3$). As stated in Section 5.1.1, the maximum 1-hour SO_2 impact occured at 800 meters, instead of 250 meters, downwind from the main stack. This confirmed the necessity for modeling CO impacts independently.

The total lead emission of the ICL stacks is less than the significant emission level (see Table 2-2); thus, no air quality analysis for lead is required.

5.1.4 NON-CRITERIA POLLUTANTS

In addition to the air quality impacts of criteria pollutants (i.e., those for which an NAAQS has been established) discussed in the previous subsections, an impact analysis is also required for noncriteria pollutants. Table 2-2 identified the following noncriteria pollutants which are trace elements emitted by the ICL plant in significant amounts: beryllium, fluorides, inorganic arsenic, and mercury.

Significant ambient air quality impact levels have not been established for these pollutants. However, as mentioned in Sections 2.2.3 and 3.7.4, the Florida Air Toxics Working Group, composed of FDER and local county air toxics staff, has developed a list of "no-threat" levels that can be used for a health-effects evaluation. As stated earlier, the main boiler stack has no contribution at the locations of maximum 8-hour, 24-hour, and annual averaging periods. The trace element emissions of the main stack are in general two orders of magnitude greater than those of the auxiliary stack, except SO_3 mist, which is only one-and-one-half times greater. As a result, for the health-effects analysis, the main stack SO_2 emission rate should be used to scale emissions of trace elements in predicting their maximum concentrations. Results of the maximum impacts produced by the main boiler stack alone are presented in Table 5-6. The maximum SO_2 8-hour, 24-hour, and annual impacts from the main boiler stack are 13.1, 5.7, and 0.56 $\mu g/m^3$, respectively.

The ratio of the estimated hourly main boiler stack emission rate for beryllium (0.0094 lb/hr) to SO_2 (582.6 lb/hr) is about 1.61 x 10^{-5}. Scaling the maximum 8-hour, 24-hour, and annual average SO_2 concentrations (see Table 5-6) by this ratio yields 2.11 x 10^{-4}, 9.20 x 10^{-5}, and 9.04 x 10^{-6} $\mu g/m^3$, respectively. These values are two orders of magnitude less than the corresponding FDER "no-threat" levels of 0.02, 0.005, and 0.0004 $\mu g/m^3$.

The ratio of the main boiler stack fluoride emission rate (5.08 lb/hr) to SO_2 (582.6 lb/hr) is about 0.0087. Scaling the maximum 8-hour and 24-hour average SO_2 concentrations by this ratio yields 0.114 and 0.050 $\mu g/m^3$, respectively. These values are much less than their corresponding FDER "no-threat" levels of 25 and 6 $\mu g/m^3$, respectively. No annual fluoride "no-threat" level is available.

The ratio of the main boiler stack emission rate for inorganic arsenic (0.175 lb/hr) to the corresponding SO_2 emission level is 3.00 x 10^{-4}. Scaling the maximum 8-hour, 24-hour, and annual average SO_2 impacts by this ratio yields 3.93 x 10^{-3}, 1.50 x 10^{-3}, and 1.68 x 10^{-4} $\mu g/m^3$, respectively. The 8-hour and 24-hour values are two orders less than the corresponding FDER "no-threat" levels of 2 and 0.5 $\mu g/m^3$. The annual value is 84 percent of its corresponding "no-threat" level (0.0002 $\mu g/m^3$).

The ratio of the main boiler stack emission for mercury (0.067 lb/hr) to the corresponding SO_2 emission level is 1.15 x 10^{-4}. Scaling 8-hour and 24-hour average SO_2 impacts by this ratio yields 1.51 x 10^{-3} and 6.56 x 10^{-4} $\mu g/m^3$, respectively. These values are two orders of magnitude less than the corresponding FDER "no-threat" levels of 0.1 and 0.024 $\mu g/m^3$. No annual "no-threat" level is available for this pollutant.

As indicated in Table 2-2, since sulfuric acid mist emissions (6.35 tons/year) are less than the significant emission level (7 tons/year), no air quality analysis is required for this pollutant.

5.2 PSD INCREMENT CONSUMPTION DETERMINATION

A PSD increment consumption analysis is required for the proposed ICL on the basis of significant impacts due to stack SO_2 and NO_2 emissions (see Sections 3.5.1 and 5.1). However, TSP impacts are below the significance levels for both annual and 24-hour averaging periods. As a result, a TSP increment consumption analysis was not required.

5.2.1 SO_2 INCREMENT CONSUMPTION

PSD sources of SO_2 emissions in the vicinity of the ICL plant have been established and presented in Table 4-4. The Martin CG/CC project has eight combustion turbines, and each of them ducts to a separate stack. These eight stacks are about 530 m apart and are grouped into two combined sources, instead of a single co-located source, in order to simulate them more accurately in dispersion modeling. These two combined sources are shown in Table 4-4 as

Sources 10 and 11. Two auxiliary boiler stacks for the same project are separated by about 230 m and are modeled as two separate sources (Sources 12 and 13 in Table 4-4). Similarly, two diesel generator stacks are about 230 m apart and are modeled as two sources (Sources 14 and 15 in Table 4-4). Thus, for modeling purposes, there are 15 SO_2 PSD interactive sources for the proposed ICL plant. Results of the SO_2 PSD increment consumption analysis are presented in Table 5-7. The 3-hour, 24-hour, and annual average SO_2 combined incremental concentrations are about 35 percent, 54 percent, and 20 percent of the corresponding maximum allowable PSD increment levels. The proposed ICL plant has no contribution to the combined 3-hour and 24-hour maximum impact locations and contributes only about 13 percent to the annual combined maximum impact location. This is an indication that the proposed ICL sources emit relatively small amounts of SO_2 compared to other nearby interactive SO_2 sources.

5.2.2 NO_2 INCREMENTAL CONSUMPTION

In Section 4.2.2, PSD sources of NO_2 emissions in the vicinity of the ICL plant have been established and presented in Table 4-4. Similar to the SO_2 increment consumption analysis, eight combustion turbines, two auxiliary boilers, and two diesel generators at the Martin CG/CC project were also included as NO_2 interactive sources. Thus, for modeling purposes, there are 11 NO_2 PSD interactive sources for the proposed ICL plant. Results of the NO_2 increment consumption analysis are presented in Table 5-7. The highest annual NO_2 combined incremental concentration (6.53 $\mu g/m^3$) is about 26 percent of the corresponding PSD incremental allowable (25 $\mu g/m^3$). The proposed ICL plant contributes about 68 percent to the annual combined maximum impact location.

5.3 AMBIENT AIR QUALITY COMPLIANCE DEMONSTRATION

It is necessary for the project to demonstrate compliance with the federal and state air quality standards shown in Table 2-4. For SO_2 this determination is based on the combination of ambient background concentrations (see Section 5.3.1), impacts due to background interactive sources, and the incremental impacts due to the proposed facility (see Section 5.1). Interactive source analyses are required because the facility has been shown to produce significant air quality impacts for SO_2 and NO_2. For TSP, PM-10, CO and lead, only the combination of ambient background levels and the ICL concentrations were considered to demonstrate compliance with the appropriate air quality standards.

5.3.1 BACKGROUND AIR QUALITY

As mentioned in Section 3.4, on-site monitoring is not required because the estimated impacts for all pollutants requiring an air quality analysis are well below the corresponding significant monitoring concentrations. Based on the ISCST modeling results, a summary of this finding is presented in Table 5-8. Additionally, the FDER indicated that the existing monitoring data from the adjacent FPL Martin site are representative of the proposed ICL area (see Appendix A, FDER letter). For the purpose of compliance demonstration in this permit application, ambient air quality data collected by the FDER for the ICL site vicinity and those collected by the Martin CG/CC project and by the nearby historical Martin site monitoring network are considered to establish background air quality levels.

FDER Air Quality Monitoring Network

Most of the state-run monitoring stations within a 50 km radius of the ICL site measure particulate matter only. In Palm Beach County, ambient CO, O_3, NO_2, and SO_2 data are also collected. The available state-operated air quality monitoring sites located within this area are presented in Table 5-9. A summary of the FDER air quality monitoring data collected during the most recent 3 years (1987-89) is presented in Table 5-10. Values presented in the table are the highest second-highest measured concentrations for short-term averages and the highest measured concentrations for the annual average.

The highest recorded 8-hour CO level (5 ppm) is about 56 percent of the federal and state standard (9 ppm), while the highest annual NO_2 level (25 $\mu g/m^3$) is 25 percent of the applicable standards (100 $\mu g/m^3$). The highest SO_2 measurements for short-term averaging periods are lower than those recorded by FPL existing monitors, while the highest annual average is equal to that recorded by FPL (see Table 5-11). The highest 24-hour TSP level measured at the FDER monitor at Martin County is 103 $\mu g/m^3$ (see Table 5-10), 69 percent of the state standard (150 $\mu g/m^3$). This value is also lower than that recorded by the FPL monitors (see Table 5-11).

Historical Martin Site Monitoring Network

The historical Martin site monitoring program as described in the Martin CG/CC PSD permit application is briefly discussed. Background SO_2, NO_2, and TSP measurements have been made by FPL at four sites (Nos. 1, 2, 3, and 4) in the vicinity of the Martin Plant on a once-every-sixth-day basis since October 1973. These data were supplemented in 1979-1980 with two sites (Nos. 5 and 6) monitoring SO_2 and NO_2 with continuous analyzers and a seventh site (No. 7) monitoring TSP. Only about 1 year of continuous SO_2 and NO_2 monitoring data exists at Site Nos. 5 and 6. A summary of FPL historical ambient air quality monitoring data for the Martin site vicinity for the period available (1973-1988) is presented in Table 5-11. Figure 5-1 shows the location of these historical monitoring sites. However, the historical SO_2 and NO_2 data were based primarily on "bubbler" type samplers, and 1 year of continuous analyzer monitoring data were collected in 1980. Therefore, they render only a general idea of the existing air quality levels in the vicinity of the ICL site.

Martin CG/CC Project Monitoring Network

The Martin CG/CC project conducted a 12-month (October 1988 through September 1989) on-site monitoring program. Four pollutants (SO_2, NO_2, O_3, and particulate matter) were measured. This monitoring program consists of two sites. One was located east of the Martin Plant location, and the other was located to the west. Nine months (October 1988 through June 1989) of the measurements were presented in the Martin CG/CC PSD permit application. Measurements for the rest of the 3 months (July 1989 through September 1989) were presented in the Final Data Report for the Martin CG/CC project. A summary of the 12-month measurements is presented in Table 5-12. Figure 5-1 shows the locations of these air quality monitoring sites. As shown in the table, data collected by the Martin CG/CC PSD program are in good agreement with those measured in the FPL existing monitoring network and the FDER monitors. Data reported in Table 5-12 are most current and meet the PSD monitoring data recovery rate and quality assurance requirements.

Background Determination

The two Martin CG/CC PSD monitoring sites are approximately 4.2 and 10.2 km west-northwest of the proposed ICL site, respectively. Because of the proximity of these monitoring stations to the proposed site and the currentness of the data, measurements for the Martin CG/CC project are considered to be the most representative data for the ICL site area. These data have been used to determine the background air quality levels for SO_2, NO_2, and PM-10. Background air quality levels for other criteria pollutants (CO and TSP) were determined using the existing FDER monitoring data. The background air quality levels determined for the proposed ICL site and their corresponding federal/state standards are presented in Table 5-13.

The following section presents total impacts for TSP, PM-10, SO_2, and NO_2 based on the modeled incremental concentrations in Section 5.1 and the assumed background values above.

5.3.2 INTERACTIVE BACKGROUND SOURCES

Interactive background sources are described in Section 4.2.3 and presented in Table 4-5. As stated in Section 3.5.2, SO_2 and NO_2 have significant impacts on the ambient air. Thus, SO_2 and NO_2 interactive background sources were included in the ISCST modeling to estimate the maximum background levels. Background levels estimated by modeling were added to the measured background levels established in Section 5.3.1 to determine the total background levels. Since the measured background levels already include impacts from these interactive background sources, the approach of using the total background levels (measured background + modeled background) is conservative. The combined maximum interactive impacts (ICL stack sources + background interactive sources) are presented in Tables 5-14 and 5-15 for SO_2 and NO_2, respectively.

5.3.3 CRITERIA AIR POLLUTANTS

From Section 5.1.1, based on the ICL stack emissions, the highest PSD incremental SO_2 concentrations were 1.15 $\mu g/m^3$, 11.6 $\mu g/m^3$, and 24.7 $\mu g/m^3$ for annual, 24-hour, and 3-hour averaging periods, respectively (see Table 5-3). However, detailed modeling has shown that the ICL SO_2 stack emissions have no contribution to the maximum interactive background impact locations for both 3-hour and 24-hour averaging periods within a study area of 4.25 km radius centered at the ICL main stack. On an annual basis, the ICL stack emissions contribute only about 1.6 percent (0.11 $\mu g/m^3$) to the maximum interactive background impact location within the studied area. When combined with the corresponding monitored background values identified in Table 5-16, the resultant total impacts are 8.18 $\mu g/m^3$, 61.1 $\mu g/m^3$, and 243 $\mu g/m^3$ for annual, 24-hour, and 3-hour averaging periods, respectively. These values are all well below the respective federal and state ambient air quality standards (see Table 5-16).

The highest modeled TSP impacts due to the combination of the ICL stacks and fugitive particulate emissions are 0.26 $\mu g/m^3$ (annual) and 3.3 $\mu g/m3$ (24-hour) within 4.25 km of the proposed facility (see Section 5.1.2). The corresponding background values from the previous subsection are 13.3 $\mu g/m^3$ and 39 $\mu g/m^3$, respectively. Total impacts are 13.56 $\mu g/m^3$ and 42.3 $\mu g/m^3$ for annual and 24-hour averaging periods, respectively. These values are likewise well below the primary and secondary state TSP standards. For this analysis, it has been assumed that both modeled and monitored TSP data would conservatively represent PM-10 impacts. Thus, the total "particulate (PM-10)" annual (13.56 $\mu g/m^3$) and 24-hour (42.3 $\mu g/m^3$) impacts are still below the corresponding primary and secondary NAAQS of 50 $\mu g/m^3$ and 150 $\mu g/m^3$, respectively. The conservatism lies in the assumed background level, in that it is a value for TSP; the PM-10 value would be less.

Total annual NO_2 impact is 11.5 $\mu g/m^3$ (Table 5-16) based on the modeling results in Section 5.1.3 and the monitored background value. This concentration is only about 11% of the corresponding federal and state standard (100 $\mu g/m^3$).

Incremental CO impacts reported in Section 5.1.3 were several orders of magnitude below the corresponding federal and state standards. The maximum 1- and 8-hour concentrations which occur near the site boundary (250 m downwind of the main stack) are contributed solely by the downwash plume from the auxiliary boiler stack.

The maximum incremental 24-hour lead concentration was shown above to be 0.015 $\mu g/m^3$. This maximum 24-hour value is so far below the quarterly average lead standard (1.5 $\mu g/m^3$) that compliance is unquestionable.

Overall, it has been demonstrated that compliance with the federal and state ambient air quality standards will occur during operation of the proposed ICL for all criteria air pollutants.

Table 5-1
FULL AND PARTIAL LOAD SO_2 IMPACTS FROM MAIN STACK

Averaging Period	Year	Load (%)	Concen.[a] ($\mu g/m^3$)	Location[b] (Dist, Dir)
Annual	1982	100	0.56	3.0, 310
		75	0.52	3.0, 310
		50	0.42	2.5, 310
	1983	100	0.46	3.0, 310
		75	0.43	3.0, 310
		50	0.35	2.5, 310
	1984	100	0.36	3.5, 300
		75	0.34	3.0, 310
		50	0.27	2.5, 310
	1985	100	0.45	3.0, 310
		75	0.42	3.0, 310
		50	0.34	2.5, 310
	1986	100	0.41	3.5, 270
		75	0.37	3.0, 270
		50	0.30	3.0, 270
24-Hour	1982	100	5.6	3.0, 310
		75	5.2	3.0, 310
		50	4.0	3.0, 310
	1983	100	4.4	1.0, 350
		75	4.0	2.0, 300
		50	3.2	2.5, 300
	1984	100	4.8	2.5, 280
		75	4.4	2.5, 280
		50	3.6	2.0, 280
	1985	100	4.6	3.5, 290
		75	4.2	3.0, 290
		50	3.4	3.0, 290
	1986	100	4.4	2.0, 250
		75	3.9	2.0, 250
		50	3.0	1.5, 260
3-Hour	1982	100	19.8	3.0, 300
		75	17.8	2.5, 300
		50	14.2	2.5, 300
	1983	100	19.9	2.0, 300
		75	19.4	1.0, 320
		50	15.7	2.0, 300
	1984	100	22.2	2.0, 310
		75	20.7	2.0, 310
		50	16.4	1.5, 310

Table 5-1 (Continued)

Averaging Period	Year	Load (%)	Concen.[a] ($\mu g/m^3$)	Location[b] (Dist, Dir)
	1985	100	19.7	2.0, 270
		75	18.7	2.0, 270
		50	14.9	2.0, 270
	1986	100	20.5	1.5, 250
		75	17.8	1.5, 250
		50	13.8	1.0, 270

a - Maximum annual concentration, or highest second-highest average concentration from ISCST (3- and 24-hr).

b - Receptor coordinates: distance in kilometers, direction in degrees relative to ICL main stack.

Table 5-2
AUXILIARY BOILER SO_2 IMPACTS

Year	Fuel	Annual ($\mu g/m^3$)	3-Hour ($\mu g/m^3$)	24-Hour ($\mu g/m^3$)
1982	Oil	1.09 (0.5, 330)	13.9 (0.75, 350)	6.3 (0.5, 320)
	Gas	0.04 (0.5, 330)	0.5 (0.75, 350)	0.2 (0.5, 320)
1983	Oil	0.81 (0.5, 320)	14.0 (0.5, 50)	7.2 (0.5, 330)
	Gas	0.03 (0.5, 320)	0.5 (0.5, 50)	0.3 (0.5, 330)
1984	Oil	0.82 (0.5, 320)	14.1 (0.5, 360)	7.0 (0.5, 350)
	Gas	0.03 (0.5, 320)	0.5 (0.5, 360)	0.2 (0.5, 350)
1985	Oil	0.80 (0.5, 320)	14.8 (0.5, 360)	6.7 (0.5, 330)
	Gas	0.03 (0.5, 280)	0.5 (0.5, 280)	0.2 (0.5, 330)
1986	Oil	0.87 (0.5, 280)	14.7 (0.5, 310)	6.1 (0.5, 320)
	Gas	0.03 (0.5, 280)	0.5 (0.5, 310)	0.2 (0.5, 320)

Notes: Concentrations are in $\mu g/m^3$.

Shown within parentheses are distance (km) and direction (degree) relative to the main boiler stack.

Table 5-3
ANNUAL AND SHORT-TERM AVERAGE SO_2 IMPACTS (MAIN BOILER AND AUXILIARY BOILER COMBINED)

Averaging Period	Year	Concen.[a] ($\mu g/m^3$)	Location[b] (Dist, Dir)
Annual	1982	0.92	0.6, 320
	1983	1.06	0.25, 110
	1984	0.85	0.25, 120
	1985	1.15	0.25, 100
	1986	1.04	0.25, 110
24-Hour	1982	11.6	0.25, 110
	1983	9.9	0.25, 110
	1984	11.1	0.25, 120
	1985	11.3	0.25, 110
	1986	9.0	0.25, 100
8-Hour	1982	17.1	0.25, 100
	1983	17.0	0.25, 110
	1984	16.2	0.25, 120
	1985	19.0	0.25, 110
	1986	16.8	0.25, 100
3-Hour	1982	24.7	0.25, 100
	1983	22.2	0.25, 110
	1984	23.7	2.0, 310
	1985	22.5	0.25, 110
	1986	22.4	0.25, 110
1-Hour	1982	57.6	0.8, 100
	1983	59.9	0.8, 30
	1984	57.8	0.8, 250
	1985	61.2	0.8, 80
	1986	58.1	0.8, 270

a - Maximum annual concentration, or highest second-highest concentrations (1-, 3-, 8-, and 24-hr).

b - Receptor coordinates: distance in kilometers, direction in degrees relative to ICL main boiler stack.

Table 5-4
RELATIVE CONTRIBUTIONS AT MAXIMUM IMPACT LOCATIONS
(ICL STACK SOURCES ONLY)

Pollutant	Averaging Period	Main Boiler	Aux. Boiler	Total	Year	Dist. (km)	Dir. (deg.)	Julian Day
SO_2	1-Hour	57.6	3.5	61.2	1985	0.8	80	201
	3-Hour	0.0	24.7	24.7	1982	0.25	100	15
	8-Hour	0.0	19.04	19.04	1985	0.25	110	21
	24-Hour	0.0	11.6	11.6	1982	0.25	110	10
	Annual	0.0	1.15	1.15	1985	0.25	100	-
PM	24-Hour	0.0	0.92	0.92	1982	0.25	110	10
	Annual	0.0	0.09	0.09	1985	0.25	100	-
NO_2	Annual	0.0	4.42	4.42	1985	0.25	100	-
CO	8-Hour	0.0	50.9	50.9	1985	0.25	110	21
	1-Hour	0.0	78.2	78.2	1983	0.25	100	11

Notes: Concentrations are in $\mu g/m^3$.
Distance and direction shown are in km and degree, respectively, relative to the ICL main stack.

Table 5-5
PARTICULATE IMPACTS DUE TO ICL FUGITIVE EMISSION SOURCES

Year	Annual[a] ($\mu g/m^3$)	Location[b] (x, y)	24-Hour[c] ($\mu g/m^3$)	Location[b] (x, y)
1982	0.17	-760.1, 0	2.6	-760.1, 0
1983	0.16	-760.1, 0	2.4	-760.1, 0
1984	0.14	-760.1, 0	1.6	-674.4, 114.3
1985	0.13	-760.1, 0	1.3	-863.2, -137.2
1986	0.17	-760.1, 0	3.3	-760.1, 0

a - Maximum annual average concentration.
b - x, y coordinates in meters relative to ICL plant stack.
c - Highest second-highest 24-hour average concentration.

Table 5-6
MAIN BOILER STACK MAXIMUM SO_2 IMPACTS

Year	Annual ($\mu g/m^3$)	3-Hour ($\mu g/m^3$)	8-Hour ($\mu g/m^3$)	24-Hour ($\mu g/m^3$)
1982	0.56	20.3	12.1	5.7
	(3.2, 310)	(2.9, 300)	(2.6, 310)	(3.2, 310)
1983	0.46	20.1	12.2	4.8
	(3.1, 310)	(2.75, 300)	(0.9, 350)	(0.9, 350)
1984	0.36	22.2	10.7	4.8
	(3.2, 300)	(2.0, 310)	(2.6, 280)	(2.6, 280)
1985	0.44	19.8	10.6	4.6
	(3.1, 310)	(2.1, 270)	(3.6, 290)	(3.4, 290)
1986	0.41	20.5	13.1	4.4
	(3.4, 270)	(1.5, 250)	(2.1, 250)	(2.1, 250)
Maximum	0.56	22.2	13.1	5.7

Note: Shown within parentheses are distance (km) and direction (degrees) of impact relative to the ICL main boiler stack.

Table 5-7
PREDICTED PSD INCREMENT CONSUMPTION

Pollutant	Averaging Time	ICL Incremental Concentration	Combined Incremental Concentration	Maximum Allowable PSD Increment
SO_2	3-Hour	0 (3.6, 310)	176.8 (3.6, 310)	512
	24-Hour	0 (3.0, 280)	49.4 (3.0, 280)	91
	Annual	0.527 (3.5, 270)	3.98 (3.5, 270)	20
NO_2	Annual	4.42 (0.25, 100)	6.53 (0.25, 100)	25

Notes: All concentrations are in $\mu g/m^3$.

Shown within parentheses are distance (km) and direction (degrees) relative to ICL main boiler stack.

Table 5-8
PSD SIGNIFICANT MONITORING CONCENTRATIONS FOR EXEMPTION AND CORRESPONDING MODELED IMPACTS FOR THE PROPOSED ICL PLANT

Pollutant	Averaging Time	Significant Concentration[a] (μg/m3)	Modeled Concentration[b] (μg/m3)
Carbon Monoxide	8-Hour	575	50.9
Nitrogen Dioxide	Annual	14	4.42
Sulfur Dioxide	24-Hour	13	11.6
TSP	24-Hour	10	3.3
PM-10	24-Hour	10	3.3
Ozone	d	--	--
Lead	3-Month	0.1	0.0003[e,f]
Asbestos	g	--	0.0[f,h]
Beryllium	24-Hour	0.001	<<0.001[i]
Mercury	24-Hour	0.25	<<0.001[f,j]
Vinyl Chloride	24-Hour	15	0.0[f,h]
Fluorides	24-Hour	0.25	0.05
Sulfuric Acid Mist	24-Hour[g]	--	0.014[f]
Total Reduced Sulfur	k	--	0.0[f,h]
Reduced Sulfur	k	--	0.0[f,h]
Hydrogen Sulfide	1-Hour	0.2	0.0[f,h]
Benzene	l	--	0.0[h]
Radionuclides	l	--	--
Radon 222	l	--	--
Arsenic	8-Hour[l]	--	0.0039

Table 5-8 (Continued)

a - Source: PSD Monitoring Guidelines (Table A-2) (EPA, 1987).

b - Except as noted, based on maximum annual average concentration, or highest second-highest 24-hour average, or maximum 1-hour average.

d - No specific concentration for ozone is prescribed. Exemptions are granted when a source's VOC are <100 tons/year.

e - The 3-month average concentration for lead was not estimated because the maximum 24-hour average value was about 300 times less than the corresponding 3-month significance level.

f - Under the PSD regulations, an air quality impact analysis is not required for this pollutant because its emission is below the applicable significance level.

g - No acceptable monitoring techniques available at this time. Therefore, monitoring is not required until acceptable techniques are available.

h - No impacts. There are no emissions expected for this pollutant.

i - The maximum 24-hour average concentration for beryllium is 4.75×10^{-5} ug/m^3, about 20 times less than the corresponding significance level.

j - The maximum 24-hour average concentration for mercury is 1.44×10^{-4} ug/m^3, about 10 times less than the corresponding significance level.

k - No acceptable monitoring techniques available at this time. However, techniques are expected to be available shortly.

l - No monitoring techniques, significant concentration, or averaging period specified in the PSD Monitoring Guidelines.

Table 5-9
FDER AIR QUALITY MONITORING SITES USED FOR THE ICL PLANT VICINITY

County	Site ID	TSP	SO_2	NO_2	CO	O_3
Palm Beach	017 J02		x			
	003 G02		x			
	004 G02		x			
	004 G01	x		x	x	
	006 G03					x
	007 G01					x
	004 J02	x				
	005 J02	x				
	006 J02	x				
	006 J09	x				
	007 G01	x				
	001 G01	x				
	002 G01	x				
	003 G01	x				
	001 G01	x				
	002 J03	x				
	005 G01	x				
	006 G01	x				
	008 J02	x				
	009 J02	x				
	010 J02	x				
	011 J02	x				
	012 J02	x				
	013 J02	x				
	014 J02	x				
	015 J02	x				
	001 G01	x				
	003 G01	x				
	002 J02	x				
Martin	004 F02	x				
	002 F01	x				
	002 G01	x				
	002 G09	x				
	003 G01	x				
Hendry	002 f01	x				
	002 J02	x				
Highlands	001 F03	x				
Okeechobee	002 F03	x				
St. Lucie	004 F01	x				
	004 F09	x				
	009 F02	x				
	001 F01	x				
	001 F09	x				

Source: FDER, 1987, 1988, 1989.

Table 5-10
SUMMARY OF FDER AIR QUALITY DATA FOR THE ICL SITE VICINITY

Pollutant	County	Averaging Period	Maximum Concentration 1987	1988	1989	NAAQS	FAAQS
SO2(a)	Palm Beach	3-hr	52	58	68	1300	1300
		24-hr	12	11	27	365	260
		Annual	3	3	8	80	0
	Palm	1-hr	152	137	117	-	-
		Annual	22	25	24	100	100
CO(b)	Palm Beach	1-hr	6	7	7	35	35
		8-hr	4	5	4	9	9
Ozone(b)	Palm Beach	1-hr	0.091	0.107	0.106	0.12	0.12
TSP(a)	Palm Beach	24-hr	251	250(e)	161	260(c)	150
		Annual	50	50	128	75(d)	60
	Hendry	24-hr	650	576(f)	73	260	150
		Annual	42	36	47	75	60
	Highlands	24-hr	50	143	35	260	150
		Annual	20	20	26	7560	
	Martin	24-hr	98	103	78	260	150
		Annual	39	39	40	75	60
	Okeechobee	24-hr	52	72	105	260	150
		Annual	26	26	28	75	60
	St. Lucie	24-hr	457	189(g)	219	260	150
		Annual	72	67(g)	82	75	60
PM-10(a)	Palm Beach	24-hr	-	-	78	150	150
		Annual	-	-	33	50	50
		24-hr	-	-	65	150	150
		Annual	-	-	23	50	50

(a) Concentration in $\mu g/m^3$.
(b Concentration in ppm.
(c) Primary standard specified with a secondary standard of 150 $\mu g/m^3$.

Table 5-10 (Continued)

(d) Primary standard specified with a secondary standard of 60 $\mu g/m^3$.
(e) FDER indicated that this exceedance was caused by a fugitive dust event associated with a sugar cane transfer station operated 12/17/88 (Source: Martin CG/CC PSD Application, 1989).
(f) FDER indicated that this exceedance was caused by reentrained particulate matter due to sugar cane harvesting activities and occurred on 12/17/88 (Source: Martin CG/CC PSD Application, 1989).
(g) FDER indicated that these exceedances were due to fugitive dust from a nearby cement plant and an asphalt plant and heavy vehicle traffic on 8/1/88 (Source: Martin CG/CC PSD Application, 1989)

Table 5-11
FPL HISTORICAL AIR QUALITY MONITORING DATA FOR THE MARTIN SITE VICINITY (1973-1988)

Pollutant	Averaging Period	Station Number	Concen.(a) ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	FAAQS ($\mu g/m^3$)
SO_2	3-Hour	5	105	1,300	1,300
	24-Hour	5	61	365	260
	Annual	6	8	80	60
NO_2	24-Hour	1	158	-	-
	Annual	5	16	100	100
TSP	24-Hour	3	200(c)	150(b)	150
	Annual	-	N/A	60(b)	60

(a) Highest concentration.
(b) Federal secondary standard.
(c) This exceedance occurred in 1986 and is considered uncharacteristic of the overall TSP monitoring data recorded for the Martin site.

Source: FPL Martin CG/CC PSD Application, 1989.

Table 5-12
FPL MARTIN CG/CC PROJECT ON-SITE AIR QUALITY MONITORING DATA (OCTOBER 1988 THROUGH SEPTEMBER 1989)

Pollutant	Averaging Period	Monitored Concen. ($\mu g/m^3$)	Site	NAAQS ($\mu g/m^3$)	FAAQS ($\mu g/m^3$)
SO_2					
	3-Hour	61	East	1300	1300
	24-Hour	12.6	East	365	260
	Annual	1.3	East	80	60
NO_2	1-Hour	62	West	-	-
	Annual	5.4	East	100	100
Ozone	1-Hour	165	East	235	235
	Annual	47	Both	-	-
PM-10	24-Hour	39	East	150	150
	Annual	13.3	West	50	50

Sources:
FPL Martin CG/CC PSD Application, 1989.
Envirosphere Company, Final Data Report for Martin CG/CC, 1989.

Table 5-13
BACKGROUND AIR QUALITY LEVELS FOR THE ICL SITE VICINITY

Pollutant	Averaging Period	Monitored Concen. ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	FAAQS ($\mu g/m^3$)
SO_2(1)	3-Hour	61	1,300	1,300
	24-Hour	12.6	365	260
	Annual	1.3	80	60
NO_2(1)	1-Hour	62	-	-
	Annual	5.4	100	100
PM-10(1)	24-Hour	39	150	150
	Annual	13.3	50	50
TSP(2)	24-Hour	105	260	150
	Annual	40	75	60
CO(3)	1-Hour	7	35	35
	8-Hour	5	9	9

Sources:
(1) FPL Martin CG/CC PSD Monitors, 1989.
(2) FDER monitors at Martin and Okeechobee, highest recorded among the two stations within 3 years (1987-1989).
(3) FDER monitor at Palm Beach, concentration in ppm.

Table 5-14
INTERACTIVE BACKGROUND SO_2 IMPACTS
(Including ICL Stack Sources)

Year	Annual	3-hour	24-hour
1982	6.88 (4.25, 170)	182.0 (4.1, 300)	43.5 (0.6, 310)
1983	5.98 (0.25, 110)	179.5 (4.2, 300)	48.5 (4.25, 180)
1984	6.27 (4.25, 180)	167.1 (4.25, 290)	37.7 (4.2, 180)
1985	6.21 (0.25, 100)	162.4 (4.0, 310)	37.6 (4.25, 150)
1986	5.71 (4.25, 180)	159.9 (0.8, 270)	37.0 (1.0, 240)

Notes: Concentrations are in $\mu g/m^3$.

Shown within parentheses are distance (km) and direction (degree) relative to ICL main boiler stack.

Table 5-15
INTERACTIVE BACKGROUND NO_2 IMPACTS
(Including ICL Stack Sources)

Year	Annual	Distance (m)	Direction (degree)
1982	5.58	600	320
1983	5.71	250	110
1984	5.07	250	120
1985	6.10	250	100
1986	5.33	250	110

Notes: Concentrations are in $\mu g/m^3$.

Table 5-16
SUMMARY OF AIR QUALITY ANALYSIS

Pollutant	Averaging Period	Year (Julian Day, Period)	ICL Sources	Interactive Background Sources	Monitored Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	FAAQS ($\mu g/m^3$)
SO_2	3-Hour	1982 (164,4)	0.0	182.0	61.0	243	1,300	1,300
	24-Hour	1983 (96)	0.0	48.5	12.6	61.1	365	260
	Annual	1982	0.11	6.77	1.3	8.18	80	60
NO_2	Annual	1985	4.42	1.68	5.4	11.5	100	100
PM[a]	24-Hour	1986 (164)	3.3	None	39.0	42.3	150	150
	Annual	1982	0.26	None	13.3	13.56	50	50
CO	1-Hour	1983 (11,11)	78.2	None	8,001	8,079.2	40,000	40,000
	8-Hour	1985 (21,1)	50.9	None	5,715	5,765.9	10,000	10,000

a - Stack and fugitive emissions combined.

6.0 VISIBILITY IMPACT ANALYSIS

An analysis was performed to assess the degree of visibility impairment to the nearest PSD Class I Area (Everglades National Park) associated with operation of the proposed ICL. The analysis was made in accordance with technical guidance provided in the Workbook For Plume Visual Impact Screening and Analysis (EPA, 1988b), as discussed in Section 3.6. Specifically, this evaluation quantified the visual impairment in terms of atmospheric discoloration from NO_X, particulates, and secondary aerosols and the visual range reduction (increased haze) from particulates and sulfates.

6.1 MODEL INPUT

The VISCREEN model was used to assess visibility impacts. Model inputs include particulate and NO_X stack emissions; distance from the ICL plant to the impact area; source-observer distance; the typical background visual range; and the hypothetical worst case meteorological conditions. These inputs are summarized as follows:

o	Maximum Stack Emissions	
	Particulates	61.65 lb/hr
	NO_X	582.6 lb/hr
o	Background Visual Range	40 km (EPA, 1980, p. 59)
o	Distance to Everglades NP	140 km (minimum distance)
o	Meteorological Conditions	Pasquill Stability Class F
		Wind Speed = 1 m/s

6.2 IMPACT ASSESSMENT

Using the data described above, the Level-1 model generates critical indexes for plume perceptibility (Delta E) and plume contrast against the sky or terrain.

If the absolute value of any one of these indexes is greater than 2 or 0.5 for Delta E or plume contrast, respectively, the emission source fails the Level-1 visibility screening test and continued evaluation using the Level-2 procedure is necessary. Results of the Level-1 visibility screening test are discussed in this section.

Emissions from the proposed ICL plant will be reduced by pollution control equipment such that only SO_2 and NO_2 have significant impact areas within 4.25 km and 4.5 km radii from the main stack, respectively. In addition, the opacity of emissions from the facility are limited to 20 percent. Therefore, impairment to visibility in the Everglades National Park, which is about 145 km to the south of the proposed facility, is expected to be minimal. However, the Class I visibility analysis has been made to demonstrate that no significant effects will be observed.

Various VISCREEN runs were also made to identify the optimum source-observer distance so that maximum visual impacts inside and outside the Class I area do not exceed the screening criteria. Two screening runs shown in Tables 6-1(a) and (b) are with different source-observer distances, 60 and 65 km, respectively. Table 6-1(b) shows that the optimum source-observer distance is 65 km. Since all of the indexes are below the corresponding screening limits, the proposed ICL plant passes the Level-1 visibility screening test. This indicates that, when operational, the facility will have insignificant visibility impairment during the worst meteorological conditions and that no significant visibility impairment will be observed in the Everglades National Park.

Table 6-1(a)
VISUAL EFFECTS SCREENING ANALYSIS FOR SOURCE: INDIANTOWN COGENERATION CLASS I AREA: EVERGLADES NATIONAL PARK

*** Level-1 Screening ***

Input Emissions for

Particulates	61.65	lb/hr
NO_X (as NO_2)	582.60	lb/hr
Primary NO_2	.00	lb/hr
Soot	.00	lb/hr
Primary SO_4	.00	lb/hr

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	60.00 km
Min. Source-Class I Distance:	140.00 km
Max. Source-Class I Distance:	145.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	161.	140.0	8.	2.00	.002	.05	.000
SKY	140.	161.	140.0	8.	2.00	.001	.05	.000
TERRAIN	10.	161.	140.0	8.	2.00	.006	.05	.000
TERRAIN	140.	161.	140.0	8.	2.00	.002	.05	.000

Table 6-1(a) (Continued)

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	60.	54.9	109.	2.00	2.480*	.05	-.004
SKY	140.	60.	54.9	109.	2.00	.862	.05	-.017
TERRAIN	10.	45.	51.0	124.	2.00	.508	.05	.008
TERRAIN	140.	45.	51.0	124.	2.00	.156	.05	.007

Table 6-1(b)
VISUAL EFFECTS SCREENING ANALYSIS FOR
SOURCE: INDIANTOWN COGENERATION
CLASS I AREA: EVERGLADES NATIONAL PARK

*** Level-1 Screening ***

Input Emissions for

Particulates	61.65	lb/hr
NO_X (as NO_2)	582.60	lb/hr
Primary NO_2	.00	lb/hr
Soot	.00	lb/hr
Primary SO_4	.00	lb/hr

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	60.00 km
Min. Source-Class I Distance:	140.00 km
Max. Source-Class I Distance:	145.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	159.	140.0	9.	2.00	.003	.05	.000
SKY	140.	159.	140.0	9.	2.00	.002	.05	.000
TERRAIN	10.	159.	140.0	9.	2.00	.008	.05	.000
TERRAIN	140.	159.	140.0	9.	2.00	.002	.05	.000

Tab;e 6-1(b) (Continued)

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	65.	60.6	104.	2.00	1.971	.05	-.003
SKY	140.	65.	60.6	104.	2.00	.682	.05	-.013
TERRAIN	10.	50.	56.8	119.	2.00	.374	.05	.006
TERRAIN	140.	50.	56.8	119.	2.00	.113	.05	.005

7.0 OTHER AIR-QUALITY-RELATED IMPACTS

7.1 POTENTIAL GROWTH IMPACTS

7.1.1 CURRENT LAND USE IN THE AREA

The proposed site is to be located 9 miles east of Lake Okeechobee within Indiantown Township, Martin County, Florida. The site is southwest of and abuts the Caulkins Citrus Processing Plant and the Florida Steel Corporation Indiantown steel mill property.

The site is currently zoned as industrial but has historically been used for agricultural purposes (grazing cows). This is consistent with the area surrounding the site as well. An aerial survey of the site area revealed patterns associated with a rural agricultural land use, multiple wetlands, and a few isolated rural residential pockets and industrial facilities. No areas of special value, scenic vistas, or recreational areas exist within the immediate site area.

7.1.2 PROJECTED GROWTH

The proposed facility will be capable of producing up to 225,000 pounds per hour of steam that will be sold to the Caulkins Citrus Processing Plant for use in its facility immediately to the northeast. The electric power that will be produced will be sold to FPL.

Construction of the proposed facility will require a work force averaging approximately 800 workers over an approximately 42-month period. An adequate work force now exists in an area of about 60-100 miles around the site to support this construction without importation of workers. As a result, there is very little projected influx of workers into any adjacent communities. A few workers will be expected to relocate temporarily during construction, and there will be some permanent relocation associated with operation. However, these numbers will be within planned area growth projections and will not be the cause of any increased development.

7.1.3 POTENTIAL IMPACTS

Minimal associated growth is anticipated as a result of the construction and eventual operation of the ICL plant and is within the growth projected to occur within the area. As a result no air-quality-related impacts directly attributable to the growth associated with the proposed plant are anticipated. Conversely, the construction and operation of the plant will eliminate the agricultural activity that currently occurs on the site.

7.2 POTENTIAL IMPACTS ON SOILS AND VEGETATION

Section 7.1.1 briefly discusses existing land use patterns found in the site area. As is stated in that section, the area is relatively rural and exhibits a mixed pattern of agricultural use for grazing and citrus groves, rural residential, industrial development and undeveloped woodland, open field, and wetland.

The 232-acre site is characterized by three vegetation communities: pine flatwoods, freshwater marsh (wet prairie), and ruderal lands (disturbed). Pine flatwoods occupy approximately 200.7 acres (87 percent); freshwater marsh and ditch occupy 23.3 acres (10 percent); ruderal lands (roads, trails, clearings, and existing transmission corridor) are found on approximately 8 acres (3 percent of the site).

7.2.1 SOILS

Soils are capable of removing sulfur dioxide and nitrogen dioxide directly from the atmosphere (Abeles, et al., 1971; Ghiorse and Alexander, 1976). Calculations indicate that soils in the United States have the capacity to accommodate the total sulfur dioxide and nitrogen oxide production rate current in the United States (Mudd and Kozlowski, 1975). Sulfur dioxide, when absorbed by the soil, is primarily converted to sulfite and sulfate; however, some may also be converted to organic sulfur. Nitrogen dioxide absorbed by the soil is likewise converted to nitrite and nitrates. This conversion, in contrast to that occurring with the sulfur compounds, may be aided by nitrifying micro-organisms in the soil (Ghiorse and Alexander, 1976). Nitrogen, in contrast to sulfur, is also a primary plant nutrient.

The primary effect of sulfur dioxide and nitrogen dioxide deposition and absorption by soils is the resultant lowering of the soil pH. Low soil pH will have an influence on most chemical and biological reactions in the soil. It accelerates mineral weathering and the release of phytotoxic ions to the soil solution. It will affect the migration of clay and organic materials down through the soil-profile development process, and it will affect the level and availability of most plant nutrients in the soil solution.

Aluminum and manganese mobility is also a primary area of concern, relative to heightened soil acidity. The presence of soluble aluminum in the soil is generally a result of acid weathering of clay materials. The solubility of soil minerals at low pH is of considerable importance to plant growth and is also a consideration when assessing the potential for the transport of ions to aquatic systems. Heavy metals that may be present in the soil will also be more readily available for uptake by vegetation at lower soil pH levels.

Trace elements absorbed to particulates emitted from coal-fired power plants reach soils by direct deposition, the washing of plant or any other particulate intercepting surfaces by rainfall, and the decomposition of plant litter. The potential for toxicity from particulate deposition on soils depends on the specific elements present and whether or not those elements are present in the soil in states that can be readily absorbed and assimilated by rooted growing plants. This availability is dependent on a variety of factors, including the physicochemical properties of the trace elements, the soil chemistry, the vegetation present, the biological characteristics of the soil, and any other affecting environmental parameter, such as temperature and precipitation.

Considerable work has been done on the effects of carbon monoxide on man and animals; however, little has been done in regard to potential impacts to soils and vegetation. It is known that soil micro-organisms will use carbon monoxide as a carbon source (Bennett and Hill, 1950).

Site Soils

According to the Martin County Soil Survey, soils on the proposed ICL site include: Lawnwood fine sand; Lawnwood fine sand, depressional; Waveland sand; Waveland sand, depressional; Basinger fine sand, Basinger fine sand, depressional; Sanibel muck; and Placid sand.

The three most common soil types are Waveland sand, Lawnwood fine sand, and Basinger fine sand. All are nearly level, poorly drained soils supporting pine flatwoods. The remaining soil types are hydric soils associated with the wet prairies. These are nearly level, poorly drained soils of depressions in the flatwoods. These soils are ponded for 6 or more months of the year.

Potential Impacts to Soils

Particulate deposition may affect soils by altering pH and by potentially increasing the availability of heavy metals in the soil for plant uptake. It has also been determined that uptake by vegetation will not increase dramatically unless the deposited trace elements were considerably more available than the endogenous forms. Those levels are projected not to be surpassed. In regard to the sizes of the deposited particles and the relationship of that particle size distribution to potential impacts, if it can be determined that the impact to soils of the total particulate deposition is insignificant, then the related impact of a portion of that total (particles less than 10 microns in diameter, or PM-10) would likewise be insignificant.

As to the potential for impact from emissions of carbon monoxide, the levels expected from the proposed plant (see Section 5.1.3) will not result in the potential for any significant adverse impacts to soils in the site area.

7.2.2 VEGETATION

This section discusses the potential for detrimental effects to vegetation associated with operation of the proposed ICL plant. General information concerning the variability of plant response to air pollution, types of injury, and characteristics of injury is presented to establish a background for consideration of the results of the analysis. Background land use and vegetational data are discussed to establish which plant species are to be considered in the analysis. Specific data relating to the sensitivity of important plants to SO_2, NO_2, and particulates is also provided.

The response of individual plant species to air pollutants varies not only with the concentration to which they are exposed and the duration of exposure, but with a wide range of environmental, physiological, and genetic factors as well. For example, SO_2 injury may be less likely for a plant's growth in sulfur-deficient soils. Under these conditions, SO_2 may even have a fertilizing effect (EPA, 1976). In general, factors which enhance plant growth may also increase injury.

The effects of air pollutants on vegetation can be placed into three broad categories: acute, chronic, and long-term. In the first case, injury is due to exposure to high concentrations over a relatively short period of time. Chronic injury is the result of exposure to relatively low concentrations over a longer period of time, whereas long-term injury includes abnormal changes in ecosystems and subtle physiological alterations of plants. Effects can be caused by both direct exposure to air pollutants and secondary factors such as changes in soil pH (FWS, 1978).

Air pollution may also affect entire ecosystems, as well as individual plants (Smith, 1974). Effects will, of course, vary, depending upon the pollutant load to which the system is subjected and the ecosystem in question.

Site Vegetation

Approximately 200 acres of pine flatwoods and 24 acres of wet prairie and ditch are present on the proposed plant site. An additional 8 acres of ruderal or disturbed land also occur within the proposed site as an existing transmission line right-of-way, clearings, roads, and trails. The ruderal land component of the proposed site contains a diverse array of opportunistic weedy plants, such as common ragweed, bahia grass, beggar's ticks, and dropseeds.

The wet prairies wetlands on the project site vary slightly in size, configuration, topographic relief, and hydroperiod. These natural features tend to regulate species composition and structure, together with other environmental factors such as drainage, rainfall, cattle/hog perturbations, edaphic conditions, and exotic species invasion. For comparative purposes, two hydrologically isolated wet prairies were sampled: a 0.45-acre, shallow depression located in the northeastern corner of the site and an 8.16-acre, deeper wetland located in the center of the property.

Both of the wet prairies sampled were relatively undisturbed. The smaller wet prairie was dominated by big carpetweed, blue maidencane, and bushy goldenrod, in order of magnitude. These three species are indicative of a transitional hydroperiod (i.e., dry most of the year with saturated to inundated conditions seasonally). The surface soil within the depression was dry at the ground surface during the sampling period. Species composition was uniform across the relatively flat system.

The larger wetland was moist at the upland/wetland interface (saw palmetto edge) and contained 6 to 14 inches of water in the center. Transitional wetland species occurred in a somewhat homogeneous fashion along the more landward reaches of the wetland. However, the ponded center of the wetland supported more obligate hydrophytes, such as pickerelweed, maidencane, frog's-bit, and mermaid's weed.

The zonation of obligate and facultative wetland species within the wetland conformed to the hydroperiod and soil types. The center of the wetland is ponded for 2 to 6 months in the rainy season and has a poorly drained, organic surface layer (Sanibel muck), while the wetland fringe is drier and is supported by a more sandy, poorly drained hydric soil (Lawnwood fine sand, depressional). The dominant wetland species of the larger wet prairie included blue maidencane, big carpetweed, shortspike bluestem, and maidencane, in order of magnitude.

The physiognomy of the pine flatwoods was rather homogeneous throughout. The herbaceous layer was dominated by wiregrass and other typical flatwoods species such as broomsedge, bottlebrush threeawn, dichanthelium grass, St. John's wort, and gallberry seedlings.

The shrub strata was dominated by the conspicuous saw palmetto. Woody components of the shrub layer in order of magnitude include gallberry, staggerbush, dwarf live oak, pawpaw, and tarflower. The canopy was open and consisted solely of south Florida slash pine. The south Florida slash pine sampled ranged in diameter-at-breast-height from 4 to 16.5 inches.

Potential Impacts to Vegetation from SO_2 Emissions

Since research on acute effects of SO_2 on vegetation has been carried out for a number of years, it is possible to classify various plants with respect to their sensitivity to this pollutant (FWS, 1978). Plants have been ranked as sensitive, intermediate, or resistant in this regard. Table 7-1 lists the sensitivity of 47 plants, trees, and important agricultural crops which have been identified as sensitive to SO_2 emission. Dose-response curves have been presented for each sensitivity class and may be used to determine the possibility of SO_2 injury (see Figures 7-1 to 7-3). As noted in the figures, the lowest 3-hour concentration expected to cause injury or damage to sensitive vegetation is about 0.15 ppm (390 $\mu g/m^3$).

The highest second-highest incremental 3-hour ground-level SO_2 concentration predicted to result from operation of the ICL plant is 24.7 $\mu g/m^3$, occurring 0.25 km east of the site (see Section 5.3.2). Since this concentration is well below threshold values for sensitive species, it is not expected to result in vegetation injury. Even considering the combined 3-hour maximum impact (ICL + interactive background sources + monitored background), the concentration is 242 $\mu g/m^3$ which is only about 62 percent of the injury threshold level (390 $\mu g/m^3$) for sensitive vegetation.

Potential Impacts to Vegetation from NO_2 Emissions

Of the various oxides of nitrogen, NO and NO_2 are important air pollutants. In relation to air pollution injury to vegetation, NO_2 is of primary concern, since NO is oxidized to NO_2 in the atmosphere. While the database is not as extensive for NO_2 as for SO_2, plant sensitivity ratings have nonetheless been developed for this pollutant (EPA, 1976). As with SO_2 response, plants have been ranked as sensitive, intermediate, or resistant with respect to their susceptibility to injury from NO_2. Table 7-2 categorizes plants which are important agricultural or forest species, with respect to NO_2 sensitivity.

A dose-response curve has also been developed for NO_2; this may be used to determine the possibility of injury to vegetation Figure 7-4). As shown in the figure, threshold levels for 3-hour and 24-hour exposures are about 1.0 and 0.4 ppm (1,890 and 750 ug/m^3), respectively. The maximum 3-hour and 24-hour NO_2 impacts calculated for the ICL area are 95 and 44.5 $\mu g/m^3$, respectively. Since the maximum expected levels are several orders of magnitude below the threshold levels, no injury to vegetation from this pollutant is expected.

<u>Potential Impacts to Vegetation from Particulate Emissions (TSP/PM10)</u>

In comparison with the effects of SO_2 and NO_2 on plants, less is known concerning particulate matter. Particulate matter varies greatly in size and chemical composition. However, most studies fail to define one or both of these parameters when discussing effects on vegetation. Thus, dose-response curves, such as those utilized for SO_2 and NO_2, have not been generated.

Studies relating to particulates have addressed a number of pollutant sources and specific particles; however, most data pertain primarily to the effects of settlable dusts. Studies have shown that cement kiln dust, which is higher in lime than coal combustion particulates (Jones, et al., 1979), does have an affect on both fir trees and bean plants (Mudd and Kozlowski, 1975; Darley, 1966). Limestone dust in concentrations averaging 824 $\mu g/m^3$ has also been shown to affect tree growth, disease susceptibility of plants, and forest composition (Brandt and Rhodes, 1972, 1973; Manning, 1971). This average concentration, however, is several times greater than either of the applicable federal or state particulate standards to which the plant will be held (see Table 2-5). The highest second-highest predicted 24-hour ground level concentration from the ICL facility is 3.3 $\mu g/m^3$ (for TSP) at the site boundary (42.3 $\mu g/m^3$ with background) (see Section 5.3.2). It can therefore be concluded that particulate emissions from the ICL plant are not anticipated to cause injury in vegetation.

As with impacts to soils, the fact that impacts to vegetation are expected to be insignificant from deposition of all potential particulate emissions supports the expectation that impacts from the deposition particles in the PM-10 size range will likewise be insignificant.

Potential Impacts to Vegetation from CO Emissions

In comparison with other pollutants, relatively little research has been accomplished regarding the effects of CO on vegetation. Available information indicates that a potential does exist for impacts to vegetation, but only at levels of concentration far in excess of those expected from operation of the ICL. The maximum incremental 1-hour CO concentration expected is 78.2 $\mu g/m^3$. At this level, vegetation damage is not anticipated. Furthermore, soil micro-organisms can use carbon monoxide as a carbon source (Bennett and Hill, 1950).

7.3 COOLING TOWER IMPACTS

This section addresses impacts associated with the operation of the ICL cooling tower. Potential effects of long-term salt deposition, due to cooling tower drift, on nearby soils and vegetation are discussed. Additionally, climatological impacts (i.e., enhanced potential for fogging and icing conditions) in the site vicinity are also summarized.

General tower design and performance data are provided, as well as input to the cooling tower drift model used for these analyses (see Section 3.7.3). The results from these analyses are summarized in the following subsections.

7.3.1 COOLING TOWER DESIGN

A mechanical draft, counter-flow cooling tower with a bank of 10 cells is proposed to meet the closed-loop cooling requirements of the ICL plant. Design data for the cooling tower are presented in Table 7-3. The drift rate of the proposed cooling tower is 0.002 percent, or 5.3 gpm. The total dissolved solids of the system is about 2,800 milligrams per liter (mg/l).

7.3.2 MODEL INPUT

The SACTI mathematical model (see Section 3.7.3) incorporates the tower performance, which relates exit air temperature to ambient wet bulb temperature, and drift rate, which is expressed as a percentage of the total circulating water flow, as discussed above. The model also requires a drift droplet size distribution. The distribution input to the model is based on a study of mathematical models that characterize plume and drift behavior from cooling towers (EPRI, 1980), and is listed in Table 7-4.

Meteorological data used by the model were from the NWS station in West Palm Beach, (see Section 4.3). To assess the impacts of cooling tower operation with respect to salt deposition rates and enhanced fogging and icing conditions in the site vicinity, a 5-year composite meteorological data set (1982-1986) from West Palm Beach was used.

The SACTI model calculations used a polar coordinate receptor grid system. The grid system was centered on the center cell of the proposed cooling tower.

Receptors were placed at 22.5-degree intervals at downwind distances ranging from 0.1 to 10 km at successive 100-meter intervals for salt deposition estimates. For the visible plume analysis, receptors ranged from 50 to 5,000 m at successive intervals of 50 meters.

7.3.3 IMPACT ASSESSMENTS

The environmental impacts addressed include an assessment of the potential effects on nearby soils and vegetation from salt drift deposition. Climatological impacts are discussed in terms of the potential for enhanced fogging and icing in the vicinity of the plant and possible related impacts to traffic.

Soil/Vegetation Impacts

Seasonal and annual salt deposition rates were calculated in units of $kg/km^2/month$. By applying a factor of 0.0089, this unit can be converted to lb/acre/month. Table 7-5 shows that the majority of the drift is deposited on site, within 100 meters of the cooling tower on an annual basis. The maximum off-site salt deposition rate is about 18.1 lb/acre/month. This value occurs 200 m north of the cooling tower during the summer season. The Caulkins Citrus Processing Plant and Florida Steel Corporation are located to the north and east of the ICL cooling tower, respectively; thus, the maximum off-site salt deposition rate occurs within the Caulkins Citrus property. Beyond the property boundaries of the neighboring facilities, the maximum salt deposition rate in all directions is 2.8 lb/acre/month, occurring 600 m to the west of the cooling tower. This maximum impact occurred during the fall season.

One mechanism for the impact of saline drift on plants is through the absorption of salt accumulated in the soil. Accumulation will occur if the annual deposition of salt exceeds the rate at which salt is washed from the soil by rainfall. The results of studies (MPPSP, 1979, pp. 4-18 to 4-23) with sandy loam soil suggest that a deposition rate of about 89 lb/acre/month (100 kg/Ha/month) of NaCl can cause some accumulation of salt in the soil. As stated above, the maximum off-site salt deposition rate is 18.1 lb/acre/month. This value is much lower than the monthly threshold value that causes salt accumulation in soil. Therefore, no significant soil impacts are expected. The annual average rainfall rate at the ICL site area is considerably higher than the Chalk Point, Maryland area in the quoted study. Therefore, the threshold value used in the analysis is conservative.

Direct salt damage to vegetation is due to the absorption of salt from drift that is deposited on a plant's leaves. The absorbed salt can cause immediate damage or accumulate in the woody tissue of perennial plants until it reaches toxic levels.

An investigation of the potential effects of cooling tower drift on vegetation was conducted in which predicted salt deposition rates (i.e., an estimated amount of salt deposited over a unit area per season and year at a certain direction and "distance" away from the tower) were compared to available salt injury thresholds.

Near the edge of the proposed power plant site boundary, salt deposition rates on an annual basis (i.e., the equivalent rate in lb/acre/month times 12 months per year) range from 0.42 to 216.9 lb/acre/year. The greatest concentrations are generally located to the north and east of the proposed power plant, where existing industrial facilities are located. Citrus, a potentially sensitive plant to salt deposition, is present in large groves from the south-southeast clockwise through the southwest and also to the northwest of the cooling tower. The closest groves are about 4,000 feet to the southwest and about 4,200 feet to the south of the cooling tower. At these locations the highest levels of salt deposition over an annual period are about 0.6 lb/acre/year and 1.1 lb/acre/year, respectively; this should not result in any significant foliar, shoot, or fruit damage or any long-term reductions in growth, yield, or photosynthesis.

Cooling tower drift will also deposit salt on the surrounding improved pasture, truck crops, dairy farms, and sugar cane agricultural land and in the area around the proposed cogeneration plant site, but at distances from the tower much greater than to the citrus groves. The agricultural land around the proposed plant should not be affected by these emissions, since the maximum amount of salt deposited will only amount to about 1 lb/acre/year at the closest distance to agriculture near the site (i.e., the citrus groves). A cautionary limit of 100 lb/acre/year can be used for agricultural areas based upon known salt injury thresholds to crops, e.g., tobacco, 214 lb/acre/year; corn, 107 lb/acre/year; and soybean, 107-154 lb/acre/year (Mulchi, Wolf, and Armbruster, 1978). Therefore, the proposed plant operation would not cause the cautionary limit to be approached or exceeded within agricultural areas.

Based upon a literature review, one of the most sensitive native plant species to salt injury is flowering dogwood (<u>Cornus</u> florida). The lowest injury threshold for flowering dogwood is reported at 81 lb/acre/year (Curtis, <u>et</u> <u>al</u>., 1978). Although flowering dogwood is only naturally occurring much further north of Martin County, a similar dogwood species, stiff cornell (<u>Cornus</u> <u>foemina</u>) would be expected within the mixed and cypress swamps in the immediate area (approximately 2,900 feet southeast of the cooling tower).

On the basis of the reported injury threshold and a predicted maximum annual salt deposition rate of 2.7 lb/acre/year in the vicinity of forested wetlands offsite, no adverse effects to dogwood or other indigenous vegetation is expected at this location. Native vegetation associated with pine and wet prairies does occur on the site and along property boundaries. Salt deposition could, at a maximum, range from 172.8 to 216.9 lb/acre/year on the northern property boundary and at higher rates within the site, possibly resulting in plant injury. Furthermore, the "units" of the modeling results shown in Table 7-5 (whether kg/km^2/month or lb/acre/month) imply that the deposition rate value applies uniformly over the entire unit area; for example, a square kilometer. However, the value is actually determined for the specific receptor point; if the rate of deposition at the point were the same over the entire unit area, then the reported value would result. But, as the values in Table 7-5 show, there is a large gradient in deposition rates between adjacent direction sectors and successive downwind distances. Therefore, the numerical results are generally conservative, and so it is not known to what degree and over what period any adverse effects to plant physiology would be evidenced.

Based upon the assumption that ambient salt deposition rates in the region are minimal, salt deposited from the cooling towers should have no significant adverse effect on natural vegetation or crops just outside site boundaries or in the region of the proposed cogeneration plant.

Climatological Impacts

Local climatological data from the West Palm Beach NWS station were used to characterize ambient fogging and icing conditions in the absence of the proposed cooling tower (DOC, 1972). On average, heavy fog conditions (i.e., with visibility at 1/4 mile or less), which are generally in response to synoptic-scale meteorological conditions, occur about 8 days per year. Because of the prevailing subtropical conditions, no snow was observed during the 29-year period.

In this study, 5 years of hourly surface data and twice-daily mixing height data for the NWS station at West Palm Beach (1982 to 1986) were input to the model to describe ambient atmospheric conditions. The model sorts the hourly meteorological data into classes defined by wet-bulb temperature, relative humidity, and wind speeds for the 16 compass directions (i.e., north, north-northeast, northeast, etc.). The maximum downwind horizontal extent of the elevated visible cooling tower plume is more than 5 km at a height of 1 km above the ground. The highest frequency of this condition occurred 0.73 percent of the time in the northeast direction. The frequency and vertical extent of visible plume occurrence resulting from the operation of the cooling tower is presented in Table 7-6 for all 16 directions out to 5 km.

In view of the small frequency of the occurrence (64 hours/year) of the visible plume in any given direction, the impact of the cooling tower on local climatology is expected to be insignificant.

Potential Traffic Impacts

The visible plume may reduce visibility if it crosses the path of ground-based or air traffic. The only nearby public road is U.S. Route 710. Its closest approach to the plant site is at least 750 meters to the northeast. At this distance, the plume height is about 150 meters above the ground (see Table 7-6(c)). Since terrain around the plant site is essentially flat, visibility on nearby roads is not expected to be degraded by the formation of this elevated visible plume. With respect to potential visibility impacts to air traffic, the Circle T Ranch airport, located about 5 miles to the east-northeast of the plant site, is the closest airport to the proposed facility that is open to the general public. The visible plume length in the ENE direction of the ICL cooling tower is only 150 meters. Therefore, the visible plume will not hinder the safe operation of aircraft during takeoff or landing at the Circle T Ranch airport. The nearest private airport is located 2.5 miles north of the plant site. The visible plume length in the north direction of the ICL cooling tower is only 150 meters. Thus, the visible plume will not have adverse impact on the safe operation of aircraft during takeoff or landing. Two major airports, West Palm Beach and Stuart, are more than 20 miles away from the ICL site. No significant visible plume impacts are expected at these distant airports.

Induced ground-level fogging will occur during plume downwash conditions. This locally induced fog will be dissipated rapidly due to the high winds associated with plume downwash conditions. Most of the plume fogging events occurred within 300 meters of the cooling tower (see Table 7-7). Plume fogging is estimated to occur up to 1.25 kilometers from the tower for the south and south-southeast directions only. Since the northwest-southeast oriented Route 710 is more than 750 meters from the plant, the building-induced ground fog occurred in the south and south- southeast directions will never obstruct the traffic flow on that road. Similar to the climatological data, the SACTI model predicted no occurrence of icing in this subtropical area. The frequency of fogging and icing occurrences resulting from the operation of the cooling tower is presented in Table 7-7.

Table 7-1
RELATIVE SENSITIVITY TO SO_2 OF PLANTS IDENTIFIED ON SITE AND OF IMPORTANT AGRICULTURAL CROPS AND FOREST TREES[a]

SPECIES	SENSITIVITY RATING[b]
Trees and Shrubs	
Blackberry	S
Black willow	S
Blueberry	S
Green ash	S
Large-toothed aspen	S
Staghorn sumac	S
Tulip poplar	S
Virginia pine	S
Cottonwood	I
Red maple	I
Rose	I
White oak	I
Beech	R
Black gum	R
Black locust	R
Pin oak	R
Red oak	R
Smooth sumac	R
White dogwood	R
Herbaceous Plants	
Bindweed	S
Black mustard	S
Broomgrass	S
Cocklebur	S
Dandelion	S
Goldenrod	S
Iris	S
Lambs quarters	S
Nightshade	S
Orchard grass	S
Prickly lettuce	S
Ragweed	S
Sour dock	S
Sweet clover	S, I[c]

Table 7-1 (Continued)

SPECIES	SENSITIVITY RATING[b]
Violet	S
Cordgrass	I
Milkweed	I
Deptford pink	R
Barley	S
Cucumber	S
<u>Herbaceous Plants</u> (Continued)	
Lima bean	S
Pea	S, I[c]
Rye	S
<u>Crops and Vegetables</u>	
Soybean	S
Spinach	S
Wheat	S
Irish potato	I
Corn	R

NOTES:

a - Sources: (Anderson, 1979; Ghiorse and Alexander, 1976).

b - S = sensitive, I = intermediate, R = resistant

c - This species is noted in two categories since the source list was compiled from the data of numerous researchers.

Table 7-2
RELATIVE SENSITIVITY TO NO_2 OF PLANTS IDENTIFIED IN THE SITE AREA AND OF IMPORTANT AGRICULTURAL CROPS AND FOREST TREES[a]

SPECIES	SENSITIVITY RATING[b]
<u>Trees and Shrubs</u>	
Black locust	R
Hornbean	R
Oak	R
Pine	R
<u>Herbaceous Plants</u>	
Black mustard	S
Dandelion	I
Lamb's quartersR	
Pigweed	R
<u>Crops and Vegetables</u>	
Apple tree	S
Barley	S
Bean	S, I[c]
Pea	S
Corn	I
Tomato	I
Wheat	I
Asparagus	R

a - Source: EPA, 1976.

b - S = sensitive, I = intermediate, R = resistant

c - This species is rated in two categories since several varieties are involved.

Table 7-3
ICL MECHANICAL-DRAFT COOLING TOWER DESIGN PARAMETERS

Number of Cells	10
Heat Load	1,655 MMBtu/hr
Circulating Water Flow Rate	265,000 gpm
Design Wet Bulb Temperature	80 °F
Approach	10 °F
Range	83 °F - 108 °F
Air Flow Rate Per Cell	1,575,000 acfm/cell
Drift Rate	0.002%
Tower Dimension	60 ft x 600 ft x 56 ft
Fan Diameter	32.8 ft

Table 7-4
COMPOSITE COOLING TOWER DRIFT EMISSION SPECTRUM[a]

Interval	dl (μm)	d_u (μm)	Mass Fraction(%)
1	0	10	0.00
2	10	20	0.53
3	20	30	4.43
4	30	40	7.41
5	40	50	6.51
6	50	60	5.48
7	60	70	3.51
8	70	90	3.26
9	90	110	1.78
10	110	130	0.95
11	130	150	0.76
12	150	180	1.10
13	180	210	1.17
14	210	240	1.32
15	240	270	1.41
16	270	300	1.82
17	300	350	2.67
18	350	400	2.33
19	400	450	2.29
20	450	500	1.51
21	500	600	4.33
22	600	700	3.51
23	700	800	3.82
24	800	900	2.73
25	900	1000	1.71
26	1000	1200	3.19
27	1200	1400	3.32
28	1400	1600	6.43
29	1600	1800	2.21
30	1800	2000	3.07
31	2000	2200	15.4

a - Source:EPRI, 1984.
b - Droplet diameter lower (d_l) and upper (d_u) size range in microns (um) for given interval.

TABLE 7-5. COOLING TOWER SALT DEPOSITION

************************************ PLUME SALT DEPOSITION TABLE (KG./(KM.**2-MO.)) ************************************

INDIANTOWN, 1982-86 WEST PALM BEACH MET. DATA (LMDCT, 10 CYCLES)

SEASON=ANNUAL

DISTANCE FROM TOWER (M)	WIND FROM																
	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	AVG
	PLUME HEADED																
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	14275.	9260.	20325.	29540.	58567.	32095.	33592.	19129.	22912.	8524.	9615.	8029.	12659.	9890.	13048.	11616.	19567.
200.	1220.	811.	1648.	2432.	4783.	2309.	2425.	1618.	2031.	1135.	1247.	709.	1132.	752.	989.	1024.	1642.
300.	355.	189.	368.	626.	1222.	641.	681.	424.	552.	306.	332.	210.	338.	212.	274.	317.	440.
400.	155.90	96.79	185.59	302.16	607.37	376.13	398.54	215.03	276.18	152.30	167.71	92.40	145.42	137.64	182.63	130.66	226.40
500.	112.58	44.19	84.58	150.72	307.94	187.54	205.79	132.92	197.61	72.64	80.82	70.61	111.35	48.03	62.36	106.76	123.53
600.	86.71	19.36	33.76	111.32	224.80	143.09	156.47	94.10	141.12	38.27	42.48	54.99	87.23	40.59	53.27	84.55	88.26
700.	40.49	14.31	25.33	68.80	137.59	111.68	121.19	50.23	67.68	24.14	27.51	23.41	36.79	32.73	41.81	34.50	53.64
800.	26.35	8.65	13.97	30.49	62.18	74.86	82.44	28.58	44.64	19.16	21.46	16.12	26.15	22.03	29.61	25.87	33.29
900.	17.79	5.45	8.69	21.67	42.54	46.63	53.01	16.99	24.76	11.74	13.02	9.95	16.54	18.80	25.19	16.77	21.85
1000.	15.45	3.94	6.25	20.88	40.77	44.66	50.22	15.49	21.44	8.49	9.47	8.33	13.74	17.80	23.43	14.02	19.65
1100.	18.58	3.21	4.99	18.81	37.24	40.36	44.53	15.44	27.17	7.17	7.95	12.08	20.93	14.30	18.10	18.99	19.37
1200.	23.52	4.59	5.93	16.86	32.89	36.44	40.44	15.73	36.24	14.22	15.35	17.48	31.64	12.28	15.42	26.54	21.60
1300.	10.34	3.75	4.78	12.42	24.36	26.30	29.60	9.37	14.34	11.93	12.80	5.62	9.62	7.83	10.04	10.25	12.71
1400.	21.07	1.63	2.84	20.06	47.09	18.41	19.82	30.39	41.71	2.80	3.24	11.69	17.61	3.89	5.52	13.51	16.33
1500.	14.12	1.48	2.68	15.65	35.62	18.36	19.75	21.52	28.55	2.47	2.82	7.66	11.43	3.87	5.50	8.51	12.50
1600.	3.34	.80	1.23	6.08	11.61	16.80	18.23	3.60	4.72	2.03	2.30	1.80	3.04	3.65	5.28	3.16	5.48
1700.	3.31	.51	.61	5.86	11.34	13.06	14.11	3.56	4.70	1.79	2.03	1.79	2.99	3.26	4.78	3.15	4.80
1800.	3.20	.49	.60	5.82	11.28	5.31	5.66	3.49	4.58	1.74	1.95	1.75	2.93	2.72	3.93	3.06	3.66
1900.	3.17	.48	.58	5.80	11.26	5.18	5.49	3.48	4.56	1.69	1.87	1.74	2.91	2.47	3.45	3.03	3.57
2000.	3.16	.46	.56	5.80	11.24	4.95	5.18	3.46	4.52	1.64	1.83	1.73	2.89	2.02	2.66	3.02	3.45
2100.	3.15	.41	.50	5.80	11.22	4.88	5.06	3.45	4.52	1.47	1.67	1.73	2.89	1.93	2.49	3.01	3.39
2200.	2.55	.37	.45	3.08	5.98	4.56	4.76	2.32	3.64	1.31	1.47	1.51	2.53	1.88	2.45	2.76	2.60
2300.	2.39	.34	.41	3.02	5.88	1.58	1.92	2.20	3.42	1.18	1.34	1.43	2.40	1.17	1.60	2.56	2.05
2400.	2.00	.29	.36	2.91	5.63	1.28	1.56	1.95	2.86	.94	1.09	1.18	2.00	.66	1.00	2.01	1.73
2500.	1.55	.26	.33	2.75	5.31	1.23	1.49	1.70	2.30	.80	.88	.85	1.43	.63	.97	1.38	1.49
2600.	1.27	.25	.32	2.68	5.17	1.05	1.25	1.59	2.01	.77	.83	.66	1.09	.59	.92	1.00	1.34
2700.	1.15	.23	.30	2.41	4.83	.76	.90	1.51	1.87	.74	.80	.57	.92	.46	.76	.87	1.19
2800.	1.10	.23	.30	2.40	4.80	.76	.90	1.48	1.79	.73	.80	.54	.86	.43	.73	.82	1.17
2900.	.95	.16	.21	2.34	4.63	.76	.90	1.36	1.51	.54	.62	.45	.69	.43	.73	.68	1.06
3000.	.73	.14	.19	1.63	3.18	.76	.89	.94	1.05	.47	.55	.34	.55	.43	.72	.57	.82
3100.	.40	.13	.17	.21	.44	.35	.46	.34	.58	.41	.49	.23	.37	.40	.68	.43	.38
3200.	.36	.12	.17	.19	.41	.33	.41	.31	.53	.39	.46	.21	.34	.38	.63	.39	.35
3300.	.34	.11	.15	.18	.40	.32	.40	.30	.52	.35	.40	.20	.33	.38	.62	.38	.34
3400.	.34	.11	.15	.18	.40	.32	.40	.30	.52	.35	.40	.20	.33	.38	.62	.38	.34
3500.	.34	.10	.13	.18	.40	.32	.40	.30	.52	.28	.35	.20	.33	.38	.62	.38	.33
3600.	.34	.09	.12	.18	.40	.32	.40	.30	.52	.21	.27	.20	.33	.38	.62	.38	.32
3700.	.34	.08	.10	.18	.40	.32	.40	.30	.52	.20	.26	.20	.33	.38	.62	.38	.31
3800.	.34	.04	.05	.18	.40	.32	.40	.30	.52	.11	.15	.20	.33	.38	.62	.38	.30
3900.	.34	.03	.04	.18	.40	.27	.32	.30	.52	.06	.07	.20	.33	.29	.46	.38	.26
4000.	.32	.02	.04	.16	.37	.24	.28	.28	.50	.06	.07	.20	.32	.23	.33	.36	.23
4100.	.30	.02	.04	.14	.34	.23	.27	.26	.48	.06	.07	.20	.31	.19	.28	.35	.22
4200.	.30	.02	.04	.14	.34	.22	.26	.26	.47	.06	.06	.19	.31	.19	.27	.35	.22
4300.	.30	.02	.03	.14	.34	.21	.24	.26	.47	.06	.06	.19	.31	.17	.25	.35	.21
4400.	.30	.02	.03	.14	.34	.17	.18	.26	.47	.05	.06	.19	.31	.13	.17	.35	.20
4500.	.24	.02	.03	.09	.21	.17	.18	.16	.34	.05	.06	.16	.26	.12	.17	.32	.16
4600.	.24	.02	.03	.09	.20	.16	.17	.16	.33	.05	.06	.16	.26	.12	.16	.32	.16
4700.	.24	.02	.03	.09	.20	.16	.17	.15	.32	.05	.06	.16	.25	.12	.16	.31	.16
4800.	.24	.02	.03	.09	.20	.16	.17	.15	.32	.05	.05	.16	.25	.12	.16	.31	.15
4900.	.24	.02	.03	.09	.20	.16	.17	.15	.32	.05	.05	.16	.25	.12	.16	.31	.15
5000.	.20	.02	.03	.08	.17	.16	.17	.13	.27	.05	.05	.13	.20	.12	.16	.25	.14

TABLE 7-5. COOLING TOWER SALT DEPOSITION (Contd.)

1 ************************************ PLUME SALT DEPOSITION TABLE (KG./(KM.**2-MO.)) **********************************

INDIANTOWN, 1982-86 WEST PALM BEACH MET. DATA (LMDCT, 10 CYCLES)

SEASON=ANNUAL

DISTANCE FROM TOWER (M)	WIND FROM N / PLUME HEADED S	NNE / SSW	NE / SW	ENE / WSW	E / W	ESE / WNW	SE / NW	SSE / NNW	S / N	SSW / NNE	SW / NE	WSW / ENE	W / E	WNW / ESE	NW / SE	NNW / SSE	AVG / AVG
5100.	.20	.02	.03	.08	.17	.16	.17	.13	.27	.05	.05	.13	.20	.12	.16	.25	.14
5200.	.20	.02	.03	.08	.17	.16	.17	.13	.27	.05	.05	.13	.20	.12	.16	.25	.14
5300.	.19	.02	.02	.08	.17	.16	.17	.12	.25	.05	.05	.12	.19	.12	.16	.24	.13
5400.	.17	.02	.02	.07	.16	.16	.17	.10	.23	.05	.05	.11	.18	.12	.16	.21	.12
5500.	.16	.02	.02	.07	.15	.16	.17	.10	.22	.05	.05	.11	.17	.12	.16	.20	.12
5600.	.13	.02	.02	.06	.14	.16	.17	.09	.18	.05	.05	.08	.14	.12	.16	.16	.11
5700.	.12	.02	.02	.06	.13	.16	.17	.09	.18	.05	.05	.08	.13	.12	.16	.14	.10
5800.	.10	.02	.02	.06	.12	.16	.17	.08	.15	.05	.05	.07	.12	.12	.16	.12	.10
5900.	.09	.02	.02	.05	.12	.16	.16	.07	.14	.05	.05	.06	.11	.10	.14	.11	.09
6000.	.09	.02	.02	.05	.12	.15	.16	.07	.14	.05	.05	.06	.11	.09	.12	.11	.09
6100.	.09	.02	.02	.05	.12	.15	.16	.07	.14	.05	.05	.06	.11	.09	.12	.11	.09
6200.	.09	.02	.02	.05	.12	.15	.16	.07	.14	.05	.05	.06	.11	.09	.12	.11	.09
6300.	.09	.02	.02	.05	.12	.15	.16	.07	.14	.05	.05	.06	.11	.09	.12	.11	.09
6400.	.09	.02	.02	.05	.12	.15	.16	.07	.14	.05	.05	.06	.11	.09	.11	.11	.09
6500.	.09	.02	.02	.05	.11	.15	.16	.07	.14	.05	.05	.06	.11	.08	.11	.11	.09
6600.	.09	.02	.02	.05	.11	.14	.15	.07	.14	.05	.05	.06	.11	.07	.09	.10	.08
6700.	.09	.02	.02	.05	.11	.14	.15	.07	.14	.05	.05	.06	.11	.07	.09	.10	.08
6800.	.09	.02	.02	.05	.11	.14	.15	.07	.14	.05	.05	.06	.11	.07	.09	.10	.08
6900.	.09	.02	.02	.05	.11	.14	.15	.07	.14	.04	.05	.06	.11	.07	.09	.10	.08
7000.	.09	.02	.02	.05	.11	.14	.15	.07	.14	.04	.05	.06	.11	.07	.09	.10	.08
7100.	.09	.02	.02	.05	.11	.14	.15	.07	.14	.04	.05	.06	.11	.07	.09	.10	.08
7200.	.09	.02	.02	.05	.11	.14	.15	.07	.14	.04	.05	.06	.11	.07	.09	.10	.08
7300.	.09	.02	.02	.05	.11	.14	.15	.07	.14	.04	.05	.06	.11	.07	.09	.10	.08
7400.	.08	.02	.02	.05	.11	.14	.15	.06	.13	.04	.05	.06	.10	.07	.09	.09	.08
7500.	.07	.02	.02	.05	.11	.14	.15	.06	.12	.04	.05	.06	.09	.07	.10	.08	.08
7600.	.07	.02	.02	.05	.11	.14	.15	.06	.12	.04	.05	.06	.09	.07	.10	.08	.08
7700.	.07	.02	.02	.05	.11	.14	.15	.06	.12	.04	.05	.06	.09	.07	.10	.08	.08
7800.	.07	.02	.02	.05	.11	.14	.15	.06	.12	.04	.05	.06	.09	.07	.10	.08	.08
7900.	.07	.02	.02	.05	.11	.14	.15	.06	.12	.04	.05	.06	.09	.07	.10	.08	.08
8000.	.07	.02	.02	.05	.11	.14	.15	.06	.12	.04	.05	.06	.09	.07	.10	.08	.08
8100.	.07	.02	.02	.05	.11	.14	.15	.06	.12	.04	.05	.06	.09	.07	.10	.08	.08
8200.	.07	.02	.02	.05	.11	.14	.15	.06	.12	.04	.04	.05	.09	.07	.10	.08	.08
8300.	.06	.02	.02	.05	.10	.14	.15	.05	.11	.04	.04	.05	.09	.07	.10	.08	.07
8400.	.06	.02	.02	.05	.10	.14	.15	.05	.11	.04	.04	.05	.09	.07	.09	.08	.07
8500.	.06	.02	.02	.05	.10	.14	.15	.05	.11	.04	.04	.05	.09	.07	.09	.08	.07
8600.	.06	.02	.02	.05	.10	.14	.15	.05	.11	.04	.04	.05	.09	.07	.09	.08	.07
8700.	.06	.02	.02	.05	.10	.14	.14	.05	.11	.04	.04	.05	.09	.07	.09	.08	.07
8800.	.06	.02	.02	.05	.10	.14	.14	.05	.11	.04	.04	.05	.08	.06	.09	.07	.07
8900.	.06	.01	.02	.04	.10	.14	.14	.05	.10	.04	.04	.04	.07	.06	.08	.07	.07
9000.	.05	.01	.02	.04	.08	.13	.14	.04	.08	.03	.04	.04	.07	.06	.07	.06	.06
9100.	.05	.01	.02	.04	.08	.13	.13	.04	.08	.03	.04	.04	.07	.04	.05	.06	.06
9200.	.05	.01	.02	.04	.08	.13	.13	.04	.08	.03	.04	.04	.07	.04	.05	.06	.06
9300.	.05	.01	.02	.04	.07	.13	.13	.03	.07	.03	.03	.03	.05	.04	.05	.05	.05
9400.	.04	.01	.02	.03	.07	.11	.11	.03	.06	.03	.03	.03	.05	.04	.05	.05	.05
9500.	.04	.01	.02	.03	.07	.10	.10	.03	.06	.03	.03	.03	.05	.04	.05	.05	.05
9600.	.04	.01	.02	.03	.07	.10	.10	.03	.06	.03	.03	.03	.05	.04	.05	.05	.05
9700.	.04	.01	.02	.03	.07	.10	.10	.03	.06	.03	.03	.03	.05	.04	.05	.05	.05
9800.	.04	.01	.02	.03	.07	.10	.10	.03	.06	.03	.03	.03	.05	.04	.05	.05	.05
9900.	.04	.01	.02	.03	.07	.10	.10	.03	.06	.03	.03	.03	.05	.04	.05	.05	.05
10000.	.04	.01	.02	.03	.07	.10	.10	.03	.06	.03	.03	.03	.05	.04	.05	.05	.05

TABLE 7-6(a). VISIBLE PLUME FREQUENCY

1 ************************************* PLUME LENGTH FREQUENCY TABLE *************************************

INDIANTOWN, 1982-86 WEST PALM BEACH MET. DATA (LMDCT, 10 CYCLES)

SEASON=ANNUAL

DISTANCE FROM TOWER (M)	WIND FROM: N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	SUM
	PLUME HEADED: S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	SUM
50.	5.30	2.44	4.80	7.74	15.68	9.62	10.42	6.05	8.35	3.53	3.95	3.23	5.09	3.76	5.10	4.93	100.00
100.	.34	1.75	3.62	.81	1.02	.30	.39	.16	.22	2.17	2.57	.17	.40	.37	.40	.33	15.02
150.	.12	.44	.53	.77	.98	.13	.18	.13	.09	1.69	1.96	.05	.18	.30	.29	.05	7.89
200.	.02	.37	.41	.01	.04	.13	.18	.00	.00	1.51	1.79	.00	.00	.30	.29	.01	5.08
250.	.02	.25	.25	.01	.04	.13	.18	.00	.00	1.15	1.41	.00	.00	.30	.29	.01	4.05
300.	.00	.21	.19	.00	.00	.03	.03	.00	.00	.99	1.21	.00	.00	.20	.24	.00	3.10
350.	.00	.17	.15	.00	.00	.03	.03	.00	.00	.82	1.02	.00	.00	.20	.24	.00	2.67
400.	.00	.17	.15	.00	.00	.03	.03	.00	.00	.82	1.02	.00	.00	.20	.24	.00	2.67
450.	.00	.17	.15	.00	.00	.03	.03	.00	.00	.82	1.02	.00	.00	.20	.24	.00	2.67
500.	.00	.13	.12	.00	.00	.03	.03	.00	.00	.62	.73	.00	.00	.20	.24	.00	2.11
550.	.00	.13	.12	.00	.00	.03	.03	.00	.00	.62	.73	.00	.00	.20	.24	.00	2.11
600.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
650.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
700.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
750.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
800.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
850.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
900.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
950.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1000.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1050.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1100.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1150.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1200.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1250.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1300.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1350.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1400.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1450.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1500.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1550.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1600.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1650.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1700.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1750.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1800.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1850.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1900.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1950.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2000.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2050.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2100.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2150.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2200.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2250.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2300.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2350.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2400.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2450.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2500.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08

TABLE 7-6(b). VISIBLE PLUME FREQUENCY (Contd.)

1 ************************************** PLUME LENGTH FREQUENCY TABLE **************************************

INDIANTOWN, 1982-86 WEST PALM BEACH MET. DATA (LMDCT, 10 CYCLES)

SEASON=ANNUAL

DISTANCE FROM TOWER (M)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	SUM
	*****	*****	*****	*****	*****	*****	*****	PLUME	HEADED	*****	*****	*****	*****	*****	*****	*****	*****
	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	SUM
2550.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2600.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2650.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2700.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2750.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2800.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2850.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2900.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
2950.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3000.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3050.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3100.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3150.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3200.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3250.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3300.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3350.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3400.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3450.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3500.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3550.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3600.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3650.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3700.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3750.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3800.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3850.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3900.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
3950.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4000.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4050.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4100.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4150.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4200.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4250.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4300.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4350.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4400.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4450.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4500.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4550.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4600.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4650.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4700.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4750.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4800.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4850.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4900.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
4950.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
5000.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08

TABLE 7-6(c). VISIBLE PLUME FREQUENCY

1 ************************************ PLUME HEIGHT FREQUENCY TABLE ************************************

INDIANTOWN, 1982-86 WEST PALM BEACH MET. DATA (LMDCT, 10 CYCLES)

SEASON=ANNUAL

HEIGHT FROM TOWER (M)	WIND FROM N / PLUME HEADED S	NNE / SSW	NE / SW	ENE / WSW	E / W	ESE / WNW	SE / NW	SSE / NNW	S / N	SSW / NNE	SW / NE	WSW / ENE	W / E	WNW / ESE	NW / SE	NNW / SSE	SUM / SUM
10.	5.30	2.44	4.80	7.74	15.68	9.62	10.42	6.05	8.35	3.53	3.95	3.23	5.09	3.76	5.10	4.93	100.00
20.	5.30	2.30	4.37	7.74	15.67	9.62	10.42	6.05	8.35	3.48	3.89	3.23	5.09	3.76	5.10	4.93	99.30
30.	.42	.45	.53	.06	.13	.55	.73	.11	.45	1.69	1.96	.31	.55	1.01	1.20	.54	10.70
40.	.22	.41	.44	.03	.04	.03	.03	.03	.13	1.65	1.91	.12	.21	.20	.24	.28	5.96
50.	.00	.41	.44	.00	.00	.03	.03	.00	.00	1.65	1.91	.00	.00	.20	.24	.00	4.91
60.	.00	.33	.33	.00	.00	.03	.03	.00	.00	1.44	1.73	.00	.00	.20	.24	.00	4.32
70.	.00	.28	.29	.00	.00	.03	.02	.00	.00	1.31	1.60	.00	.00	.18	.24	.00	3.95
80.	.00	.25	.25	.00	.00	.03	.02	.00	.00	1.15	1.41	.00	.00	.18	.24	.00	3.53
90.	.00	.21	.19	.00	.00	.03	.02	.00	.00	.99	1.21	.00	.00	.18	.24	.00	3.07
100.	.00	.17	.15	.00	.00	.03	.02	.00	.00	.82	1.02	.00	.00	.18	.24	.00	2.64
110.	.00	.17	.15	.00	.00	.03	.02	.00	.00	.82	1.02	.00	.00	.18	.24	.00	2.64
120.	.00	.17	.15	.00	.00	.03	.02	.00	.00	.82	1.02	.00	.00	.18	.24	.00	2.64
130.	.00	.17	.15	.00	.00	.03	.02	.00	.00	.82	1.02	.00	.00	.18	.24	.00	2.64
140.	.00	.17	.15	.00	.00	.03	.02	.00	.00	.82	1.02	.00	.00	.18	.24	.00	2.64
150.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
160.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
170.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
180.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
190.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
200.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
210.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
220.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
230.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
240.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
250.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
260.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
270.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
280.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
290.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
300.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
310.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
320.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
330.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
340.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
350.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
360.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
370.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
380.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
390.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
400.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
410.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
420.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
430.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
440.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
450.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
460.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
470.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
480.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
490.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
500.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08

TABLE 7-6(d). VISIBLE PLUME FREQUENCY (Contd.)

1 ************************************ PLUME HEIGHT FREQUENCY TABLE ************************************

INDIANTOWN, 1982-86 WEST PALM BEACH MET. DATA (LMDCT, 10 CYCLES)

SEASON=ANNUAL

HEIGHT FROM	***** WIND FROM *****																
FROM	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	SUM
TOWER	***** PLUME HEADED *****																
(M)	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	SUM
510.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
520.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
530.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
540.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
550.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
560.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
570.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
580.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
590.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
600.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
610.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
620.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
630.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
640.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
650.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
660.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
670.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
680.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
690.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
700.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
710.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
720.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
730.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
740.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
750.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
760.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
770.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
780.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
790.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
800.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
810.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
820.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
830.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
840.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
850.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
860.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
870.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
880.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
890.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
900.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
910.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
920.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
930.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
940.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
950.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
960.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
970.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
980.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
990.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08
1000.	.00	.13	.12	.00	.00	.03	.02	.00	.00	.62	.73	.00	.00	.18	.24	.00	2.08

TABLE 7-7. FOGGING AND ICING FREQUENCIES

1 ************************************** HOURS OF PLUME FOGGING TABLE **************************************

INDIANTOWN, 1982-86 WEST PALM BEACH MET. DATA (LMDCT, 10 CYCLES)

SEASON=ANNUAL

DISTANCE FROM TOWER (M)	WIND FROM N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	AVG
PLUME HEADED	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	4.7	6.7	8.4	10.2	14.9	.0	.0	.9	.9	.8	1.5	.8	1.3	.0	.0	.9	51.9
150.	7.5	2.6	5.7	23.5	37.8	8.5	.5	2.5	2.5	.5	.4	.8	3.0	.8	.5	3.8	100.7
200.	7.1	.4	.8	16.9	34.8	1.9	.1	2.1	2.1	.1	.0	.2	3.0	.2	.1	2.4	72.3
250.	6.3	.0	.0	13.0	29.4	.0	.0	1.7	1.7	.0	.0	.0	2.6	.0	.0	2.0	56.7
300.	3.8	.0	.0	5.5	12.5	.0	.0	.7	.7	.0	.0	.0	1.1	.0	.0	2.0	26.4
350.	2.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	2.0	4.0
400.	2.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	2.0	4.0
450.	2.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	2.0	4.0
500.	2.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	2.0	4.0
600.	1.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	1.5	3.0
750.	1.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	1.0	2.0
1000.	1.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	1.0	2.0
1250.	.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.7	1.5
1500.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1750.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2000.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

1 ************************************** HOURS OF RIME ICING TABLE **************************************

INDIANTOWN, 1982-86 WEST PALM BEACH MET. DATA (LMDCT, 10 CYCLES)

SEASON=ANNUAL

DISTANCE FROM TOWER (M)	WIND FROM N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	AVG
PLUME HEADED	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	AVG
100.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
150.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
200.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
250.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
300.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
350.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
400.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
450.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
500.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
600.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
750.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1000.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1250.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1500.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
1750.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2000.	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Bob Martinez, Governor | Dale Twachtmann, Secretary | John Shearer, Assistant Secretary

July 23, 1990

Ms. Mary E. Coffey
Bechtel
15740 Shady Grove Rd.
Gaithersbury, Maryland 20877-1454

Re: Preconstruction Monitoring Exemption Request

Dear Ms. Coffey:

The preliminary modeling provided in your Plan of Study for the Indiantown Site Certification Application shows that the maximum air quality impacts are less than the pollutant-specific "de minimus" concentrations for each pollutant. In addition, as we discussed, the existing monitoring data from the Martin site of Florida Power and Light is representative of the proposed source area.

Based on this information and the discretion of the Department, the preconstruction ambient air quality monitoring requirement for the preliminary Indiantown Cogeneration Project is exempted.

If you have any questions, please call me at (904)488-1344.

Sincerely,

Alex Meng
Meteorologist
Air Modeling and Assessment
Bureau of Air Monitoring & Assessment

cc: Tom Rogers

8.0 REFERENCES

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10.1.6 COASTAL ZONE MANAGEMENT CERTIFICATIONS

The Coastal Management Act of 1978 (Section 380.21-380.25, Florida Statutes) requires that the Coastal Zone Management Section of FDER be responsible for certification of consistency with the Florida Coastal Management Program (FCMP) for all federal licenses, permits, activities, and projects listed in Section 380.23 (3) (C), Florida Statutes, when such activities are subject to federal consistency review and affect land or water use, are seaward of the jurisdiction of state, or there is no state agency with sole jurisdiction for such consistency review.

In accordance with FCMP consistency evaluation procedures, copies of the following documents are included in Section 10.1 of this Site Certification Application:

- Combined applications for construction in, and discharge of dredge or fill materials to, waters of the United States, Section 404 of the Water Pollution Control Act of 1972, as amended);

- Notice of Proposed Construction or Alteration (required by Part 77 of the Federal Aviation Regulations [14 CFR Part 77] pursuant to Section 1011 of the Federal Aviation Act of 1958, amended).

Federal Consistency Evaluation Procedures (15 CFR 930.50) require these permit applications and the FAA Notice to be accompanied by a consistency certification attachment which includes:

- A written and pictorial description of the project;

- An assessment of probable impacts relevant to applicable FCMP statutes; and

- A signed statement by the applicant regarding consistency of the project with FCMP statues.

Each application included with this Site Certification Application is accompanied by such consistency certification.

10.1.7 FAA PERMIT APPLICATION

FCMP CONSISTENCY CERTIFICATION
INDIANTOWN COGENERATION, L.P.

DESCRIPTION OF THE PROJECT

Indiantown Cogeneration, L.P. (ICL) proposes to construct and operate a cogeneration project in Martin County, Florida, appproximately 3 miles northwest of Indiantown. This project is a pulverized coal fired steam unit that will produce approximately 330 MW of electricity for sale to Florida Power and Light Company, and up to 225,000 lb/hour of process steam for sale to the Caulkins Citrus Processing plant. The anticipated commercial operation date for the facility is December 1, 1995. The project will be a qualifying facility (QF) as defined by the Public Utility Regulatory Policies Act of 1978.

The ICL plant will occupy a 232 acre industrially zoned site, north of Indiantown. To the north of the site is the Caulkins Citrus Processing plant and an abandoned Florida Steel Corporation plant. The site is bounded on the west by Tampa Farm Products and on the south and east by vacant industrially zoned land. The site will be designed to accommodate all the facilities necessary to generate power from coal while maintaining the wetlands and a significant portion of the uplands on the site as required by Martin County regulations. These facilities will include the power block, coal and ash handling equipment, a rail loop and a water storage pond. The figure attached to this notice provides a conceptual layout for the proposed cogeneration project.

Assessment of Probable Project Impacts

As part of the Federal Consistency Evaluation Procedures, an assessment of the probable impacts of the project on the coastal zone were determined in relation to the Florida Coastal Management Program (FCMP) statutes.

Flood Zones - The ICL plant will be within Zone B (100 to 500 year flood plain area) as defined by flood insurance rate maps. All ICL facilities will be at or above the 100 year flood elevation of 31 ft. NGVD. In addition, all ICL facilities will be designed to comply with all applicable South Florida Water Management District (SFWMD) and Florida Department of Natural Resources (FDNR) requirements regarding flood protection control. Installation and operation of the ICL facility is expected to have no adverse impact on the 100 year flood elevations or flood flows. Since the plant will be entirely above the limits of the 100 year flood, adjacent properties owners will not be adversely affected.

Air and Water Impacts - These concerns will be addressed by obtaining the appropriate facility operation and discharge permits and using polltion control measures to abate impacts from facility construction and operations. All construction and operation permits will be obtained through the Power Plant Siting Act process in accordance with requirements established in the Prevention of Significant Deterioration (PSD) air quality regulations and the air quality regulations governing New Sources. An Underground Injection Control permit will be obtained for discharge of wastewater to the Boulder Zone of the Floridan aquifer.

Stormwater retention basins will be used to collect runoff waters from the site. The discharge from these basins will comply with all DER and SFWMD requirements for protection of surface and ground waters.

Archaeological and Historical Resources Impacts - A comprehensive evaluation of archaeological and historic resources within the ICL site and along the proposed water pipeline was conducted by Piper Archaeological Research, Inc. with the conclusion that no archaeological or historical resources occur onsite. This study will be submitted to the State Historic and Preservation Office for concurrence with the findings as part of the licensing effort for the ICL plant.

Water Resource Impacts - The SFWMD will review the project for water resources impacts. Consumptive use of water is anticipated, therefore, permits for such use will be obtained from SFWMD. Stormwater management practices will be employed to mitigate impacts to water resources from runoff.

Power Plant Siting Act - An application is being filed with the Florida Department of Environmental Regulation (FDER) under the Power Plant Siting Act. This application will present information discussing the conditions resulting from construction, and the anticipated impacts from facility operation, in order to provide assurance that all applicable state, regional and local regulations are met and that the project will be consistent with the FCMP.

Consistency Determination

The proposed project complies with Florida's approved coastal management program and will be conducted in a manner consistent with such program.

BEST AVAILABLE COPY

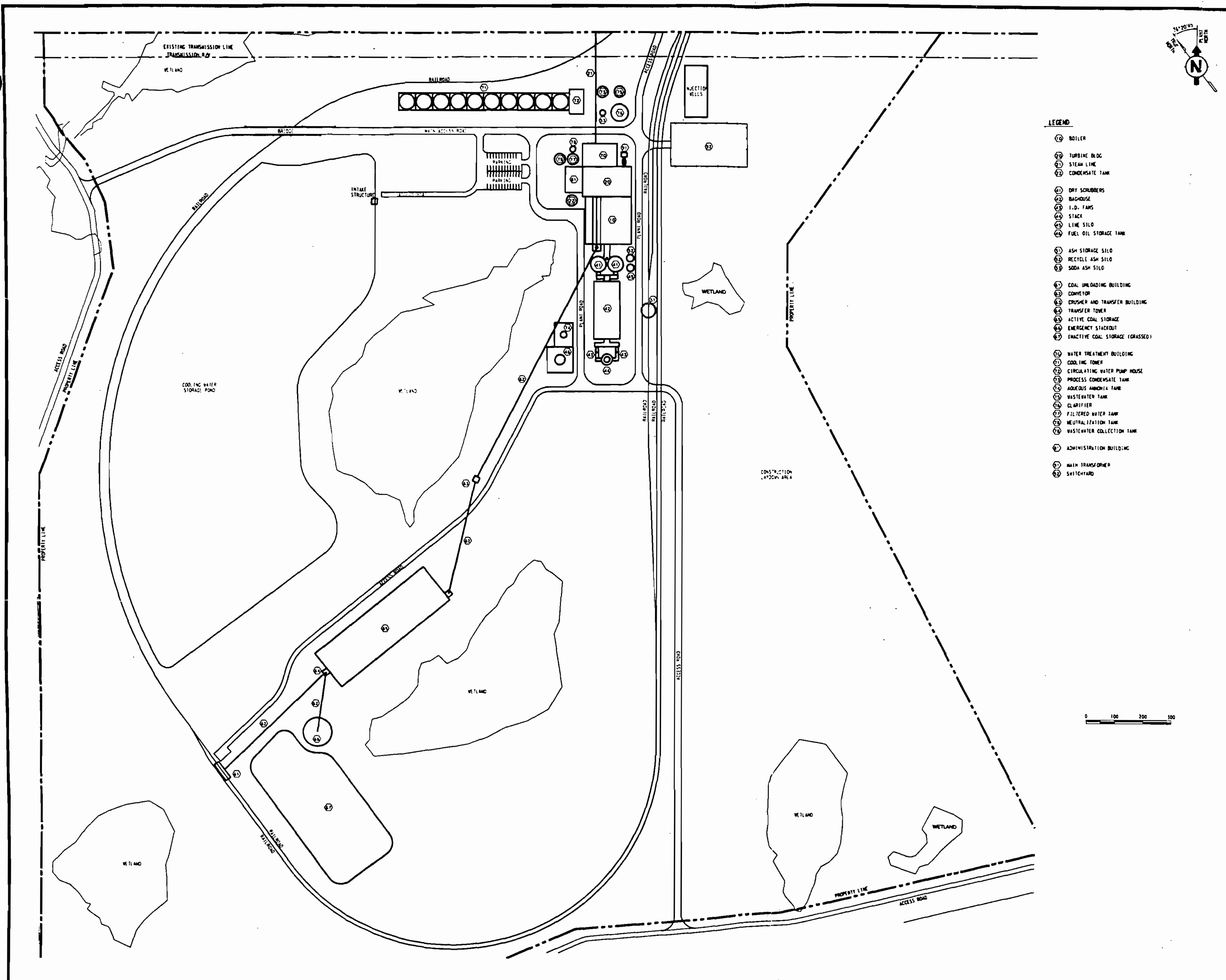


Figure 3.2.0-1.

PLOT PLAN

Source: Bechtel, 1990

INDIANTOWN
COGENERATION
PROJECT

Indiantown Cogeneration, L.P.

BEST AVAILABLE COPY

DO NOT REMOVE CARBONS

Form Approved OMB No. 2120-[illegible]

U.S. Department of Transportation
Federal Aviation Administration

NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION

Aeronautical Study Number

1. Nature of Proposal

A. Type	B. Class	C. Work Schedule Dates
☒ New Construction	☒ Permanent	Beginning ______
☐ Alteration	☐ Temporary (Duration ______ months)	End ______

3A. Name and address of individual, company, corporation, etc. proposing the construction or alteration. *(Number, Street, City, State and Zip Code)*

( ) ______
area code Telephone Number

Mr. Stephen A. Sorrentino
Indiantown Cogeneration, L.P.
7475 Wisconsin Avenue
Bethesda, MD 20814-3422

B. Name, address and telephone number of proponent's representative if different than 3 above.

2. Complete Description of Structure

A. Include effective radiated power and assigned frequency of all existing, proposed or modified AM, FM, or TV broadcast stations utilizing this structure.

B. Include size and configuration of power transmission lines and their supporting towers in the vicinity of FAA facilities and public airports.

C. Include information showing site orientation, dimensions, and construction materials of the proposed structure.

One (1) power facility stack

(If more space is required, continue on a separate sheet.)

4. Location of Structure

A. Coordinates (To nearest second)	B. Nearest City or Town, and State	C. Name of nearest airport, heliport, flightpark
	Indiantown, FL	Indiantown
Latitude 27° 2' 20"	Three (3) Miles	(1) Distance from structure to nearest point of nearest runway 4 1/4 miles
Longitude 80° 30' 45"		(2) Direction from structure to airport East (83°)

5. Height and Elevation *(Complete to the nearest foot)*

A. Elevation of site above mean sea level	39
B. Height of Structure including all appurtenances and lighting *(if any)* above ground, or water if so situated	495'
C. Overall height above mean sea level (A + B)	534'

D. Description of location of site with respect to highways, streets, airports, prominent terrain features, existing structures, etc. Attach a U.S. Geological Survey quadrangle map or equivalent showing the relationship of construction site to nearest airport(s). *(If more space is required, continue on a separate sheet of paper and attach to this notice.)*

The proposed stack location is approximately 3500 feet SW of SR 710 and about 2000 feet SSW of the existing Caulkins Citrus Processing Plant. The area is basically flat.

See Attached Figure

Notice is required by Part 77 of the Federal Aviation Regulations (14 C.F.R. Part 77) pursuant to Section 1101 of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1101). Persons who knowingly and willingly violate the Notice requirements of Part 77 are subject to a fine (criminal penalty) of not more than $500 for the first offense and not more than $2,000 for subsequent offenses, pursuant to Section 902(a) of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1472(a)).

I HEREBY CERTIFY that all of the above statements made by me are true, complete, and correct to the best of my knowledge. In addition, I agree to obstruction mark and/or light the structure in accordance with established marking & lighting standards if necessary.

Date	Typed Name/Title of Person Filing Notice	Signature

FOR FAA USE ONLY *FAA will either return this form or issue a separate acknowledgement.*

The Proposal:

☐ Does not require a notice to FAA.

☐ Is not identified as an obstruction under any standard of FAR, Part 77, Subpart C, and would not be a hazard to air navigation.

☐ Is identified as an obstruction under the standards of FAR, Part 77, Subpart C, but would not be a hazard to air navigation.

☐ Should be obstruction ☐ marked, ☐ lighted per FAA Advisory Circular 70/7460-1, Chapter(s) ______

☐ Obstruction marking and lighting are not necessary.

Remarks:

Supplemental Notice of Construction FAA Form 7460-2 is required any time the project is abandoned, or

☐ At least 48 hours before the start of construction.

☐ Within five days after the construction reaches its greatest height.

This determination expires on ______ unless:

(a) extended, revised or terminated by the issuing office;

(b) the construction is subject to the licensing authority of the Federal Communications Commission and an application for a construction permit is made to the FCC on or before the above expiration date. In such case the determination expires on the date prescribed by the FCC for completion of construction, or on the date the FCC denies the application.

NOTE: Request for extension of the effective period of this determination must be postmarked or delivered to the issuing office at least 15 days prior to the expiration date.

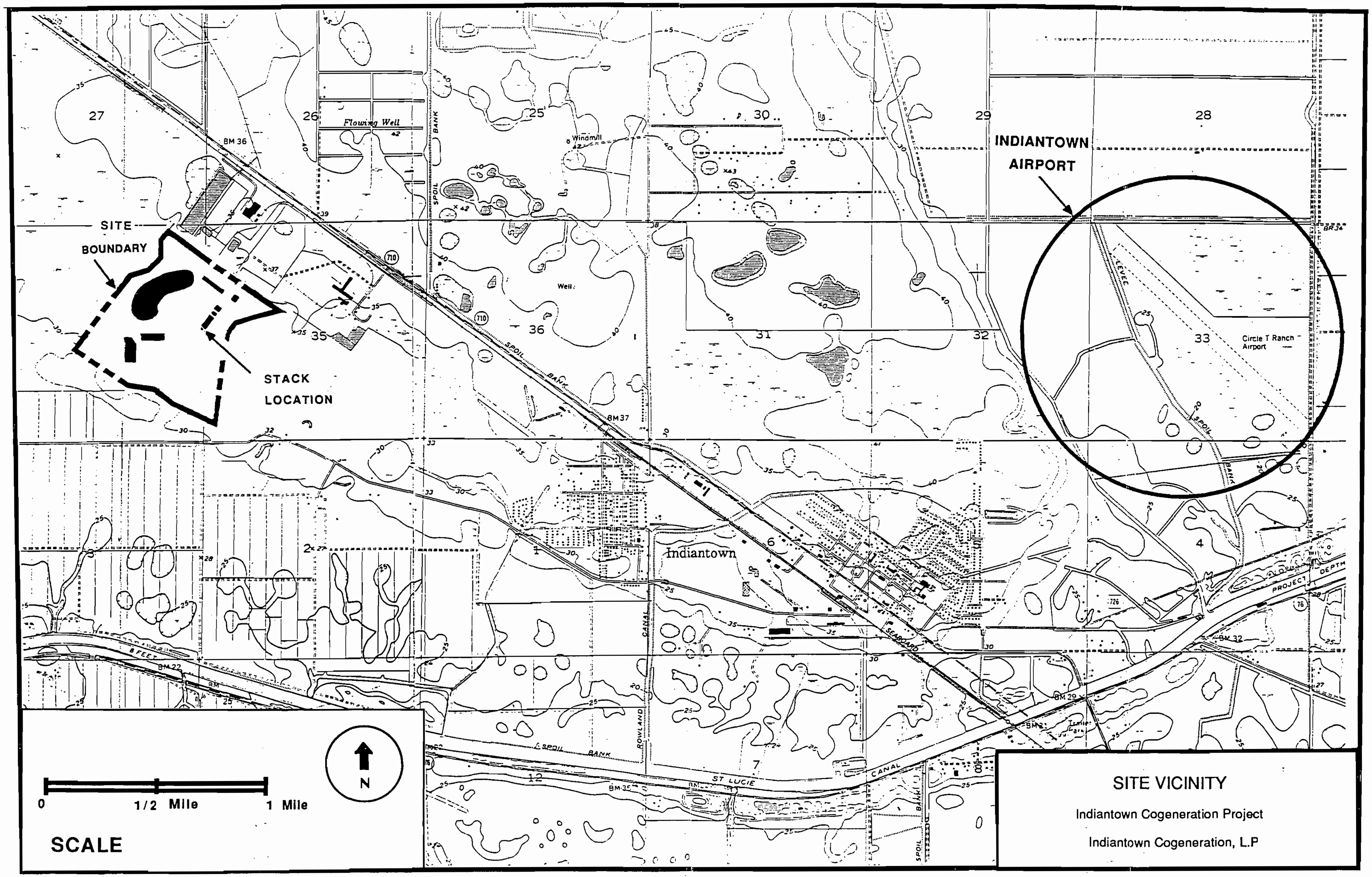
If the structure is subject to the licensing authority of the FCC, a copy of this determination will be sent to that Agency.

Issued in	Signature	Date

FAA Form 7460-1 (4-83) SUPERSEDES PREVIOUS EDITION

DO NOT REMOVE CARBONS

Best Available Copy



10.2 ZONING DESCRIPTIONS

10.2.1 EXCERPTS FROM CHAPTER 33 ZONING OF THE MARTIN COUNTY CODE RELATED TO:

- **ARTICLE XXXVIA. PUD PLANNED UNIT DEVELOPMENT DISTRICTS**

- **ARTICLE LX. AMENDMENTS**

(b) Minimum width along front property lines shall be one hundred (100) feet.

(c) There shall be no limit on the maximum height, except where adjacent to a residential district, in which case the maximum height is limited to three (3) stories.

(d) The height of any structure shall not be such so as to intrude into a gliding angle where adjacent to air fields.

(e) When located upon streets or highways carrying a large volume of traffic, tracts located in this district shall provide for a marginal access road with a minimum of access and egress points. There shall be a ten-foot planter strip between such access road, the right-of-way of the street or highway, and parking areas within the tract shall be accessible only from the marginal access road. (Res. of 5-9-67, Art. XXVIII, § 28.1)

Sec. 33-570. Minimum yards required.

(a) *Front:* 30 feet.

(b) *Rear and side:*

1 story—10 feet.
2 stories—12 feet.
3 stories and over—15 feet.

(c) No structure shall be built within 50 feet of the center line of any public platted right-of-way not a designated through-traffic highway.

(d) No structure shall be built within 65 feet of the center line of a designated through-traffic highway. (Res. of 5-9-67, Art. XXVIII, § 28.2)

ARTICLE XXXVIA. PUD PLANNED UNIT DEVELOPMENT DISTRICTS*

DIVISION 1. GENERAL

Sec. 33-571. Purpose and intent.

(a) The purpose of this district is to provide an alternative zoning procedure that may be used to establish Planned

*Cross reference—Special requirements for Hutchinson Island, Long Island and Jupiter Island, §§ 33-72.

Unit Development Districts at appropriate locations in accordance with the planning and development objectives of the county.

(b) Although planned developments produced in compliance with the terms and provisions of this article may depart from the strict application of use, setback, height, and minimum lot requirements of standard zoning districts, such developments are to be in keeping with the overall planning and development goals and objectives of the county as set forth in the general plan. Planned Unit Development Districts will further serve to guide the resource development of Martin County as defined by adopted specific area plans. The intent of this article is to provide standards by which such flexibility may be accomplished, while maintaining and protecting the public health, safety and welfare.

(c) A further purpose of this article is to encourage the establishment of a more complete living environment through the application of enlightened and imaginative approaches to community planning and shelter design. The planned unit development alternative should provide for a variety of architectural solutions, provide for the preservation of natural features and scenic areas, provide for the efficient use of open space, promote high standards in development layout, design and construction, reduce land consumption by roads, separate vehicular and pedestrian circulation systems, originate approaches to a meaningful intergration of common open area networks and developed recreation areas, help establish neighborhood identity and focus, encourage projects that will be designed to fit the natural conditions of the property, and ideally provide for the compatible co-existence of man with his environment.

(d) It is also the purpose and intent of the Planned United Development District to encourage development to occur in accordance with a coordinated and planned extension of existing and programmed community facilities. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-572. "Planned unit development" definition.

(a) A "planned unit development" (also hereinafter referred to as "PUD") is a land area under unified control which is planned and programmed in a single development operation or by a series of prescheduled development phases according to an officially approved final development plan: such planned unit development does not necessarily correspond to property development and use regulations of the standard zoning district in which the property was previously placed.

(b) A "major planned unit development" is defined as a residential PUD of greater than fifty (50) residential dwelling units, or greater than ten (10) acres in area.

(c) A "minor planned unit development" is defined as a residential PUD of fifty (50) residential dwelling units or less, or ten (10) acres or less in area. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-573. Relation of planned unit development regulations to general zoning, subdivision or other applicable regulations.

(a) The following provisions shall apply generally to the creation and regulation of all PUD Districts, regardless of any conflicts therein with general zoning, subdivision, or other applicable regulations:

(1) Application and review of the preliminary development plan shall be in lieu of sketch plan review under Ordinance No. 25 [section 33-73] for multiple-family developments and preliminary plat review under the subdivision regulations for subdivision lots. Application and review of the final development plan shall be in lieu of site and construction plan review under Ordinance No. 25 [section 33-73] for multiple-family dwellings and final plat review under the subdivision regulations for subdivision lots, except that for subdivision lots a final plat must be submitted and reviewed simultaneously.

(2) The planned unit development guidelines and standards adopted as part of this zoning ordinance shall apply to the creation of PUD Districts and to the issuance of building permits and certificates of occupancy in such districts. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-574. Location; plan.

(a) PUD Districts may be established anywhere in the county, regardless of the existing zoning districts, wherever there are tracts of land suitable in location, size, and character for the structures and uses proposed to be planned and developed under unified control pursuant to this article. In addition to the particular requirements of this article, all PUD Districts shall require an amendment of the official zoning map as it affects the property in question to show the change from the existing zoning district to the PUD District, and a redistricting or rezoning of the property in question from its existing zoning district to the PUD District.

(b) PUD District zoning must be based either upon a county general plan or upon a specific area plan. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-575. Effect of planned unit development zoning.

When the board of county commissioners grants final approval to a proposed PUD zoning application, the final development plan including all related information, agreements, and supporting materials required pursuant to this article shall be adopted as an amendment to the PUD Zoning District and shall become the standards of development for the subject PUD. Thenceforth, development in the area delineated as a PUD District on the official zoning map shall proceed only in accord with the adopted plan and standards for said district. Such development shall conform to any order of staging or set of priorities or limitations or time table of development in the amendment or elsewhere in this article. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-576. Uses authorized in planned unit development districts.

All uses authorized in PUD Districts as set out in the general plan or a specific area plan are conditional uses subject to approval of a final development plan by the board of county commissioners. All review agencies, boards and commissions shall consider whether the proposed uses are compatible with the general plan and/or the specific area plan and whether any adverse fiscal, physical and community service impacts of the development on the county will be adequately provided for. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-577. Planned unit development standards.

All PUD applications submitted shall conform to the purpose and intent of this article, and be in compliance with the following development standards:

(1) *General standards.*

(a) A PUD shall conform to the appropriate provisions of the general plan or specific area plan.

(b) Scenic assets and natural features, such as trees, dunes, intertidal areas, areas of archeological or historical significance, natural marine and terrestrial biotic communities, floodplains, streams, aquifer recharge areas, and topographic features should be protected and preserved to the extent feasible.

(c) A PUD site shall be developed in such a manner as to prevent substantial injury to the use and value of existing surrounding development, and shall not hinder, deter, or impede development of surrounding undeveloped properties in accordance with the general plan or a specific area plan. More specifically, such development shall not create undue hazards to persons or property, on or off the tract, from possible flooding, wind or water erosion, subsidence of buildings or other structures or facilities. The condition and type of soil, ground water level, tidal fluctuations, drainage and topography shall be appropriate to both type and pattern of use intended. The site shall also contain sufficient width and depth to adequately accommodate its proposed use and design.

(d) Structures and common areas should be arranged in such a way as to best serve the needs of occupants and/or other users of the PUD and minimize any adverse effects on neighboring properties.

(e) Integrated architectural design for buildings, structures, landscaping and common open areas will be encouraged.

(f) The public health, safety, and general welfare, and the purpose and intent of this article and the general plan, or a specific area plan shall be maintained and preserved.

(g) All land included for purposes of development within a PUD District shall be owned or under control of the petitioner for such zoning designation.

(h) All proposed PUD's must be in accordance with the adopted capital improvements program, if any.

(i) If a PUD contains a mixture of land uses, such as residential and commercial or some other combination, the schedule of development shall provide for coordination of these mixed uses.

(j) Underground utilities will be encouraged wherever possible. Control and maintenance of any privately owned utilities provided by the applicant shall be governed by section 33-577(9).

(k) County standards for roads, streets, drainage and other such items shall be adhered to unless otherwise provided in this article.

(l) Those parts of development or construction plans involving engineering, architecture, landscape architecture or land surveying shall be prepared and certified respectively by an engineer, architect, landscape architect, or land surveyor duly licensed by the state.

(2) *Public facility and public safety standards.*

(a) A PUD shall be located in an area in which police and fire protection and other public facilities are available and adequate for the uses proposed; provided, however, that the applicant may provide such facilities which are not presently available, and written assurance of such provision shall be included as a part of the approved final development plan. The criteria under which such applicant-provided facilities will be accepted shall include consideration of facility-timing as outlined in the general plan or specific area plan, or capital improvements program, if any, as well as other applicable county standards for such construction.

(b) Within a PUD, there must be adequate space to permit accessibility to all structures by fire-fighting and similar emergency equipment.

(c) The applicant shall install fire hydrants within a PUD so that there are no more than six hundred (600) feet between hydrants.

(d) All residential buildings of two (2) or more stories shall incorporate a heat and smoke detection device in each living unit. All buildings of three (3) or more stories shall incorporate sprinkler systems for enclosed hallways and stairwells.

(e) Where water pressure or lack thereof in a project is considered by the county to present a potential problem, the applicant may be required to install and maintain booster pumps or a system of wet standpipes in all buildings of three or more stories in height.

(f) The applicant may also be required to provide and maintain power packs for emergency lighting in the event of fire or similar conflagration.

(g) Elevators and passageways provided in residential structures shall be capable of accommodating a stretcher.

(3) *Fill and excavation.*

(a) The applicant's plans should minimize the hauling of fill along county rights-of-way.

(b) The applicant should avoid placing fill in natural floodplains to the extent possible.

(c) Any artificial lake created for the purposes of storm water containment or for fill material is expected to meet all applicable county standards.

(d) The applicant is encouraged to utilize naturally existing high and dry land for higher density residential uses.

(4) *Vehicular and pedestrian movement.*

(a) Principal vehicular access to a PUD shall be from streets and roads that meet county standards and are capable of supporting existing and anticipated volumes of traffic, as well as traffic that will be generated by the PUD. Access points shall be designed to provide smooth flow, controlled turning movements, and minimum hazard to vehicular or pedestrian traffic. Merging lanes, deceleration lanes, left-turn stacking lanes, and traffic dividers shall be provided where existing or anticipated heavy flows of traffic indicate such need. Where present or potential traffic loads indicate a need, traffic signals shall be provided. No streets or roads within a planned unit development shall connect to exterior streets in such a way as to encourage use of minor local streets for through traffic. Dedication to the public of internal streets may be required by the board of county commissioners, if necessary, and internal as well as external PUD circulation patterns shall be coordinated with the adopted county thoroughfare plan, if any.

(b) Traffic visibility, both automobile and pedestrian, shall be preserved as follows: No impediment to visibility within the right-of-way between two and one-half (2½) and seven (7) feet above centerline grades may exist at the intersection of any street or road internal to or at the perimeter of a PUD within a triangle beginning at the junction of right-of-way lines (projected if round corners exist), thence fifty (50) feet along said lines, thence along the line connecting those two (2) points.

(c) Project entrances from a PUD to arterial and collector roads should not be closer than one-quarter (¼) of a mile from the next entrance along an arterial or collector road.

(d) Jog-type and nonright angle intersections shall be avoided.

(e) Commercial truck traffic should be separated from other vehicles to the maximum extent feasible.

(5) *Parking.*

(a) The applicant is encouraged to provide attractive, landscaped, well-lighted storage and loading areas for all types of motor vehicles, as appropriate to the development.

(b) Minimum off-street parking space requirements for residential uses shall be related to the number of bedrooms provided by the applicant as follows:

Efficiency apartments, 1.50 parking spaces per unit;

One-bedroom units, 1.75 parking spaces per unit;

Two or more bedroom units, 2.0 parking spaces per unit.

(c) Commercial parking standards. The applicant shall provide a minimum of five and five-tenths (5.5) off-street parking spaces per one thousand

(1,000) square feet of gross leasable commercial floor area; except that the applicant may provide information to justify anticipated multiple use of off-street parking areas. If such multiple use of parking areas will not create parking problems or traffic hazards, a reduction in the number of required off-street commercial parking spaces may be authorized.

(d) Subgrade parking accommodations are encouraged where feasible.

(e) Residentially oriented parking areas should be designed for no more than a sixty (60) vehicle storage capacity, and for a maximum of fifteen (15) vehicular spaces unbroken by landscaping.

(f) Parking areas are encouraged to be within one hundred fifty (150) feet of any residence served by such areas.

(g) Entrances to parking areas should be identified by appropriate lighting.

(h) Parking spaces shall be not less than ten (10) by twenty (20) feet in dimension, and parking aisles should be at least twenty-five (25) feet in width. Angle and parallel parking shall meet standards set forth in the American Institute of Architects' "Architectural Graphic Standards, Sixth Edition" (New York, 1970).

(6) *Drainage.*

(a) The applicant shall meet all applicable state, federal, and county standards for the design of drainage facilities, including on-site containment of storm water runoff.

(b) The applicant, wherever possible, shall utilize skimmers and other mechanical devices to remove undesirable pollutants, especially from water runoff from pavement areas.

(c) The applicant shall take particular care in the design of drainage facilities to preserve or enhance the quality of any adjacent bodies of water in accordance with federal, state and county guidelines.

(7) *Screening.*

(a) Fences, walls and/or vegetative screening should be provided at the perimeter of PUD's where necessary to reduce noise, glare, or other influences having an adverse impact either on the PUD or on adjacent property. Screening should be of sufficient height to eliminate the impact of such adverse elements on the first floor of any use located either within or adjacent to the PUD.

(b) Such screening requirements may also be necessary to separate different land uses within the PUD, such as residential uses from commercial uses, developed recreation areas, utility facilities, or outdoor loading and/or storage areas.

(8) *Open space.*

(a) There should be reasonably convenient access from all occupied structures to common open spaces.

(b) Contiguous and interrelated open spaces are desired.

(c) Open space plans should attempt to preserve valuable site amenities such as trees, natural land forms, topography, dunes, etc.

(d) Open spaces should not be physically altered except for the addition of landscaping and except as necessary to further one or more specific development objectives of the applicant.

(e) If a proposed PUD is to be constructed in a timed series of development phases, and if such phases include provisions for either common or dedicated open spaces including developed recreation space, the total area of common or dedicated open space, including developed recreation space, provided at the end of any phase of development shall bear substantially the same relationship or greater to the total open space to be provided in the entire PUD as the structures or units completed or under development bear to the entire PUD.

(9) *Management and care of common elements.*

(a) The applicant shall provide for and establish a property owners' association, organization or other legal entity for the ownership and maintenance of any common elements, such as open spaces or utilities designated on the development plans. The power and authority of such organization shall be insured and protected by covenants running with the land, and such covenants shall be included as part of the development plans subject to approval by the county attorney and board of county commissioners. The established organization shall not be dissolved nor shall it dispose of any common elements, by sale or otherwise (except to an organization conceived and organized to own and maintain the common elements) without first receiving approval from the board of county commissioners. The board, as a condition precedent to the dissolution or disposal of common elements, may require dedication of common open areas or utilities to the public as deemed necessary.

(b) Such covenants shall further provide that if the organization established to own and maintain common elements (or any successor organization) fails at any time to maintain the common elements in reasonable order and condition in accordance with the approved final development plan, then the board of county commissioners can serve written notice by certified mail, return receipt requested, upon such organization and upon each owner of real property within the PUD, which notice shall set forth the manner in which the organization has failed to maintain the common elements in reasonable order and condition and shall demand that such failure be remedied within thirty (30) days of the sending of such notice or in the alternative that such organization appear before the board at a specified time (at least ten (10) days but not more than thirty (30) days after the sending of such notice) either to contest the alleged failure to maintain the common elements or to show cause why it cannot remedy such failure within the thirty-day period. If such failure has not been remedied within the thirty-day period or such longer period as the board may have allowed, then the board, in order to preserve the taxable values of the real property within the development and to prevent the common elements from becoming a public nuisance, shall hold a public hearing to consider the advisability of the county entering upon such common elements and maintaining them for a period of one year. Notice of such hearing shall be sent by certified mail, return receipt requested, to the organization involved and to each owner of real property within the PUD and shall be published one time in a newspaper of general circulation published in the county. Such notice shall be sent and published at least fifteen (15) days in advance of the hearing. At such hearing the board may determine that it is or is not advisable for the county to enter upon such common elements, take possession of them and maintain them for one year. The covenants running with the land occupied by the PUD shall grant to the county such right of entry, possession and maintenance, provided that the above procedures have been followed and shall provide that such entry, possession and maintenance shall not constitute a trespass. Such entry, possession and maintenance shall not give the public any right to use the common elements.

(c) The covenants running with the land occupied by the PUD shall further specify that the board may, upon public hearing with notice given and published in the same manner as above, return possession and maintenance of such common elements to the organization, or successor organization, abandon such possession and maintenance, or continue such possession and maintenance for additional one-year periods.

(d) The covenants creating such organization shall further provide that the cost of such maintenance by the county shall be assessed ratably against the properties within the development that have a right to enjoyment of the common elements and shall become a charge or lien on said properties, and such charge shall be paid by the owners of said properties within thirty (30) days after receipt of a statement therefor.

(10) *Fees:* Each petitioner for a PUD District shall pay a fee to the county for the examination of development plans or an amendment thereto and the inspection of all required improvements shown on such plans. Such fees shall be determined by the board of county commissioners, which by resolution shall establish or change from time to time a schedule of said fees for the examination of preliminary and final development plans and plan amendments, as well as the inspection of all required improvements included in these plans. Such fees shall be payable to the Martin County Board of County Commissioners and deposited to the credit of the general fund. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-578. Planned unit development general procedures.

Petitions for PUD zoning shall be submitted and processed in the same manner as for zoning changes generally and in accordance with the following general procedures:

(1) *Preapplication conference.* Prior to submitting a formal application for PUD zoning, the petitioner is

required to jointly confer not less than once with representatives of the planning and zoning department and such other agencies or staffs of the county as may be involved in the review and processing of such applications. The applicant shall be notified in advance as to which other county agencies will be involved in such meeting. The petitioner is encouraged to consider at least two (2) alternative plan concepts to discuss with staff members. The staff will advise the applicant on the feasibility of various possible design alternatives and also provide information regarding any projected plans, programs or other matters that may affect the proposed PUD. The required preapplication conference shall address the following matters:

(a) Physical characteristics of the site for the proposed development.

(b) The relation between the anticipated project and surrounding uses, and the effect of the proposed development on the general plan or specific area plan and/or stated planning and development objectives of the county.

(c) The status of existing and proposed streets, utilities, or other public and private facilities to serve the development, specifically as the development relates to the county's capital improvements program, if any.

(d) The nature, design, efficiency and appropriateness of the proposed streets, utilities, and other common facilities planned to service occupants and users of the PUD.

(e) Common open areas proposed by the applicant.

(f) Maintenance mechanisms and procedures designed to guarantee the care and upkeep of common elements.

(g) The applicability of Chapters 380.05 and 380.06, Florida Statutes, dealing respectively with areas of critical state concern, and developments of regional impact (DRI).

(h) Regional, state or federal permits required, if any.

(2) *Application form.* The application form for a change of zoning to a PUD District shall include the following information:

(a) Name, address, and telephone number of the owner of record of the property to be rezoned.

(b) Name, address and telephone number of the developer if different from the owner and an explanation for the difference.

(c) Name, address and telephone number of the project liaison.

(d) Names, addresses and telephone numbers of the professionals involved with the PUD.

(e) Exact location of the proposed project, with project boundaries clearly marked, as shown on a copy of current county assessment maps.

(f) Proposed name of project, which name is subject to acceptance by the board of county commissioners and which must comply with the spirit and intent of Chapter 177.051, Florida Statutes.

(3) *Filing of applications.* Any application required under this article shall be filed with the planning and zoning department, where it shall be reviewed for general completeness and for compliance with this article before being sent to reviewing departments, agencies and officials. Except as directed by the board of county commissioners, the following requirements shall be adhered to by the planning and zoning department in processing a PUD application:

(a) A PUD application including the preliminary development plan with supporting documents as identified in this article shall be submitted to the planning and zoning department on an official application form together with a check payable to the "Martin County Board of County Commissioners" in an amount equal to the proper processing fee.

(b) All written correspondence concerning the application either between the applicant and the county, between the applicant and the various individual review staffs, or between these various staffs, shall be submitted through the planning and zoning department. Both the applicant and the planning and zoning department shall designate a liaison for purposes of such communication.

(c) The application shall be reviewed by the planning and zoning department for any items requiring correction or completion. If the application is incomplete, or if corrections are required, it will be returned to the applicant with a list of deficiencies within ten (10) working days from the date of submission. After submission of a corrected application, the planning and zoning department shall have ten (10) working days in which to determine that all deficiencies have been corrected.

(4) *Application materials—Evidence of unified control.* The applicant shall present with the application form, evidence of unified control of the entire area within the proposed PUD district. This shall include a title insurance policy or attorney's certificate of title or other evidence acceptable to the county attorney for the subject property, and a covenant of unified control as described in section 33-581.2(F).

(5) *Same—PUD agreement.*

(a) The applicant shall provide a proposed agreement wherein it is stipulated that the proposed development, if initiated, will be undertaken and carried out in accordance with:

1. The preliminary and final development plans as officially adopted.

2. The regulations existing when the amendments creating the PUD were approved.

3. Such other conditions or modifications as may be attached to the PUD District in the process of the zoning change.

(b) Following approval of a PUD application the applicant shall provide a final agreement stipulating to the specific conditions under which the PUD will be constructed.

(6) *Same—Preliminary development plan for a major PUD.*

(a) Development site information to be submitted with a major PUD application shall include the following information:

1. Vicinity map at a scale of not less than one inch equals two thousand (2,000) feet.

2. Recent (less than twelve (12) months old) vertical aerial photograph of the site, with project boundaries clearly marked.

3. Boundary survey related to true meridian or U.S. Coast and Geodetic Survey state grid north.

4. Full legal description of the property with attached copies of any instruments referred to such as deeds, plats, covenants or restrictions, etc.

5. Names of owners, zoning district classification and uses of the tract to be rezoned, the same for any contiguous holdings of the applicant (disregarding intervening roadways, easements, etc.), and the same for each adjoining tract in separate ownership. If the proposed PUD does not cover all of the contiguous holdings of applicant, said PUD must be distinctly identified and an explanation of the reason for such difference provided.

6. All adjoining property owners within three hundred (300) feet must be identified by name

and address. Where there is ownership by a condominium, only the condominium association need be listed.

7. Total area of the tract.
8. Topographic map with contour intervals of one foot at a scale of not less than one inch equals one hundred (100) feet.
9. The location of the following existing items within or immediately adjacent to the property: Buildings, structures, or other improvements; utilities; drainageways, ditches, swales, coastal construction setback line, anti-mosquito ditches; easements of any kind whether used or not, abutting streets and roads including width and route numbers; railways, culverts, burial grounds; and property lines and recorded plats; docks, jetties, boat ramps, bulkheads or other water-related structures.
10. The location and approximate area of the following existing items within or immediately adjacent to the property: Watercourses, water surfaces, wooded areas, and wetlands by types (i.e., fresh water swamp, salt water marsh, intertidal area, wet prairie or savanna), unless such information is otherwise available to the county.
11. Detailed soils analysis with associated vegetation types, unless such information is otherwise available to the county.
12. Wet and dry season water tables, unless such information is otherwise available to the county.
13. Evidence of unified control per section 33-578(4).

(b) Preliminary development design information for a major PUD shall include:

1. Statement of intended market, indicating probable occupant characteristics.

2. Land use plan or plans showing the location, arrangement and dimensions of all proposed land uses, including the number of floors and height of all buildings above finished grade or above the first floor living elevation, building setbacks from the development boundaries and from adjacent streets, roads, alleys, and ways; the proposed traffic circulation pattern including the location and width of all streets, driveways, walkways, bikeways, and entrances to parking spaces; all proposed off-street parking and loading areas; all proposed common elements including common open spaces; and dedicated open space and developed recreation areas.

3. A plan or statement showing the location and design of all landscaped buffers or other screening and indicating the type of materials proposed and height of such screening.

4. A plan or statement detailing the manner of improving common or dedicated open spaces, including developed recreation areas, together with all covenants including lease-hold interests, restrictions and conditions pertaining to the use, maintenance, and operation of common elements.

5. A statement in tabular form of the anticipated residential density (if any), the total number of dwelling units by type, size, number of bedrooms and site location, and gross leasable floor area for commercial as well as other nonresidential uses, as appropriate.

6. Percentage of the site to be covered with buildings, sidewalks, parking areas, roofed structures, and other impervious surfaces; percentage of the site to be covered with water

bodies; percentage of the site to be in golf course use (if any); percentage of the site to be landscaped; and percentage of the site to be left in a natural undisturbed condition.

7. An engineer's statement detailing preliminary proposals for providing drainage outfall and on-site retention conforming with such county regulations and ordinances as are in force and effect, including calculations, size of storm water retention areas, methods for pollutant removal, location of berms, swales, culverts, storm water sewers, finished grades, and proposed slopes and grades adjacent to bodies of water.
8. A plan or statement detailing preliminary proposals for connection with existing water supply and sanitary sewer systems or an alternative means of supplying water for drinking and irrigating and of supplying sanitary waste treatment and disposal.
9. Architectural sketches of typical proposed structures including exterior lighting systems, signs and landscaping.
10. When a development is to be constructed in phases or units, a sequence of development schedule showing the construction of each principal functional element of such phases or units, the approximate completion date for each phase or unit and the extent, timing, and estimated costs of all improvements or items to be dedicated, such as roads, sewerage, drainage, and other public or private facilities, required to construct the proposed PUD.
11. Location of temporary perimeter stakes and a temporary sign three (3) by five (5) feet in size located at the front of the property identifying the project by number in order for county personnel, members of review agencies, plan-

ning and zoning commissioners and county commissioners to locate the project and to make site inspections, such sign to be erected within ten (10) days of application submission.

12. If the PUD contains subdivision lots, a preliminary plat of such lots or parcels.

13. A statement illustrating the relation of the PUD to the general plan and the specific area plan.

14. When a proposed PUD contains fifty-one (51) or more dwelling units or more than twenty thousand (20,000) square feet of gross leasable commercial floor area, the following additional materials will be provided:

    a. A plan or statement detailing the ecology of the site in its existing state, including a description of the flora and fauna (including aquatic communities) normally found there, and assessing the impact of the proposed development on these natural resources.

    b. A plan or report discussing costs and benefits that will accrue to Martin County as a result of the PUD including a brief evaluation of police, fire protection, ambulance service, emergency rescue service, water, sewerage, solid waste, schools, transportation facilities, health and welfare service, parks, recreation, open space and cultural facilities, and other public facilities.

(7) *Same—Preliminary development plan for a minor PUD.* Preliminary development site and design information to be submitted with a minor PUD application shall include:

(a) Items 2 through 9, both inclusive; and item 13 of section 33-578 (6)(a).

(b) Item 2; items 4 through 8, both inclusive; and items 11 and 12 of section 33-578 (6)(b).

(8) *Same—Final development plan for a major PUD.* Final detailed information for a proposed major PUD or phase thereof shall include:

(a) Detailed plans showing the exact location, arrangement and dimensions of all proposed land uses, including the number of floors and height of all buildings above finished grade and above the first floor living elevation; building setbacks from the development boundaries and adjacent streets, roads, alleys and ways; exact location of the traffic circulation pattern including the location and width of all streets, driveways, walkways, bikeways, and entrances to parking spaces; final design of off-street parking and loading areas with exact dimensions; final design for all common areas including common open areas, dedicated open space and developed recreation areas.

(b) A detailed plan showing the location and design of landscaped buffers and other screening, indicating the type of materials proposed and the height of such screening.

(c) A detailed plan or document indicating the exact manner of improving developed recreation areas and all covenants including lease-hold interests, restrictions and conditions pertaining to the use, maintenance, and operation of common areas.

(d) An exact statement in tabular form, summarized by phases, of the approved residential density (if any), total number of dwelling units by type, size, site location, and number of bedrooms and total floor area (gross leasable) for commercial as well as nonresidential uses.

(e) The exact percentage of the site to be covered with buildings, sidewalks, parking areas, roofed structures, and other impervious surfaces, areas to be covered by water bodies, or by golf courses (if any), areas to be landscaped; and those to be left in natural undisturbed condition.

(f) A detailed engineer's statement and working drawings for providing drainage outfall and on-site retention conforming with such county regulations and ordinances as are in force and effect, including appropriate calculations, exact size of storm water retention areas, final diagrams of pollutant removal structures, exact location of berms, swales, culverts, storm water sewers, and finished slopes and grades.

(g) Final working drawings and details for providing water supplies for drinking and irrigating and for providing sanitary sewer systems, with all applicable permits.

(h) Architectural drawings of the proposed structures including front, side and rear elevations, precise building layout (external and internal), exact site design, including exterior lighting systems, signs, and landscaping.

(i) A final plan or report indicating extent, timing and estimated cost of all improvements such as roads, sewerage, drainage, and other public and private facilities required to construct the PUD or applicable phase thereof, including proposed form of bonds and other instruments as needed, which plan or report will relate to the sequence of development schedule if the PUD is to be constructed in phases or units.

(j) A final plan showing street and house numbers and names in the PUD or phase thereof, in compliance with Ordinance No. 23 [Chapter 30, Article II], which plan must have been presented to and approved by the county office administering Ordinance No. 23 [Chapter 30, Article II].

(k) If the PUD or phase thereof contains subdivision lots, a final plat for recording with the office of the county clerk, which plat meets all applicable provisions of the subdivision regulations.

(l) All necessary regional, state and federal permits or approvals in writing.

(9) *Same—Final development plan for a minor PUD.* Final detailed information for a proposed minor PUD shall include item (a); items (c) through (g), both inclusive; and items (j), (k) and (l) of section 33-578(8).

(10) *Same—Number of copies.* In addition to information generally required for change of zoning petitions, the applicant shall submit that material or information as herein described in sufficient copies for necessary referrals and records:

(a) Upon submission of a preliminary development plan application, twelve (12) copies of all plans, reports, maps, documents, and other related information must be supplied to the planning and zoning department.

(b) Upon submission of an application for final development plan review, twelve (12) copies of all final plans, reports, maps, documents and other related information must be submitted to the planning and zoning department.

(c) Documents reflecting changes or amendments to previously submitted plans shall be furnished in sufficient copies to satisfy the requirements of subparagraphs (a) and (b) above.

(d) If the proposed PUD is a development of regional impact (DRI) as defined in Section 380.06, Florida Statutes, six (6) copies of all plans, reports, maps, documents and other related information required by the regional reviewing agency (in addition to the normal requirements of this article) shall be submitted to the planning and zoning department.

(11) *Other general provisions.*

(a) The submission of building construction plans and applications for building permits and certificates of occupancy and other such administrative requirements shall be accomplished in accordance with established county regulations and policy, except as herein provided.

(b) No building permit or certificate of occupancy shall be issued in or for development in a PUD District except in conformity with all provisions of the rezoning to the PUD District.

(c) Anything in this article to the contrary notwithstanding, the board of county commissioners may by resolution shorten or extend the time period for review of PUD applications generally, and may direct such shortening or extension for any given application, if the board determines that such shortening or extension is necessary and proper to the orderly and efficient processing of such plans. (Ord. No. 35, Part 1, 6-28-74; Ord. No. 161, Part 1, 8-12-80)

Sec. 33-579. Procedures for preliminary plan review.

(A) *Development review committee (DRC).*

(1) Applications for a preliminary development plan for a major PUD shall be reviewed within sixty (60) working days of the date on which said application is accepted as complete by the planning and zoning department. Applications for preliminary development plan for a minor PUD shall be reviewed within thirty (30) working days of the date on which said application is accepted as complete by the planning and zoning department. Every effort shall be made to complete the review within a shorter period of time. Extensions of the review time period may be specifically authorized by the applicant. Notification of such authorized extension shall be transmitted to the board of county commissioners by the planning and zoning department.

(2) A review of the application shall be conducted by the individual staffs of the development review committee (hereinafter called the DRC) and consolidated into a

written report. The DRC shall consist of the department head (or the department head's designee) of the following:

(a) Planning department;

(b) Zoning department;

(c) Engineering department;

(d) Building department;

(e) County (or tri-county) health department.

(3) The legal department shall provide the DRC such legal counsel as may be required.

(4). In addition, other staffs or agencies (local, regional, state or federal) may be requested to review the application. Notification in writing of such other staff or agency reviews shall be given to the applicant by the planning and zoning department.

(5) Serious problems or difficulties with the application that occur during the review period shall be brought to the attention of the applicant at the earliest possible date so as to allow time to amend the application without undue delay. If the applicant agrees to amend the application as deemed necessary, said applicant shall notify the planning and zoning department in writing. If the amendment is significant and would change the conclusions that might be reached, processing of the application will cease pending receipt of the amendment and the applicant will be notified of such action. When the application is resubmitted, the time period of section 33-578 (3) (c), shall begin again. After acceptance of the revised or amended application, the unexpired balance of the DRC review (sixty (60) or thirty (30) working days, as appropriate) period shall apply.

(B) *Prehearing conference.*

(1) The purpose of the prehearing conference shall be to assist in bringing the application for PUD zoning as nearly as possible into conformity with the intent and

provisions of this article or other applicable regulations, and/or to define specifically any justifiable variations from the application of such regulations.

(2) At the end of the aforesaid sixty (60) or thirty (30) working day review period, as appropriate, (sooner if the various staffs complete their review in less time; later if the applicant requests an extension, but in no case later than fifteen (15) days prior to the public hearing of the planning and zoning commission at which time the application is scheduled to be discussed), the applicant and/or his representatives shall meet with the DRC during a regularly scheduled public meeting to review the application.

(3) The summary report prepared by the DRC pursuant to section 33-579 (A) (2) shall be made available to the applicant at least five (5) working days prior to the regularly scheduled prehearing conference with the DRC, and shall become a part of the public record of the matter.

(4) The applicant shall, in writing, not later than five (5) days before the scheduled public hearing of the petition before the planning and zoning commission, submit to the planning and zoning department an indication of agreement or disagreement with the recommendations of the DRC. Reasons for disagreement should be clearly stated. All such responses by the petitioner shall be included in the public record of the matter.

(C) *Review by the water management advisory board.*

(1) Applicants for preliminary development plan review shall be furnished a copy of the county standards on water management. If the county engineer determines that the preliminary development plan conforms to these standards, or if the applicant amends his plan within the sixty (60) or thirty (30) working day review period, as appropriate, such that the standards are met, the application will not require review by the water management advisory board.

(2) If the county engineer determines that the application for preliminary development plan does not meet such standards as determined during the DRC review, the application shall be scheduled for the next available public meeting of the water management advisory board.

(3) The scope of the water management advisory board review may include any development issues concerning ground and/or surface water resources and management; however, specific reasons for referral of the application to the board shall be clearly stated on the public agenda.

(4) Written recommendations of the water management advisory board should be submitted to the planning and zoning department and to the applicant at least five (5) days prior to the date of the scheduled public meeting before the DRC, and shall be included in the public record of the matter.

(5) The applicant shall, in writing, not later than five (5) days before the scheduled public hearing of the application before the planning and zoning commission, submit to the planning and zoning department an indication of agreement or disagreement with any recommendations of the water management advisory board, with reasons for disagreement clearly stated; said correspondence shall be included in the public record of the matter.

(D) *Hearing before the planning and zoning commission.*

(1) Upon completion of the DRC review and conditional upon the applicant's compliance with all applicable provisions of this article, appropriate public notice shall be given and a public hearing shall be held before the planning and zoning commission on the application for preliminary development plan approval. Advertised public notice shall be given in a newspaper of general circulation published in the county at least fifteen (15) days prior to the public hearing. Notice shall be mailed by certified mail,

return receipt requested, to all property owners within three hundred (300) feet of the subject property at least fifteen (15) days prior to the public hearing. When a property owner consists of a condominium, notice need only be given to the condominium association. If a proposed PUD is within one mile of a municipality of another county, notification by certified mail, return receipt requested, must also be given to such municipality or county at least fifteen (15) days prior to the public hearing.

(2) The planning and zoning commission shall consider whether the county has the capabilities to accept the proposed PUD without adverse fiscal, physical or community service impacts pursuant to the general standards of this district.

(3) In support of its recommendations, the planning and zoning commission shall make determinations as to the:

(a) Suitability of the locale for the type and pattern of development proposed in relation to:

1. Physical characteristics of the site and of surrounding areas.

2. Existing and probable future development, traffic patterns and volumes, drainage, sewerage, water availability.

3. The proposed PUD relative to the capital improvements program, if any.

(b) Ability of the proposed development design to achieve the general and specific PUD standards of this article.

(c) Adequacy of evidence of unified control and the suitability of any proposed agreements, contracts, or other instruments, or the need for such instruments (or for amendments in those proposed), particularly as they reflect arrangements or provisions to be made for the continuing operation and maintenance of such common areas and facilities as are not to be provided and maintained at public expense. Determinations and recommendations of this type shall be made only after consultation with the county attorney.

(4) The planning and zoning commission shall take one of the following actions:

(a) Recommend approval to the board of county commissioners of the preliminary development plan conditional upon submission of an acceptable final development plan and pertinent documents.

(b) Recommend approval to the board of county commissioners of the preliminary development plan conditional upon:

1. Modifications to the plan clearly stated.

2. Submission of an acceptable final development plan and pertinent documents.

3. Such other provisions as may be determined by the planning and zoning commission.

(c) Recommend disapproval to the board of county commissioners of the preliminary development plan, clearly stating the reasons therefor.

(d) Table one time only for lack of information.

(5) The action and minutes of the planning and zoning commission shall become a part of the public record of the matter.

(E) *Hearing before the board of county commissioners.*

(1) Upon completion of the planning and zoning commission review, and unless the petition is withdrawn by the applicant or unless an additional prehearing conference has been scheduled, the board of county commissioners shall schedule the application for public hearing at the next available commission meeting. Advertised public notice shall be given in a newspaper of general circulation published in the

county at least fifteen (15) days prior to the public hearing. Notice shall be mailed by certified mail, return receipt requested, to all property owners within three hundred (300) feet, at least fifteen (15) days prior to the public hearing, except that when a property owner consists of a condominium, notice need only be given to the condominium association. If a proposed PUD is within one mile of a municipality or another county, notice must also be given to such municipality or county by certified mail, return receipt requested, at least fifteen (15) days prior to the public hearing.

(2) When a development proposal is a development of regional impact (DRI) as defined by Section 380.06, Florida Statutes, the additional public hearing requirements for a DRI shall be followed simultaneously.

(3) The board of county commissioners shall consider the written recommendations of the DRC, water management advisory board, planning and zoning commission, and presentations by the public in arriving at a decision on the preliminary development plan.

(4) The board of county commissioners shall consider whether the county has the capabilities to accept the proposed PUD without adverse fiscal, physical, or community service impacts pursuant to the general standards outlined in this article.

(5) The board of county commissioners may approve a preliminary development plan; approve it with conditions; disapprove the plan; or take any other action it deems necessary. When an application is adopted with conditions, the board should specify what actions must be taken by the applicant in order to fulfill such conditions. When an application is disapproved, the board should state the reasons for the disapproval and indicate what further actions, if any, by the applicant or modifications to the proposed plan, if any, might be undertaken in order to secure the board's approval.

(6) If a preliminary development plan is disapproved by the board of county commissioners, no further

applications or reviews regarding the property in question will be allowed within twelve (12) months from the date of disapproval, except by specific authorization from the board, unless the applicant has incorporated into a revised application all changes or modifications necessary to meet the expressed conditions of the board of county commissioners. The submission of an amended application under the conditions of this subparagraph shall be processed as a new application for preliminary development plan review, subject to the provisions set forth elsewhere in this article, except as directed by the board of county commissioners; and there shall be no presumption that any such amended application for preliminary development plan review will necessarily or automatically be approved by the board of county commissioners.

(7) Following adoption of a preliminary development plan by the board of county commissioners, the planning and zoning department shall change the official zoning map of Martin County to reflect the change of zoning to a PUD District for the subject property. If a preliminary development plan is adopted with conditions, the planning and zoning department shall change the official zoning map to reflect the PUD Zoning District only after the board of county commissioners has received sufficient documents and/or guarantees from the applicant that the required conditions have been or are being fulfilled. The change of zoning district will normally, but need not necessarily, precede adoption of the final development plan. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-580. Procedures for final development plan review.

(a) The purpose of the final development plan review is to provide a mechanism for the county to examine the applicant's detailed construction plans, legal documents and other related materials required to bind the agreements made during preliminary development plan review and approval. The final development plan for all of the proposed PUD, or any designated phase thereof, including all agreements, provisions, documents, maps and other pertinent information, shall be adopted as an amendment to the PUD Zoning District by resolution of the board of county commissioners, and shall control developmentof the entire PUD or applicable phase(s) thereafter.

(b) Upon receipt of an application for final development plan review, the planning and zoning department shall have ten (10) working days to ascertain if any items require correction or completion, as described in section 33-578(3).

(c) Completed applications for a final development plan for a major PUD shall be reviewed by the DRC within thirty (30) working days from the date of acceptance of the completed application. Completed applications for a final development plan for a minor PUD shall be reviewed by the DRC within fifteen (15) working days from the date of acceptance of the completed application. Every effort shall be made to complete the review within a shorter period of time. Extensions of the review time period may be specifically authorized by the applicant. If the completed applications are found satisfactory with respect to form, content, accuracy, and other such requirements including any conditions as attached to the preliminary development plan by the board of county commissioners, such applications shall be scheduled for final development plan review at the next available regularly scheduled public meeting of the board of county commissioners.

(d) Serious problems or difficulties that occur during the final development plan review shall be brought to the attention of the applicant at the earliest possible date. Failure of the applicant and the DRC to resolve such issues, or questions as to the intent of the board of county commissioners in approving the preliminary development plan, shall cause the application to be returned to the next available public meeting of the board of county commissioners for clarification. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-581. Procedure upon breach of PUD agreement.

(a) In the event that an applicant has received final development plan approval and has not sought building permits within six (6) months from the date of such approval, or has fallen behind the agreed development construction schedule by twelve (12) months or more, the board of county commissioners shall serve notice to the applicant in writing of the date and place of a public hearing on the planned unit development, at which time the applicant will be given an opportunity to explain the reasons for the scheduling delays and to propose a method of fulfilling his obligations under the planned unit development zoning agreement. The board may at its discretion allow the applicant time to demonstrate his willingness to meet the county's conditions.

(b) If at the end of a reasonable period of time, the applicant is clearly unable or unwilling to abide by the PUD zoning agreement, or if the conditions of the zoning agreement have in some other manner been clearly violated, the board of county commissioners shall advertise for a public hearing on the PUD, the purpose of which shall be to cause the property to revert to its immediately pre-existing zoning classification.

(c) In the event of such breach of a PUD agreement, and the reversion of the property to its prior zoning classification, no further building permits shall be issued to the applicant (or to his successors in interest) based upon the final development plan. Those portions of the property which may have buildings or structures constructed upon them in conformity with the final development plan shall thenceforth be regarded as nonconforming uses with respect to the revised zoning classification. (Ord. No. 35, Part 1, 6-28-74)

Sec. 33-581.1. Procedures for amending a PUD.

(a) Upon application by owner, the board of county commissioners may amend the preliminary development plan or final development plan of a PUD. Minor amendments may be reviewed and approved or disapproved by the board of county commissioners after being placed on an agenda for a regularly scheduled meeting. Any amendment to a PUD district other than a minor change shall be processed with the necessary data to be determined by the DRC and shall meet all other substantive and procedural requirements of this article, except that the letter notice shall only be sent to all property owners within three hundred (300) feet of the building(s), structure(s) or other improvement(s) to be amended. The DRC shall determine whether a proposed amendment is minor or major, and in making that determination, the DRC shall consider the following:

(1) The extent, if any, to which the amendment would affect the cubic volume of any building, the number of structures, the number of dwelling units.

(2) The extent, if any, to which the proposed amendment would affect the location of any lot, block, building, structure, setback or common open area.

(3) The extent, if any, to which the proposed amendment would affect the location or amounts of land devoted to specified land uses.

(4) The extent, if any, to which the proposed amendment would affect the PUD agreement or any of its exhibits.

(5) The extent, if any, to which the proposed amendment would affect the intent of the preliminary development plan or final development plan.

(6) Any change of the perimeter boundary of the PUD district shall be considered to be a major change.

(b) Any determination by the DRC that an amendment is minor may be reversed by the board of county commissioners. Any determination by the DRC that a proposed amendment is major may be appealed by the applicant to the board of county commissioners and may be reviewed by the board after being placed on the agenda of any regularly scheduled meeting. In making a determination as to whether an amendment is minor or major, the board of county commissioners shall use the criteria established in subsection (a) above.

(c) In the event the construction of any building, structure or other improvement does not comply with the preliminary or final development plan, the developer shall be ordered by the planning and zoning department to cease all such construction and no further building permits shall be issued until the construction has been reviewed as a major or minor amendment by the board of county commissioners in accordance with paragraph (a) above. At such public meeting it shall be the applicant's responsibility to justify to the board of county commissioners any variation from the preliminary or adopted final development plan. The board may, at its discretion, authorize any necessary modifications to the original PUD agreement or preliminary or final development plan. If the applicant is unable to justify such modifications to the board, the provisions of section 33-581, paragraphs (b) and (c) shall apply. (Ord. No. 35, Part 1, 6-28-74; Ord. No. 161, Part 1, 8-12-80)

Sec. 33-581.2. Planned unit development—Definitions.

(a) *Common elements.* Lands, structures and facilities whose ownership or use is shared by all owners or occupants within the PUD. Common elements may include but are not limited to open space, recreation facilities, water bodies, private streets and roads, utility systems, and joint parking or loading provisions.

(b) *Common open areas.* Any lands under common ownership and control that are not covered by buildings, roofed structures or impervious surfaces, specifically excluding golf courses and natural water bodies. Also referred to as open space, or common open space.

(c) *Developed recreation areas.* Lands, structures and facilities under common ownership and control that have been improved to accommodate active recreational activities, including but not limited to play areas, ball fields and courts, golf courses, artificially created water bodies, recreational or social clubhouses, buildings and structures, bike trails and other paved recreational areas.

(d) *Property owners' association.* A nonprofit organization legally recognized by the laws of the State of Florida and operated according to recorded land agreements, through which private landowners share the direct and indirect expenses of maintaining common areas. Also referred to as home owners' association.

(e) *Applicant.* Any owner, developer or individual legally authorized by the owner(s) of property to represent such owner(s)' interest in the development of the property.

(f) *Covenant of unified control.* In order to preserve the integrity of the development plan and insure its execution, the owner or owners shall provide a covenant of unified control to be recorded that stipulates that all of the subject property within the PUD will not be transferred, conveyed, sold or divided in any unit other than its entirety, except that individual fully constructed units and subdivision lots, if any, may be conveyed to individual purchasers. The covenant of unified control may also provide, upon approval by the board of county commissioners, for the following conveyances:

(1) If the PUD is designed and planned to be developed in phases or portions of phases, and each phase or portion of a phase complies with the requirements contained within the PUD agreement, then each phase or portion of phases may be conveyed separately upon final development plan approval of that phase or portion of a phase, unless otherwise provided for in the PUD agreement.

(2) Common elements, common open areas and developed recreation areas, if any, may be conveyed to a property owners' association or other legal entity so long as such conveyance shall be subject to the express restriction that the subject property will never

be used for any purpose other than as common elements, common open areas or developed recreation areas as applicable.

(3) Other portions of the subject property that will be used or maintained by governmental, environmental, charitable or other organizations or agencies for such purposes as the board of county commissioners may deem appropriate.

(4) Any amendment to an existing PUD agreement that affects the covenant of unified control shall be considered a major amendment and letter notice shall be provided to all residents within the development.

(g) *Parking area.* A land area devoted to the storage and maneuvering of motor vehicles, whether such area is of pavement or grassed surface, including automobile storage spaces, parking aisles and other streets and roads permitting ingress and egress to parking spaces, and associated landscaped areas and structures.

(h) *Gross leasable floor area.* The total floor area within buildings designed for nonresidential use, which area is or might be leased to tenants.

(i) *Total residential floor area.* The total floor area within the exterior walls of all buildings devoted to residential purposes, excluding only garages, carports, covered parking structures, breezeways, open porches, open balconies and storage or utility rooms not accessible from the interior of a building. For single-family lots upon which the purchaser will eventually build a dwelling structure, a figure of two thousand (2,000) square feet may be used to calculate total floor area. (Ord. No. 35, Part 1, 6-28-74; Ord. No. 161, Part 1, 8-12-80)

Secs. 33-581.3—33-581.10. Reserved.

DIVISION 4. PUD (I) PLANNED UNIT DEVELOPMENT (INDUSTRIAL) SUB-DISTRICT

Sec. 33-581.41. Purpose and intent.

(A) The purpose of this sub-district is to provide a district that may be used at the option of the developer to establish industrial planned unit developments at appropriate locations.

(B) Industrial planned unit developments, which are approved in accordance with the terms and provisions of this sub-district, may depart from the strict application of use, setback, height and lot requirements of standard zoning districts, provided that such developments do not conflict with the public health, safety and general welfare.

(C) A further purpose of this sub-district is to provide for broad discretionary authority by the board of county commissioners to approve or disapprove industrial planned unit development applications based upon the health, safety and general welfare of the present and future residents of Martin County.

(D) It is also the purpose and intent of the industrial planned unit development sub-district to encourage developments that meet most, but not necessarily all, of the following criteria:

(1) A location with frontage on an arterial highway;

(2) An integrated circulation and parking plan with provision for adequate parking and delivery access;

(3) The provision of management, maintenance and/or promotional services to individual occupants;

(4) Unified architectural design and landscaping. (Ord. No. 164, Part 1, 4-14-81)

Sec. 33-581.42. PUD(I) Definitions.

Editor's note—Part 1 of Ord. No. 164 enacted the catchline of § 33-581.42, as set forth above, with no substantive provisions. At the request of the county, said section is included herein as enacted.

Sec. 33-581.43. Uses authorized in the industrial PUD(I) district.

All uses authorized within a PUD(I) district as stipulated by this article shall be conditional uses subject to approval of a PUD development plan by the board of county commissioners. No use, location of use, intensity of use or condition of use shall be approved if it is found by the board of county commissioners to be contrary to the adopted planning and development policies and objectives of Martin County or contrary to the health, safety and general welfare of the present and future residents of the county.

Subject to the above, the following uses may be permitted:

(a) Uses permitted in the public service district and any industrial use other than those uses permitted in the M-3 industrial district.

(b) Utility plants and substations to include wastewater, potable water, electricity, telephone and natural gas services.

(c) General office, retail, service and wholesale commercial activities which are compatible with the industrial usage.

(d) Residential uses not to exceed fifty (50) per cent of the total developed area.

(e) Off-street parking areas, garages and structures, as accessory to any of the permitted uses. (Ord. No. 164, Part 1, 4-14-81)

Sec. 33-581.44. Development standards.

(A) All PUD(I) projects shall conform to the standards for planned unit developments as set forth in section 33-577 of this Code except where in conflict with the provisions of this division.

(B) All PUD(I) projects shall conform to federal, state and local codes, and all applicable permits and approvals shall be obtained from the appropriate agencies prior to approval of the final development plan.

(C) Circulation:

(1) No permanent entrance to a PUD(I) shall be permitted within five hundred (500) feet of an existing or designated arterial or collector highway intersection, unless there exists a parallel road system for the arterial highway or some other traffic arrangement designated to accommodate additional vehicular traffic without congestion at the intersection.

(2) The use of parallel service or reverse frontage roads for access to large PUD(I) projects with high rates of traffic generation is recommended.

(3) Parking areas shall have pedestrian walkways, striped and signed pedestrian crosswalks, raised curbs, bumper stops, landscaped areas and traffic signs located in accordance with good safety practice.

(D) Off-street parking:

(1) Parking spaces should be located within walking distance of the buildings they are intended to serve.

(2) Parking area designs shall conform to Martin County's landscape ordinance (section 23-52 of this Code).

(3) Parking areas shall contain outdoor lighting (at appropriate intervals and levels of illumination in accordance with county lighting policies).

(4) No parking shall be allowed immediately in front of building entry driveways.

(5) Within a parking aisle or parking area, the design shall not mix right-angle (ninety (90) degree) spaces with diagonal parking.

(6) Consideration shall be given to allowing credit for on site multiple uses and required parking spaces.

(7) Parking shall be provided for handicapped persons as required by the Florida Statutes and this Code.

(8) The following are minimum standards for the design of parking areas (excluding loading areas):

	90-Degree Parking Two-Way	*60-Degree Parking One-Way*	*45-Degree Parking One-Way*
Aisle width	23′	18′	15′
Stall width	10′	12′	14′2″
Stall depth	20′	25′9″	30′
Stall depth when confined within walls (nested)	20′	18′	17′
Overhang	2′	2′3″	2′6″

(9) The following minimum standards shall be used to determine the required number of parking spaces for various uses within an industrial PUD:

(a) *General industrial usage:* One (1) space for each fifty (50) square feet of customer service area, plus one (1) space for each five hundred (500) square feet of gross floor area.

(b) *Research/Development Laboratory:* One (1) space for each fifty (50) square feet of customer service area, plus one (1) space for each five hundred (500) square feet of gross floor area.

(c) *Warehouse:* One (1) space for each fifty (50) square feet of customer service area, plus one (1) space for each one thousand (1,000) square feet gross floor area.

(d) *Wholesale trade:* One (1) space for each four hundred (400) square feet of gross floor area.

(e) *Retail trade:* One (1) space for each two hundred (200) square feet of gross floor area.

(f) *Restaurants (sit-down):* One (1) space for each one hundred fifty (150) square feet of gross floor area.

(g) *Bars/lounges:* One (1) space for each one hundred (100) square feet of gross floor area.

(h) *Financial institutions:* One (1) space for each two hundred (200) square feet of gross floor area, plus sufficient area for eight (8) stacking spaces for the first drive-in window and five (5) stacking spaces for each additional window.

(i) *Hotels and motels:* One (1) space for each guest room or suite, plus one (1) space for each three (3) seats of any restaurant lounge, or convention center that is part of the hotel and motel.

(j) *Medical, dental or veterinary office or clinic:* Five (5) spaces plus one (1) space for each one hundred fifty (150) square feet of gross floor area.

(k) *Professional or business office:* One (1) space for each two hundred (200) square feet of gross floor area.

(l) *Residential:* Minimum off-street parking space requirements for residential uses shall be related to the number of bedrooms provided by the applicant as follows: Efficiency apartments, one and five-tenths (1.5) parking spaces per unit; one-bedroom units, one and seventy-five-hundredths (1.75) parking spaces per unit; two (2) or more bedroom units, two (2) parking spaces per unit.

(m) *Utility plants and substations for waste water, potable water, electricity, telephone and natural gas services:* One (1) space for each five hundred (500) square feet of office and work area floor space.

(n) *Other uses not specifically set forth above:* One (1) space for each two hundred (200) square feet of gross floor area.

(10) Designated grassed areas with stabilized sub-base for overflow parking purposes may be used to provide up to ten (10) per cent of the required number of parking spaces.

(11) Areas shall be provided for the delivery and storage of goods, truck parking and the storage and collection of refuse and such areas shall be screened appropriately.

(E) Utilities, including drainage:

(1) Consideration should be made to having electrical, water and sewer, and communication utility lines

placed underground. Utilities shall conform to all applicable federal, state and local codes.

(2) Parking area lighting fixtures within three hundred (300) feet of any adjacent private residence or public road shall be designed or shielded or be of nonglare lighting so as to eliminate glare to residents and to users of the road.

(3) Any areas used for the storage or collection of refuse shall be screened from view, except that self-contained trash collection systems may be utilized.

(4) Drainage plans shall retain on-site the standard design year rainfall. Drainage shall be provided in accordance with subsections 30½-43(II and III) of this Code and Chapter 14 (Flood Damage Prevention) of this Code. All developments shall retain the stormwater runoff attributable to the ten-year, one-hour storm, except for lots less than thirty thousand (30,000) square feet, for which on-site retention shall be a five-year, one-hour storm. Runoff shall be directed to percolation areas prior to introduction into the storm sewer or other receiving facilities. Adequate filtration of runoff from impervious surface areas shall be provided; drainage plans shall take into consideration the drainage of surrounding private or public property and shall not adversely impact such property; and the existing water table of the site shall not be lowered if by so doing there would be damage to the county's natural water sources.

(F) Open spaces:

(1) A minimum of fifteen (15) per cent of the total site shall be open space and shall be landscaped by the developer in accordance with the landscape ordinance, sections 23-49 to 23-56. Additional open space that may be required in order to satisfy the Martin County on-site storm drainage detention policies shall be similarly landscaped with appropriate shrubs and trees. Landscaping plans shall meet the minimum

requirements of the county landscape ordinance (Code section 23-52).

(2) The maximum permitted building coverage shall be fifty (50) per cent.

(3) The use of semipermeable pavement to reduce the volume of surface water runoff may be considered in appropriate site locations.

(G) Performance standards:

(1) No smoke of a density greater than No. 1, according to Ringelmann's scale, shall be emitted, except [that] smoke not in the excess of No. 2, Ringelmann's scale shall be permitted for not more than six (6) minutes of any one hour.

(2) No particle from any flue or smokestack exceeding two-tenths (0.2) graphics per cubic foot of flue gas at stack temperature of five hundred (500) degrees Fahrenheit shall be permitted.

(3) Industrial uses shall present detailed plans and programs for the elimination of odors, dust and dirt to the planning and zoning director before a permit shall be granted.

(4) No processes which result in the escape of obnoxious gases or fumes in concentrations dangerous to plant or animal life or damaging to property as defined by state and federal regulations shall be permitted.

(5) Operations creating glare shall be so shielded that the glare cannot be seen from outside the plant site.

(6) Where processes involve disposal of industrial sewage wastes, approval of the proposed method of disposal by the county health officer and the county engineer shall be secured before a permit shall be issued.

(H) Other standards:

(1) All PUD(I) projects shall provide for fire prevention and fire extinguishment (to include a unified water system for the entire project) that meets or exceeds the

requirements of the National Fire Codes, Volumes 1 through 16, 1980 Edition, together with Supplements A and B for that edition.

(2) The maximum height of any building or structure shall be forty (40) feet above the finished grade, except within one hundred (100) feet of a residential use where the maximum height shall be thirty (30) feet.

(3) All PUD(I) projects shall provide a fifty-foot wide buffer which shall be walled, fenced or densely landscaped adjacent to any residential use or district. Said wall, fence or landscaping shall be a minimum of six (6) feet high. Any residential uses within the PUD(I) shall be suitably buffered by fences or dense landscaping. No roads, buildings or other structures shall be placed within the buffer area unless specifically authorized by the board of county commissioners.

(4) All industrial uses and activities shall be conducted entirely within enclosed structures and the adequacy of outside open air assembly, storage, display or sale of equipment, products or materials, shall be made a part of the planned unit development agreement.

(5) All residential uses shall be suitably buffered by fences, walls or dense landscaping so as to eliminate adverse impacts from incompatible nonresidential uses.

(6) Details regarding sign control, lighting and maintenance responsibilities proposed for the owners or tenants association documents shall be considered by the planning and zoning board and approved by the board of county commissioners.

(I) It is the intention of the board of county commissioners that these development standards shall be considered to be minimums for the development of a PUD(I) project and that there shall be no presumption that any PUD(I) project that meets these minimums will necessarily or automatically be approved by the board of county commissioners. (Ord. No. 164, Part 1, 4-14-81)

Sec. 33-581.45. PUD(I) procedures.

Procedures for review of preliminary and final development plans and for amending or voiding industrial PUD agreements shall be as specified in sections 33-579, 33-580 and 33-581, Code of Laws and Ordinances of Martin County, Florida. (Ord. No. 164, Part 1, 4-14-81)

Secs. 33-581.46—33-581.61. Reserved.

DIVISION 5. PUD (MH) PLANNED UNIT DEVELOPMENT (MOBILE HOME) SUB-DISTRICT

Sec. 33-581.62. General provisions.

(a) The purpose of this division is to provide a district that may be used at the option of a devéloper to establish mobile home planned unit developments at appropriate locations in keeping with the planning and development objectives of Martin County, Florida.

(b) A further purpose of this sub-district is to provide for broad discretionary authority by the board of county commissioners to approve or disapprove mobile home planned unit development applications based upon the health, safety and general welfare of the present and future residents of Martin County. Prior to approval of a development plan the board of county commissioners shall make a finding of fact that the proposed mobile home planned unit development is in accordance with the general or comprehensive plan; the specific area plan, if such plan has been adopted; the capital improvements program, if any, or other coordinated and planned extension of existing community facilities; and other development policies and objectives as may be in force and effect. Such findings of fact shall take precedence over any other rules and regulations of Martin County with which they may be in

Sec. 33-812. Penalties.

(a) Violations of this article is a misdemeanor pursuant to Section 125.69, Florida Statutes, and is punishable under said section by imprisonment for up to sixty (60) days, or a fine of up to five hundred dollars ($500.00), or both such imprisonment and fine.

(b) In addition to the above, the construction industry licensing board may, pursuant to Chapter 7 3/4 of this Code, investigate the actions of any person holding a Martin County contractor's license, or qualifying agent, who is believed to have deliberately or willfully violated the provisions of this article or who is believed to have aided and abetted any uncertified person to evade any provision of this article and if said contractor or agent is found guilty, take appropriate disciplinary action as set forth in Chapter 7 3/4. (Ord. No. 257, Part 1, § 12, 6-25-85)

Secs. 33-813—33-954. Reserved.

ARTICLE XLVIII—LIX. RESERVED

ARTICLE LX. AMENDMENTS

Sec. 33-955. General.

Whenever the public necessity, convenience, general welfare or good zoning practice requires, the board of county commissioners may by resolution amend, supplement or change the regulations, district boundaries or classifications of property, now or hereafter established by this chapter or amendments thereto. (Res. of 5-9-67, Art. XXXIX, § 39.1)

Sec. 33-956. Area for rezoning.

In case of a petition for a change in the zoning of property, the zoning board shall consider whether the area described in the original petition should be enlarged in order to reflect the interests of the county and to correspond with the county plan. The zoning board shall study and recommend to the commission such enlargement, if any, as it may deem desirable. (Res. of 5-9-67, Art. XXXIX, § 39.2)

Sec. 33-957. Board initiation.

The zoning board shall carry on a continual study of zoning, zoning techniques and the relation of zoning to private developments and public improvements and any pertinent parts of any county plan for the orderly growth of the county, and may from time to time submit recommendations on the amendments of this chapter. (Res. of 5-9-67, Art. XXXIX, § 39.3)

Sec. 33-958. Basis for recommendations.

In reviewing and formulating recommendations to the commission on requested or proposed changes in this chapter, the zoning board shall consider and evaluate the changes in relation to all pertinent factors, including the following:

(1) The character of the district and its peculiar suitability for particular uses.

(2) Conservation of the value of buildings and encouraging the most appropriate use of land and water throughout the county.

(3) The applicable portions of any current county plans and programs, such as land use, trafficways, recreation, schools, neighborhoods, drainage and housing.

(4) The needs of the county for land areas for specific purposes to serve population and economic activities.

(5) Whether there have been substantial changes in the character or development of areas in or near an area under consideration for rezoning.

(6) The facts and opinions presented to the zoning board through hearings. (Res. of 5-9-67, Art. XXXIX, § 39.4)

Sec. 33-959. Action by commission.

If a petition or recommendation for a change or amendment to this chapter is not acted upon finally by the commission within six (6) months of the date upon which the report of the zoning board is filed with the commission, said petition shall be deemed to have been denied. (Res. of 5-9-67, Art. XXXIX, § 39.5)

Sec. 33-960. Conditional rezoning.

No amendment to this chapter to rezone property shall contain conditions, limitations or requirements not applicable to all other property in the zoning district to which the particular property is rezoned. (Res. of 5-9-67, Art. XXXIX, § 39.6)

Sec. 33-961. Limit on petitions.

(a) Whenever the zoning board has taken action to recommend denial of a petition for rezoning property, the zoning board shall not consider any further petition for the same rezoning of any part of the same property for a period of two (2) years from the date of such action.

(b) Whenever the commission has changed the zoning of property by an amendatory resolution, the zoning board shall not consider any petition for rezoning of any part of the same property for a period of two (2) years from the effective date of the amendatory resolution.

(c) The above time limits for zoning board consideration may be waived by the commission by the affirmative vote of four (4) commissioners, when the commission deems such action necessary to prevent an injustice or to facilitate the proper development of the county. (Res. of 5-9-67, Art. XXXIX, § 39.7)

Sec. 33-962. Procedure for amendments.

(a) A petition for a change of district regulations may be filed by any citizen or owner of land in Martin County.

(b) Petitions for change of zoning or district regulations shall be addressed to the zoning board and shall be filed with the county planning department. Such petitions shall contain or be accompanied by all pertinent information which may be required by the zoning board for its proper consideration of the matter, including, in the case of petitions for rezoning of land with any improvements located thereon, at least one photograph. Petitions shall also be accompanied by a fee to be set from time to time by resolution of the board of county commissioners.

(c) After consideration of a petition for a change in zoning classification or in a district regulation, the zoning board shall transmit the petition and the board's recommendations thereon to the commission.

(d) No recommendation for a change in zoning district classification or in district regulations shall be made by the zoning board to the commission unless and after a public hearing as hereinafter prescribed has been held by the zoning board.

(e) Proposals originating with the commission or initiated by the zoning board shall be processed in the same manner as provided for petitions in the preceding sections. (Res. of 5-9-67, Art. XXXIX, § 39.8; Ord. No. 138, Part I, § B, 4-10-79; Ord. No. 184, Part IV, 9-22-81)

Cross reference—Procedure for enactment of zoning regulations, restrictions, boundaries, § 23-16.

Sec. 33-963. Hearings before zoning board.

(a) Notice of hearings before the zoning board in connection with changes in zoning district classification or changes in district regulations under this chapter shall be published in a newspaper of general circulation in Martin County at least fifteen (15) days prior to the date of the hearing. Such notice shall specify the time and place of the hearing and the matter to be considered at such hearing.

(b) In connection with hearings on petitions for change in the zoning district classification, all owners of property in the area proposed for zoning change and all owners of property within three hundred (300) feet of the land subject to such petition, shall be given notice of such hearing by mail. Such notice shall be mailed at least ten (10) days prior to the date of the hearing. For the purposes of such notification, an owner of property shall be deemed to be the person who, with his address, is so shown on the tax rolls of the Martin County Tax Collector. (Res. of 5-9-67, Art. XXXIX, § 39.9)

Secs. 33-964—33-974. Reserved.

ARTICLE LXI. LEGAL PROVISIONS

Sec. 33-975. Interpretation, purpose and conflict.

In interpreting and applying the provisions of this chapter, they shall be held to be a minimum requirement for the promotion of the health, safety, morals and general welfare of the county. It is not intended by this chapter to interfere with, abrogate or annul any easements, covenants or agreements between parties; provided, however, where the regulations of this chapter on the same point as contained in any other law or resolution are more restrictive, the provisions of this chapter shall govern; and where the regulations of the other law or resolution are more restrictive than those of this chapter, the other shall govern. (Res. of 5-9-67, Art. XL, § 40.1)

Sec. 33-976. Validity.

Should any article, section, paragraph, sentence, clause, phrase or other part of this chapter be declared by a court of competent jurisdiction to be invalid, such decisions shall not affect the validity of the chapter as a whole or any part thereof, other than the part so declared to be invalid. (Res. of 5-9-67, Art. XL, § 40.2)

Sec. 33-977. Saving clause.

Any prosecution arising from a violation of any resolution repealed by this chapter, which prosecution may be pending at the time this chapter becomes effective, or any prosecution which may be started within one year after the

10.2.2 EXCERPTS FROM THE MARTIN COUNTY LAND DEVELOPMENT CODE RELATED TO:

- **SECTION 35-2.26: PUD (I), INDUSTRIAL PLANNED UNIT DEVELOPMENT**
- **SECTION 35-4.3: HEIGHT EXCEPTIONS**
- **SECTION 35-5.5: SPECIFIC CRITERIA REGULATING ADVERTISED CONDITIONAL USES**

Conditional Uses:

All conditional uses permitted in the COR, LC, GC, WRC and WGC districts except townhouse cluster dwellings
Any community and public service uses found appropriate.

(D) *Additional Uses.* In addition to the permitted and conditional uses allowed in this district, expressway-oriented transient commercial service centers may be permitted subject to compliance with the performance specified in section 4-2(E)(5) of the comprehensive plan. (Ord. No. 293, Part 1, 4-29-86)

Sec. 35-2.26. PUD(I) industrial planned unit development.

(A) *Purpose and Intent.* The PUD(I) district is established to provide an alternative zoning procedure that may be used to encourage the establishment of desirable industrial parks containing complete employment centers through the application of enlightened and imaginative design approaches at appropriate locations in accordance with the planning and development objectives of the comprehensive plan. Appropriate locations for the establishment of PUD(I) districts shall be limited to those areas that are designated for industrial uses in the comprehensive plan.

(B) *Permitted Uses.* In this district as a permitted use a building or premises may be used for the below uses. All applicable provisions of this code shall be satisfied including site plan review and performance criteria.

Permitted Uses:

Limited impact industries
Trades and skilled services
Wholesale trades and services

(C) *Conditional Uses.* In this district as a conditional use a building or premises may be used for only the following conditional uses upon compliance with applicable conditions stated in article V and all other applicable provisions of this code, including site plan review and performance criteria.

Conditional Uses:

Any acceptable community and public service uses
General industrial uses
Utilities
Protective and emergency services

(D) *Additional Uses.* In addition to the permitted and conditional uses allowed in this district, business and professional offices, general retail sales and services, limited commercial activities, private parking and recreation areas, private protective and emergency services, restaurants (excluding drive-ins), and vehicular service and maintenance uses may be permitted provided that such uses are internally located and oriented to the principal industrial uses within the PUD(I) project, serving needs not otherwise served in the general area of the project. (Ord. No. 293, Part 1, 4-29-86)

ARTICLE III. CATEGORY "B" DISTRICT REGULATIONS

This article describes the zoning district regulations in effect at the time of adoption of this code. Existing zoning district regulations as established in Chapter 33 of the Code of Laws and Ordinances will remain in full effect. (Ord. No. 293, Part 1, 4-29-86)

ARTICLE IV. SUPPLEMENTARY REGULATIONS

Sec. 35-4.1. Fences, walls and hedges.

(A) *General Requirements.* Screening and buffer zone requirements of section 23-49, the Martin County landscape ordinance No. 285, must be met.

(1) All salvage operations shall be visually screened with a fence or wall of not less than eight (8) feet in height, which shall be of masonry or wood construction and shall be without openings, except for entrance and exit. Such opening shall be equipped with gates forming a visual obstruction.

(2) The director of community development may require the screening of any use or condition considered detrimental to

(B) *Allowable Encroachments.* In all districts, structural and mechanical overhangs such as roof extensions or cantilevered balconies, sills, gutters, window air conditioners and awnings may extend up to three (3) feet into required setbacks.

(C) *Center Line Setbacks.*

(1) No structure shall be built within fifty (50) feet of the center line of any public or private right-of-way designated as a local street.
(2) No structure shall be built within sixty-five (65) feet of the center line of any public or private right-of-way designated as a collector arterial street or highway.
(3) No structure shall be built within one hundred (100) feet of the center line of the existing median strip of U.S. Highway 1. (Ord. No. 293, Part 1, 4-29-86)

Sec. 35-4.3. Height exceptions.

(A) Church steeples, spires and belfries may exceed district height limitations after approval by the community development director. However, the heights of these structures shall not exceed sixty (60) feet from ground level and shall be a part of a principal building and not used for human occupancy.

(B) Roof structures, including chimneys, parapet walls not over four (4) feet high, tanks and supports, elevator machinery or shafts, penthouses used solely to enclose stairways and ventilation or air conditioning apparatus may exceed district height regulations provided that such structures do not exceed ten (10) percent of the roof structure measured on a horizontal plane, provided that such structures are not used for human occupancy and provided that the use of such structure does not increase the district height requirements by more than eight (8) feet.

(C) Agricultural structures, communication towers, permanent installations for utilities or industrial processes, and protective and emergency service installations can be exempt from district height restrictions subject to the following criteria:

(1) Utility poles and support structures are exempt from height restrictions.

(2) Unmanned structures in conjunction with agricultural uses, industrial uses and associated towers may exceed the district height limitation up to fifty (50) percent over the standard.

(3) Any use, structure or tower in this category in excess of sixty (60) feet in height must be authorized by the board of county commissioners following the advertising requirements of section 35-5.8 (public hearing notification requirements for special exceptions), must not be occupied and must comply with fire code requirements. (Ord. No. 293, Part 1, 4-29-86)

Sec. 35-4.4. Model dwelling units.

In any residential district where there is active development of ten (10) or more residential units, a developer or his agent may operate a sales office within a model dwelling unit or other temporary facility. All model dwelling units and sales offices shall meet all district requirement and be subject to the following restrictions:

The sales office, if not in a model dwelling unit, may be permitted as an accessory use on the same lot, but shall not be used except solely in connection with the development in which located.

Model dwelling units may be used as a means to sell similar homes for a period of up to one (1) year. Extensions may be granted by the code enforcement administration; however, each such extension shall not exceed a period of one (1) year.

The sales office, if not in a model dwelling unit, may be used as an office for one (1) year, and thereafter shall either be removed or used in accordance with regulations generally applicable within the district. Extensions may be granted by the code enforcement administrator; however, each such extension shall not exceed a period of one (1) year.

At least five (5) off-street parking spaces shall be provided on the same lot as the sales office or model dwelling unit or on contiguous lots, and shall be maintained as long as the model fifty (50) feet of the front street property line, or within thirty (30) feet of any side or rear property line.

(c) The storage of inoperative vehicles or any other junk or scrap shall not exceed a height of twelve (12) feet.

(d) The site plan shall comply with the supplemental screening requirements of article IV including a berm and a fence. (Ord. No. 293, Part 1, 4-29-86)

Sec. 35-5.4. Appeal of the decision of the community development director.

Any appeal of the decision of the community development director to approve or deny a request for a conditional use approval under this section must be filed in writing with the county administrator within fifteen (15) calendar days of the decision. Said appeal will be placed on the next available agenda of the planning and zoning board for consideration of the appeal. The planning and zoning board shall not request to waive or alter the criteria established in this section. Any further appeal of the request for conditional use shall be filed with the circuit court. (Ord. No. 293, Part 1, 4-29-86)

Sec. 35-5.5 Specific criteria regulating advertised conditional uses.

In addition to satisfaction of the general provisions cited in section 35-5.2, an advertised conditional use shall be permitted only upon a finding by the board of county commissioners at a regular scheduled meeting that the proposed use complies with the requirements for the respective advertised conditional use as specified below. The board's decision regarding the advertised conditional use shall be rendered after the public hearing notification requirements of section 35-5.6 are met.

(A) *Advertised Conditional Community Land Use Activities.*

(1) *Airfield facilities.* Within the AG and PS districts.

(a) A plan sealed by a registered engineer shall be presented which indicates the landing and take-off corridors comprising the airfield. Such plan shall satisfy all requirements of the Federal Aviation Administration including conformance with appropriate flight hazard criteria which may hereinafter be imposed. The airfield plan shall include land use considerations within a five-thousand-foot radius of the boundaries of the proposed facility.

(b) No area used by aircraft under its own power shall be located within two hundred (200) feet from any boundary line of the facility.

(c) No runway primary surface shall be closer than three hundred (300) feet from any property line and one hundred (100) feet from any residential structure.

(2) *Child care facilities.* Within the AG, RR-5A, RE-2A, RE-1A, RE-0.5A, RS-15, RS-10, RS-7.5, RM-5, RM-8, RM-15, COR and LC districts.

(a) Site shall be located on a paved public road with sufficient width to accommodate pedestrian and vehicular traffic generated by the use. The facility should be located near a major thoroughfare or collector street so as to discourage traffic along residential streets in the impacted area.

(b) No such facility shall be permitted on a zone lot unless it contains a minimum of fifteen thousand (15,000) square feet.

(c) One (1) accessory off-street parking space shall be provided for each five (5) children accommodated in the child care facility.

(d) Special passenger loading and unloading facilities shall be provided on the same lot for vehicles to pick up or deliver clientele. Such facilities shall include driveways that do not require any backup movements by vehicles to enter or exit the premises.

(e) All regulations of the State of Florida that pertain to the use shall be satisfied.

(f) A fenced area stabilized and maintained with suitable ground cover of not less than three thousand (3,000) square feet of usable outdoor recreation area shall be provided for the first twenty (20) children at any one time. One hundred fifty (150) square feet of usable outdoor recreation area shall be required for each such child over twenty (20). Such area shall be delineated on the site plan submitted at the time the application is filed. For the purpose of this provision usable outdoor recreation area shall be limited to:

(i) That area not covered by building or required off-street parking spaces and shall be fenced and screened from adjacent property lines.

(ii) That area outside the limits of the required front yard.

(iii) Only that area which is developable for active outdoor recreational purposes.

(iv) An area which occupies no more than eighty (80) percent of the combined total areas of the rear and side yards.

(g) The site plan shall comply with supplemental screening requirements of article IV.

(3) *Public or private not-for-profit clubs and cultural or civic activities.* Within the RM-8, RM-15 and WRC districts.

(a) No building shall be located closer than fifty (50) feet to any lot line which abuts a residential district.

(b) No off-street parking or loading space shall be located closer than twenty-five (25) feet to any property line abutting a residential district.

(c) The site plan shall comply with supplemental screening requirements of article IV.

(4) *Educational institutions.* Within the AG, RR-5A, RE-2A, RE-1A, RE-0.5A, RS-15, RS-10, RS-7.5, RM-5, RM-8, RM-15, MHP, COR and PS districts.

(a) Sites shall be located near major thoroughfares so as to discourage traffic along local residential streets in residential subdivisions.

(b) Depending on the type facility proposed, the minimal special requirements for the site shall be similar to standards utilized by the Martin County School Board and the State of Florida.

(c) No main or accessory building shall be located within one hundred (100) feet of any property line.

(d) The applicant shall demonstrate a program of systematic instruction and site development plan reasonably conforming with customary standards for respective forms of similar instruction.

(e) The applicant shall submit a description of anticipated service area and projected enrollment by stages if appropriate and relate the same to a development plan explaining:

(i) Area to be developed by construction phase.

(ii) Adequacy of site to accommodate anticipated facilities enrollment, recreation areas, off-street parking and pedestrian and vehicular circulation on site including loading, unloading and queing of school bus traffic.

(iii) Safety features of development plan.

(iv) Landscaped areas especially treatment of property lines abutting residential properties which shall meet screening requirements established in article IV.

(5) *Nursing homes, including rest homes and convalescent homes.* Within the RM-5, RM-8, RM-15, and COR districts.

(a) No building or structure shall be located closer than fifty (50) feet to any lot line abutting a residential district.

(b) No off-street parking shall be located closer than twenty-five (25) feet to any lot line abutting a residential district.

(c) A description of the program of services shall be submitted with the application and the applicant shall demonstrate that the method of operation and delivery of such health services and daily care shall be in compliance with all relevant state and federal standards for operation of nursing homes.

(d) The site plan shall comply with supplemental screening requirements of article IV.

(7) *Group housing, foster housing and adult congregate facilities.* Within all agricultural and residential districts (AG, RR-5A, RE-2A, RE-1A, RE-0.5A, RS-15, RS-10, RS-7.5, RM-5, RM-8 and RM-15).

(a) All applicable regulations of the State of Florida shall be satisfied.
(b) There shall not be more than twelve (12) unrelated residents in any living unit.
(c) The intensity of care shall be low, providing an environment that approximates family living.
(d) Subject to review and acceptance of traffic impacts to adjacent properties.

(8) *Places of worship.* Within the RE-2A, RE-1A, RE-0.5A, RS-15, RS-10, RS-7.5, RM-5, RM-8, RM-15, MHP and MHS districts.
(a) The minimum site for places of worship in residential districts shall be twenty thousand (20,000) square feet with a minimum width of one hundred (100) feet.
(b) Sites shall be located near major thoroughfares in order to discourage traffic along local residential streets within residential neighborhoods.
(c) No building or structure shall be located closer than thirty (30) feet to any property line abutting a residential district and no off-street parking shall be located closer than twenty-five (25) feet to any lot line abutting a residential district.
(d) The site plan shall comply with supplemental screening requirements of article IV.

(9) *Utilities with the exception of normal distribution and/or collection facilities (i.e., poles, lines, cable in trench and associated equipment).* Within all districts.
(a) Site plan proposed shall show the proposed utility together with an existing system of which the proposed system will be an integral part. A statement shall be submitted which explains the function of the proposed improvement and its consistency with any overall utility system plan as well as the comprehensive plan.
(b) All equipment, machinery, and facilities not located within an enclosed building shall be screened from any abutting residential district pursuant to article IV.

(c) The proposed location of the utility shall be demonstrated necessary relative to the other sites for effective service to consumers within the applicant's service area.

(10) *Communication towers.* Within the AG and PS districts.

(a) Such structures shall comply with applicable FAA and FCC regulations.

(b) Such structures shall maintain a minimum one hundred-foot setback from adjacent properties.

(c) A site plan for such structures shall comply with the supplemental screening requirements of article IV.

(11) *Congregating housing for agricultural farm workers.* Within the AG district after review and recommendation by the planning and zoning commission at a regularly scheduled meeting.

(a) The minimum area to be used shall not be less than sixty (60) acres of productive agricultural land.

(b) The total number of dwelling units cannot exceed the number of dwelling units that would be normally permitted in the AG district.

(c) There shall be a twenty-foot open space maintained between structures.

(d) The housing shall be inhabited solely by families who work on the agricultural lands identified in (a), above.

(e) Once the agricultural activities have been abandoned, the residential units must be vacated and demolished or converted to a use conforming to the AG district.

(f) Must be consistent with the provisions of the comprehensive plan.

(B) *Advertised Conditional Commercial Use Activities.*

(1) *Recreational vehicle park.* Within all AG, mobile home and commercial districts (AG, RR-5A, MHP, MHS, COR, WRC, WGC, LC and GC).

(a) Submit to the development criteria for a mobile home planned unit development as per section 35-2.24.

(b) Document that the mix of uses is justified and consistent with the characteristics of the immediate community.

(2) *Rifle ranges.* Within the AG district.

(a) Such use shall require a minimum twenty-acre site.

(b) No structure, building or mechanical equipment associated with the range shall be located within three hundred (300) feet of any property line.

(c) The applicant shall demonstrate compliance with all applicable regulations of the State of Florida. The applicant shall also demonstrate how safety and noise factors have been addressed through the site plan and other special features of the proposed development.

(3) *Limited commercial activities and restaurant uses (excluding fast food and drive-in service).* Within the COR district after the planning and zoning commission has been satisfied that the following criteria and standards have been met:

(a) The nature and scale of the retail use are consistent and compatible with the principal residential or principal office development.

(b) Previous or concurrent residential or office development on the subject site provides an on-site buffer from abutting property which is designated for residential use, including COR.

(c) A plan for the entire parcel is submitted for review and approval in an advertised public hearing.

Duly approved offices and shops located within COR designated areas as of the effective date of this chapter shall be deemed permitted uses within the COR area.

(4) *Vehicle and automotive fuel and lubricant retail sales.* Within the LC District:

(a) A minimum lot area of ten thousand (10,000) square feet with a minimum lot frontage of one hundred (100) feet on each of two (2) separate and intersecting arterial roads as identified on the Martin County Major Thoroughfare Plan (Article V of the Comprehensive Plan).

(b) No building or structure including signs, gasoline pumps, tank, vents, pump islands or canopies shall be located within twenty-five (25) feet of any right-of-way line.

(c) The minimum buffer standards for the site must comply with general commercial district buffer types as established in section 23-56(f), Landscape Regulatory Zones, of the Martin County Landscape Ordinance, as revised.

(d) Any parcel proposed for this use must maintain the physical separation of all buildings, structures, signs, gasoline pumps, tanks, vents, pump islands or canopies associated with fuel sales from abutting properties zoned for residential use by a minimum of fifty (50) feet. Where the parcel abuts a public road or natural water body, having a minimum width of fifty (50) feet, the parcel shall be considered as abutting residentially zoned property as defined by section 23-56(f)(4) of the Martin County Landscape Ordinance.

(e) The internal traffic circulation system and parking areas shall conveniently provide for safe and efficient on-site maneuvering of all vehicles using the site. The separation of parking areas for the convenience store/limited commercial retail use from the pump islands and stacking lanes for fuel sales must be maintained. Access to the site shall be from arterial roads only, unless the board of county commissioners specifically determines that access from a collector or local road would be beneficial to the surrounding neighborhoods.

(f) Special fuel storage requirements:

(i) All receptacles, tanks or facilities for the storage of combustible products in excess of two hundred-gallon quantities shall be located underground and within all required setbacks. Flammable materials shall be stored within the building setback lines and in a manner satisfactory to the county fire marshal and the director of the department of community development.

(ii) All gasoline and petroleum product storage tanks shall be permitted and monitored for potential leakages in accordance with the applicable regulations of the State of Florida, as amended.

(iii) When an active site dispensing flammable materials becomes vacant for a period exceeding one (1) year, the property owner shall be required to remove or treat, in a manner approved by the State of Florida, all flammable materials or storage tanks on site. (Ord. No. 293, Part 1, 4-29-86; Ord. No. 312, Part 1, 11-18-86)

Sec. 35-5.6. Public hearing notification requirements for advertised conditional use.

Prior to granting approval for any use identified as an advertised conditional use, the board of county commissioners shall hold a public hearing on the subject request. Said public hearing shall be scheduled for any regularly scheduled meeting of the board after the following notification requirements are met:

(A) *Advertised Conditional Uses in the AG, RR-5A, and RE-2A Districts.*

(1) Public notice in newspaper of general circulation at least fifteen (15) days prior to the hearing.

(2) Notification by the owner of the subject property by return receipt mail of the requested advertised conditional use at least ten (10) days prior to the hearing to all property owners within six hundred (600) feet of the proposed advertised conditional use as determined by the most recent tax roll maintained by the property appraiser.

(B) *Advertised Conditional Uses in All the Residential Districts and COR, LC, GC, WRC, WRC, LI, GI, and PS Districts.*

(1) Public notice in newspaper of general circulation at least fifteen (15) days prior to the hearing.

10.2.3 ARTICLE VIII OF CHAPTER 23 OF THE MARTIN COUNTY CODE:

- **DEVELOPMENT APPROVAL PROCEDURES**

trator on any matter relating to the administration of this article shall constitute a violation thereof. (Ord. No. 267, § 13, 9-10-85; Ord. No. 358, § 1(14), 1-10-89)

Secs. 23-165—23-170. Reserved.

ARTICLE VIII. DEVELOPMENT APPROVAL PROCEDURES*

Sec. 23-171. Development review committee.

(a) There shall be a committee known as the development review committee (DRC) of Martin County, Florida, which shall consist of the department director or his designee from the following departments:

(1) Community development department,

(2) Public works department,

(3) County administrator,

(4) Health department,

(5) Public safety department.

(b) The county attorney or his designee shall serve as legal advisor to the DRC.

(c) The county administrator shall appoint the chairman of the DRC.

(d) The Martin County school district shall appoint an advisory nonvoting member of the DRC.

(e) The director of public utilities shall be an advisory, nonvoting member of the DRC. (Ord. No. 297, Part 1(I), 6-24-86)

Sec. 23-172. Approval procedures—Optional preapplication conference.

(a) *Applicability.* This section shall apply to all applications for master plan or final approval as specified in sections 23-173 and 23-174, below, at the sole option of the applicant.

*Editor's note—Ord. No. 297, Part 1, adopted June 24, 1986, effective Sept. 1, 1986, added an Art. VII to Ch. 23. To avoid duplicate numbering, the editor has added the material as Art. VIII, §§ 23-171—23-175.

(b) *Intent.* The preapplication conference is intended to provide the applicant with the opportunity to jointly confer with members of the development review committee (hereinafter referred to as the DRC) prior to submitting a final formal application. The DRC will advise the applicant on the feasibility of various possible design alternatives, will generally advise the applicant as to which areas of the land development code and comprehensive plan are applicable, and also provide the applicant information regarding any projected plans, programs or other matters that may affect the project. The opinions expressed at the preapplication conference are intended to be solely for the general assistance of the applicant and to provide general direction to the applicant and are in no event to be considered binding on the county staff, the county commission or the applicant.

(c) *Procedure.*

(1) Any person may submit a written request for a preapplication conference to the community development department together with the required application fee. The form and content of the application and the amount of the fee shall be as set from time to time by resolution of the county commission.

[The next page is 1337]

(2) The application shall be reviewed by the members of the DRC and their comments orally presented to the applicant at a meeting arranged for that purpose. The meeting shall take place within fifteen (15) calendar days after submission of the written request. (Ord. No. 297, Part 1(IIA), 6-24-86)

Sec. 23-173. Same—Master plan approvals.

(a) *Applicability.* This section shall apply to all applications for master plan approval, unless otherwise specified, including but not limited to:

(1) Preliminary plats for all subdivisions.

(2) Preliminary development plans for all planned unit developments.

(3) Master plan approval of major site plans, which for purposes of this article are defined as residential developments of fifty (50) units or more, or nonresidential development which contains fifty thousand (50,000) square feet or more gross leasable area, or mixed developments wherein the percentage of the above threshold amounts together total one hundred (100) percent or more (e.g., 25 units (50%) + 25,000 sq. feet (50%) = 100%; 15 units (30%) + 40,000 sq. feet (80%) = 110%).

(4) Minor site plans, which for purposes of this article are defined as residential developments of less than fifty (50) units or nonresidential, development which contains less than fifty thousand (50,000) square feet gross leasable area, are not required to obtain master plan approval but should instead apply for final approval as set forth below.

(5) At the applicant's option, and solely at the applicant's risk, an application for final approval may be submitted concurrent with or at anytime after application for master plan approval, and may be reviewed concurrent with the master plan. In that event the following provisions also apply:

a. No final plan approval shall be granted until master plan approval has been granted.
b. DRC comments regarding the final plan request are conditional and may be revised as a result of the master plan approval.
c. The maximum time frames for DRC review of the final plan as set forth in section 23-174 shall be waived, and the final plans shall be reviewed generally concurrent with review of the master plan.
d. Although a final plan application may be submitted concurrent with the master plan application, each application must contain all required materials and stand on its own merits.

(b) *Procedure.*

(1) The following persons may apply for master plan approval of developments to real property:

a. The owner of the property or his authorized agent.
b. The lessee of the property with the written consent of the owner.
c. A person under contract to purchase the property, with the written consent of the owner.
d. A person having an option to purchase the property with the written consent of the owner.

(2) An application shall be submitted to the community development department together with the required application fee. The purpose of the application is to demonstrate compliance with all applicable laws and regulations, including the comprehensive plan, and to provide a basis for decision-making by the development review committee (hereinafter referred to as the DRC) the planning and zoning commission (hereinafter referred to as P&Z) and the board of county commissioners. The form and content of the application, and the amount of the fee shall be as set from time to time by resolution of the county commission.

(3) The director of community development shall review the application within two (2) working days of submittal, to determine whether all necessary materials have been sub-

mitted, and may refuse to accept any application which is not complete. For the following applications the period for staff determination of completeness shall be five (5) working days:

a. Preliminary plats for all subdivisions having more than fifty (50) lots.
b. Preliminary development plans for planned unit developments.
c. Site plans for residential developments with fifty (50) or more units.
d. Site plans for nonresidential developments with fifty thousand (50,000) square feet or more of building area.
e. Major amendments to approved planned unit developments which are also developments of regional impact.

A determination of completeness is for the purpose of allowing a review of the material only and is not to be construed as approval of any of the materials submitted. After a determination of completeness, the applicant shall, within ten (10) calendar days, cause to be placed on the property a sign notifying interested persons that an application for development has been made. The size, location and content of the sign shall be as approved by resolution of the county commission.

(4) After a determination of completeness, the members of the DRC shall have no more than forty (40) calendar days to review the application and prepare preliminary reports and recommendations, unless an extension of this time period is agreed to in writing by the applicant. For the following applications the period for staff review and recommendations shall be no more than ninety (90) days after a determination of completeness:

a. Preliminary plats for all subdivisions having more than fifty (50) lots.
b. Preliminary development plans for planned unit developments.
c. Site plans for residential developments with fifty (50) or more units.
d. Site plans for nonresidential developments with fifty thousand (50,000) square feet or more of building area.

e. Major amendments to approved planned unit developments which are also developments of regional impact.

In preparing their reports, the members of the DRC shall request assistance as needed from any other departments or agencies. A copy of the preliminary reports and recommendations shall be made available to the applicant no later than at the end of the review period. The applicant shall, within ten (10) calendar days of the availability of the DRC's preliminary report and recommendations, submit to the community development department a written response as to whether he agrees or disagrees with each of the DRC comments. No later than ten (10) calendar days after receipt of the applicant's written response, the DRC shall meet to discuss the preliminary reports and recommendations with the applicant. The applicant may elect to respond to any deficiencies noted in the preliminary reports. Every effort shall be made to notify the applicant of serious deficiencies discovered before the expiration of the review period. If the applicant elects to respond to any deficiencies noted in the preliminary reports, an intent to do so must be submitted in writing to the community development department within ten (10) calendar days after the DRC meeting. The response must be submitted within ninety (90) calendar days of the filing of the notice of intent. After submittal of a response, the members of the DRC shall have at least seven (7) but no more than thirty (30) calendar days to amend their reports and recommendations, if needed. For the following applications the period for staff amendment of reports and recommendations shall be at least thirty (30) days but not more than forty (40) days:

a. Preliminary plats for all subdivisions having more than fifty (50) lots.
b. Preliminary development plans for planned unit developments.
c. Site plans for residential developments with fifty (50) or more units.
d. Site plans for nonresidential developments with fifty thousand (50,000) square feet or more of building area.

e. Major amendments to approved planned unit developments which are also developments of regional impact.

Any further request to respond to deficiencies shall be processed in the same manner as the first request. Once the applicant has elected not to respond to the preliminary reports and recommendations, the reports and recommendations shall be determined to be final. No additional information or material shall be submitted after the reports and recommendations have been determined to be final.

(5) The matter shall then be scheduled for consideration by the P&Z at its next available meeting. The P&Z may take any of the following actions:

a. Recommend approval.
b. Recommend approval, subject to conditions clearly stated.
c. Recommend disapproval with reasons clearly stated.
d. Table once or more, but for no more than a total of forty-five (45) calendar days for further information or review as determined by the P&Z.
e. Table at the applicant's request. If tabled more than twice, the applicant must renotify the public in the same manner as required for the original hearing.

When considering items tabled from a prior meeting, the P&Z may choose to dispense with hearing material which has been presented at the prior meeting.

(6) After recommendation of approval, approval subject to conditions, or disapproval, the matter shall be considered by the board of county commissioners at its next available meeting. The applicant may elect to respond to any conditions imposed by the P&Z. An intent to do so must be submitted in writing to the community development department with ten (10) calendar days after the action by the P&Z. The response must be submitted to the community development department within thirty (30) calendar days of the notice of intent. The members of the DRC shall have fourteen (14) calendar days to review the response and to comment on that response, as they deem appropriate. If the applicant elects to respond to any conditions imposed by the P&Z then the matter shall be considered

by the board of county commissioners at its next available meeting after DRC review of the response. The board of county commissioners may take any of the following actions:

a. Approve.
b. Approve, subject to conditions clearly stated.
c. Disapprove with reasons clearly stated.
d. Table twice, but for no longer than a total of sixty (60) calendar days for further information or review as determined by the board of county commissioners.
e. Table at the applicant's request. If tabled more than twice, the applicant must renotify the public in the same manner as required for the original hearing.

(7) In all cases, applications which are not brought before the board of county commissioners within one (1) year from determination of completeness will be considered withdrawn. This provision may be waived by the board of county commissioners upon a showing that the applicant has made a good faith effort to diligently proceed in obtaining the development order requested.

(c) *Additional requirements for PUD's and DRI's.*

(1) In the case of applications for PUD preliminary development plans, the additional public notice requirements for rezoning petitions as set forth in Chapter 33, Article LX must be met.

(2) In the case of applications for master plan approval of a development of regional impact, as defined by Section 380.06, Florida Statutes, the additional public notice requirements of that section must be met. The time periods set forth in this article may be extended to the extent necessary to accommodate the requirements of Section 380.06, Florida Statutes. (Ord. No. 297, Part 1(IIB), 6-24-86; Ord. No. 360, Part 1, 3-28-89)

Sec. 23-174. Same—Final approvals.

(a) *Applicability.* This section shall apply to all applications for final approval unless otherwise specified, including but not limited to:

(1) Final development plans for subdivisions, including the final plat.

(2) Final development plans submitted pursuant to planned unit development zoning agreements.

(3) Minor site plans, which for purposes of this article are defined as residential developments of less than fifty (50) units or nonresidential developments containing less than fifty thousand (50,000) square feet gross leasable area.

(4) Major site plans, which for purposes of this article are defined as residential developments of fifty (50) units or more, or nonresidential development which contain fifty thousand (50,000) square feet or more gross leasable area, or mixed developments wherein the percentage of the above threshold amounts together total one hundred (100) percent or more (e.g., 25 units (50%) + 25,000 sq. feet (50%) = 100%; 15 units (30%) + 40,000 sq. feet (80%) = 100%).

(b) *Procedure.*

(1) The following persons may apply for final approval of developments to real property:

a. The owner of the property or his authorized agent.
b. The lessee of the property with the written consent of the owner.
c. A person under contract to purchase the property, with the written consent of the owner.
d. A person having an option to purchase the property with the written consent of the owner.

(2) An application shall be submitted to the community development department together with the required application fee. The purpose of the application is to demonstrate compliance with all applicable laws and regulations, including the comprehensive plan, and to provide a basis for decision-making by the DRC and the board of county commissioners. The application shall also contain a statement that any conditions which were imposed at the time of master plan approval have been met. The form and content of the application and the amount of the fee shall be

as set from time to time by resolution of the county commission.

(3) The director of community development shall review the application within two (2) working days of submittal, to determine whether all necessary materials have been submitted, and may refuse to accept any application which is not complete. A determination of completeness is for the purpose of allowing a review of the material only and is not to be construed as approval of any of the materials submitted. After a determination of completeness in the case of minor site plans only, the applicant shall, within ten (10) calendar days, cause to be placed on the property, a sign notifying interested persons that an application for development has been made. The size, location and content of the sign shall be as approved by resolution of the county commission.

(4) a. After a determination of completeness (where no change from an approved master plan is proposed) or after a determination of minor change by the DRC, and confirmed by the county commission pursuant to section 23-175, below, the members of the DRC shall have no more than forty (40) calendar days to review the application and prepare preliminary reports and recommendations, unless an extension of this time period is agreed to in writing by the applicant. In preparing their reports, the members of the DRC shall request assistance as needed from any other departments or agencies. A copy of the preliminary reports and recommendations shall be made available to the applicant no later than at the end of the specified review period. The applicant shall, within ten (10) calendar days of the availability of the DRC's preliminary reports and recommendations, submit to the community development department a written response as to whether he agrees or disagrees with each of the DRC comments. No later than ten (10) calendar days after receipt of the applicant's written response, the DRC shall meet to discuss the preliminary reports and recommendations with the applicant. The applicant may elect to

respond to any deficiences noted in the preliminary reports. Every effort shall be made to notify the applicant of serious deficiencies discovered before the expiration of the review period. If the applicant elects to respond to any deficiencies noted in the preliminary reports, an intent to do so must be submitted in writing to the community development department within ten (10) calendar days after the DRC meeting. The response must be submitted within ninety (90) calendar days of the notice of intent. After submittal of a response, the members of the DRC shall have no more than thirty (30) calendar days to amend their preliminary reports and recommendations, if needed. Any further request to respond to deficiencies shall be processed in the same manner as the first request. Once the applicant has elected not to respond to the preliminary reports and recommendations, the reports and recommendations shall be determined to be final. No additional information or material shall be submitted after a report and recommendation has been determined to be final. Within seven (7) calendar days of the final report and recommendation, the DRC shall issue a written memorandum of approval or disapproval based on that report.

b. Except in the case of final plats, the final DRC report and recommendation shall be considered to be the final determination by Martin County, and no further action will be taken on this application. If an applicant is in disagreement with the final DRC determination, then he may appeal this determination to the board of county commissioners by filing a written notice of appeal with the county administrator within thirty (30) calendar days of that determination.

(5) Final plats together with any required contracts and security documents shall be scheduled for consideration by the board of county commissioners at its next available meeting after issuance of the final DRC reports and recommendations. The board of county commissioners may take any of the following actions:

a. Approve.
b. Approve, subject to conditions clearly stated.
c. Disapprove with grounds clearly stated.
d. Table twice, but for no longer than a total of sixty (60) calendar days for further information or review as determined by the board of county commissioners.
e. Table at the applicant's request.

(6) Within ten (10) calendar days after county commission approval, or within ten (10) calendar days after meeting all conditions of approval, the original record plat and original contracts and security documents shall be executed by county officials and the original plat submitted to the clerk of the circuit court for filing.

(7) In all cases, applications which have not received final DRC action, and final plats which are not brought before the board of county commissioners within one (1) year from determination of completeness will be considered withdrawn.

(c) *Additional requirements for DRI's.* In the case of changes to the development plan approval for a development of regional impact, as defined by Section 380.06, Florida Statutes, the additional procedures and requirements of that section must be met. The time periods set forth in this article may be extended to the extent necessary to accommodate the requirements of Section 380.06, Florida Statutes. (Ord. No. 297, Part 1(IIC), 6-24-86)

Sec. 23-175. Same—Amendments and modifications.

(a) *Applicability.* This section shall apply to all applications for amendment or modification to a previously approved master or final plan.

(b) *Procedure.*

(1) The following persons may apply for amendments or modifications to master or final plan approvals:

a. The owner of the property or his authorized agent.
b. The lessee of the property with the written consent of the owner.
c. A person under contract to purchase the property, with the written consent of the owner.

d. A person having an option to purchase the property with the written consent of the owner.

(2) An application shall be submitted to the community development department together with the required application fee. The purpose of the application is to demonstrate compliance with all applicable laws and regulations, including the comprehensive plan, and to provide a basis for decision-making by the DRC and the board of county commissioners. The application shall contain a brief summary of the changes being requested. The form and content of the application and the amount of the fee shall be as set from time to time by resolution of the county commission.

(3) The director of community development shall review the application within two (2) working days of submittal, to determine whether all necessary materials have been submitted, and may refuse to accept any application which is not complete. A determination of completeness is for the purpose of allowing a review of the material only and is not to be construed as approval of any of the materials submitted.

(4) The DRC and the applicant shall meet within twenty (20) calendar days of the determination of completeness, (unless an extension of this time period is agreed to in writing by the applicant) to determine whether the modification is major or minor. If any member of the DRC is of the opinion that a change constitutes a major change within his area of responsibility, then the revised project must be submitted to the community development department to be reviewed in accordance with the master plan procedures. All determinations of major or minor modification shall be reported to the board of county commissioners at its next regularly scheduled meeting, which board shall have power to reverse the determination of the DRC.

(5) All applications containing major modifications must be submitted to the community development department for revised master plan approval in accordance with the procedures set forth in this article. Minor modifications may

proceed forward in the final approval process for appropriate recommendations by the DRC.

(c) *Major or minor change criteria.* In determining whether a modification constitutes a major or minor change, the following criteria shall be used:

(1) The extent to which the modification would affect the height of any building, the number of structures, the number of dwelling units, or square footage of any building.

(2) The extent to which the proposed modification would affect the location of any lot, block, building, structure, setback or common open area.

(3) The extent to which the proposed modification would affect the location or amounts of land devoted to specified land uses.

(4) The extent to which the proposed modification would affect the intent of the master development plan or final development plan and the extent to which it impacts the surrounding land uses and community facilities.

(5) The extent to which the proposed modification affects the total land area, the perimeter boundaries or the covenant of unified control. In the case of PUD's only, any change affecting the perimeter boundary of the PUD zoning district or the covenant of unified control must be considered a major change. (Ord. No. 297, Part 1(IID), 6-24-86)

10.2.4 RESOLUTION NUMBER 86-8.34 OF THE BOARD OF COUNTY COMMISSIONERS, MARTIN COUNTY, FLORIDA, REGARDING THE ESTABLISHMENT OF THE FORM AND CONTENT OF SUBMITTAL MATERIALS FOR REQUESTS FOR MASTER PLAN APPROVAL AND FINAL PLAN APPROVAL

[1700]

BEFORE THE BOARD OF COUNTY COMMISSIONERS

MARTIN COUNTY, FLORIDA

RESOLUTION NUMBER 86-8.34

[REGARDING THE ESTABLISHMENT OF THE FORM AND CONTENT OF SUBMITTAL MATERIALS FOR REQUESTS FOR MASTER PLAN APPROVAL AND FINAL PLAN APPROVAL]

WHEREAS, Chapter 23, Article VII, of the Martin County Code of Laws and Ordinances provides for a development approval procedure;

WHEREAS, said Section provides that petitions for such approvals shall be accompanied by an application in a form and content to be set from time to time by resolution of the Martin County Board of County Commissioners;

WHEREAS, such a consolidated list of submittal materials does not currently exist;

WHEREAS, the Board of County Commissioners has reviewed the form and content of submittal materials for such petitions as proposed by its staff as shown in Exhibits "A" and "B" of this resolution; and

WHEREAS, the Board of County Commissioners has determined that the proposed form and content of submittal materials as shown in Exhibits "A" and "B" is reasonable and is necessary to document the compliance of such petitions complying with requirements of the Code of Laws and Ordinances.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MARTIN COUNTY, FLORIDA, THAT:

A. Exhibit "A" (Master Plan Submittal Materials), as attached to this resolution, is hereby approved pursuant to the Martin County Code of Laws and Ordinances; and

B. Exhibit "B" (Final Plan Approval Submittal Materials), as attached to this resolution, is hereby approved pursuant to the Martin County Code of Laws and Ordinances.

DULY PASSED AND ADOPTED THIS 12TH DAY OF AUGUST, 1986.

ATTEST:

Louise V. Isaacs

LOUISE V. ISAACS, CLERK

BOARD OF COUNTY COMMISSIONERS
MARTIN COUNTY, FLORIDA

BY:

THOMAS G. KENNY, III, CHAIRMAN

APPROVED AS TO FORM AND CORRECTNESS:

Official Records Book 687

BY: Noreen S. Dreyer

NOREEN S. DREYER, COUNTY ATTORNEY

EXHIBIT "A"

MASTER PLAN APPROVAL SUBMITTAL MATERIALS

(For Developments of 50 or More Residential Units
or More Than 50,000 Square Feet of Non-Residential Use)

I. Development Site Information Shall Include:

A. Tract/Developer Information

1. Name and location of proposed development.

2. Name, address and telephone number of developer and project representative liaison.

3. Name, address and telephone number of attorney, engineer, surveyor, and land planner.

4. Present zoning and land use designation of subject parcel and abutting properties.

5. A full legal description of the property with attached copies of any instruments referred to, such as deeds, plats, covenants or restrictions, etc.

6. A vicinity map at a scale of not less than one inch equals two thousand (2,000) feet.

7. The most recent vertical aerial photograph available from the County Property Appraiser or, alternatively, a less than 12 month old vertical aerial photograph at a scale of not less than one inch equals two hundred feet (200') and providing coverage at least 200' outside the project boundaries of the project site with the project boundaries clearly marked.

B. Site Information

1. A boundary survey related to true meridian or U.S. Coast and Geodetic Survey state grid north.

2. A topographic map with contour intervals of one foot (minimum) to two feet (maximum) at a minimum scale of not less than one inch equals two hundred (200) feet. Spot elevations shall be used in flat areas.

3. A graphic or aerial illustration of the location of the following items existing on and within 200 feet adjacent to the property:

- buildings, structures or other improvements;
- utilities drainageways, ditches, swales, any applicable coastal construction control lines or easements of any kind;
- abutting streets and roads including width, route numbers and railways;
- fill disposal grounds, docks, jetties, boat ramps, bulkheads or other water-related structures;
- property lines and recorded plats;
- Wetland areas by type, soils analysis, unique vegetation communities, and the seasonal high water tables as analyzed by the Martin Soil and Water Conservation District on the basis of the most accurate environmental documentation available.

II. Application Materials

A. Evidence of Unified Control

The Applicant shall provide evidence of unified control of the entire area subject to the application. This evidence shall include a title insurance policy or attorney's certificate of title or other evidence acceptable to the County Attorney for the subject property.

B. Development Information, Master Plan Site Data

1. A statement indicating probable residential unit types or non-residential uses as applicable.

2. Land use plan or plans which documents compliance with Comprehensive Plan Performance Standards identified in Section II.C. below and which show the location, arrangement and dimensions of all proposed land uses, including the number of floors and height of all buildings above finished grade or above the first floor living elevation, building setbacks from the development boundaries and from adjacent streets, roads, alleys, and ways; the proposed traffic circulation pattern including the location and width of all streets, driveways, walkways, bikeways, and entrances to parking spaces; all proposed off-street parking and loading areas; all proposed common elements including common open spaces; all wetland and other natural areas preserved in compliance with established ordinances; and dedicated open space and developed recreation areas.

3. A plan showing the location and compliance with the established Landscape Code and providing landscaped buffers and indicating the type of materials proposed and height of such screening.

4. A statement in tabular form of the anticipated residential density (if any), the total number of dwelling units by type, size, and site location, and gross leasable floor area for commercial or other nonresidential uses, as appropriate.

5. Percentage of the site to be covered with buildings, sidewalks, parking areas, roofed structures, and other impervious surfaces; percentage of the site to be covered with water bodies; percentage of the site to be in golf course use (if any); percentage of the site to be landscaped; and percentage of the site to be left in a natural undisturbed condition.

6. An engineer's statement recognizing the South Florida Water Management District permitting requirements, and detailing preliminary proposals for providing drainage outfall and on-site retention conforming with such county regulations and ordinances as are in force and effect, including preliminary calculations, size of storm water retention areas, methods for pollutant removal, location of berms, swales, culverts, storm water sewers, finished grades, and proposed slopes and grades adjacent to bodies of water.

7. A plan or statement detailing preliminary proposals for connection with existing water supply and sanitary sewer systems or an alternative means of supplying water for drinking and irrigating and of supplying sanitary waste treatment and disposal.

8. Location of typical proposed structures including exterior lighting systems, signs and landscaping, not to be construed to require actual footprint.

9. When a development is to be constructed in phases or units, a sequence of development schedule showing the construction of each principal functional element of such phases or units, the approximate completion date for each phase or unit and the extent, timing, and estimated costs of all improvements or items to be dedicated, such as roads, sewerage, drainage, and other public or private facilities, required to construct the proposed development.

10. Location of temporary perimeter stakes and a temporary sign three (3) by five (5) feet in size located at the front of the property identifying the project by number and name in order for the public, county personnel, members of review agencies, planning and zoning commissioners and county commissioners to locate the project and to make site inspections, such sign to be erected within ten (10) days of application submission.

11. If the development contains subdivision lots, a preliminary plat of such lots or parcels.

12. Identify existing land as unplatted or platted; if platted, state subdivision name, plat book and page number.

13. Any other reasonable information which may be required from time to time by the Community Development, Public Works or Legal Departments which is commensurate with the intent and purpose of this Exhibit "A".

C. Comprehensive Plan Performance Standards - Documentation of Compliance

1. Section 4-3(A) - Tabular statement and graphic representation of the density/intensity transition areas and buffer zones.

2. Section 4-3(B) - Description and representation of wetland vegetative cover identified on the master plan.

3. Section 4-3(C) - Tabular description and area calculations documenting open space by phase.

4. Section 4-3(D) -- Relate the preliminary drainage plan with the master plan.

5. Section 4-3(E) - Completion of the approved Park and Recreation Land Dedication Worksheet.

6. Section 4-3(F) - a professionally prepared traffic impact analysis, meeting the specifications of Section 5-2.

7. Section 4-3(G) and (H) - Basic solution to the water supply and sewage disposal systems prepared by a registered engineer; letter of service capability from the applicable provider.

8. Section 4-3(I) - A Soil Erosion and Sedimentation Control Plan which protects developed and natural preserve areas during the construction and completed development phases of the project.

9. Section 4-3(J) - Layout of the roadway sections to illustrate the internal circulation and parking system coordinated with pedestrian and bicycle systems.

10. Section 4-3(K) - A fire and emergency services proposal to meet the standards of the Director of the Department of Public Safety.

11. Other standards:

    - Statement as to the mix of housing types;
    - Letter of service capability from the Sheriff and Emergency Medical Services;
    - Letter of service capability from the Martin County School Board.

D. A Proposed PUD Agreement Including the Covenant of Unified Control (When Required)

III. Number of Copies. In addition to information generally required for any required change of zoning petitions, the applicant shall submit that material or information as herein described in sufficient copies for necessary referrals and records:

A. Upon submission of a master development plan application, ten (10) copies of all plans, reports, maps, documents, and other related information must be supplied to the Community Development Department.

B. Documents reflecting changes or amendments to previously submitted plans shall be furnished in sufficient copies to satisfy the requirements of subparagraphs I(A) and I(B) above.

C. If the proposed PUD is a development of regional impact (DRI) as defined in Section 380.06, Florida Statutes, six (6) copies of all plans, reports, maps, documents and other related information required by the regional reviewing agency (in addition to the normal requirements of this article) shall be submitted to the Community Development Department.

EXHIBIT "B"

FINAL PLAN APPROVAL SUBMITTAL MATERIALS

(Unless Previously Supplied in a Request for Master Plan Approval, Application for Final Plan Approval Must Supply the Documentation in Exhibit "A" Plus the Following)

I. Final Detailed Information for a Proposed Development or a Phase Thereof Shall Include:

A. Detailed plans showing the exact location, arrangement and dimensions of all proposed land uses, including the number of floors and height of all buildings above finished grade and the first floor living elevation; building setbacks from the development boundaries and adjacent streets, roads, alleys and ways; location of the traffic circulation pattern including the width of all streets, driveways, walkways, bikeways, and entrances to parking spaces; final design of off-street parking and loading areas in accordance with current Martin County standards; final design for all common areas including dedicated open space and developed recreation areas; exact location and notation of all preserved wetland and other natural preserve areas. When project is to be phased, a complete phasing plan will be provided.

B. A detailed plan showing the location and design of landscaped buffers. It shall indicate the materials proposed and the height and proposed degree of opaqueness of such screening.

C. A detailed plan indicating the exact manner of improving developed recreation areas. It will include covenants including lease-hold interests, restrictions and conditions pertaining to the use, maintenance, and operation of common areas.

D. An exact statement in tabular form, summarized by phases, of the approved residential density (if any), and total number of dwelling units by type, size and site location. For all nonresidential uses the total gross leaseable floor area shall be summarized.

E. The exact percentages of the site to be covered with buildings or structures, sidewalks, paved areas, and other impervious surfaces, areas to be covered by water bodies, or by golf courses (if any), areas to be landscaped; and those to be left in natural undisturbed condition.

F. A detailed engineer's plan and working drawings for providing drainage outfall and on-site retention conforming with such county and state regulations and ordinances as are in force and effect. It shall include calculations of the size of storm water retention areas, final diagrams of pollutant removal structures and the configurations of outfall control structures, pollution control and filtration facilities and on-site retention systems such as berms, swales, culverts, storm sewers and all finished slopes and grades.

G. Final working drawings and details for construction of grading, paving, drainage and all appurtances required to develop a complete project.

H. Final working drawings and details for providing water supplies for drinking and irrigating and for providing sanitary sewer systems, with all applicable permits and executed service agreements, including, as applicable, agreement with the County for interim systems.

I. Architectural drawings of the proposed structures including front, side and rear elevations, precise building layout (external and internal), exact site design, including exterior lighting systems, signs, and landscaping.

J. A final plan or report indicating extent, timing and estimated cost of all improvements such as roads, sewerage, drainage, and other public and private facilities required to construct the Development or applicable phase thereof, including proposed contracts for construction of required improvements and/or landscaping; along with appropriate security for same and other instruments as needed, which plan or report will relate to the sequence of development schedule if the Development is to be constructed in phases or units.

K. A final plan showing tentative street names and house numbers and names in the Development or phase thereof.

L. If the Development or phase thereof contains subdivision lots, a final plat for recording with the office of the county clerk, which plat meets all applicable provisions of the Florida State Chapter 177, Part I (see attached Plat Law Checklist), along with a completed Subdivision Plat Filing Form.

M. All necessary regional, state and federal permits or approvals in writing prior to final action.

N. Any other reasonable information which may be required from time to time by the Community Development, Public Works or Legal Departments which is commensurate with the intent and purpose of this Exhibit "B."

References: (May be revised from time to time)

1. Martin County reviewer's list; (Part I not attached)
2. Guidelines to items anticipated on working drawings;
3. Standard details as may be issued;
4. Inspection requirements to be attached to final working plans; and
5. Project certification requirements.

II. Other General Provisions

A. Upon submission of an application for final plan review, ten (10) copies of all final plans, reports, maps, documents and other related information must be submitted to the Community Development Department.

B. The submission of building construction plans and applications for building permits and certificates of occupancy and other such administrative requirements shall be accomplished in accordance with established county regulations and policy, except as herein provided.

C. No building permit or certificate of occupancy shall be issued in or for development except in conformity with all provisions of the applicable zoning district.

10.2.5 EXCERPTS FROM THE OKEECHOBEE COUNTY ZONING ORDINANCE PERTAINING TO:

- **SECTION 7.9 - ESSENTIAL SERVICES**

deemed to be met where the owner of such land can demonstrate to the Administrative Official that he has legal access or established access to such lands.

No building permit shall be issued in violation of these requirements.

7. Parking and Storage of Certain Vehicles. Automotive vehicles, mobile homes, or trailers of any type without current license plates shall not be parked or stored on any residentially zoned property other than in completely enclosed buildings; provided, this regulation shall not prohibit the parking of a mobile home in current use for dwelling purposes in an RMH district.

8. Moving of Buildings or Structures. No building or structure shall be moved from one lot to another lot, or moved to another location on the same lot, unless such building or structure shall thereafter conform to all of the applicable provisions of these zoning regulations and all other applicable regulations of the County of Okeechobee.

9. Essential Services. Essential services shall be permitted in any zoning district. Essential services are hereby defined to include and be limited to water, sewer, gas, telephone, and electrical systems, including sub-stations, lift stations, and similar installations necessary for the performance of these services; provided, however, that this subsection shall not be deemed

10.2.6 EXCERPTS FROM THE OKEECHOBEE COUNTY ZONING ORDINANCE PERTAINING TO:

- **SCHEDULE OF DISTRICT REGULATIONS**

SCHEDULE OF DISTRICT REGULATIONS

OKEECHOBEE COUNTY, FLORIDA

See Also Supplementary District Regulations, Section 7

AC

DISTRICT & INTENT

AC - AGRICULTURE CONSERVATION -- These districts are composed of large, open land areas. It is intended by the use of these districts to retain and preserve, insofar as desirable and practicable, the open character of the land. To that end, permitted and permissible uses are basically limited to conservation, agriculture, recreation, and, with certain limitations, other uses not contrary to the character of these districts. It is intended that this classification basically serve three purposes: (1) to preserve for agricultural uses those lands with agricultural development potential, to the end that man's future needs for food and fiber will be met; (2) to preserve and protect marsh lands, water sheds and water recharge areas, wilderness areas, open spaces, scenic areas, and park areas(where not otherwise zoned OU); (3) to serve as a "holding classification" for lands which may be eventually be required for more intensive uses. In the case of (3) it is the intention of these zoning regulations that such lands not be rezoned for more intensive uses without a clear showing of the public need, availability of services consistent with the more intensive uses proposed, and insurance that, upon rezoning, the development will not result in undue added financial burden to the residents of the County.

The regulations for the AC districts discourage or prohibit non-agriculturally oriented residential development, prohibit all commercial or industrial development except for certain agriculturally related commercial or industrial activity permissible by special exception and certain recreational activities not inappropriate for the districts. The regulations are intended to protect life and property in areas subject to periodic flooding and to conserve fish and wildlife

PERMITTED PRINCIPAL USES and STRUCTURES - AC

1. Agricultural uses, including accessory structures and uses incident to agricultural activity.
2. Roadside stands of a temporary nature for sale of fruit, vegetables, or other agricultural products.
3. Railroad right of way; electric power or natural gas line right of way.
4. Publicly owned and operated parks, campgrounds, recreation areas, and uses and structures appropriate to such activities.
5. Permanent housing for agricultural labor employed on the premises located not closer than 200 ft. to any other property under separate ownership and with a ratio not greater than one dwelling unit for each 20 acres of land contained in the premises on which the labor is employed. Mobile homes may be used for this purpose subject to Section 8.15(b).
6. Cemetary, columbarium, or mausoleum, provided no grave, monument, or building shall be closer than 25 ft. to any boundary line of the property.
7. Public and private game preserves and wildlife management areas; fish hatcheries and refuges, private hunting and fishing camps.
8. Water conservation areas, water reservoirs and control structures, water and drainage wells.
9. Boarding stable, provided no structure for the housing of animals shall be located within 200 ft. of any property line in separate ownership.
10. House of worship (including temporary revival and gospel establishments), provided minimum parcel size shall not be less than 5 acres.
11. Private camps sponsored by religious or non-profit organizations (including day camps) for young people, such as boy or girl scout camp or church group.
12. Golf course and country club meeting requirements as for RSF, Special Exceptions.
13. Radio or television trnasmitting or receiving station, line of sight relay towers or devices.

14. Public or private elementary and high schools with conventional academic curriculums.
15. Monasteries, convents, and the like.
16. Off-site signs (See also this Schedule, Limitations on Signs).

PERMITTED ACCESSORY USES AND STRUCTURES -- AC

Uses and structures which are customarily accessory and clearly incidental and subordinate to permitted or permissible principal uses and structures. Residential structures shall be permitted as accessory uses only when such buildings are for the residence of the owner, operator, or employees of agricultural, conservation, or other permitted or permissible activities. Such dwellings where located in flood prone areas, shall have a floor elevation of not less than 2 ft. above flood height based on a 25 year frequency storm.

PROHIBITED USES AND STRUCTURES -- AC

Any use or structure not specifically or provisionally permitted herein. Listed permitted or permissible uses do not include as a principal or an accessory use any of the following which are listed only for purposes of emphasis.

1. Manufacturing, or industrial establishments; commercial establishments or activities; except as specifically provided.
2. Wholesale warehouse or storage establishments.
3. Junkyard or automobile wrecking yard.
4. Contractor, construction, or equipment yard.
5. Residential and institutional uses, except as specifically provided.
6. All uses not specifically listed as permitted or permissible uses.

SPECIAL EXCEPTIONS -- Permissible by Board of Adjustment After Public Notice and Hearing and Subject to Appropriate Conditions and Safeguards (See Section 13.3)

1. Commercial campgrounds(see Section 8.12) or recreation areas; commercial hunting or fishing camps; commercial fishery; marina. All buildings or parking for such facilities must be at least 50 ft. from any property line in separate ownership or [illegible].

2. Airports and landing fields.
3. Housing for agricultural labor when such labor is not employed on the same premises upon which the housing is located, when housing has a greater capacity than one dwelling unit for each 20 acres of land contained in the premises, or when proposed structures are to be located closer than 200 ft. to any other property in separate ownership. Mobile homes may be used for this purpose subject to Section 8 and particularly Section 8.15(b).
4. Garbage dump or sanitary landfill.
5. Race track or training course for animals or vehicles.
6. Animal hospital, veterinary clinic, animal boarding place, or fur-farm, provided no building for the housing of animals shall be located within 75 ft. of any property line in separate ownership.
7. Outdoor or indoor rifle, shotgun, or pistol range, field archery range, golf driving range; par three golf course.
8. Commercial packing house for fruits or vegetables, but not citrus concentrate plant.
9. Milk processing plant or milk receiving station; poultry slaughtering and dressing, but not livestock slaughtering; sawmills. No structure to be located within 200 ft. of any residentially zoned property.
10. Livestock auction.
11. Prisons or prison farms.
12. Quarries, mines, and borrow pits, subject to meeting all other applicable governmental regulations.
13. Drive-in theaters.
14. Electrical generating facilities, well fields, water or sewerage treatment plant.
15. Riding academy; dude ranch.
16. Rodeo arena.
17. Flea Markets
18. Residential Child Care Facility. A residential child care facility is a child care program licensed by the Department of Health & Rehabilitative Services to provide 24-hour care and services to minors in either a group home or outdoor living program.

AC

MINIMUM LOT REQUIREMENTS -- AC (Area & Width)

Residential buildings as accessory to principal agricultural uses:

20 acres; provided, a single residential structure may be erected as an accessory use on a parcel of lesser size where such parcel is classified under Ch. 193.461, Fla. Stats., as in agricultural use.

For all other uses, except as otherwise specified or as necessary to meet all other requirements herein set out:

None.

MAXIMUM LOT COVERAGE BY ALL BUILDINGS -- AC

Unrestricted

MINIMUM YARD REQUIREMENTS -- AC (Depth of front & rear yards, width of side yards)

All buildings, except where a greater distance for yard or setback is required for the particular use involved.

Front: 50 ft.

Side and rear: 35 ft.

MAXIMUM HEIGHT OF STRUCTURES NO PORTION SHALL EXCEED -- AC

Un-restricted

LIMITATIONS ON SIGNS -- AC (See Also Section 10) No Signs Intended to be Read From off the Premises Except:

As for RSF for uses permitted or permissible in RSF, and in addition:

1. Identification signs for dairies, farms, groves, ranches, nurseries, or other permitted or permissible agricultural uses, such signs not to exceed 25 ft. in height above ground or road grade level, whichever is highest.
2. For permitted principal uses not otherwise herein specified, on-site identification and directional signs, provided no single sign shall exceed 16 sq. ft. in area and that no activity for profit shall display more than 2 such signs at each entrance, and 2 additional such signs elsewhere on the premises.

3. For uses permissible by special exception and not otherwise specified: to be determined at time of grant of special exception, provided that where uses permissible as special exceptions in AC districts are permitted or permissible uses in other districts, the limitaions on signs for such uses in other districts shall not be exceeded in the grant of special exception in the AC district.
4. Riding academy, dude ranch, or boarding stable: 2 ground signs each not to exceed 32 sq. ft. in area.
5. Temporary roadside stands: 2 temporary ground signs each not to exceed 10 sq. ft. in area.
6. Off-site directional signs to activities permitted or permissible in the district and located in the district, provided no such sign (1) shall exceed 16 sq. ft. in area, (2) shall contain any matter beyond the name of the facility and the directions to it, and (3) no such sign shall be closer than 2000 ft. to any other such sign, or closer than one mile to any other sign advertising the same facility and location.
7. Off-site advertising signs, providing no such sign shall be greater than 500 sq. ft. in area, or be closer than 2,500 ft. to any other off-site advertising sign.

MINIMUM OFFSTREET PARKING REQUIREMENTS -- AC (See also Section 7.13 For Off-street loading requirements see Section 7.13, m-p)
Unrestricted; provided (1) no offstreet parking or loading shall at any time be on public rights of way and (2) for uses permitted or permissible in RSF, offstreet parking requirements shall be as for RSF.

10.3.7 OKEECHOBEE COUNTY COMPREHENSIVE PLAN 1980

- **UTILITY ELEMENT**

UTILITY ELEMENT

The following is submitted as the Utility Element:

In conformance with the requirements of section 163.3177, F.S., this utility element shall at all times be consistent with the current 10-year site plan submitted by Florida Power and Light Company to the Department of Community Affairs.

Consistent with the requirement that the utility element conform to Florida Power & Light Company's 10-year site plan, the projections and proposals of that plan as it is amended from time to time by the utility and found to be suitable by the Division of State Planning are hereby adopted by reference and made a part of this comprehensive plan.

Whatever support facilities are needed to provide electric utility service to existing land uses, to such future land uses as are authorized by other elements of this plan and to such future land uses as may be lawfully authorized by the commission, shall be permitted in any use category and shall be deemed to be consistent with this comprehensive plan.

To assure that Florida Power & Light Company is able to continue to meet the requirements imposed upon it by law, to provide a reliable and economical supply of electrical power to its customers, the maximum amount of flexibility possible consistent with sound planning shall be maintained in locating future generating and substation sites and transmission line corridors.

Decisions regarding the need for and proposed location of futre electrical power facilities shall recognize Florida Power & Light Company's legal requirement to provide electrical power to customers in its service area irrespective of geographical location.

Section 163.3177 (2), F.S., requires that all elements of the local Government Comprehensive Plan be economically feasible. Land use and other regulations adopted pursuant to the comprehensive plan shall weight the economic costs involved for customers of Florida Power & Light Company.

In order for Florida Power & Light to provide reliable and economic electrical power to its customers in the face of fluctuating growth trends and patterns of energy use, it is necessary to maintain flexibility for as long as possible. It is recognized that the ability to provide reliable electric service to existing and future customers and developments at the lowest practical cost necessitates flexibility in location, configuration and operation of all facilities required to provide such service as mandated by law. Every effort shall be made by the commission and Florida Power & Light Company to work together to insure that the future energy needs of the county will be met as they arise.

Nothing in the Comprehensive Plan is in conflict with or will interfere with any of the items in the foregoing element or the Power Company's ten year plan.

It is the County's policy that all utilities should utilize existing road rights of way and existing drainage and utility rights of way whenever practical. Also, utilities should follow section lines when placing power lines, poles, etc, whenever practical. The Utility Element and the policies provided herein do not exclude Glades Electric Coop. or other applicable utilities.

10.3 LAND USE PLAN DESCRIPTIONS

10.3.1 EXCERPTS FROM THE MARTIN COUNTY COMPREHENSIVE GROWTH MANAGEMENT PLAN RELATED TO:

- **GOAL G (ENCOURAGE URBAN DEVELOPMENT IN URBAN SERVICE AREAS)**

a. Policy: At a minimum, the Historic Preservation Ordinance shall:

(1) Provide protection for the resources locally defined to have historic significance as well as those listed on the national Register of Historic Places, the Florida Master Site File, the Local Register of Historic Places, and those to be discovered in the future.

(2) Outline standards for the identification and evaluation of historic resources.

(3) Utilize the Standards for Rehabilitation established by the United States Department of the Interior shall be used in the review of alterations to historic buildings.

(4) Encourage rehabilitation and adaptive reuse of historic properties through incentives, and regulate activities that would harm or destroy the historic value of such resources.

4. <u>OBJECTIVE</u>

By December, 1991, Martin County shall aid and cooperate with the Treasure Coast Regional Planning Council in identifying and and mapping significant historical, archaeological, and paleontological resources within the County.

a. Policy: Access to these resources shall be evaluated and increased when appropriate, for scientific, educational, and recreational purposes.

b. Policy: Historic resources and their environments shall be included in public acquisition programs for recreation, open space, and conservation areas which, at a minimum:

(1) Ensure that development or activities planned for such sites are passive in nature and do not endanger the integrity and character of the resource.

(2) Encourage the incorporation of these sites into educational programs.

c. Policy: Development proposals on or near such sites will be required to preserve these areas or necessary buffer zones adjacent to them.

G. <u>GOAL</u> (ENCOURAGE URBAN DEVELOPMENT IN URBAN SERVICE AREAS)

Martin County shall regulate urban sprawl tendencies by directing growth in a timely and efficient manner to those areas where urban public facilities and services are available, or are programmed to be available, at the levels of service adopted in this Growth Management Plan.

1. OBJECTIVE

Martin County shall concentrate higher densities and intensities of development within strategically located Primary Urban Service Districts, as delineated including commercial or industrial uses as well as residential development exceeding a density of two (2) units per acre, by this Growth Management Plan, where all forms of public facilities are available or are programmed to be available, at the base levels of service adopted in the Capital Improvement Element.

a. Policy: Martin County shall designate land uses within the Primary Urban Service District so as to provide for the use and extension of all necessary urban services and needs in an efficient and economical manner.

b. Policy: Martin County shall require that new residential development, containing one-half acre or smaller lots, commercial uses and industrial uses shall be located within the Primary Urban Service District unless a waiver is obtained pursuant to Implementation Strategy D.3. (p. 4-80).

   The inclusion of lands within the Primary Urban Service District shall be based upon consistency with the County's growth management policies and Capital Improvements Element, as well as documentation that the Plan level-of-service standards will be provided and maintained in a cost-efficient manner.

c. Policy: Martin County shall require future development necessitating access or connection to all public urban facilities, including water and sewer, to be located within Primary Urban Service Districts.

d. Policy: Martin County shall discourage the proliferation of small, individual water treatment, waste water disposal, and solid waste disposal facilities.

e. Policy: Martin County shall provide reasonable and equitable options for development outside of Primary Urban Service Districts, including agriculture and small scale service establishments necessary to support rural and agricultural uses.

f. Policy: The Primary Urban Service boundaries delineated on the Urban Services Boundary Map are not intended to be rigid delineations of land areas and the application of the urban services boundaries should be based upon the following:

   (1) Boundaries may extend beyond the established delineation to a distance of 660 feet, providing such extensions are consistent with the policies of this Growth Management Plan.

   (2) Boundaries may extend to major physical boundaries, such as railroads, water bodies, or transportation corridors, providing such extensions do not exceed 1,320 feet and are consistent with the policies of this Growth Management Plan.

(3) Boundary extensions or the creation of a new Primary Urban Service District may be considered by the Board of County Commissioners in conjunction with land use map changes which require concurrent amendment to the Primary Urban Services boundary.

g. Policy: Martin County shall maximize the use of existing public facilities by encouraging the rehabilitation and adaptive reuse of existing structures as an in-fill strategy.

h. The County shall investigate, through the Affordable Housing Task Force established under guidelines in the Housing Element (Section 6-4A, 10, k) fiscally sound means to encourage infill development on vacant lands within Primary Urban Service Districts where private reinvestment and development may not be appealing without public encouragement.

i. Policy: Freestanding Expressway Oriented Transient Commercial Service Centers and industrial parcels must be contained within a Primary Urban Service District unless a waiver is obtained pursuant to Implementation Strategy D.3 (p. 4-80). Such freestanding districts must also meet the criteria for that land use type contained within this Element and be consistent with the Capital Improvements Element.

j. Policy: Martin County recognizes the following detached, outlying areas which meet the use and/or density criteria of the Primary Urban Service District but are either subject to the waiver provisions contained in the Future Land Use Element or were in existence prior to the adoption of the 1982 Comprehensive Plan. These area will not receive the same level of urban services as provided for the (contiguous) areas in the main Primary Urban Service District of the County:

(1) County Landfill area north of C.R. 714 and east of I-95;
(2) Mobile Home Park area south of C.R. 714 between I-95 and S.R. 76A;
(3) Mobile Home Park area east of S.R. 76A immediately north of the intersection of S.R. 76A and Citrus Blvd. (S.R. 726);
(4) Triangular industrial site northeast of the Circle T Ranch (Indiantown) Airport.

2. OBJECTIVE

Martin County shall concentrate rural and estate densities not exceeding one unit per gross acre within the Secondary Urban Service Districts where a reduced level of public facility needs are programmed to be available at the base level of service adopted in the Capital Improvements Element.

a. Policy: Martin County shall designate land uses within the Secondary Urban Services District in order to provide for the use and extension of urban services in an efficient and economical manner, and consistent with the reduced intensity of urban services, particularly the need to not provide central water and sewer facilities normally associated with rural and estate densities equal to or less than one unit per gross acre.

b. Policy: Martin County shall require that residential development shall be located within Secondary Urban Service Districts at densities no higher than that specified in Policy 2.a. above unless a waiver is obtained pursuant to Implementation Strategy D.3. (p. 4-80). The inclusion of lands within the Secondary Urban Service District shall be based upon consistency with the County's growth management policies and Capital Improvements Element, as well as maintenance of all applicable level-of-service standards in a cost efficient manner.

c. Policy: The Secondary Urban Service Districts shall be delineated on the Urban Services Boundary Map for areas that meet the density criteria and are contiguous to the Primary Urban Service District. In areas where a tract that would normally qualify for Secondary Urban Service District designation is surrounded, on at least three (3) sides, by Primary Urban Service District areas, then the subject area will be included in the Primary Urban Service District.

d. Policy: In areas designated as Secondary Urban Service Districts, where development is proposed that would contain one-half acre or smaller lots, or commercial and industrial uses, a change to a Primary Urban Service District designation must be approved by the Board of County Commissioners as part of a land use amendment and must meet all of the policies listed under Objective G.1. relating to Primary Urban Service Districts unless a waiver is obtained pursuant to Implementation Strategy D.3. (4-80).

e. Policy: Martin County recognizes the following detached, outlying areas which meet the use and/or density criteria of the Secondary Urban Service District but are either subject to the waiver provisions contained in the Future Land Use Element or were in existence prior to the adoption of the 1982 Comprehensive Plan. These areas will not receive the same level of urban services as provided for the main Secondary Urban Service Districts located contiguous to the Primary USD of the County:

(1) Country Place Subdivision located on the east side of S.R. 76A just south of I-95;
(2) Linear area located between Citrus Blvd. (S.R. 726) and the Okeechobee Waterway, from Indiantown to S.R. 76A.

3. OBJECTIVE

Martin County shall initiate an investigation, in conjunction with the Treasure Coast Regional Planning Council and other interested organizations, the possibility of and potential for new land use map plans and programs for the long term future of the undeveloped areas in southern and western Martin county, to include large land holdings and the areas around I-95 interchanges at CR 708 and CR 714. This objective will also include the study and analysis of industrial and residential land use and other community issues in the Indiantown area.

a. Policy: The investigation of the long term future of the undeveloped areas in southern and western Martin County would establish that a Coordination Study with the Treasure Coast Regional Planning Council by July, 1990, would evaluate the potential of an area-wide Development of Regional Impact under provisions of Chapter 380.06 (25), Florida Statutes, to study these hinterland areas outside the urbanized areas of Martin and Palm Beach County.

b. Policy: In 1992 the County shall have completed an evaluation of the potential urban uses in the vicinity of I-95 interchanges with CR 708 and CR 714.

c. Policy: In 1991, Martin will update current plans in the Indiantown area by developing an Indiantown Future Community Development Plan. The Board of County Commissioners shall appoint an Indiantown Planning Task Force in order to assist County staff and the Local Planning Agency in plan development and implementation. This Community Plan will address land use capacity concerns as well as other community issues, such as housing, roads, urban design, water, sewer, and recreation, consistent with prevailing State guidelines and future community goals.

H. GOAL (ENERGY EFFICIENCY)

Martin County shall encourage energy conservation and promote energy efficient land use and development.

1. OBJECTIVE

By July 1990, Martin County's Land Development Regulations shall establish standards to ensure that development and redevelopment activities maximize the conservation of energy through effective and cost efficient land use and design.

a. Policy: Land Development Regulations shall be established to, at a minimum:

   (1) Encourage the location and scale of land use activities to minimize long-term energy commitments for construction, operation, maintenance, and replacement.

   (2) Encourage the design, siting, and orientation of buildings to utilize natural solar resources, wind conditions, tree canopy, and plant materials for the purpose of reducing the demand for artificial heating, cooling, ventilation, and lighting.

   (3) Ensure efficient energy conservation in building, heating, and cooling systems.

2. OBJECTIVE

By January 1992, Martin County shall develop in cooperation with the Treasure Coast Regional Planning Council an energy information program to ensure that the latest information concerning energy efficiency is readily available.

10.3.2 EXCERPTS FROM THE MARTIN COUNTY COMPREHENSIVE GROWTH MANAGEMENT PLAN PERTAINING TO:

- **GOAL K (INDUSTRIAL LAND USE)**

a. Policy: The County's design guidelines shall, at a minimum:

(1) Explain means by which physical design improvements can reinforce and improve the role of these areas as a focal point for office and institutional activity, retail trade, and civic and cultural enrichment.

(2) Illustrate means by which development can encourage pedestrian circulations while accommodating vehicular traffic flow and parking in a manner to reinforce and improve pedestrian mobility.

(3) Promote innovative themes and approaches to designs that are consistent with the purpose and unique character of these areas.

5. OBJECTIVE

By July 1990, Martin County shall establish, within the Land Development Regulations, performance standards requiring appropriate landscaping and screening to assure compatibility and smooth transitions between commercial and non-commercial land uses.

a. Policy: Office development may serve as transitional uses separating more intensive commercial uses from residential development.

b. Policy: Office use is encouraged along the outer fringe of core commercial areas in order to encourage reinvestment in declining residential areas adjacent to commercial core areas.

K. GOAL (INDUSTRIAL LAND USE)

Martin County shall provide for adequate and appropriate lands for the location of industrial land uses to support the role of industry in the County's economy.

1. OBJECTIVE

By July 1990, Martin County's Land Development Regulations shall provide adequate zoning classifications for industrial land uses to accommodate a diversity of industrial development as desired by the community.

2. OBJECTIVE

By July 1990, the County's Land Development Regulations shall recognize the locational criteria for industrial land in the Land Use Element and ensure that space requirement factors are satisfied when determining the distribution of specific types of industrial activities.

a. Policy: The development review process shall ensure that, at a minimum:

(1) Industrial activities are compatible with surrounding land uses, established or planned development, and natural systems and resources.

a. Policy: At a minimum, the development review process shall evaluate potential commercial development for:

   (1) Trip generation characteristics, impact on existing and planned transportation facilities, and ability to achieve a functional internal circulation and landscaped parking system.

   (2) Specific needs of respective commercial activities, such as market area, anticipated employment generation, and floor area requirements.

   (3) Compatibility with and impact on other surrounding commercial activities.

   (4) Relationship to surrounding land uses and natural systems.

   (5) Impact on existing and planned community services and utilities.

b. Policy: Commercial development shall be strategically directed into areas having location characteristics which best accommodate specific land area, site, public facilities, and market location requirements in order to promote efficient traffic flow along thoroughfares, achieve orderly development, and minimize adverse impacts on residential quality.

c. Policy: Zoning and land use designation changes shall not be granted if a finding by the Board of County Commissioners upon review by the Planning and Zoning Board is made that the change will lead or contribute to a proliferation of strip commercial development. The existence of commercial areas on one corner shall not dictate the development of all corners with the same or similar use nor shall the existence of commercial development on a major thoroughfare dictate that all frontage must be similarly used.

3. OBJECTIVE

In an effort to limit unnecessary commercial shopping center development, Martin County shall conduct a study, by January 1993, of innovative, fiscally sound techniques which may be utilized to encourage redevelopment or adaptive reuse of existing shopping centers or other existing commercial core areas.

a. Policy: The County shall identify those commercial properties which are currently vacant or under utilized , especially within commercial core areas and along U.S. Highway 1.

b. Policy: Possible techniques to be investigated shall include: 1) tax incentives to encourage reuse of existing centers, and 2) in areas where high commercial vacancy rates currently exist, creation of incentives for the reuse and redevelopment of existing centers rather than the creation of new developments.

4. OBJECTIVE

By January 1993, the County shall encourage improved design of commercial core areas which serve as the focal point of major unincorporated communities in the county by producing design guidelines to assist development or redevelopment decisions.

(2) Sites for industrial development are accessible to the essential public and private facilities and services at the levels of service adopted in this Growth Management Plan for transportation, potable water, solid waste, drainage, and sanitary sewer.

(3) Sites for industrial development are located with convenient access to the major roadway transportation corridors and are encouraged to locate with convenient access to air, water, and rail transportation facilities.

(4) Sites for industrial land uses are encouraged to locate with convenient access to the labor supply, raw material sources, energy resources, and market areas.

(5) A need for industrial land use is demonstrated either on a project basis or in a county wide assessment, when industrial proposals are considered by the Board of County Commissioners.

3. <u>OBJECTIVE</u>

By July 1990, Martin County's Land Development Regulations shall minimize the "nuisance" effects or other negative impacts of industrial land uses.

a. Policy: Performance standards shall be established for managing, at a minimum: noise, air pollutants, odor, vibration, fire or explosive hazard, and glare. Location and design of industrial activities shall be based on the activity's ability to comply with these standards.

b. Policy: Natural vegetation and other appropriate buffers shall be required where appropriate to minimize adverse impacts of the activity on nearby land uses.

4. <u>OBJECTIVE</u>

Beginning in January 1991, Martin County shall develop a program and prepare an annual report to selectively expand its industrial base consistent with the economic assumptions and limitations presented in the Economic Element of the Growth Management Plan.

a. Policy: The County shall encourage industries that contribute optimally to the County's economy and which:

(1) Generate high levels of employment with higher than average wage and salaries, and relative independence from cyclical changes in economy.

(2) Produce services and/or products which complement the needs and resources of existing industry within Martin County.

(3) Provide basic industry which is likely to serve as a desirable priming action for attracting additional industry compatible with the County's economic goals and objectives as in the Economic Element of this Growth Management Plan.

(4) Contribute a net revenue to the Martin County government and thus enhancing the fiscal capability of the County.

(5) Conserve the County's natural resources and public facilities by generating minimal adverse impacts on groundwater and potable water resources, the transportation system, the solid waste system, or other natural resources or community facilities.

L. GOAL (AGRICULTURAL LANDS)

Martin County shall fairly and equitably preserve agricultural lands by enhancing and protecting appropriate and productive lands for agricultural uses.

1. OBJECTIVE

By July 1990, Martin County's Land Development Regulations shall set forth procedures to ensure that the agrarian character of agricultural lands is preserved and that other methods are provided to maintain the economic viability of agriculture.

a. Policy: The County shall restrict expansion of urban public facilities and services to the urban service districts designated within this Growth Management Plan in order to preserve agricultural lands and provide maximum protection to the farmer from encroachment by urban uses.

   This policy will be accomplished by the implementation of Primary and Secondary Urban Service Districts and the careful evaluation of residential and non-residential land use applications during the planning period in order to prevent an unreasonable surplus of such uses and to protect agricultural lands.

b. Policy: The County shall encourage the use of management practices for soil conservation which best minimize erosion and protect those attributes which make the soil productive.

c. Policy: The County shall permit congregate housing for agricultural farm workers, as consistent with the Housing Element of this Growth Management Plan. This congregate housing for agricultural farm workers would be considered in conjunction with Housing Service Zones, Section 6-4, A, 4, c. of the Housing Element. Development regulations shall be established to accommodate this use in areas established as Housing Service Zones.

2. OBJECTIVE

Martin County shall monitor and evaluate new innovations and management practices for preserving agricultural farmlands while protecting the property rights of farmers, and prepare an annual report, beginning in January 1991, for the purpose of determining the applicability of these concepts to Martin County.

10.3.3 EXCERPTS FROM THE MARTIN COUNTY COMPREHENSIVE GROWTH MANAGEMENT PLAN PERTAINING TO:

- **GOAL M (ALLOCATION OF LAND USE)**

a. Policy: At a minimum, the following innovations shall be investigated:

(1) Fiscal incentives such as differential assessments for reducing burdensome property taxes.

(2) Transferable development rights (TDR's) which compensate the owners of preserved land for the loss of their rights to develop.

(3) Voluntary agricultural districts coupled with benefits and assurances to improve the conditions of farming.

M. GOAL (ALLOCATION OF LAND USE)

Martin County shall allocate land use indicated on the Year 2005 Land Use Map in order to provide for compatibility with existing development, consistency with the Capital Improvements Element, protection of natural resources, and implementation of the adopted level-of-service standards.

1. OBJECTIVE

By July, 1990, Martin County will revise the Land Development Regulations as necessary to implement the policies for land use allocation.

a. Policies (Agricultural Development)

The Land Use Map identifies those lands within Martin County which are allocated for agricultural development. This designation is intended to protect and preserve areas of agricultural soils for agriculturally related uses realizing that food and commodity production is an essential industry and basic to the economic diversity of the County. In addition, the major portion of agricultural lands are far removed from urban service districts and cannot be converted to urban use without substantial increases in cost of providing, maintaining, and operating dispersed supportive services. The allocation of agricultural land is furthered by Goal L. in this Section.

The further intent of the agricultural designation is to protect agricultural land from encroachment by urban or even low density residential development. Such development impacts the natural environment and may cause such potential adverse impacts as erosion, run-off, sedimentation and flood damage, all of which render the impacted land less adaptive to agricultural productivity. In order to avoid activities that adversely impact agricultural productivity on agricultural lands as designated on the Land Use Map, no development shall be permitted which divides landholdings into lots, parcels or other units of less than twenty (20) gross acres. While acreage may be split for bona fide agricultural uses, this is not intended to allow 20 acre residential subdivisions without platting and provision of necessary services.

Within agriculturally designated lands, the agriculture zoning districts shall provide definitive policy regarding development options. All such provisions of agricultural zoning districts shall be consistent with the Comprehensive Growth Management Plan. Limited residential and other uses directly related and supportive to agriculture or which would not jeopardize the integrity of the agricultural purpose of the district are permitted.

(1) Congregate Housing for Farmworkers. Residential development for housing farmworkers is provided for as a conditional use pursuant to Section 4-4, L,1,(c) of this Element. Agricultural zoning shall provide a policy for implementing this provision.

(2) Conversion of Land Designated Agricultural on the Land Use Map. Agriculturally designated land may be redesignated only by an amendment to the Comprehensive Growth Management Plan. The intent of this section is to permit such amendment upon a finding by the Board of County Commissioners that the applicant has demonstrated that:

(a) The proposed development shall not adversely impact hydrology of the area or in any other manner adversely impact the productive capacity of adjacent farmlands not included in the amendment application;

(b) The proposed land conversion is a logical and timely extension of a more intense land use designation in a nearby area, considering existing and anticipated land use development patterns, consistency with goals and objectives of the Comprehensive Growth Management Plan, availability of supportive services, including improved roads, recreation amenities, adequate school capacity, satisfactory allocations of water and wastewater facilities and other needed supportive facilities. Such findings shall be based on soil potential analysis as well as on agricultural site assessment for the proposed land use conversion.

b. Policies (Agricultural Ranchette Development)

The Land Use Map identifies those lands within Martin County which are allocated for agricultural ranchette development. These lands are primarily located West of the Sunshine State Parkway, which serves as a major barrier to transportation and the provisions of fiscally sound systems for the delivery of many urban services. This condition is a major rationale supportive to the growth policy and development pattern established in the Comprehensive Growth Management Plan. The above mentioned designation is intended to protect and preserve areas of Martin County which are generally located between the fringe of the agricultural heartland and outer fringe of urban development. These areas are situated in locations removed from urban services, have developed at very sparse densities, and maintain their original agricultural and rural character. The Plan recognizes the primary value of these lands for small agricultural operations and open space, and, therefore, assigns reasonable development options consistent with the existing and anticipated agricultural character in the area. A density of one (1) unit per five (5) gross acres shall be permitted within the areas designated for agricultural ranchettes. However, residential development on these lands should be related to agricultural uses. Five (5) acre lots with this land use designation shall meet this requirement. This plan recognizes the need to concentrate urban development on lands closer to the urban core communities where urban facilities may be more economically provided, maintained and operated. These areas still require minimal levels of urban services, such as fire and emergency medical, thus ranchette areas should be located adjacent to the Secondary Urban Service District.

The zoning regulations which shall govern the future development options within the areas designated for agricultural ranchette development shall be consistent with the Comprehensive Growth Management Plan. Development standards of the Land Development Code shall assure that future development within the area is compatible with established uses sharing common lot lines in order to provide for smooth transition in use and densities.

Standards governing agricultural land conversion in Policy M.1.a.(2) shall also be used as criteria in evaluating future plan amendment requests within areas designated for agricultural rural ranchettes.

c. Policies (Rural Development)

The Land Use Map identifies those lands within Martin County which are allocated for rural development. This designation is intended to protect and preserve the value of rural suburban lands which are located outside the normal economical service radius of intensive (primary) urban service systems including regional potable water distribution and wastewater collection systems. In general, the County cannot economically provide, maintain and operate the full complement of intensive services in these areas.

The rural lands shall develop at a density not exceeding one (1) dwelling unit per two (2) gross acres. This density allocation recognizes the need to concentrate urban development on lands closer to the urban core communities where intensive urban facilities and services can be provided in a manner compatible with the objectives of fiscal conservancy. This policy also provides reasonable development options to landowners whose property is located within the fringe of secondary urban development in sparsely developed rural or rural suburban areas. Zoning regulations shall provide standards for these areas which are designed to permit development compatible with the need for preserving the rural character. These standards shall reflect the high value placed on open space, the need to preserve wetland areas, the function and value of recharge areas, and the need to minimize changes in the natural hydrology of the area. Standards governing agricultural land conversion of in Policy M.1.a.(2) shall also be used as criteria in evaluating future plan amendment requests within areas designated for rural development.

d. Policies (Residential Development)

The Land Use Map allocates residential density based on population trends; housing needs; past trends in the character, magnitude, and distribution of residential land consumption patterns; and, pursuant to goals, objectives, and policies of the Comprehensive Growth Management Plan, including the need to provide and maintain quality residential environments, preserve unique land and water resource and plan for fiscal conservancy.

(1) Residential Estate Densities (RE-1A). Residential estate densities are primarily assigned to established stable residential areas and those transitional areas having a density up to one (1) unit per gross acre. These areas are generally on the fringe of the urban service districts and generally are not accessible to a full complement of urban services. The Plan also assigns estate densities to selected areas near existing estate development where the lands so designated, share similar characteristics to existing residential estates and to areas within the urban service district which require density limitations because of unique problems of urban services. Review of specific densities shall be directed toward preserving the stability and integrity of established residential development and toward providing equitable treatment to lands sharing similar characteristics. Design techniques of landscaping, screening and buffering shall be employed to assure smooth transition in residential structure types and densities. Where single family structures comprise the dominant structure type within these areas, new development on undeveloped abutting lands shall be required to include compatible structure types on lands immediately adjacent to existing single-family development. Existing agricultural uses within this land use designation shall be allowed to continue in a non-conforming status. This land use designation differs from the RE-0.5A category in that lot sizes are generally larger and the areas are more compatible to rural settings.

(2) Residential Estate Densities (RE-0.5A). Residential estate densities are primarily assigned to established stable residential areas, having a density up to two (2) units per gross acre. These areas are generally on the fringe of the urban service districts and generally are not accessible to a full complement of urban services. The Plan also assigns estate densities to selected areas near existing estate development where the lands so designated, share similar characteristics to existing residential estates and to areas within the urban service district which require density limitations because of unique problems of urban services. Review of specific densities shall be directed toward preserving the stability and integrity of established residential development and toward providing equitable treatment to lands sharing similar characteristics. Design techniques of landscaping, screening and buffering shall be employed to assure smooth transition in residential structure types and densities. Where single family structures comprise the dominant structure type within these areas, new development on undeveloped abutting lands shall be required to include compatible structure

types on lands immediately adjacent to existing single-family development. Existing agricultural uses within this land use designation shall be allowed to continue in a non-conforming status.

(3) Low Density Residential Development. The low density residential designation is reserved for land accessible to existing urban service centers or located in the immediate expansion area. Densities permitted in this area shall not exceed five (5) units per gross acre. Review of specific densities shall be directed toward preserving the stability and integrity of established residential development and toward providing equitable treatment to lands sharing similar characteristics. Design techniques such as landscaping, screening and buffering shall be employed to assure smooth transition in residential structure types and densities. Generally, where single family structures comprise the dominant structure type within these areas, new development on undeveloped abutting lands shall be required to include compatible structure types on the lands immediately adjacent to existing single family development.

(4) Medium Density Residential Development. The medium density residential designation is reserved for land within the core of urban service districts and accessible to employment centers. Medium density ranges upward to a maximum of eight (8) units per gross acre. Review of specific densities shall be directed toward preserving the stability of established residential areas. Design techniques of landscaping, screening and buffering shall be employed to assure smooth transition in residential structure types and densities. Generally, where single family structures comprise the dominant structure type within these areas, new development on undeveloped abutting lands shall be required to include compatible structure types on the lands immediately adjacent to existing single family development.

(5) High Density Residential Development. The high density residential development designation is reserved for land within the core of an urban service district adjacent to a less restrictive land use and on a site serviced by a full complement of urban facilities. High density ranges upward to a maximum of ten (10) units per gross acre. However, sites shall be approved for a maximum of fifteen (15) units per gross acre, assuming compliance with all of the following criteria:

(a) Density bonus will be granted to development sites committing to rental to households meeting the definition of very low, and low income and complying with the criteria being studied and accepted by the Affordable Housing Task Force called for in Section 6-4, A,10,k, of the Housing Element.

(b) Site location on a major or minor arterial or major collector street as defined in the Traffic Circulation Element, Chapter 5 of the Comprehensive Growth Management Plan.

(c) Site location shares a common zoning district boundary with commercial or industrial district or a high density residential area as reflected on the Land Use Plan.

(d) Site location does not share a common zoning district boundary with a single family zoning district.

(e) Site is serviced by a full complement of urban services including water and wastewater service from a regional public utility as defined in the Comprehensive Growth Management Plan Data Inventory and Analysis. (Part II of the Potable Water Element and Wastewater Element)

(f) Applicant provides significant open space buffer, natural landscape including a landscaped berm where appropriate, plant material and/or an aesthetic wall or fence to effectively shield the residential use from any existing or potential adjacent non-residential use or from any single family use.

(g) Applicant provides assurances that all performance standards shall be met.

Review of specific densities shall be directed toward preserving the stability and integrity of, and maintaining compatibility with, established residential development and toward providing equitable treatment of lands with similar characteristics. Design techniques of landscaping, screening and buffering shall be employed to assure smooth transition in residential structure types and densities. Generally, where single family structures comprise the dominant structure type within these areas, new development on undeveloped abutting lands shall be required to include compatible structure types on the lands immediately adjacent to existing single family development.

6. <u>Mobile Home Development</u>. Mobile home residential development shall be permitted on sites appropriately zoned for mobile home development. However, all development applications for mobile home parks and subdivisions for which site plan approval has not been granted, shall be encouraged to develop under provisions of the mobile home planned unit development district. The density of the mobile home parks or subdivisions shall be permitted up to a maximum of eight (8) units per gross acre; however, specific site densities must be consistent with the policy, map and standards of the Comprehensive Growth Management Plan and Zoning Code. The more restrictive density provision shall rule where any inconsistency may exist. Review of specific densities shall be directed toward preserving the established residential development. Replacement of existing mobile homes in existing mobile home plats and sites of record, as of the effective date of this ordinance, shall be permitted and shall not be deemed inconsistent with the Comprehensive Growth Management Plan. Mobile homes shall be reviewed as reasonable development options but the applicant shall provide plans for mobile home development which assure the development contains a significant open space buffer. Natural landscaping, including a landscaped berm where appropriate, plant material, and/or an aesthetic wall or fence to effectively screen the mobile home development from adjacent residential development which exists or may potentially exist in the future.

Due to the unique hazards associated with mobile home residences in hurricane storm events, and not withstanding the density allocations provided for on the Land Use Map for Hutchinson Island, any property designated for residential use on Hutchinson Island must be not be developed for any mobile home use.

e. Policies (Commercial Development)

The Land Use Map identifies the allocation of commercial land for office use, limited commercial, general commercial and marine waterfront commercial activities. The allocation is compatible with goals and objectives identified in the Comprehensive Growth Management Plan and consistent with supportive research and analysis.

(1) Commercial Office/Residential Development (COR). Commercial office/residential development is allocated to accessible sites adjacent to major thoroughfares and also can serve as a transitional use separating more intensive general commercial uses from residential development assuming all performance standards and zoning criteria are met. Office and residential development is also allocated along the outer fringe of core commercial areas where such development opportunities may encourage reinvestment in declining residential areas adjacent to commercial core areas.

Development within the commercial office/residential area shall be restricted to professional and business offices and financial institutions and multiple-family residential development. This land use classification expressly excludes freestanding retail sales and service establishments. However, restaurants, certain service commercial uses, and limited commercial uses, as identified in the Land Development Code, may locate in this district as advertised conditional uses. These advertised conditional uses must be initially approved by the Planning and Zoning Commission. The Planning and Zoning Commission's determination shall be based on a finding that initial residential or office development has provided an on-site buffer pursuant to zoning regulations restricting the nature and scale of the retail uses. The Board of County Commissioners may approve the advertised conditional use following action by the Planning and Zoning Commission. Duly approved offices and shops located within COR designated areas as of the effective date of this ordinance shall be deemed permitted uses within the COR area.

Residential storage facilities may be approved as a conditional use by the Planning and Zoning Commission in areas designated "COR" or "Limited Commercial". The Zoning Ordinance shall establish criteria for review of such use which may, notwithstanding the above paragraph, be located in a freestanding building. However, the building shall be restricted to structures with small modules adaptive exclusively to storage of personal household accessory items of residential clients. Commercial tenants shall be expressly prohibited. The facility shall be designated in appearance to blend harmoniously with residential structures. The cumulative impacts of any non-residential conditional uses must be evaluated and criteria allowing for these uses must be expressed in the Land Development Code. Multiple-family residential uses are encouraged to develop within areas designated for office development at densities compatible with criteria cited in Section 4-4M.1.(5) for high density residential development with a designated maximum density of 10 units per gross acre. Performance standards shall require appropriate landscape and screening including vegetative berm system where feasible, plant material and/or aesthetic decorative fence or walls to assure compatibility among established residential uses and office developments. Facilities for transient lodging catering to the seasonal resident and generally having kitchen facilities to accommodate occupants for visiting periods exceeding the general motel trip duration of one to four nights are permitted as a conditional use in this land use classification when approved by the Planning and Zoning Commission pursuant to criteria to be established in the Zoning Ordinance. Duly approved transient lodging facilities existing as of the effective date of the Comprehensive Growth Management Plan shall be deemed to be permitted in such area.

Review of specific residential densities shall be directed toward preserving the stability and integrity of, and maintaining compatibility with, established residential development and toward providing equitable treatment of lands with similar characteristics.

Design techniques of landscaping, screening and buffering shall be employed to assure smooth transition in residential structure types and densities. Generally, where single family structures comprise the dominant structure type within these areas, new development on undeveloped abutting lands shall be required to include compatible structure types on the lands immediately adjacent to existing single family development.

(2) Limited Commercial Development. Limited commercial development is allocated to commercial sites accessible to major thoroughfares near residential neighborhoods. Commercial uses accommodated within limited commercial areas shall have a scale and intensity compatible with adjacent residential neighborhoods. Sites within this designation are intended to accommodate shops with limited inventory or goods as well as transient lodging facilities meeting performance standards of the Comprehensive Growth Management Plan and the zoning code. This designation is not intended to accommodate residential development. Duly approved residential uses existing at the effective date of the Comprehensive Growth Management Plan shall be deemed permitted uses. In addition, such shops cater to the following markets:

(a) Neighborhood residential markets within the immediate vicinity as opposed to county-wide or regional markets;

(b) A specialized market with customized market demands, or

(c) A tourist oriented market in the immediate vicinity.

Commercial development within the limited commercial district shall be restricted pursuant to the provisions of the Code of Laws and Ordinances.

Areas designated for limited commercial development are not intended to accommodate large scale retail sales, service, and trade activities, generally serving a larger market area. Such stores would usually require a larger floor area, carry a relatively larger inventory, and require a substantially greater parking area.

(3) General Commercial Development. The general commercial areas are designated on the Land Use Map for purposes for accommodating general retail sales and services; highway oriented sales and services; commercial amusement; and trade and warehousing facilities. These areas are principally located in highly accessible areas of the urban service district within areas compatible with the unique location and market requirements of the respective uses. The sites are located on major or minor arterials. The zoning policy allocated to areas within the general commercial service district stipulates the land allocation for the specific uses defined above. This area is not intended to accommodate businesses, trades, or services which generate any significant amounts of nuisance impacts, including glare, smoke or other air pollutants, noise vibration, major fire hazards, need for extensive outside storage and display, or other impacts associated with more intensive industrial uses. Automotive sales and services shall be located within the general commercial land use classification on sites appropriately designated for highway oriented commercial uses within the Land Development Code.

The areas designated for general commercial development are specifically not adaptive to permanent residential housing and such uses shall be located in other areas designated for residential development. On the other hand, transient residential facilities including hotels and motels, timesharing or fractional fee residential complexes, or other transient quarters should be located in areas designated for commercial use. Areas planned for mixed use developments as allowed by the Traditional Neighborhood Goal, Section 4-4, C, are considered compatible for mixed use.

Amendments to the Land Use Map for added general commercial designations shall be favorably considered by the Board of County Commissioners only after a finding that the proposed amendment:

(a) Satisfies at least an additional need for general commercial land use within the area to be served; and

(b) The site should generally be removed from single family residential development and able to be buffered and screened pursuant to performance standards requiring appropriate landscaping and screening including vegetative berm systems where feasible, plant material and/or aesthetic decorative fence or walls to assure compatibility with less intensive uses existing or anticipated on adjacent sites.

Prior to approval of a development plan, all applicants for development within the general commercial designated area shall provide assurances that central water distribution and wastewater collection utilities shall be provided by a regional public utility system, as described in the Comprehensive Growth Management Plan Data Inventory and Analysis, Part II (Chapter 10, Sanitary Sewer and Chapter 11, Potable Water Elements).

If in the future a general commercial service is proposed in a dispersed rural area located outside of the Primary Urban Service District and the applicant adequately demonstrates to the satisfaction of the Board of County Commissioners that a need for such a service exists for the population within the area and that the required water and wastewater services are unavailable, the Board of County Commissioners may permit the use and waive the required urban service based on unique and compelling factors, including cost-efficient provision of all required urban services consistent with adopted LOS standards and the Capital Improvements Element, successfully demonstrated by the applicant to the Board of County Commissioners.

(4) Marine Waterfront Commercial. The Land Use Map designates marine waterfront commercial areas which shall accommodate marine resort, marina and water related services along the more highly accessible waterfront sites with the potential to satisfy the unique location, market, and resource needs of the water dependent more intense marine service/industrial uses. Generally, waterfront commercial uses are either water dependent or water related. Specific zoning district regulations shall be drafted and adopted to regulate the nature of marine waterfront commercial operations, and to assist in maintaining the stability of adjacent and nearby residential areas through use restrictions, landscaping and screening, and nuisance abatement standards. The regulations shall also guard against environmentally adverse impacts to biologically active and environmentally sensitive habitats in a manner consistent with the coastal and natural resource protection performance standards of this Plan. The Land Development Code shall provide for several marine waterfront commercial districts which accommodate the variety of waterfront commercial activities, including transient residential facilities, other marine resort oriented facilities such as restaurants and shops, as approved as a conditional use by the Planning and Zoning Board, and the more intense marine service uses which have their own unique locational criteria to assure compatibility with human and natural resources identified in Section 8-4, A,5, of the Coastal Management Element.

(5) Expressway Oriented Transient Commercial Service Centers. This special land use designation is established to recognize the immediate and unique needs of the through traffic traveling public. The areas immediately adjacent to the interchanges of the limited access facilities, as defined in Chapter 334.03, Florida Statutes, with major arterials identified in the Traffic Circulation Element, with the exclusion of the I-95/Palm City Interchange, are the subject of this policy. The subject interchange locations are designated by

a "black diamond" symbology on the Year 2005 Future Land Use Maps. The area around the subject interchange which is eligible for this land use category is specified in subsections (f) and (g) below. Parcels at the I-95/Palm City Interchange may be eligible for formal amendment to the Comprehensive Growth Management Plan in accordance with Section I-12(A) of the Comprehensive Growth Management Plan. Transient Lodging and Service Commercial Centers are subject to compliance with the following performance standards:

(a) Any application must be submitted and processed as a Commercial Planned Unit Development, PUD(c).

(b) Any application must be compatible with the surrounding land use designation to comply with the performance standards in Section 4-5 of the Comprehensive Growth Management Plan.

(c) A market feasibility analysis, acceptable to Martin County, that demonstrates a need must be submitted to document that the uses proposed are warranted by the traveling public they are intended to serve.

(d) Uses permitted within the PUD(c) allowed by this policy are limited to the following:

1) Convenience Stores
2) Gift Shops
3) Hotels and Motels, excluding permanent residential units
4) Restaurants, including drive-ins and fast food service
5) Vehicular service and maintenance (gas stations)

(e) Direct access to the property upon which the PUD(c) is proposed must be from a major arterial. The requirements of this paragraph shall be deemed to have been met for parcels immediately adjacent to the limited access facility which have had their direct legal access to a major arterial replaced by the F.D.O.T. in the form of a newly created access road. Such parcels are typically located between the limited access facility and the newly created access road. Should the PUD(c) require improvements to the newly created access road, those improvements shall be completed at the developer's expense.

(f) All the property upon which the PUD(c) is proposed must be within 1320 feet of any access ramp to the limited access facility and within 1320 feet of the intersecting arterial.

(g) The access point to any property upon which the PUD(c) is proposed shall not be located closer than 660 feet to any access ramp to the limited access facility unless it can be specifically proven by a traffic study performed by a registered Florida engineer that a shorter distance would allow for a continuing function of the road system and not be detrimental to the health, safety and welfare of the public.

(h) Applicant must successfully demonstrate how the full range of urban services needed by the PUD(c) will be funded and provided in a cost-efficient manner consistent with the adopted facility level-of-service standards in this Plan and the Capital Improvements Element.

f. Policies (Industrial Development)

The Land Use Map allocates land resources for existing and anticipated future industrial development needs. The allocation process provides a high priority to industry's frequent need for strategically located lands accessible to rail facilities, major arterials or interchanges, labor markets, and requisite urban services located within planned Urban Service Districts (Figure 4-5).

The locational criteria for Industrial Development require that all development within Industrial designated areas shall provide assurances that central water distribution and wastewater collection utilities shall be provided by a regional public utility system, as described in the Comprehensive Growth Management Plan, Data, Inventory and Analysis (Part II, Chapter 10, Sanitary Sewer and Chapter 11, Potable Water Elements). Those areas of the County, where free standing urban services (ie., central public utility system) can be provided by a group of industrial land uses, may be considered as independent or free-standing Urban Service Districts and may be illustrated as such on Figure 4-7 in conjunction with formal amendments to the Future Land Use Map as provided in Section 1-11, Amendment Procedures. All independent or freestanding USD's must comply with the adopted level-of-service standards in this Plan and the Capital Improvements Element.

Industrially designated areas are not generally adaptive to residential use and such uses shall not be located in areas designated for residential development unless planned for within mixed use developments allowed under the Traditional Neighborhood Goal (Section 4-4, C) or in large scale PUD's. This provision shall not prohibit residences for night watchmen or custodians whose presence on industrial sites is necessary for security purposes. Such a use may be permitted as a conditional use through appropriate zoning procedures.

Based on the extensive impacts which industrial development frequently generates, industrial development requiring future plan amendment or rezoning shall be encouraged to develop under provisions of a planned unit development petition in order to allow maximum flexibility in design to the applicant and to avoid any major adverse impacts which may not be anticipated during a less in-depth plan review.

The Zoning Ordinance shall be amended to include performance standards for regulating the nuisance impacts sometimes associated with intense commercial and industrial development. Salvage yards shall be considered as an industrial use due to the potential intensity and nature of the use, acreage requirements, aesthetic impact, and the heavy truck traffic associated with the use.

g. Policies (Institutional Development)

The Land Use Map provides for Institutional Development on publicly owned active recreation and passive open space sites. This designation also accommodates public and semi-public not-for-profit facilities such as the larger schools, government buildings, civic centers, public cemeteries, fire and emergency operation center facilities, active parks and recreation areas, and extensive open space/passive recreation areas comprising major committed public and semi-public open spaces. The future land use maps shall identify the facilities as to type without limiting the Institutional use. Active County operated recreation sites/parks are identified by either a picnic table or star symbol in addition to the Institutional land use designation. Other recreation/passive open space areas are identified by name (i.e., Jonathan Dickinson State Park). Public conservation areas such as the White Belt Ranch and the Savannas State Preserve are designated by a double star symbology over the Institutional land use pattern. The Land Development Code will provide for two or more zoning districts to allow for the differentiation of recreation sites from the more intense Institutional uses which may be inappropriate adjacent to residential areas.

h. Policies (Public Utilities - Major Power Generation Facilities)

Land uses in this category are confined to major power generation sites and related facilities. Currently, the only such designated area is the Florida Power and Light Martin Plant site and cooling reservoir west of Indiantown. This designation is required for all power generation sites of ten acres or more in size which contribute electricity to the power grid in Martin County. Such land uses are subject to the same locational and compatibility considerations as required of industrial development.

i. Policies (Potential Private Conservation)

By 1991, Martin County will evaluate environmentally sensitive lands in the County and consider the designation of a Private Conservation land use category which would be appropriate for very low density residential uses such as one unit per 20 acres to one unit per 40 acres and/or various types of low intensity agricultural uses, such as ranch land.

SECTION 4-5. PERFORMANCE STANDARDS

This section contains basic standards applicable to future land use development approvals and conservation proposals within Martin County. Performance standards are coordinated with the various other Elements and specified as requirements for development approvals in accordance with Martin County Land Development Code requirements.

10.3.4 EXCERPTS FROM THE MARTIN COUNTY COMPREHENSIVE GROWTH MANAGEMENT PLAN PERTAINING TO:

- **SECTION 4-5: PERFORMANCE STANDARDS**

g. Policies (Institutional Development)

The Land Use Map provides for Institutional Development on publicly owned active recreation and passive open space sites. This designation also accommodates public and semi-public not-for-profit facilities such as the larger schools, government buildings, civic centers, public cemeteries, fire and emergency operation center facilities, active parks and recreation areas, and extensive open space/passive recreation areas comprising major committed public and semi-public open spaces. The future land use maps shall identify the facilities as to type without limiting the Institutional use. Active County operated recreation sites/parks are identified by either a picnic table or star symbol in addition to the Institutional land use designation. Other recreation/passive open space areas are identified by name (i.e., Jonathan Dickinson State Park). Public conservation areas such as the White Belt Ranch and the Savannas State Preserve are designated by a double star symbology over the Institutional land use pattern. The Land Development Code will provide for two or more zoning districts to allow for the differentiation of recreation sites from the more intense Institutional uses which may be inappropriate adjacent to residential areas.

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SECTION 4-5. PERFORMANCE STANDARDS

This section contains basic standards applicable to future land use development approvals and conservation proposals within Martin County. Performance standards are coordinated with the various other Elements and specified as requirements for development approvals in accordance with Martin County Land Development Code requirements.

The Code of Laws and Ordinances of Martin County, as it exists or may hereafter be amended, specifies the procedure for review and approval of all development proposals. For purposes of this Comprehensive Growth Management Plan, the term "development" shall mean the carrying out of any building activity, mining operation, the making of any material change in the redevelopment or modification of an existing use or appearance of any structure or land, which creates additional impacts or the dividing of land into three (3) or more lots, tracts or parcels, including PUD's and acknowledging all exceptions to subdivisions.

Remodeling, renovation, restoration to improved real estate to a former, better condition (as by cleaning, repairing or rebuilding), shall be exempt from the performance standards of this plan. Any proposed man-made change to improved real estate shall meet the requirements of this plan but only to the extent of such man-made change.

Minor accessory uses (such as a swimming pool, fences, screened enclosures, etc.) and as further defined by the Land Development Code shall be exempt from provisions of Section 4-5 (E, F, G, H, I, J, and L) and Section 4-4 (A, 3, a), Concurrency Management System.

The Code of Laws and Ordinances of Martin County, as it exists or may hereafter be amended, establishes a legal requirement of obtaining development permits and orders for various development activity and specifies the procedure for review and approval of all development permits and orders.

A. Density

The following density provisions are herein incorporated as performance standards. Notwithstanding, the density provisions herein shall not prevent the owner of a lot of record created prior to the adoption of subdivision regulations of Martin County on November 7, 1972, in accordance with the codes and ordinances of Martin County, or the owner of a lot of record created pursuant to the subdivision regulations subsequent to November 7, 1972, and in conformance with the Zoning Code, from constructing one single-family unit in accordance with the other provisions of this plan and the Code of Laws and Ordinances of Martin County.

1. Gross Density. The permitted densities stipulated in Section 4-4 or the Land Use Map designations shall be gross residential densities and the gross land area of which this density is applied is described as follows:

   Those contiguous land areas under common ownership with the following provisions and exceptions:

   a. In cases where land abuts the waters of the Atlantic Ocean, St. Lucie River, Indian River, Loxahatchee River, Intracoastal Waterway, Lake Okeechobee, and all tributaries and man-made canals thereof, the boundary of the land shall be delineated as established by State Statutes (Chapter 177, Part II, Coastal Mapping or as may be amended).

   b. No submerged land areas waterward of the boundary above described shall be included under this definition.

c. No land areas proposed to be allocated to non-residential uses shall be included under this definition except for contiguous land areas for:

   (1) Utilities under common ownership and principally supporting the residential use;

   (2) Recreational facilities for the primary use of on-site residents;

   (3) Dedication to the County or other County approved agencies or not-for-profit corporations.

d. Maximum gross density is defined as maximum allowable units divided by gross land areas as herein defined.

2. Density Allocations and Intensity

In considering density allocation in site plan approvals, the County shall consider the following:

a. Projects directly adjacent to lands used or designated for higher intensity use may be given maximum density.

   (1) Such projects must comply with the provisions of the concurrency management system (Section 4-3) to assure all required services are available.

   (2) Design of the new project shall assure that comparable density and dwelling unit types are planned for the area of the project abutting the existing development.

   b. Projects immediately adjacent to lands used or designated for lower intensity use should be given lesser density.

      (1) For that portion of said project abutting the existing development or area of lesser density, a density transition zone of comparable density and compatible dwelling unit types shall be established in the new project for a depth from the shared property line that is equivalent to the depth of the first tier of the adjoining development's lower density (i.e., the depth of the first block of single-family lots.

      (2) The new development project shall comply with all current regulations for concurrency management to assure the adequate provision of public services.

   c. Height limits for all structures shall be specified in the Land Development Code. In all instances the maximum height limit of 4-stories shall be followed.

B. Wetland Areas. Wetland Protection Requirements are detailed in the Conservation and Open Space Element.

1. Wetland Areas. Wetland areas are defined as land that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under natural circumstances does support a prevalence of native vegetation typically adapted for life in saturated soil conditions. Wetland areas are generally typified in Martin County as forested saltwater areas, forested and mixed forested freshwater areas and non-forested freshwater areas. The soils listed below shall be used as guides in determining wetland areas.

	Type of Wetland Area	Associated Soil Types
a.	Forested Saltwater	30, 40, 50, 67, 79
b.	Non-Forested Freshwater	3, 5, 10, 12, 19, 49, 54, 56, 57, 70, 74
c.	Forested and Mixed Forested Freshwater	13, 22, 38, 40, 51, 58, 60, 62, 69, 73

Source: - Soil Survey of Martin County Area (Florida, Martin County Soil and Water Conservation District, U.S.D.A. Soil Conservation Service, 1981; Florida Division of Forestry, 1981).

This data shall be maintained in the Growth Management Department.

2. Wetland Development Restrictions. No negative impacts shall be allowed in a wetland area unless:

   a. The data from the Soils Potential Study from the Martin Soil and Water Conservation District indicates that the specific soil has characteristics supportive to the proposed development; and

   b. The area no longer functions as a wetland and failure to function was not caused by clearly evident illegal activities in violation of the Comprehensive Plan as adopted on April 1, 1982.

3. Vegetation and Drainage Considerations. This subsection 4-5(B) is not intended to prohibit development in areas that no longer function as wetlands, when "competent evidence" indicates that:

   a. Dominant vegetation is no longer comprised of wetland types normally found in the specified soil; and

   b. The water regime has been permanently altered artificially or naturally in a manner to preclude its associated watershed areas from functioning as wetlands.

   c. Applicants for site plan review shall have an opportunity to so demonstrate that any wetland designations within the confines of their property no longer function as wetlands as explained above. The Martin County Soil and Water Conservation District or the Growth Management Department shall be made a part of the site plan review process to assist in identifying and delineating wetlands.

d. All wetland areas defined here and in Section 9-4 A,7, Natural Systems, of the Conservation and Open Space Element shall be managed as required in Section 9-4, A,7,b(4) and (5).

4. Violations. Where evidence indicates that drainage, clearing, or other development has taken place subsequent to the adoption of the Comprehensive Growth Management Plan, and in violation of standards established in Section 9-4, A,7(b),(6), restoration shall be required before any development permits are issued.

5. Waivers. No exceptions or waivers shall be granted to these standards except pursuant to procedures established below:

   a. As outlined in Section 9-4, A,8,a,(4),(c) to provide riparian access;

   b. Where applicant demonstrates that encroachment of the wetlands or wetland buffers is necessary for access and no reasonable upland alternative exists. In such cases an exemption shall be granted only when appropriate environmental agencies, including the Martin County Soil and Water Conservation District, certify in writing that it is the least damaging alternative and that the applicant has submitted a proposal for mitigation which will minimize damage to the extent technically feasible.

   c. When a plan has been approved by the Growth Management Department for the removal and continued management of undesirable exotic vegetation (including revegetation with appropriate native plant material).

   d. On existing parcels of record where there is insufficient adjacent upland property to make any reasonable use of the land, one single family home shall be allowed subject to the requirements of procedure b. above.

   e. Where the applicant demonstrates that encroachment of the wetlands or wetland buffers, as defined above, is necessary for the construction and/or maintenance of a public utility, as defined in Section 366.02 F.S. (1983), an exemption may be granted subject to the following conditions:

      (1) The utility has demonstrated that the encroachment is necessary and that no reasonable upland alternative exists.

      (2) The activity is designed and located in such a manner that the least amount of damage to the wetland is assured.

      (3) The applicant has submitted a proposal for reforestation and/or mitigation, to offset the impact.

      (4) Permits have been received from the appropriate State and Federal Environmental Agencies and copies of those permits have been supplied to Martin County, prior to issuance of the County permit.

(5) The Martin County Soil and Water Conservation District has reviewed the application and has determined in writing that the proposed encroachment is the least damaging alternative.

(6) The applicant has provided proof of ownership or easement over the property to be encroached.

(7) A plan has been approved by the Growth Management Department for the removal of undesirable exotic vegetation as part of the reforestation and/or mitigation proposed in Item C.

(8) The applicant has demonstrated that the construction and/or maintenance activity will maximize the preservation of native indigenous vegetation.

(9) The utility will demonstrate that, should fill be required, the minimum necessary is used, to assure reasonable access to the property or construction activity.

f. When a plan has been approved by the Growth Management Department and applicable state and federal agencies for shoreline boardwalks, docks and marina facilities, provided they are consistent with the policies and criteria of the Coastal Management and Conservation Elements.

6. Density Transfer. All property owners shall have the right to transfer density to the upland area on any site which contains functional wetland properties pursuant to the following stipulations:

a. This development must be submitted for review as either a planned unit development or a clustered multi-family project in one of the multiple family residential zoning districts.

b. In addition, the following equations shall apply:

(1) The resulting residential density of the upland property shall be no greater than 10 units per acre.

(2) The total number of units allowed in any development using this density transfer formula shall be equal to or less than the allowed maximum density for the entire parcel as shown on the Future Land Use Map;

(3) Density transferred must be equal to or less than the wetland acreage multiplied by gross density; and

(4) For parcels with wetlands that occupy 50 percent or more of the total site, the gross residential density of the upland property, must be equal to or less than two times the gross residential density of the entire parcel.

c. All performance standards including upland preservation requirements shall apply to all upland development.

d. The increase in net residential density created by density transfer may not create unreasonable impacts or incompatibility with adjacent properties unless such impacts are mitigated to the satisfaction of the Board of County Commissioners.

e. Whenever density transfers are proposed, the provisions in Section 9-4, A.7.b. notwithstanding, the net buildable residential area of all plans shall include a minimum of 50 percent permeable open space. A golf course may account for no more than 60 percent of the required open space.

(Net buildable density is defined as the allowable number of residential units divided by the net buildable upland area; net buildable upland area is defined as the gross land area less all wetlands.)

C. Open Space Requirements

Open space shall be comprised of permeable open surfaces, excluding principle structures and impermeable surfaces. No parking areas shall be included as open area. All residential development shall preserve a minimum of 50% of the gross land area as open space. Wetlands and landlocked water bodies may be used in calculating open space as long as a minimum of 40% of the upland property is comprised of open space.

Golf courses should be encouraged to retain and preserve native vegetation over thirty (30) percent of the total upland area of the course due to their characteristically high water and heavy nutrient loads, and may be used in calculating open space as long as 30% of the residential area is comprised of open space. This section shall not apply to construction of a single-family home on a lot of record.

Non-residential development shall provide a minimum of the following, or as adopted in the Land Development Code, whichever is greater:

1. Fifty (50) percent open space in any areas designated on the Land Use Map for agricultural uses;

2. Forty (40) percent open space in any areas designated on the Land Use Map for commercial office/residential (COR), or institutional use;

3. Thirty (30) percent open space in any areas designated on the Land Use Map for limited commercial and marine waterfront commercial uses, and

4. Twenty (20) percent open space in any areas designated on the Land Use Map for general commercial and industrial.

D. Surface Water Management

All development permits shall be reviewed to assure adequate drainage and flood protection consistent with the Drainage and Storm Water Management Elements of this Plan.

Storm Water Management Criteria. The surface water management criteria of the South Florida Water Management District (S.F.W.M.D., August, 1980, or as may be hereinafter amended) shall be used as a basis for reviewing development of surface water management plans. Surface water management plans shall be submitted by the applicant as part of the site plan review procedure and shall be approved by Martin County Director of Engineering prior to the release of a building permit for any construction including construction incidental to a new or changed use or major expansion. The Director of Engineering may waive the requirement for minor construction including construction incidental to a new or changed use or major expansion. The Director of Engineering may waive the requirement for minor construction projects as shall be defined in departmental operations policy within six (6) months after adoption of this Comprehensive Growth Management Plan. All publications incorporated in the S.F.W.M.D. criteria by reference and herein cited below are to be used in planning and reviewing surface water management plans:

1. Florida State Road Department, Drainage Manual. 2nd Ed., revised 1978.

2. U.S. Department of Agriculture, Soil Conservation Service, Technical Paper No. 149, A method of Estimating Volume and Rate of Runoff in Small Watersheds, 1973.

3. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55, Urban Hydrology for Small Watersheds, 1975.

4. U.S. Department of Agriculture, Soil Conservation Service, NEH-4, National Engineering Handbook, Section 4 Hydrology, 1972.

5. U.S. Department of Agriculture, Soil Conservation Service, Rainfall Frequency Atlas of Alabama, Florida, Georgia and South Carolina for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years, 1973.

6. U.S. Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Duration of 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years, 1961.

7. U.S. Weather Bureau, Technical Paper No. 49, Two-to-Ten Day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States, 1964.

The Martin County Director of Engineering coordinate the review process with the S.F.W.M.D. to prevent unnecessary duplication of effort. The County shall, notwithstanding S.F.W.M.D. policy, exercise County review functions on all projects with less than two (2) acres of impervious surface (S.F.W.M.D. exempts such development from District review).

E. Provision of Adequate Park and Recreation Capital Facilities

1. Land development shall not be permitted unless adequate park and recreation capital facilities exist or are ensured at the Level of Service adopted by the Board of County Commissioners.

2. Land Development shall bear a proportionate share of the cost of the provision of the new or expanded park and recreation capital facilities required by such development.

3. The imposition of impact fees and dedication requirements is a preferred method of regulating land development in order to ensure that it bears a proportionate share of the cost of park and recreation capital facilities necessary to accommodate that development and to promote and protect the public health, safety, and general welfare.

4. Dedication of Lands for Parks and Recreation. All residential development shall provide an equitable dedication of land for public park purposes and/or fees in lieu thereof pursuant to the standards below stated. The standards provided herein are stipulated to implement policies within the parks and recreation element. The standards shall apply to all residential applications for subdivision approval or site plan review. No property shall be assessed twice for respective subdivision plat applications and subsequent site plan applications.

   a. Requirements. As a condition of development, the developer shall dedicate land to Martin County, pay a fee in lieu thereof, or a combination thereof, at the option of the County, for park and recreational purposes at the time and according to the standards and formula to follow in this section.

   b. General Standard. The public interest, convenience, health, welfare and safety require that two (2) acres of public developed community park for each one thousand (1,000) persons residing in the County be devoted for park and recreational purposes. To determine park and recreational land dedication requirement and the mandatory level of service, see Section 7-7, 1,a, Recreation Goal.

   c. Fees in Lieu of Land Dedication. If it is demonstrated by the applicant to the satisfaction of the Board of County Commissioners that no park or recreation facility can be located in whole or part within the proposed development to serve the immediate and future needs of the residents of the development, or if the proposed development is estimated to have an ultimate population resulting in a public recreation demand of less than 5 acres, the developer may, in lieu of dedicating land, pay a fee equal to the fair market value of the land which would have been required to be dedicated as defined in Section 4-5(E)(4).

   d. Use of Fees. The money collected be paid to Martin County and placed in a reserve account within the special taxing district fund. Monies within the reserve account shall be used and expended solely for the acquisition, improvement, expansion or implementation of parks and recreational facilities of the County. The monies and accrued interest from fees paid for any given development shall be used solely for acquisition of parkland or facilities reasonably related to serving said development. The service area shall generally correspond to Planning Areas as illustrated in Figure 4-8.

e. Requirement of Both Land Dedication and Fee. A developer shall both dedicate to Martin County land and pay a fee whenever only a portion of the land calculated by the formula for park and recreational use is to be dedicated, in which case that portion shall be dedicated for park and recreational purposes and a fee shall be paid in lieu of dedicating the remainder of the land that would otherwise have been required to be dedicated. Development approvals requiring dedications of land, capital improvements or equitable contributions of fees, or any combination of the foregoing, shall be granted appropriate credit for said dedications, capital improvements or equitable contributions at the time of the collection of an impact fee. The development regulations shall stipulate the mechanism by which impact fee credits may be granted.

f. Determination of Fair Market Value. Where a fee is required to be paid in lieu of land dedication, the recreation impact fee ordinance shall specify the method for determining the appropriate fee to assure that new development will pay for necessary public park lands.

g. Beach Impact Fee in Connection With Recreational Impact Assessments. The County shall include in the Land Development Code beach impact fees in conjunction with recreation impact fees for all developments. Development approvals requiring dedications of land, capital improvements or equitable contributions of fees, or any combination of the foregoing, shall be granted appropriate credit for said dedications, capital improvements or equitable contributions at the time of the collection of an impact fee. The development regulations shall stipulate the mechanism by which impact fee credits may be granted.

5. Technical Standards for Subdivision and Site Plan Approvals.

a. Technical standards for subdivision and site plan approval shall be consistent with those established for the recreation level of service (LOS) standard in Section 7-7, A,1,a, Objectives for Mandatory Level of Service.

b. By 1990, the County shall establish recreational impact fees for land and facilities. All such fees and credits shall be designed to assure that new growth pays for itself but is not required to pay for existing deficiencies.

F. Transportation Impact Analysis

A transportation impact report shall be required for subdivision and site plan reviews that meet the criteria established in the Traffic Circulation Sub-element, Chapter 5A.

The transportation impact analysis is designed to achieve objectives stipulated in the Transportation Element and is discussed in Appendix 5a-3. The nature and standards of the transportation impact analysis is set forth in the Transportation Element.

G. Available Potable Water

All future applications for new development shall be required to connect to a regional water system as defined in Chapter 11, Potable Water Service Element. The system shall have sufficient allocation of water supply from the South Florida Water Management District.

In rural developments outside the urban service district and in residential subdivisions with minimum lot sizes of 1/2 acre or more, the County Public Health Director and Director of Public Works may approve the use of private wells. In low density residential development, when connection to a regional public utility is not presently feasible, the applicant shall provide an interim water system, approved by the Director of Public Works subject to the following conditions:

1. Assurance in writing from the utility that extension of lines to the development is part of their 10-year expansion plans; and

2. Agreement by the developer that the system will be connected to the regional utility at no cost when service becomes available.

Where a regional system for water service is unavailable, the applicant shall provide an interim water system approved by the Director of Engineering and shall agree that the system will be connected to a regional utility at no cost to the County when service becomes available. The water source, supply and system design shall satisfy performance standards of the South Florida Water Management District, the DER, other applicable regional, state or federal standards, or standards which may hereafter be adopted by the Board of County Commissioners. However, where a well is required to be permitted by the South Florida Water Management District, (SFWMD) the permit granted by the SFWMD shall be filed by the applicant with the County which may exercise its power to monitor withdrawal rates to assure applicants adhere to established regulations protecting surrounding wellfields. Furthermore, in order to prevent abuse of County water resources, the installation and operation of wells not covered by the South Florida Water Management District regulations shall be subject to County permitting and monitoring regulations using standards which may hereafter be adopted by the Board of County Commissioners.

The intent of this permitting procedure is:

1. To maintain a comprehensive data base concerning water supply and quality;

2. To discourage unregulated proliferation of private water systems; and

3. To achieve a subsystem design which can be effectively and economically integrated into a regional public utility system certified and regulated by the Public Service Commission or by Martin County at a later point in time and to encourage a compact urban development pattern by managing the location, timing and scale of land development to assure that new development can be efficiently served by public facilities without adversely impacting the County's fiscal capacity.

In addition, the County shall undertake any necessary action to prevent or remedy water supply and water quality problems.

The County may require analysis of water quality and supply of all permitted private wells based on evolving problems and issues associated with water resources. The private well owner may be assessed by the County after due public hearings for needed water quality, supply problems, requisite testing, laboratory analysis, and improvements deemed necessary and fiscally equitable.

H. Wastewater Service

All applicants for development within the urban service district shall be required to connect to a regional utility as defined in the Sanitary Sewer Service Element, Chapter 10. Where a regional system for wastewater service is unavailable, the applicant shall provide an interim wastewater system approved by the Director of Public Works and shall agree that the system will be connected to a major regional at no cost when service becomes available.

The intent of this provision is:

1. To discourage unregulated proliferation of private package treatment plants;

2. To achieve a subsystem design which can be effectively and economically integrated into a regional wastewater system at a future point in time which would be certified and regulated by the Public Service Commission or by Martin County; and

3. To encourage a compact urban development pattern by managing the location, timing, and scale of land development to assure that new development can be efficiently served by public facilities without adversely impacting the County's fiscal capacity.

The system shall be designed to satisfy performance standards of the Department of Environmental Regulation (DER), other applicable regional, state, or federal standards, or standards which shall be hereafter adopted as part of the Land Development Code. The standards in the Land Development Code shall address such issues as demonstration of need, service area, system design and specification, required easements, maintenance and operation considerations, screening, security, right of entry provision, future dedication to a regional public utility when deemed appropriate, and notice and procedure.

1. Notwithstanding any other provisions of this Plan, when a septic tank is the only means of individual sewage disposal, the following standards shall apply to residential development:

    a. Each septic tank shall be located on a lot.

    b. Each lot shall have a usable minimum area of one-half acre per unit when the development is serviced by a private well.

    c. Each lot shall have a usable minimum area of one-third acre per unit when the development is serviced by a public water system.

2. The above subsection 1 shall not apply to a lot of record (as described in Section 4-5 (A)) in the following instances:

a. Construction of a single family dwelling in accordance with the other applicable provisions of this Plan and the Code of Laws and Ordinances.

b. Construction of a duplex when the lot of record includes at least one-half acre and will be serviced by a major or interim water supply system and in accordance with the other applicable provisions of this Plan and the Code of Laws and Ordinances.

c. Construction of a duplex when the following criteria are met:

(1) The duplex will be serviced by public water.

(2) The duplex is located in a subdivision, or all that portion of a subdivision, which is zoned for duplex use and is designated for medium density or high density use on the future land use map of the Comprehensive Plan; and which was three-fourth (3/4) developed in duplex use on the effective date of the Comprehensive Growth Management Plan.

(3) Public sewage treatment service is not available within 1000 feet of the subject duplex lot.

(4) An agreement is executed with the County to connect to a public sewage treatment service within one year from the date the service is available to the duplex.

(5) The Health Department reviews the request and finds that all requirements for septic systems are met without any need for State of Florida variance.

(6) The duplex is located in an area where the Health Department has determined that groundwater or surface water contamination or a high failure rate for septic systems does not exist.

The intent of this subsection is to permit infilling of duplex units in existing duplex subdivisions where most of the lots are occupied by duplex units.

3. The above subsection 1 shall not apply to remodeling, rebuilding or reconstruction.

4. The above subsection 1 shall not apply to replacement or repair of septic tanks.

5. This section shall not be interpreted to deny the use of individual sewage disposal systems other than septic tanks when provided for in the Code of Laws and Ordinances.

6. Development shall not be approved pursuant to this Section unless the Martin County Health Department has approved the septic tank or other individual wastewater treatment system based on soil conditions and all rules of the Florida Department of Health and Rehabilitative Services.

7. For purposes of this section, the term "unit" shall mean one single family dwelling, one-half of a duplex, one-third of a triplex and one-fourth of a quadraplex.

8. When a regional wastewater system is not available, non-residential uses generating less than 2,000 gpd per establishment shall be allowed to use septic tanks except when uses are judged by the Health Department to constitute a high expected failure level.

I. Soil Erosion and Sedimentation Control

The Land Development Code shall address methods of controlling soil erosion and sedimentation.

Technical Standards. In order to prevent both soil erosion and sedimentation, a soil erosion and sedimentation control plan shall be required as a part of an application for site plan review whenever a development shall involve any clearing, grading, transporting, or other form of disturbing land by the movement of earth, including the mining of minerals, sand and gravel.

All measures necessary to minimize soil erosion and to control sedimentation in the disturbed land area shall be implemented. The following protection shall be provided for all disturbed areas: minimize velocities of water runoff, and retain sedimentation within the development site as early as possible following disturbances.

J. Parking, Internal Circulation, and Access to Public or Private Streets

Driveways and areas for the parking and internal circulation of vehicles shall be located, designed and controlled so as to provide for safe and convenient circulation within the site and safe and convenient access from adjoining streets.

Technical Standards. Parking requirements of the Zoning Ordinance shall be applied for calculating required off-street parking. Among factors to be considered shall be the number and location of access drives from adjacent streets, the location and width of driveways and access aisles to parking spaces, the arrangement of parking areas and means of access to building for fire-fighting apparatus and other emergency vehicles. All non-residential development and all residential development, except for single-family homes, shall be required to provide adequate off-site parking and facilities for on-site back-up and turn-around movements.

Parking areas and driveways shall be clearly identified and separated from principal pedestrian routes and recreation areas by curbs, pavement markings, planting areas, fences or similar features designed to promote pedestrian safety.

K. Appearance and Nuisances

Subdivision and site plan reviews shall assure that nuisance impacts of sight, sound, and smell shall be minimized. No standards on appearance shall be enforced unless adopted as part of the Land Development Code.

Technical Standards.

1. Screening and Mechanical Equipment. Mechanical equipment or other utility hardware other than antennas and stacks on roofs shall be harmonious with the building or they shall be located and/or screened so as not to be visible from any public way within the impacted area, except within industrial districts. Utilities in or adjacent to residential areas shall be designed in a manner which minimizes nuisance impacts, such as noise and odor, and shall be landscaped and screened in order to minimize adverse visual impacts and enhance their general appearance and to preserve the stability and integrity of adjacent residential areas.

2. Maintenance of Activities within Enclosed Building. All businesses, services or manufacturing or processing shall be conducted within completely enclosed buildings in all zoning districts excepting industrial districts. If the Planning and Zoning Commission determines that a demonstrated necessity exists for outside storage or display due to the impracticality and unreasonableness of enclosure requirements, in which case service, storage, display areas or yard shall be screened to the greatest reasonable and practical extent.

3. Exterior Lighting. Exterior lighting shall be so arranged as to shield or deflect the light from adjoining properties and public streets.

L. Fire Service and Height of Structures

The height of structures is regulated pursuant to the Martin County Zoning Code. In addition to the zoning policy, and consistent with the objectives and policies for fire service contained in this Plan, no application for a structure with habitable floor space over two stories or twenty-five feet (whichever is lesser) shall be permitted unless the Board of County Commissioners and the applicant has provided assurance of the availability of a fire company equipped to service the structure together with an available water supply which satisfies fire flow requirements of the National Fire Prevention Association Code adopted or as may hereinafter be amended.

SECTION 4-6. IMPLEMENTATION STRATEGIES

The implementation of the Martin County Comprehensive Growth Management Plan (GMP) must be an integrated, coordinated and dynamic program. The need to amend such development regulations as the Land Development Code (zoning regulations), subdivision and platting regulations, landscape code and environmental regulations, while providing for the creation of the concurrency management system shall establish the priority work program of the Board of County Commissioners, Local Planning Agency, County Administrator and the Growth Management Department.

Subsequent to the adoption of implementing regulations the County shall establish a formal Evaluation and Appraisal Report (EAR) beginning with the fifth (5) year after adoption of the Plan. Less formal but no less systematic written critiques of the Plan implementation shall be reported by the Growth Management Department to the Local Planning Agency at least every two and one half (2.5) year after the

10.3.5 EXCERPTS FROM THE MARTIN COUNTY COMPREHENSIVE GROWTH MANAGEMENT PLAN PERTAINING TO:

- **SECTION 4-6: IMPLEMENTATION STRATEGIES**

Technical Standards.

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Plan Adoption. In both instances, implementation of the Comprehensive Growth Management Plan goals shall be evaluated against the established, objectives, policies, measures and thresholds established in each of the Plan Elements. Each operating Department responsible for the particular Element shall file a written report in a form established by the Growth Management Department to detail the efforts underway to implement the Comprehensive Growth Management Plan.

The continuing Evaluation, process established in Section 1-8 shall be used to establish the success of the County in providing for the development standards established for public and private land use activities established in this section. At a minimum evaluation of the Comprehensive Growth Management Plan shall be based on the following implementation strategies for each land use activity.

A. Strategies for Residential Development

1. Plan and Design for Residential Quality. Sufficient space provided for residential development and required community facilities to adequately meet the housing needs of the present and expected future population of the County shall be measured in accordance with Section 4-4, I.

   (Residential Land Use) and Section 4-4, D (Eliminate Inconsistent Uses). Residential development shall be planned and designed to create and perpetuate stable living areas and protect investments in land and land improvements. Part II, Data, Inventory and Analysis, Comprehensive Growth Management Plan presents supportive statistical analysis of population, land use and housing which shall be updated annually as part of the Concurrency Management and Capital Improvement System of CIE Plan Element, Chapter 14.

2. Protect Residential Areas from Encroachment by Incompatible Development. Existing and future residential areas shall be protected from encroachment by commercial or industrial development or other non-residential uses which exhibit characteristics which would be incompatible with residential development. This objective does not preclude necessary community facilities and compatible uses established in planned communities from locating within residential areas when such activities satisfy established zoning criteria. Non-residential land uses other than community facilities, houses of worship, and certain not-for-profit public or quasi public institutions or clubs shall be expressly excluded from exclusively residential areas, except as provided for in the Land Development Code. No commercial land uses shall be permitted in residential areas delineated on the Land Use Map unless such uses are approved by the County as a home occupation or approved as an incidental commercial use which is supportive to residential units located within a Residential Planned Unit Development pursuant to the Martin County Code of Laws and Ordinances. No industrial use may be permitted within any exclusively residential areas as denoted on the Land Use Map. The elimination of inconsistent uses shall follow the provisions established in Section 4-4, D.

Any non-residential use proposed as part of a Residential Planned Unit Development is to be designed principally to support and shall be incidental to the residential units contained within the subject Residential Planned Unit Development. No land area used for commercial, industrial, other non-residential purposes including parking, access ways, open space, or utilities principally supporting the non-residential development shall be used in calculating residential density. The maximum size of the non-residential use shall be determined by a formula as provided in the Land Development Code.

This formula may be adjusted by the Board of County Commissioners upon an acceptable demonstration by the applicant that a larger non-residential allocation is a necessary convenience for a larger market area. Such demonstration by the applicant shall include a market feasibility report which shall analyze: 1) all existing competing commercial facilities within a six (6) mile radius of the site, including delineation of estimated market areas and projected number of users assigned to each respective primary and secondary market area; 2) impacts of the proposed commercial facility on land resources designated on the Future Land Use map for future non-residential development and 3) impact of the proposed non-residential development on the quality and character of existing and anticipated future residential development within the neighborhood, including traffic impacts. The Planning and Zoning Commission shall recommend to the Board of County Commissioners whether the demonstrated need exists for additional non-residential area beyond the maximum allowable gross leasable floor area (as determined in the Land Development Code) after reviewing the applicant's plan and supportive market feasibility report. The Board of County Commissioners shall make the final determination as to whether a net beneficial public use is served by the proposal.

3. Promote Mixed Use Development. The Board of County Commissioners shall establish by way of the Traditional Neighborhood District (TND) Goal (Section 4-4, C) mechanisms for mixed use development to encourage diversification for neighborhood development, provide for natural and historic resource protection (Section 4-4, E and F), encourage urban mixed use development in urban areas (Section 4-4, G) and energy efficiency (Section 4-4, H). The measure of success of the Traditional Neighborhood District will revolve around the integration of neighborhood plan to the development of the whole community. The County shall endeavor to assist in the planning for such neighborhoods with both capital facilities and physical planning to support neighborhood development as provided by Section 4-4(C).

4. Promote Orderly Land Use Transitions. Where it is physically not feasible to separate residential from non-residential land uses, buffering shall be required to promote a smooth land use transition. Buffering may take the form of: 1) physical barriers, such as berms, hedges or other landscape cover; walls or fences aesthetically designed for screening purposes; or, indigenous densely vegetated open space; or 2) the development of a transitional use between the incompatible uses (such as low intensity office development between general retail commercial centers and residential areas). Development regulations are to be established to provide for transition performance standards as provided in Section 4-5(A).

5. Promote Orderly Transition in Residential Densities. Highest residential densities generally continue to be allocated to sites highly accessible to major urban thoroughfares or urban collector streets and adjacent to existing development with the same or higher density or less restrictive zoning districts. Residential densities are to be allocated in manner compatible with available public services, natural features of land and existing and anticipated future development. Existing residential development, particularly single-family residential subdivisions shall be protected from negative impacts of new development proposals as specified in Sections 4-3, D (Policies for Allocating Residential Development) and Section 4-4, I, 4, Policy for orderly transition of land use intensity in the Residential Land Use Goal.

6. Reinforce and Enhance Appearance of Residential Areas and Provide Amenities. Scenic vistas, especially along the ocean; the intracoastal waterway; St. Lucie River; Loxahatchee River; Indian River, Savannas; and along major transportation corridors shall be enhanced by preservation of open space, by installation and maintenance of landscape and by application of community appearance criteria which reinforces good principles of design as noted in Section 4-4(E).

B. Strategies for Commercial Development

1. General Considerations in Locating Commercial Development. Commercial development, comprised of a wide range of business activities in Section 4-3(E), is to be allocated land resources considering the locational and space requirements of commercial activities and potential fiscal and environmental impacts to Martin County. The location and distribution of specific types of commercial activities shall be determined based on the following considerations:

   a. Trip generation characteristics, impact on existing and planned transportation facilities and ability to achieve a functional internal circulation and landscaped off-street parking system;

   b. Location and site requirements based on specific needs of respective commercial activities, their market area, anticipated employment generation and floor area requirements;

   c. Compatibility with and impact on other surrounding commercial activities;

   d. Relationship to surrounding land uses and natural systems;

   e. Impact on existing and planned community services and utilities.

2. General Pattern of Commercial Land Use. In order to promote efficient flow of traffic along thoroughfares, achieve orderly development and minimize adverse impact on residential quality, commercial development is concentrated in strategically located areas having location characteristics which best accommodate specific land area, site, public facilities and market location requirements of respective commercial uses. Sites that comply with these locational criteria and strategies may be considered for commercial designation in addition to the existing sites illustrated in Section 4-3. E, Future Land Use Map.

However, proliferation of strip commercial development shall not be extended. The existence of commercial areas on one corner of an intersection shall not dictate the development of all corners with the same or similar use; nor does the existence of commercial development on a major thoroughfare dictate that all frontage must be similarly used.

3. <u>Encourage Improved Design of the Commercial Core Areas which Serve as the Focal Point of Major Unincorporated Communities in the County.</u> Commercial development is to be used as a focal point to promote the improved design of the central commercial core areas within the communities of Jensen Beach, Palm city, Port Salerno, Hobe Sound and Indiantown. Improvements in the physical design of these centers shall reinforce and improve their role as community centers of office and institutional activity, retail trade, and civic and cultural enrichment. Design strategies shall provide for innovative themes and approaches to designs that are consistent with the purpose and unique character of these areas. Development shall accommodate and encourage pedestrian circulation while vehicular traffic flow and parking shall be designed to reinforce and improve pedestrian mobility.

4. <u>Provide for the Various Commercial Uses.</u> The implementation of policies for the variety of commercial uses specified in Section 4-3(E), shall be assured through the development regulations that provide for the unique needs supporting each of the zoning districts, of the Land Development Code. Martin County shall evaluate the success of these policies and the Goal in Section 4-4(J) regularly.

C. <u>Strategies for Industrial Development</u>

1. <u>General Considerations in Locating Industrial Development.</u> Sufficient land shall be allocated to accommodate industrial development. The allocation of land resources for industrial development shall reflect the location and space requirements of industrial activities and potential fiscal and environment impacts on Martin County. The location and distribution of specific types of industrial activities shall be determined based on the following consideration:

   a. Trip generation characteristics and impact on existing and planned transportation systems, including dependency on rail, air, or trucking for distribution of materials and goods;

   b. Anticipated employment generation, floor area requirements, and market area;

   c. Ability to meet established performance standards for preventing or minimizing nuisance impacts, such as emission of air pollutants, glare, noise or odor;

   d. Impact on established or planned development and natural systems; and

   e. Impact on existing and planned public services, utilities, water resources, and energy resources.

   f. Ability to connect to a regional water and wastewater treatment system.

2. Policies for Allocating Industrial Development. The Land Use map policies in Section 4-3(F) allocates land resources for existing and anticipated future industrial development needs. The allocation process provides a high priority to industries frequent need for strategically located lands accessible to rail facilities, major arterials or interchanges, labor markets, and the requisite urban services planned for Urban Development Areas (Figure 4-7).

3. Pursue Selective Industrial Expansion Policy. Martin County shall pursue a strategy of selective expansion of its industrial base and diversification of the employment opportunities as established in Chapter 15, the Economic Element. Examples of such economic opportunities include but are not limited to:

    a. Generating high levels of employment with higher than average wage and salaries, and relative independence from cyclical changes in economy;

    b. Producing services and/or products which complement the needs and resources of existing industry within Martin County;

    c. Providing basic industry which is likely to serve as a desirable priming action for attracting additional industry compatible with the County's economic goals and objectives as well as the County's growth management and resource conservation policies;

    d. Contributing a net revenue to the Martin County government and thus enhancing the fiscal capacity of the County; and

    e. Conserving the County's natural resource and public facilities by generating minimal adverse impacts on either groundwater or potable water resources, the transportation system, solid waste system or other costly impacts to either natural resources or community facilities.

4. Prevent Nuisance Impacts of Industry. The County shall prevent nuisance impacts frequently associated with industrial activities by incorporating performance standards for managing emission of noise, air pollutants, odor, vibration, fire or explosive hazard, and glare into the Land Development Code. Similarly, land shall be allocated to industrial uses in a manner which allows for separation and co-location of industrial activities capable of complying with the most restrictive performance standards and exhibiting minimal adverse impacts on surrounding development.

5. Evaluation of Industrial Lands. Lands allocated for Industrial Use by the Future Land Use Maps (Section 4-3) shall be evaluated periodically to assure their utility for said use and the potential for expansion to meet the future demands.

D. Strategies for Urban and Rural Supportive Facilities and Services and Fiscal Capacity

1. Achieve and Maintain and Efficient System of Urban and Rural Facilities and Services. Martin County shall assure the equitable provision of facilities and services required to support urban and rural development. Deficiencies in necessary supportive facilities and service for urban and rural development shall be satisfied through equitable fiscal contributions prior to issuing permits for such development. Support facilities for urban services shall be assured by the implementation of Section 4-4(G), Encourage Urban Development in Urban Service Areas. Similarly, areas of rural development as defined by the Urban Services District Boundary Map, Figure 4-7, shall be encouraged for rural services provided. Allowances for Housing Service Zones in the Housing Element, Section 6-4, A, 4, c, shall assure that the full complement of urban facilities and services is assured prior to any change to the Urban Service District Map.

2. Manage the Location, Timing, Intensity and Design of Future Urban and Rural Development. Martin County shall closely coordinate the location, timing, intensity and design of future development. Development permits shall be only after the owner/applicant has provided plans and requisite assurances that all requirements for road improvements, potable water service, wastewater disposal, drainage, recreation areas, schools and protective services shall be satisfied prior to the issuance of a development order as provided in the Capital Improvement Element, Chapter 14.

   The Martin County Board of County Commissioners shall, in accordance with Section 1-9 of the Comprehensive Growth Management Plan, review each element every five (5) years. The evaluation shall include analysis of evolving trends in land development on the outer fringe of urban areas, depicted on the Urban Services Boundary Map, Figure 4-7.

3. Concentrate Urban Development within Strategically Located Urban Centers. Urban development shall be restricted to the primary and secondary urban service districts delineated in Figure 4-7. The Primary Urban Service District includes areas located within the planned expansion area of public and private utilities certified and regulated by the Public Service Commission or by Martin County. Urban Development shall be defined as commercial, office or industrial as well as residential development exceeding a density of one-half unit per gross acre. The Local Planning Agency and the Board of County Commissioners may consider a waiver of this requirement if the location and use proposed is demonstrated by the applicant to: 1) generate a net beneficial public purpose; 2) be necessary due to the unique location and supportive service requirements of the use; 3) meet all Plan policies with regard to cost-efficient provision of necessary urban services, LOS standards, and funding of needed capital improvements; 4) provide a net beneficial fiscal contribution to the short and long term fiscal capacity of the County; and 5) generate no significant negative impacts to the growth management and resource conservation policies of Martin County. Housing Service Zones per Section 6-4, A, 4, c, of the Housing Element could be an important component of criteria number 1 and would have to meet criteria number 4 above only to the maximum extent feasible. Large industrial areas removed from central urban service districts shall be contained within individual urban service districts which supply all applicable urban services such as fire, water, sewer, and emergency services.

4. Development Outside the Urban Services District Shall be Restricted to Low Intensive Development in order to Promote Cost-Effective Practices in the Delivery of Public Services. Outside Urban Service Districts development options shall be restricted to low intensity uses including agriculture and agricultural ranchettes, not exceeding one unit per five (5) gross acres, and small scale service establishments necessary to support rural and agricultural uses as provided by Section 6-4, A, 5, c, Housing Service Zones in the Housing Element.

5. Congregate Housing for Agricultural Farm Workers as a Conditional Use Outside the Urban Services District. Special conditional use permits granted for development of congregate housing for families employed on productive farms, having a minimum of sixty (60) acres shall be deemed consistent with the above stated paragraph. However, the granting of such permit must be approved by the Board of County Commissioners after review by the Planning and Zoning Commission. Prior to the granting of such permit the Board of County Commissioners shall find that applicant provides legal assurances that:

    a. The congregate housing and the land on which the housing is located shall be under common ownership with a contiguous producing farm;

    b. The housing shall be inhabited solely by families who work on the farm, and the facilities shall satisfy the Southern Building Code and the County's Housing Code.

    c. The County Commission may require removal of such facilities if after due process such facilities are found to be unsafe, unsanitary, or inconsistent with the adopted code, standards and/or regulations of Martin County.

    d. The development plan shall satisfy all requirements of the Martin County Code of Laws and Ordinances.

6. Provisions of Adequate Capital Facilities. Land development shall not be permitted unless adequate capital facilities exist or are ensured at the Level of Service adopted by the Board of County Commissioners. Prior to granting a development approval, Martin County shall assure that adequate capital facilities and public services are available to support the new development as specified in the Concurrency Management System provided in Chapter 14, the Capital Improvement Element. Land development shall bear a full share of the cost of the provision of the new or expanded capital facilities required by such development. The imposition of impact fees and dedication requirements is a preferred method of regulating land development in order to ensure that it bears a proportionate share of the cost of capital facilities necessary to accommodate that development and to promote and protect the public health, safety, and general welfare. Development approvals requiring dedications of land, capital improvements or equitable contributions of fees, or any combination of the foregoing, shall be granted appropriate credit for said dedications, capital improvements or equitable contributions at the time of the collection of an impact fee.

E. Strategies for Agricultural Land Resources Preservation

1. Provide Land and Water Management Policies that Encourage Agricultural Productivity on the County's Most Productive Farmlands. Martin County strongly urges the preservation of agricultural lands within the County, realizing that these resources are valuable due to soil attributes and local climatic conditions which render the land especially productive for agriculture and silviculture. The Future Land Use Map denotes agricultural farmlands within Martin County. The agricultural lands shall be encouraged to remain in productive use through implementation of incentives addressed in Section 4-4, C. In addition, land and water management policies, including the Land Use Map, strategies for locating and timing public and private improvements, subdivision controls and other relevant land use controls shall be directed to preserving the agrarian character of the agricultural lands, especially those outside the Urban Service District Boundaries, Figure 4-5.

2. Monitor and Evaluate Best Management Practices and New Innovations Preserving Agricultural Farmlands While Protecting Private Property Rights of the Farmer. Martin County shall continue to preserve agricultural lands by restricting urban service expansion to areas centrally located to urban cores. While attaining economy and fiscal conservancy in the delivery of public services, this policy will provide maximum protection to the farmer from encroachment by urban uses. In addition, the special housing policy stated in Section 4-6 (D)(5) shall permit necessary flexibility in land management policies to assure adequate on-site housing for large farm owners requiring such facilities. As additional issues unfold, the County shall continue to apply innovative concepts to reconcile the need for agricultural land preservation and the need to protect and preserve the farmers' property rights.

10.3.6 EXCERPTS FROM THE OKEECHOBEE COUNTY COMPREHENSIVE PLAN, 1980, PERTAINING TO:

- **LAND USE ELEMENT**

Woodlands and Vacant Land

This category accounts for 8.03% of the land area of the county. Nearly 1,000 acres of the vacant land is considered to be barren land. That is land that is unusable for any purpose. This land is best left in its present state.

There are no rare species of woodland or much timber that is marketable. To the extent possible the woodlands within the county should be left untouched for aesthetic reasons. They provide habitat for wildlife as well as active and passive recreation areas.

LAND USE OBJECTIVES AND POLICIES

The purpose of a Future Land Use Plan is to guide the county's future development. To give direction to this plan basic objectives need be established. Policies giving direction to the attainment of the objectives also need to be established. The 1974 plan contains such objectives and policies. For the most part these are still valid. Those which are still valid are listed below and objectives and policies necessary to alter undesirable growth or to encourage desirable development have been added.

OBJECTIVE 1

Increase employment opportunities within the County by encouraging new industrial and commercial development.

POLICY

Encourage commercial, residential, industrial and recreational facilities development within Okeechobee County.

EFFECT

Industrial and commercial location within the County can provide jobs for County residents, add to the tax base, encourage housing rehabilitation and construction, and add to general economic well being. Industry can also pollute the environment, over tax existing circulation and refuse disposal systems and deplete natural resources

OBJECTIVE 2

Restrict development to those areas that are ecologically, physically, and economically best situated to provide for a visually pleasing as well as a safe and healthy environment.

POLICY

Update subdivision, zoning and building codes and ordinances as well as other legislation to properly guide the type and placement of development.

EFFECT

Damage to the environment can be avoided, optimum use of circulation facilities, natural resources and suitable land can be achieved. Developments must be required to be made safe and hazard-free as well as attractive and substantial.

OBJECTIVE 3

Increase the amount of commercial services and facilities within the County.

POLICY

Encourage local retailers and businesses to remain within the County and to expand their facilities. Encourage new commercial enterprise to establish themselves within the County in general.

EFFECT

Expanding existing commercial facilities and establishing new business in the community will provide additional jobs thus additional income for the County and its residents. This objective will also permit a greater percentage of the County residents' income to be spent and kept in the County as well as providing the opportunity for tourists, travelers and non-residents to add to the County's economy through their expenditures within the County. Increased commercial facilities and services should also help attract additional residential, recreational and industrial development while providing more convenient and extensive services for existing residents.

OBJECTIVE 4

Encourage intensive development in areas which are proposed for sanitary sewer and water services.

POLICY

Accept the recently adopted 201 Facilities Plan as a guideline for highest density residential and intensive commercial and industrial development.

EFFECT

By concentrating development in areas where vital utility services are proposed, the cost of these services will be considerably lower than if scattered development continues as it has in the past.

OBJECTIVE 5

Discourage development in floodplains and other environmentally sensitive areas.

POLICY

Any new development in floodplains and sensitive areas must adhere to all Federal and State regulations.

EFFECT

Flood damage will be minimized and polluting effects on both ground and surface water will be eliminated or greatly reduced.

The above general objectives and policies will be given greater detail in the following Future Land Use Plan. As development occurs in the County, the objectives and policies must be constantly reevaluated to determine if they are giving County growth and development proper direction. They should be reconsidered in light of development patterns taking place, effects on natural and human resources, ecological factors and the physical, social and economic environment being produced. It is mandated by Florida Statutes that this reconsideration should take place at the end of five year periods. Modifications and adjustments should be made to the objectives and policies as needed.

FUTURE LAND USE PLAN

This element presents County land use policies in visual as well as verbal terms in order to provide direction to future public and private land development. The Future Land Use Plan is basically represented by Exhibit 1, Future Land Use Map, and by specific policies that expand upon the general objectives and policies previously outlined.

Most of the tracts of land in the County are undeveloped. These tracts should be developed in a progressive manner or left in a natural state as indicated on Exhibit 1. Based upon the population forecasts for 2,000 which predict a continuing increase in population, the emphasis on changes in land use must be placed on providing land for possible residential, industrial and commercial development and at the same time preserve agriculture. Land must also be made available for upgrading community facilities and services for the present and future residents of the County. To implement the Future Land Use Plan, the following specific policies are recommended.

THE DEVELOPMENT OF RESIDENTIAL LAND USE SHOULD BE ENCOURAGED IN CERTAIN AREAS OF THE COUNTY.

The use of land for agricultural-rural residential purposes constitutes the largest area of the County. The present trends forecast that there will be a further increase in the agricultural use of land accompanied by an increase in homes located in the agricultural areas. This trend needs to be modified to concentrate residential development in the areas indicated on the Future Land Use Plan Map. Many of the needed services such as fire, police, sanitary sewer, schools and recreation can then be offered to the residents at an economically feasible level. Also, the best agricultural lands will be available for continued agricultural uses. On the Land Use Plan Map, low density residential land use (no more than (4) dwelling units per gross acre) is designated for large areas where the topography, ecology and existing and potential services may easily and economically be provided for the residents. Within these areas, future residential uses should be harmoniously arranged within neighborhood units, and high standards of development should be strongly encouraged for these future residential neighborhoods. Further development of these areas, grouped around the County's presently developed areas would strengthen existing commercial and other specialized activities found in these core areas and provide incentive for additional development.

The clustering of residential uses makes the provision of community utilities more economical. This will also allow for better utilization of existing or proposed community facilities, such as schools and playgrounds. This proposed future pattern of growth is a logical continuation of a presently desirable development trend.

The Future Land Use Plan Map also shows areas for medium density residential (no more than eight (8) dwelling units per gross acre). It is proposed that these areas shown as medium density be developed for residential and supporting service commercial development. Possible development might include condominium houses and recreational service development. Because of the nature of the soils and topography, it will be extremely important that proper development controls be enforced.

DEVELOPMENT WHICH CAN OCCUR ON THE FLOOD PRONE AREAS IN THE COUNTY WHERE UNSUITABLE SOILS EXIST SHOULD BE LIMITED.

The classification of land as flood prone is designated as such because of the susceptibility to and the danger of flooding. The erection of permanent dwellings should be prohibited but temporary recreational residences might be permitted. These restrictions are intended to prevent damage to permanent structures as well as to create open-space compatible with natural features. A basic purpose of the Future Land Use Plan is to use foresight in the arrangement of land uses. The creation of flood plains provides the individual property owners in the County protection against natural phenomenon which are incompatible with their property. The Future Land Use Map shows the areas of the County that have soils with very severe development constraints and that are subject to flooding. These areas are proposed on the Exhibit 8 as "conservation and recreational" lands. Some areas indicated for this category are presently developed.

FURTHER DEVELOPMENT OF COMMERCIAL AREAS SHOULD BE ENCOURAGED WITHIN THE COUNTY.

The location of existing commercial land uses in Okeechobee County should remain essentially the same as today. It is proposed that they be intensified and regulated to reinforce a more harmonious development pattern. The future land use plan indicates an increase in the acreage devoted to commercial land use. This is necessary to more adequately service the needs and desires of the inhabitants of the existing and future residential areas. As these commercial areas develop, the residents can be expected to spend more of their disposable income at commercial enterprises within the County rather than traveling to other areas.

Commercial development should be controlled and guided to minimize adverse influences on adjacent roads or land values. Activities such as gas stations, restaurants, motels, and other highway and tourist-oriented commercial enterprises, usually develop along major highway routes. These activities should be encouraged to locate in appropriate areas such as adjacent to small communities and to recreation areas. Such commercial development should be concentrated in clusters. This would avoid many ingress and egress points as well as preserve the integrity of the County's highways.

Expanded commercial usage is essential to the County's overall economy and would help strengthen the County's tax base.

ENCOURAGE THE DEVELOPMENT OF INDUSTRY AT SPECIFIC LOCATIONS IN THE COUNTY.

Industrial development should be encouraged in areas where adequate transportation is available. Such development should be directed to areas already zoned for industry.

The development of industry in the County will help strengthen the tax base as well as improve the overall economy.

THE COUNTY SHOULD DESIGNATE THE LOCATION OF FUTURE COMMUNITY FACILITIES AND SERVICES SO THE NECESSARY LAND CAN BE OBTAINED.

The land used for community facilities and services will necessarily increase with the population. Much of this land is non-revenue producing, but it is needed to increase services to the residents of the County.

THE COUNTY SHOULD OFFER SUPPORT FOR THE DEVELOPMENT OF MAJOR RECREATION FACILITIES IN THE COUNTY.

Since Okeechobee County has very little land in recreational use other than that surrounding its schools, it is recommended that the County establish or support the State in establishing sizeable areas for regional recreation activities. It is suggested that such acreage could be created in a manner as to help control or minimize damage from flooding along Lake Okeechobee.

The private sector of the County's economy should be encouraged to participate in the development of various forms of recreation and open-space consisting of the flood plains which can be developed for recreation purposes. As urban growth continues, there will be an increasing demand for recreational areas in less developed sections. Okeechobee County is in a favorable position being located in a rapidly growing region with the opportunity to create an expanded recreational industry serving the needs of the urban population outside the County. The County must plan for such expansion and reserve the land which is necessary for new facilities.

Exhibit 1, Future Land Use Plan portrays the land use objectives and policies in graphic terms. This plan is schematic in that it gives only generalized locations. It should be utilized to provide a basis for an updated zoning map. As needs and community desires change, the Future Land Use Plan should be reviewed and if need be revised.

In keeping with the 201 Facilities Plan, the Future Land Use Plan indicates areas for medium density residential, commercial, and industrial uses within those areas proposed to be sewered by the year 2000. The one exception to this is the location of low density residential reas north and east of the airport. These areas are to be sewered. However, because of the close proximity to the airport and considering the flight patterns, these areas should be developed at a lower density to reduce hazards and noise problems.

Low density residential development, in addition to the areas mentioned above, are shown adjacent to and near areas which are scheduled for sanitary sewers. These locations are on lands which should be capable of accommodating on-lot systems. Low density development is also shown in outlying rural areas. These are extensions of existing developing patterns.

Within the area intended for intense development are areas shown for conservation/ recreation. These are areas which should be held for development after the proposed sewered areas are fully developed. Within these areas, the soils are not capable of accommodating on-lot sewerage systems. Therefore, they should not be developed until public sewer can be provided.

Conservation areas are also shown for the most critical floodplains and sensitive head waters areas. These are further discussed in the conservation element.

10.4 EXISTING STATE PERMITS

There are no existing state permits.