BIOLOGICAL ASSESSMENT OF EFFECTS ON THREATENED AND ENDANGERED SPECIES CHANNEL ENERGY CENTER UPGRADE

PREPARED FOR

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EXECUTIVE SUMMARY

Pursuant to the Clean Air Act (CAA), Channel Energy Center LLC is seeking a Greenhouse Gas permit under the Environmental Protection Agency's (EPA) Tailoring Rule authorizing an additional 180 megawatt natural-gas-fired combined-cycle cogeneration unit at the existing location, located on State Highway 225, approximately two miles east of Interstate Highway 610 in Houston, Harris County, Texas. The new cogeneration unit would be similar to the two existing cogeneration units currently in operation at the site. Channel Energy Center LLC expects that an 18-month construction phase could take place from late 2012 to 2014.

This Biological Assessment (BA) provides the results of an assessment of the potential impacts of the proposed project on species that are protected under the Endangered Species Act. The table below summarizes the effect determinations for each federally listed species.

Anticipated Effects on Federally Listed Species of Potential Occurrence in the Action Area

Federally Listed Species	Agency That Listed Species "Of Potential Occurrence"	Recommended Determination of Effect
Smalltooth Sawfish	TPWD/NMFS	No effect
Houston Toad	TPWD	May affect, but is not likely to adversely affect
Green Sea Turtle	TPWD/NMFS	May affect, but is not likely to adversely affect
Kemp's Ridley Sea Turtle	TPWD/NMFS	May affect, but is not likely to adversely affect
Leatherback Sea Turtle	TPWD/NMFS	May affect, but is not likely to adversely affect
Loggerhead Sea Turtle	TPWD/NMFS	May affect, but is not likely to adversely affect
Red-cockaded Woodpecker	TPWD	No effect
Whooping Crane	TPWD	No effect
Louisiana Black Bear	TPWD	No effect
Red Wolf	TPWD	No effect
West Indian Manatee	TPWD	May affect, but is not likely to adversely affect
Texas Prairie Dawn-flower	USFWS/TPWD	May affect, but is not likely to adversely affect

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Acronyms/Initialisms

ASI	area of significant impact
AQRV	air quality related values
AWBP	Aransas-Wood buffalo population
BA	Biological Assessment
BACT	best available control technology
BMP	best management practice
CAA	Clean Air Act
CFR	Code of Federal Regulations
CWS	Canadian Wildlife Service
DLN	dry low NO_x
DMR	discharge monitoring report
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESL	Effect Screening Level
gpm	gallons per minute
GTG	gas turbine generator
HEART	Help Endangered Animals–Ridley Turtle
HSC	Houston Ship Channel
HRSG	heat recovery steam generator
LAER	lowest achievable emissions rate
MGD	million gallons per day
NAAQS	National Ambient Air Quality Standard
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRCS	National Resources Conservation Service
NSR	New Source Review
ppmvd	parts per million by volume, dry basis
PSD	Prevention of Significant Deterioration
SCR	selective catalytic reduction
SIL	significant impact levels
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TSP	total suspended particulate matter
TXNDD	Texas Natural Diversity Database
USFWS	U.S. Fish and Wildlife Service
USC	United States Code
WET	whole effluent toxicity

1.0 INTRODUCTION

Channel Energy Center LLC is seeking a Greenhouse Gas permit under the Environmental Protection Agency's (EPA) Tailoring Rule to increase capacity of the currently operating Channel Energy Center by adding a new 180 megawatt gas-fired combined-cycle cogeneration unit at the existing location, located on State Highway 225, approximately 2 miles east of Interstate Highway 610 in Houston, Harris County, Texas (**Figure 1**). The new cogeneration unit would be similar to the two existing cogeneration units currently in operation at the Channel Energy Center. **Figure 2** identifies the proposed Project Site and its associated Action Area. The anaysis used to identify the Action Area is discussed in **Section 2.0**.

This Biological Assessment (BA) provides the results of an assessment of the potential effects of the proposed project on federally listed threatened and endangered species that are protected under the Endangered Species Act (ESA). This BA is based on a review of the proposed project and pertinent literature, as well as field investigations to evaluate the Project Site and surrounding area to determine whether suitable habitat exists for protected species within the Action Area (i.e., the area of potential impacts) (**Figure 2**). The Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02).

This report includes a project description; a discussion of pertinent protected species regulations; a description of the methods for determining the Action Area; a list of federally listed threatened and endangered species of potential occurrence in the Action Area; a description of the methods utilized in determining the potential for protected species to occur in the Action Area; a discussion of the baseline environmental conditions in the Action Area; and, an assessment of potential effects to protected species.

1.1 Proposed Action

Channel Energy Center proposes adding a new 180 megawatt gas-fired combined-cycle cogeneration unit to its existing facility north of State Highway 225, two miles east of Interstate Highway 610, in Houston, Harris County, Texas (**Figures 1 and 2).** The new cogeneration unit would be similar to the two existing gas turbine generators (GTGs) with heat recovery steam generator (HRSG) units (**Figure 3**) currently in operation at the Channel Energy Center. The proposed combustion turbine will be fired with only pipeline-quality natural gas, and the HRSG duct burners will be fired with natural gas. The new unit, designated GTG/HRSG-3 (**Figure 3**), will sit adjacent to the current units. GTG/HRSG-3 will be installed on a graded, gravel-covered area, with an estimated footprint of 0.3 hectares. The project has two construction and upgrade phases that are discussed in Section 2.0.

1.2 Definition of Study Areas

Two different study areas are referenced throughout this BA. For clarity, each is defined below with references to maps that illustrate the boundaries of each study area.

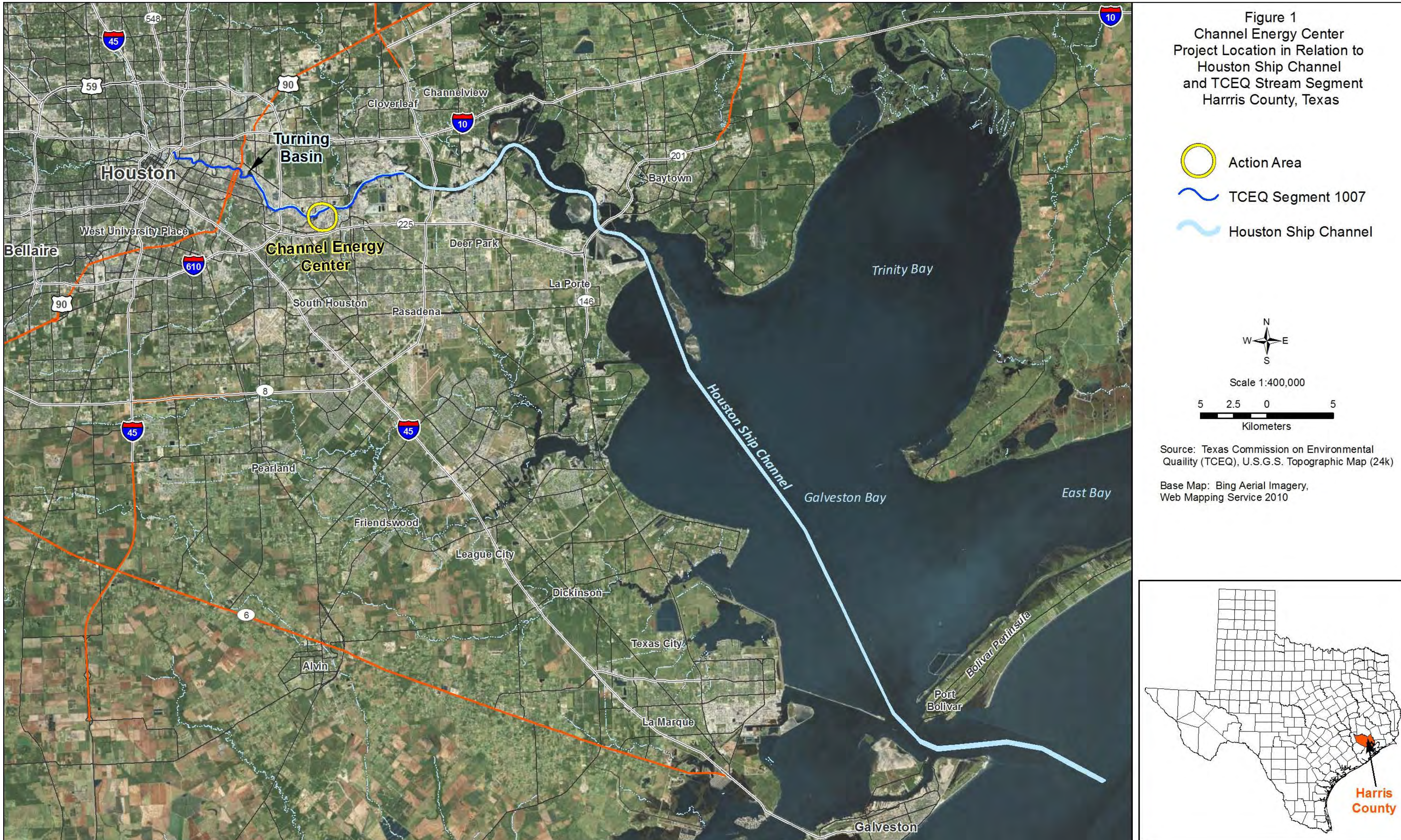

Figure 1
Channel Energy Center
Project Location in Relation to
Houston Ship Channel
and TCEQ Stream Segment
Harrris County, Texas

Source: Texas Commission on Environmental Quaility (TCEQ), U.S.G.S. Topographic Map (24k)

Base Map: Bing Aerial Imagery, Web Mapping Service 2010

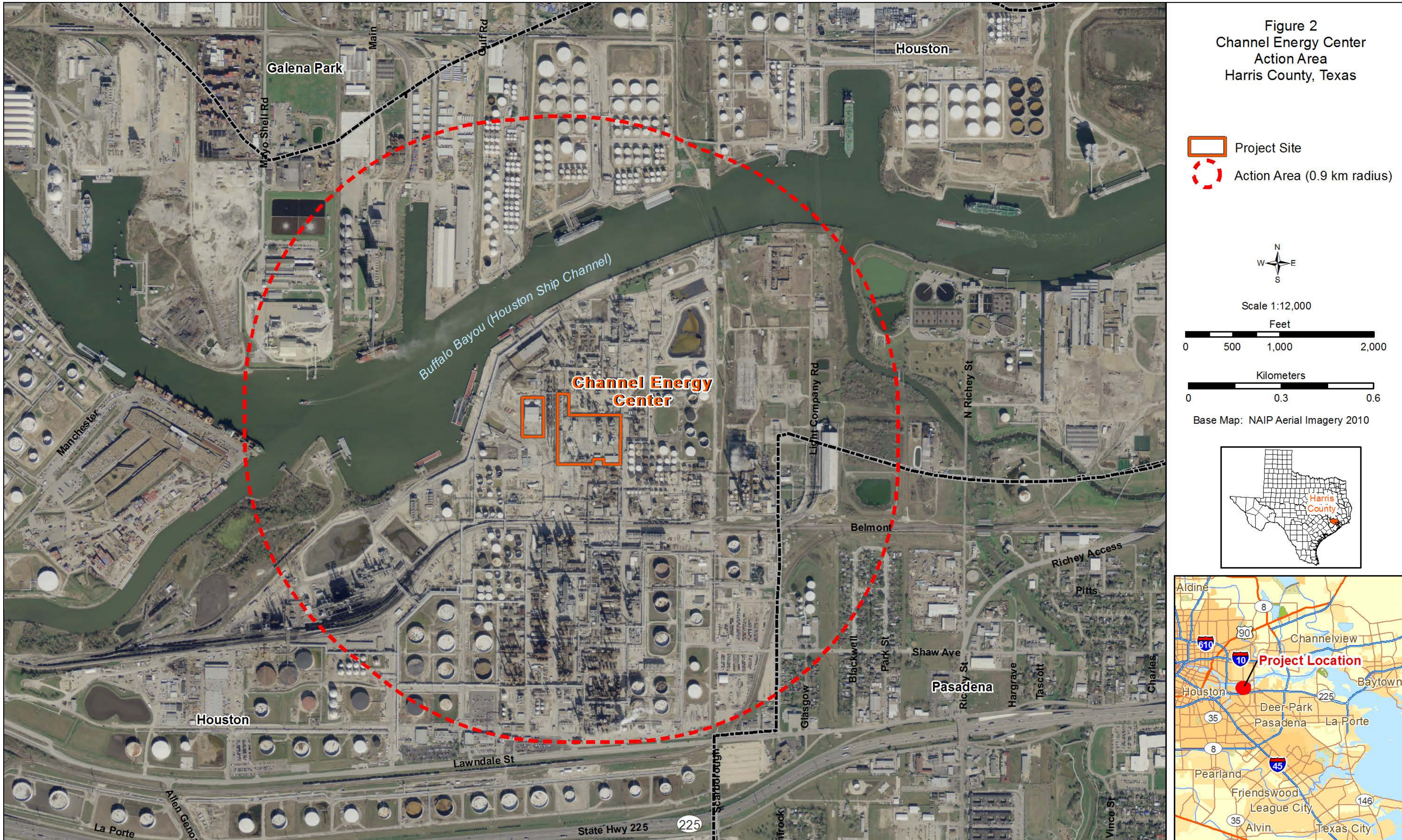

Figure 2
Channel Energy Center
Action Area
Harris County, Texas

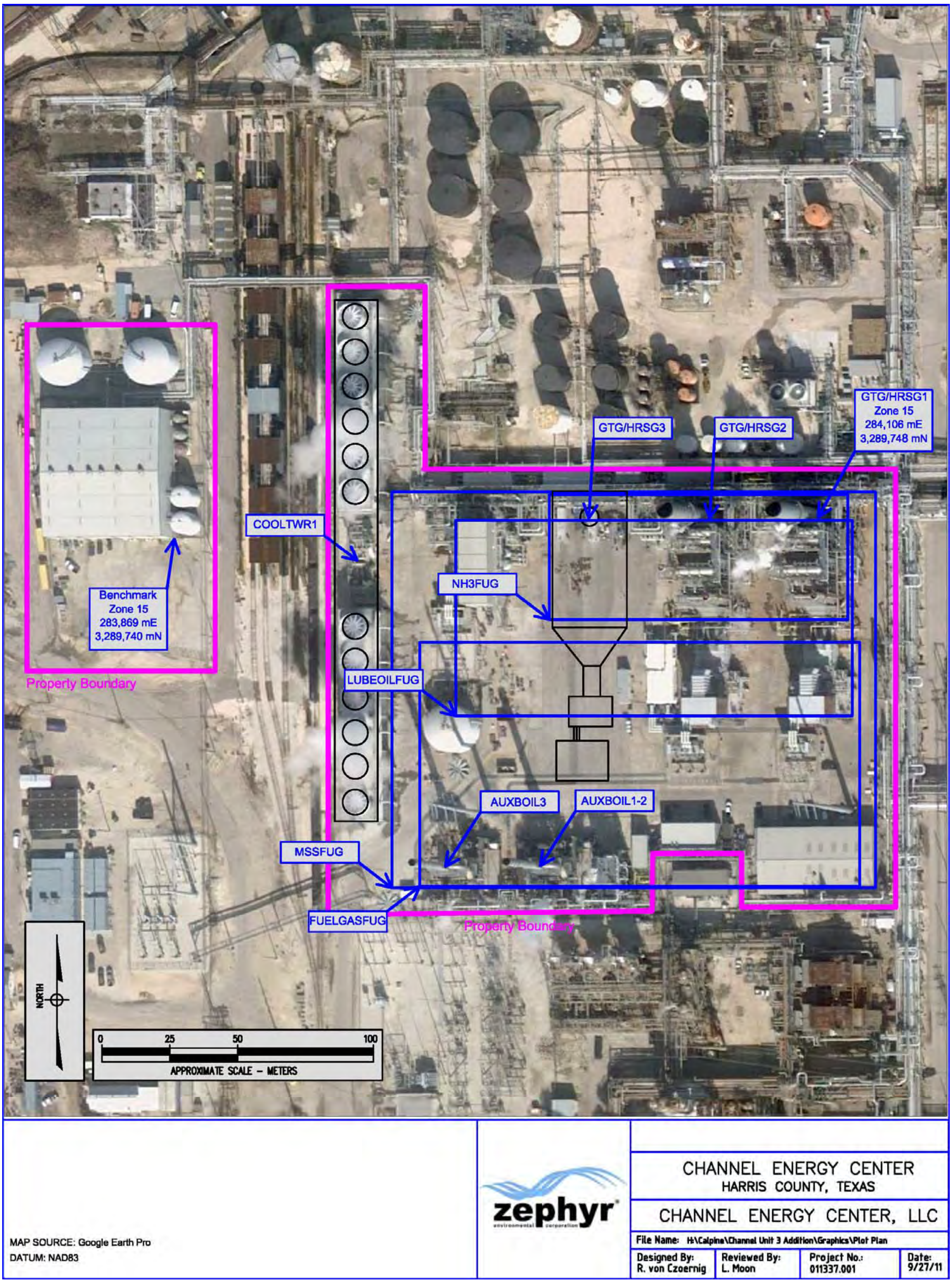

Figure 3 Channel Energy Center Plot Plan

Project Site: The proposed cogeneration unit would be constructed within the boundaries of the property leased by Channel Energy Center LLC, where the existing Channel Energy Center is located (**Figure 3**). Two separate plots comprise the Project Site: the larger, eastern plot where GTG/HRSG-3 will be constructed, and the smaller, western plot where the cooling towers are located. Together, the two plots contain the essential operating components of the Channel Energy Center facility.

Project Site

Action Area: The Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The analysis of species or designated critical habitat likely to be affected by the proposed project is focused on impacts within the project's Action Area, extending 0.9 km (0.6 mi) from the Project Site. **Figure 2** shows the delineation of the Action Area used in this BA. **Section 3.0** discusses how the Action Area boundary was determined.

1.3 Endangered Species Act

A brief overview of the ESA is presented below to provide the context for the evaluation of regulatory compliance issues. The primary objective of this BA is to evaluate the effects of the proposed action on species that are federally listed under the ESA.

The U.S. Fish and Wildlife Service (USFWS) has legislative authority to list and monitor the status of land-based and freshwater species whose populations are considered to be imperiled. The National Marine Fisheries Service (NMFS) has this authority for marine species. This federal legislative authority for the protection of threatened and endangered species issues from the ESA of 1973 and its subsequent amendments. Regulations supporting this Act, relating to the listing of species, are codified and regularly updated in 50 CFR 17.11-12. The federal process stratifies potential candidates based upon a species biological vulnerability. The vulnerability decision is based upon many factors affecting the species and is always linked to the best scientific data available to the USFWS and NMFS. In contrast, species on the *candidate* list are not provided federal protection, but may be protected by state law. USFWS and NMFS may cooperate in species management under ESA guidelines (50 CFR 402).

Species listed as endangered or threatened by the USFWS or NMFS are provided full protection. This protection not only prohibits the direct take of a protected species, but also includes a prohibition of indirect take, such as destruction of designated critical habitat.

Federal agencies must ensure that any activity that a federal agency funds, authorizes, or carries out does not jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat (16 USC §1536, Section 7 ESA). The ESA requires that federal agencies must file a Biological Assessment (BA) that analyzes and determines whether a proposed project may affect relevant listed species (50 CFR 402).

The BA will specify one of the following three possible determinations for each relevant species:

No effect—A no-effect determination means there are absolutely no effects from the proposed action, positive or negative, to listed species. A no-effect determination does not include effects that are insignificant (small in size), discountable (extremely unlikely to occur), or beneficial. No-effect determinations do not require written concurrence from the USFWS unless the National Environmental Policy Act analysis is an Environmental Impact Statement. However, the USFWS may request copies of no-effect assessments for its files.

May affect, but is not likely to adversely affect—This determination may be reached for a proposed action where all effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effect to the species or habitat (i.e., there cannot be a "balancing," where the benefits of the proposed action would be expected to outweigh the adverse effects—see below). Insignificant effects relate to the size of the effects and should not reach the scale where take occurs. Discountable effects are those that are extremely unlikely to occur. This conclusion is usually reached through the informal consultation process, and written concurrence from the USFWS exempts the proposed action from formal consultation. The federal action agency's written request for USFWS concurrence should accompany the BA/biological evaluation. *Note that with the conclusion of a finding of "may affect, but is not likely to adversely affect" by an action agency and the USFWS, consultation with the USFWS is considered complete. This is known as "informal consultation."*

May affect, and is likely to adversely affect—This determination means that all adverse effects cannot be avoided. A combination of beneficial and adverse effects is still "likely to adversely affect" even if the net effect is neutral or positive. Section 7 of the ESA requires that the federal action agency request initiation of formal consultation with the USFWS when a "may affect, likely to adversely affect" determination is made. A written request for formal consultation should accompany the BA/biological evaluation. *Note that a conclusion or finding of "may affect, and is likely to adversely affect" by an action agency and the USFWS, or if USFWS does not concur with an action agency's finding of "not likely to adversely affect" determination, then "formal consultation" is required between the action agency and the USFWS. Formal consultation results in the USFWS issuing a biological opinion as to whether the action, as proposed, will jeopardize the continued existence of any listed species.*

In summary, if an agency determines that a proposed project will have "no effect" on a listed species, consultation with the USFWS or NMFS is not required. Alternately, if a federal agency determines that a proposed project "is not likely to affect" or is "likely to adversely affect" a listed species, consultation with USFWS or NMFS is required. Therefore, the present BA will conclude with recommendations on each of the federally protected species with potential for occurrence in the Action Area.

2.0 PROJECT DESCRIPTION

2.1 Project Schedule

The proposed project has two construction and upgrade phases: construction and operation of the new GTG/HRSG-3 unit as a Siemens FD-2 model, and upgrade of the FD-2 unit to a Siemens FD-3 Series by on-site retrofit. The first phase is projected to start in December 2012, and the FD-2 unit is expected to begin operating in June 2014. Thus, the initial construction phase will span a period of approximately 18 months. Retrofit of the FD-2 series to upgrade the unit to the FD-3 series is expected to begin within 18 months of the commercial operation date of the FD-2 unit.

2.2 Project Location

USGS Mapping: Pasadena 24k Topographic Quad Map.
Coordinates: 29.718597 N latitude, 95.232742 W longitude.
Locality: Houston, Harris County, Texas North.

2.3 Emission Controls

New or modified facilities must utilize best available control technology (BACT) with consideration given to the technical practicability and economic reasonableness of reducing or eliminating the emissions from the facility (30 Texas Administrative Code (TAC) §116.111(a)(2)(c)). In addition, 116.150(b) and (e) state that any major new or modified facility located in a nonattainment area must use emission controls capable of obtaining the lowest achievable emission rate (LAER) for pollutants subject to nonattainment review. For this project, only NO_x triggers LAER requirements. **Section 6.0** (Conservation Measures) provides additional information on the project emission controls.

2.4 Noise Levels

The Project Site will be located in a developed industrial complex and the nearest potential natural habitat areas (i.e., sensitive receptors) within the Action Area are small, undeveloped patches of shrub/scrub to the west, located approximately 700 m from the Project Site. Therefore, noise levels from construction or operation of the proposed project are not expected to impact listed species.

2.5 Dust

Dust mobilization will be minimized during construction and operations by routinely employed best management practices (BMPs), and is expected to be negligible.

2.6 Water and Wastewater

The existing Channel Energy Center discharges cooling tower blowdown, low volume waste sources, and storm water to its host facility, Houston Refining LP, formerly known as Lyondell-Citgo Refining. All discharged wastewater is managed in accordance with the refinery's effluent permit issued by the Gulf Coast Waste Disposal Authority. Wastewater from the Channel Energy Center is assigned its own outfall designation in the Houston Refining effluent permit and is required to be sampled prior to comingling with refinery process wastewater. The proposed project is expected to increase the daily average discharge from the current 1.9 million gallons per day (MGD) to 2.15 MGD. The wastewater generation processes and effluent quality are expected to be the same as those from the current plant configuration. Additionally, the project will not require Houston Refining to modify or amend their existing permit and there will be no change in monitoring requirements or effluent limitations.

The majority of the wastewater discharged from the plant is cooling tower blowdown. Makeup water for the cooling tower is primarily clarified raw water from Coastal Water Authority (CWA), which is supplemented with Heat Recovery Steam Generator (HRSG) blowdown and demineralization and water polish media regeneration waste. The concentrations of chemicals used for cooling tower treatment are kept to a minimum through regular assessment. The wastewater from the Channel Energy Center is comingled with other Houston Refining wastewaters and subject to pretreatment and monitoring in accordance with the refinery's effluent permit. To date, there have been no instances of non-compliance attributed to the discharge from the Channel Energy Center. Additionally, Whole Effluent Toxicity (WET) testing per the requirements of 40 CFR §122.44(d)(1)(i) of wastewater from similar Calpine plants treated with comparable concentrations of chemicals from common vendors has shown no presence of harmful quantities of toxic constituents in the effluent. Using surrogate species of similar sensitivity to listed threatened or endangered species for WET testing is a common and well documented mechanism for identifying potential toxic effects (Mayer, et. al 2008; Dwyer, et. al. 2005; Sappington, et. al. 2001). The effluent quality from the proposed project is expected to be the same as the current discharge and it is believed that there will be no toxicological impacts to aquatic life, including listed threatened or endangered species.

In accordance with contractual agreements with Houston Refining, the wastewater from the Channel Energy Center is routinely tested for relevant categorical standards, including copper, chromium, zinc, and other Priority Pollutants listed in the 40 CFR §423 effluent guidelines. To date, there have been no instances of pollutant levels above proscribed categorical limits and the proposed project will not result in an increase in pollutant concentration, temperature, or relative toxicity of the wastewater discharged from the Channel Energy Center.

3.0 DISCUSSION AND IDENTIFICATION OF THE ACTION AREA

For this BA, the Action Area was determined by identifying the maximum area in which the proposed project may result in significant direct and indirect impacts in and around the Project Site. Both construction and operation phases of the proposed combustion turbine were considered. Indirect impacts to surrounding areas may include noise, lighting, dust, erosion, stream sedimentation, air emissions, and physical disturbances. Because air emissions have the potential for widest impact away from the Project Site, the Action Area was based on determining a *de minimis* effects boundary (see **Section 3.2**).

Through air-dispersion modeling efforts, the Action Area was determined to extend up to 0.9 km (0.6 mi) from the Project Site (see **Figure 2**). The potential impacts to federally threatened and endangered species and designated critical habitat were evaluated within the Action Area.

The following sections provide additional information on how the Action Area is defined (**Section 3.1**) and describe the methodology used to delineate the Action Area for this BA (**Section 3.2**).

3.1 Action Area Defined

An Action Area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The analysis of species or designated critical habitat likely to be affected by the proposed project is focused on effects within the project's Action Area.

The Action Area (**Figure 2**) extends up to 0.9 km (0.6 mi) from the Project Site and is located within Harris County, Texas. The following discussion explains how this Action Area delineation method was implemented for the proposed action.

3.2 Action Area Delineation Methodology and Results

The Action Area was established using air emission dispersion modeling in such a manner as to ensure that any potential impact from emissions beyond the defined boundary of the Action Area would be, by regulatory definitions, *de minimis*, or trivial.

The boundary of the Action Area was conservatively delineated by applying the EPA's "significant impact levels" (SILs). A SIL is established for each National Ambient Air Quality Standard (NAAQS), yet at a concentration significantly less than the corresponding NAAQS. By establishing such a *de minimis* threshold, EPA can determine if a potential impact will be considered insignificant.

The Clean Air Act (CAA) requires the EPA to set NAAQS for pollutants considered harmful to human health and the environment. The EPA has set NAAQS for the following seven principal pollutants, also called criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen oxides (NO_X), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), ozone, and sulfur dioxide (SO_2). The CAA establishes *primary* and *secondary* NAAQS:

Primary NAAQS: a set of limits to protect public health with an adequate margin of safety, where public health is defined to include the health of sensitive populations such as asthmatics, children, and the elderly.

Secondary NAAQS: a set of limits to protect elements germane to public welfare, such as soils, water, crops, wildlife, weather, economic values, personal comfort and personal well-being.

The TCEQ has set Property Line Standards for sulfuric acid mist (H_2SO_4) and SO_2 and has established Effect Screening Levels (ESLs) for non-criteria pollutants. ESLs are not ambient air standards but rather are screening levels used in TCEQ's air permitting process to evaluate the air dispersion modeling's predicted impacts. As described by TCEQ, ESLs are "used to evaluate the potential for effects to occur as a result of exposure to concentrations of constituents in the air. ESLs are based on data concerning health effects, the potential for odors to be a nuisance, and effects on vegetation." Accordingly, if predicted concentrations of a constituent "do not exceed the screening level, adverse health or welfare effects are not expected."

As part of the ambient air quality impacts analysis conducted during Prevention of Significant Deterioration (PSD) and nonattainment permitting, air dispersion modeling analyses are often utilized to determine the potential impact the source will have on air quality. To assess whether the potential impact is significant, EPA has established SILs for each NAAQS. In addition to establishing if an impact is *de minimis*, the SILs are also used to determine 1) if a proposed source's ambient impacts warrant a comprehensive (cumulative) source impacts analysis, 2) the size of the impact area within which the air quality analysis is to be completed, and 3) whether the increase in emissions from a proposed new source or modification is considered to cause or contribute to a modeled violation of any NAAQS.

3.2.1 Ambient Air Dispersion Modeling

Emissions associated with the proposed project were modeled using the EPA AERMOD air dispersion model in support of the PSD and state New Source Review (NSR) applications. Emissions from both phases of the proposed project were considered, and the largest emissions between the FD-2 and FD-3 series turbines were modeled. Ultimately, the Action Area was based on the FD-3 emissions. The ambient air concentration results were then compared with *de minimis* levels associated with the Primary NAAQS, Secondary NAAQS, and TCEQ property line standards (**Table 1**). The predicted concentrations of non-criteria pollutants were compared with TCEQ ESL *de minimis* levels (**Table 2**). All short term modeling concentrations correspond to the maximum proposed emission rates during normal operations.

Table 1 Channel Energy Center ASI Analysis Results from FD-3 Modeling*, Revised May 7, 2012

Pollutant	Averaging Period	NAAQS		TCEQ Property Line Standard**	SIL	ASI Modeling Results	
		Primary	Secondary			Maximum Predicted Concentration	ASI
		μg/m³	μg/m³	μg/m³	μg/m³	μg/m³	km
NO_2	1-Hour	188	None	---	7.5	2.61	0
	Annual	100	100	---	1	0.14	0
CO	1-Hour	40,000	None	---	2,000	62.6	0
	8-Hour	10,000	None	---	500	36.4	0
SO_2	30-Minutes	---	---	715	---	7.11	0
	1-Hour	196	None	---	7.8	5.85	0
	3-Hour	None	1300	---	25	5.80	0
	24-Hour	365	None	---	5	0.30	0
	Annual	80	None	---	1	0.02	0
PM_{10}	24-Hour	150	150	---	5	4.72	0
	Annual	None	None	---	1	0.25	0
$PM_{2.5}$	24-Hour	35	35	---	1.2	3.83	0.9
	Annual	15	15	---	0.3	0.17	0
H_2SO_4	1-Hour	---	---	50	---	1.09	0
	24-Hour	---	---	15	---	0.03	0
						Proposed Action Area	**0.9**

***** This information is based on FD-3 emission estimates because they exceed those for FD-2 emissions.
****** TCEQ *de minimis* value ≈ 2 percent of the standard, Air Dispersion Modeling Guidelines, RG-25, Feb. 1999.

Table 2 Channel Energy Center Impacts for Non-Criteria Pollutants*, Revised May 7, 2012

Pollutant	Averaging Period	Maximum Predicted Concentration**(μg/m³)	TCEQ ESL (μg/m³)	% of ESL	ASI*** (km)
Ammonium Sulfate	1-hour	1.47E01	50	2.9	0
	Annual	2.71E-03	5	<0.1	0
Ammonia	1-hour	5.72E01	170	3.4	0
	Annual	2.11E-01	17	1.2	0
1,3-Butadiene	1-hour	2.25E-04	510	<0.1	0
	Annual	8.01E-06	9.9	<0.1	0
Acetaldehyde	1-hour	2.09E-02	90	<0.1	0
	Annual	7.45E-04	45	<0.1	0
Acrolein	1-hour	3.34E-03	3.2	0.1	0
	Annual	1.19E-04	0.15	<0.1	0
Benzene	1-hour	6.27E-03	170	<0.1	0
	Annual	2.23E-04	4.5	<0.1	0
Ethylbenzene	1-hour	1.67E-02	740	<0.1	0
	Annual	5.96E-04	570	<0.1	0
Formaldehyde	1-hour	1.06E-01	15	0.7	0
	Annual	3.76E-03	3.3	0.1	0
Polycyclic Aromatic Hydrocarbons (PAH)	1-hour	1.83E-03	0.5	0.4	0
	Annual	5.40E-04	0.05	1.1	0
Propylene Oxide	1-hour	1.52E-02	70	<0.1	0
	Annual	5.40E-04	7	<0.1	0
Toluene	1-hour	6.79E-02	640	<0.1	0
	Annual	2.42E-03	1200	<0.1	0
Xylenes	1-hour	3.34E-02	350	<0.1	0
	Annual	1.19E-03	180	<0.1	0

* This information is based on FD-3 emission estimates because they exceed those for FD-2 emissions.
** AERMOD modeling analysis results.
*** *De minimis* for emission increases of non-criteria pollutants with no federal or TCEQ ambient standards is 10% of the ESL (TCEQ, Modeling and Effects Review Applicability, APDG 5874, July 2009).

All annual modeling concentrations correspond to the proposed annual emission rates. An *area of significant impacts* (ASI) for a given pollutant and averaging period is defined by the distance to which predicted concentrations are greater than the respective *de minimis* levels. The Action Area was then defined by the largest ASI modeled for any pollutant and averaging period (**Table 1**). As a result, this analysis defined an Action Area that is centered on the new turbine stack and that extends up to 0.9 km (0.6 mi) from the Project Site (**Figure 2**). Note that the Action Area is *not* defined by compliance with the NAAQS, but rather by the SILs and TCEQ *de minimis* levels, which are small fractions of the NAAQS, TCEQ Standards, and TCEQ ESL guideline values.

3.2.2 Deposition Modeling

Deposition modeling was conducted to compare the proposed project's potential nitrogen deposition flux to the current background levels. It is generally recognized that the EPA AERMOD air dispersion model provides conservative estimates of deposition fluxes.

AERMOD was used to conservatively estimate rates of deposition for nitrogen and sulfur emission from the proposed project into the portion of the HSC within the Action Area (HSC/AA). Total nitrogen deposition was estimated by assuming that all nitrogen species (e.g., NO_2, NH_3) associated with the proposed project deposit at a rate equal to that of nitric acid (HNO_3) which deposits at a rate greater to that of other nitrogen species (**Table 3**). Total sulfur deposition was estimated from the sulfuric acid (H_2SO_4) mist emissions (**Table 3**).

Table 3 AERMOD Results—Annual Deposition from the Channel Energy Center in the HSC/AA

	Average Deposition Results	
	($g/m^2/yr$)	(kg/ha/yr)
Total Nitrogen	0.0160	0.16
Total Sulfur from H_2SO_4	0.0000186	0.000186

Nitrogen

A recent study (Byun et al. 2008) estimated that the background deposition flux of nitrogen upon the Galveston Bay system is 6.32 kilograms per hectare year (kg/ha/yr). Galveston Bay covers approximately 600 square miles (155,404 hectares). Based on these figures, Galveston Bay alone receives approximately 982 metric tons of deposited atmospheric nitrogen per year. The HSC/AA covers approximately 56 hectares, or ~0.04% of the surface area of Galveston Bay (**Table 4**). Our conservative AERMOD modeling predicts an average nitrogen deposition rate of 0.16 kg/ ha/yr from the proposed project, or ~2.6% of the existing deposition rate in the Galveston Bay system. At this rate, the proposed project will result in an estimated total annual deposition of ~9.0 kg of nitrogen into the portion of the HSC/AA, a level of deposition less than 0.001% of the total received by the Galveston Bay system (**Table 4**). Assuming that the entire 9.0 kg of nitrogen entered the HSC/AA as HNO_3, and that the HSC is stagnant (Wang et al. 1996) and unbuffered, then the daily increase in N-containing compounds in the HSC/AA would increase on the order of 10^{-10} M, a level with no significant impact on pH. This rate of nitrate deposition is equivalent to ~0.002% of the nitrate concentration in the least eutrophic class of US groundwater (undeveloped land-use) (Spahr et al. 2010). Taking into consideration the entire Galveston Bay system, the results of these calculations for acidification and eutrophication become vanishingly small.

Table 4 Nitrogen Deposition in the HSC/AA versus that in the Galveston Bay System

	Location		Percent of Galveston Bay System
	Galveston Bay System	HSC/AA	
Estimated Surface Area (ha)	155,404	56	0.04
Atmospheric Nitrogen Deposition (kg/ha/yr)	6.32*	0.16**	2.55
Atmospheric Nitrogen Deposition (kg)	982,153	8.96	0.0009

*Source: Byun et al. 2008
**Source: AERMOD modeling results (Zephyr)

Although nitrogen levels in the HSC will increase with the installation of a new co-generation unit, the foregoing analysis demonstrates that nitrogen emissions would not be expected to have any measurable impact in terms of pH or eutrophication on the HSC. Given the relatively enormous volume of Galveston Bay, the changes in HSC effluent generated by the operation of the new co-generation unit are extremely unlikely to have any detectable effect on water quality in any part of the Galveston Bay system.

Sulfur

Our conservative AERMOD modeling predicts that operation of the proposed unit would result in an annual deposition rate of 0.000186 kg/ha (**Table 3**), or 10.4 *grams* per year of total sulfur in the HSC/AA.

By contrast, data provided in Section 2.13 of Byun et al. (2008) permit estimating that total annual deposition of sulfur in the entire Galveston Bay System is nominally on the order of 500,000 kg per year. We conclude that the proposed project's contribution to total sulfur deposition in the Galveston Bay system is negligible. Given that the volume of the HSC/AA is approximately 5.6 billion liters, the additional sulfate deposition would be on the order of 10^{-11} M (i.e., at level at which there will be no measurable effect on pH even if the HSC were stagnant and unbuffered). In summary, the added sulfur-containing chemical compounds from the operation of the new natural gas-fired co-generation unit are not expected to have any effect on measures of water quality within the HSC or Galveston Bay.

3.2.3 Literature Review of the Impacts of Air Pollution Sources on Plants, Soils, and Animals

A detailed literature review was conducted to identify any documentation, data, or research of the potential effects of air emissions on flora and fauna and specifically on the threatened and endangered species of potential occurrence in the Action Area. The methods and results of the literature review are presented in **Sections 5.2.1** and **5.3.1**, respectively.

Guidance from Smith and Levenson (1980) was followed to assess the potential for the project has for adversely affecting air quality related values (AQRV). Smith and Levenson (1980) provides minimum levels at which adverse effects have been reported in the literature for use as screening concentrations. These screening concentrations can be concentrations of pollutants in ambient air, in soils or in aerial plant tissues. A summary of the Smith and Levenson (1980) requirements follow:

Step 1. Estimate the maximum ambient concentrations for averaging times appropriate to the screening concentration for pollutants emitted by the source. Include background concentrations when appropriate.

Step 2. Determine potential effects from airborne pollutants by checking the maximum predicted ambient concentrations against the corresponding AQRV screening concentration, PSD increments or NAAQS – whichever is most conservative.

Step 3. Determine potential effects from trace metals by calculating the concentration deposited in the soil from the maximum annual average ambient concentrations assuming all deposited metals are soluble and available for uptake by plants.

Step 4. Compare the increase in metal concentration in the soil to the existing endogenous concentrations.

Step 5. Calculate the amount of trace metal potentially taken up by plants.

Step 6. Compare the concentrations from Steps 3 and 5 with the corresponding screening concentrations.

Step 7. Reevaluate the results of the Step 4 and 6 comparisons using estimated solubilities of elements in the soil recognizing that actual solubilities may vary significantly from the conservatively estimated values.

Step 8. If ambient concentration modeling results are unavailable, the significant levels for emissions may be used.

No trace metals are associated with the combustion of natural gas in turbines. Therefore, only Steps 1 and 2 of Smith and Levenson (1980) were required for this analysis.

The results from the ambient air modeling analyses conducted in support of the PSD and State NSR modeling for pollutants included in Smith and Levenson (1980), (i.e., SO_2, NO_2 and CO), show that their maximum predicted concentrations are orders of magnitude lower than their respective AQRV screening concentrations (**Table 5**).

Table 5 Screening Analysis – Impacts on Plants, Soil, and Animals – Direct Impacts

Pollutant	**Averaging Period**	**Project Sources, Only**			**Project Sources, Nearby Sources Plus Background Concentration**	
		Maximum Predicted Concentration (μg/m^3)	**AQRV Screening Concentration[1] (μg/m^3)**	**PSD Class II Increment Consumption (μg/m^3)**	**Maximum Predicted Concentration (μg/m^3)**	**NAAQS (μg/m^3)**
SO_2	1-Hour	5.85	917	---	Not Required**	196
	3-Hour	5.80	786	512	Not Required**	1,300
	24-Hour	0.30	> 18***	91	Not Required**	365
	Annual	0.02	18	20	Not Required**	80
NO_2	1-Hour	2.61	>3,760***	---	Not Required**	188
	4-Hour	2.61	3,760	---	---	---
	8-Hour	2.61	3,760	---	---	---
	1-Month	2.61	564	---	---	---
	Annual	0.14	100	---	Not Required**	100
CO	1-Hour	62.6	>1,800,000***	---	Not Required**	40,000
	8-Hour	36.4	>1,800,000***	---	Not Required**	10,000
	1-Week	36.4	1,800,000	---	---	---

*Table 3.1, Table 3.1, Smith and Levenson (1980)
**The respective project source concentrations are *de minimis*. NAAQS modeling not required.
*** Value not available. A conservative value (next the longer averaging period) is provided.

Smith and Levenson (1980) state that "no useable information other than that used to develop the ambient standards...was found in the review literature" for total suspended particulate matter (TSP) and "EPA's current procedure for TSP should suffice for the review of generic TSP." The EPA's "current procedure" for TSP review corresponds to demonstrating compliance with the PM_{10} and $PM_{2.5}$ NAAQS. Secondary NAAQS (**Section 2.2**) apply to protection of soils, water, crops and wildlife. Smith and Levenson (1980) state that "trace metals in TSP may have greater impacts on vegetation and soils than the total amount of particulates." However, there are no trace metals associated with the combustion of natural gas in turbines. The PM_{10} and $PM_{2.5}$ NAAQS modeling (conducted in support of the PSD modeling) shows that the predicted concentrations associated with the proposed project are less than the AQRV screening concentrations, PSD Class II increment consumption concentrations, Primary NAAQS and Secondary NAAQS (**Table 6**). Therefore, according to the results of the analysis shown above, the proposed project will not cause significant impacts on soils, water, crops or wildlife.

Table 6 NAAQS Modeling Results

Pollutant	Averaging Period	Project Sources, Only	Project Sources, Nearby Sources Plus Background Concentration	
		Maximum Predicted Concentration (μg/m³)	Maximum Predicted Concentration[1] (μg/m³)	NAAQS[2] (μg/m³)
PM_{10}	24-Hour	4.72	Not Required*	150
$PM_{2.5}$	24-Hour	3.83	34.2	35
	Annual	0.17	Not Required*	15

[1] This is a conservative estimate. The background monitoring concentrations utilized in the analysis included contributions from existing sources that were included in the modeling analysis (i.e., a double counting of their effects).
[2] Primary and Secondary NAAQS (have the same value).
*Project source concentrations are *de minimis* for this pollutant and averaging period. NAAQS modeling was not required.

The predicted concentrations associated with the proposed project are less than the AQRV screening concentrations, PSD Class II increment consumption concentrations, Primary NAAQS and Secondary NAAQS. Therefore, according to the results of the analysis shown above, the proposed project will not cause significant impacts on soils, water, crops or wildlife.

4.0 FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES AND DESIGNATED CRITICAL HABITAT OF POTENTIAL OCCURRENCE IN THE ACTION AREA

4.1 Federally Listed Threatened and Endangered Species

The proposed project is located in Harris County, Texas (**Figure 1**). The current list of federally listed threatened or endangered species that potentially occur in Harris County is presented in **Table 7**. **Table 7** is a comprehensive list of federal threatened and endangered species that was generated by compiling data from USFWS Southwest Region Ecological Services for Harris County (USFWS 2011a); the Texas Parks and Wildlife Department's (TPWD) annotated list for Harris County (TPWD 2011a); and the National Marine Fisheries Service list for the State of Texas (NMFS 2012) (http://sero.nmfs.noaa.gov/pr/endangered%20species/specieslist/PDF2012/Texas.pdf). It is important to note that the TPWD's county list includes several species that are federally listed under the ESA but are not considered by the USFWS as having potential to occur in Harris County. In fact, the only terrestrial species listed by the USFWS is Texas prairie dawn-flower. However, to address potential concerns from these agencies, all federally listed species identified by the agencies are discussed below.

Table 7 Threatened or Endangered Species Potentially Occurring in Harris County or Galveston Bay

Species Common Name ***(Scientific Name)***	**USFWS Southwest Region County-by-County**	**TPWD Rare Species Federal Status***	**NMFS Listing of Threatened or Endangered Species**
FISH SPECIES (1)			
Smalltooth Sawfish (*Pristis pectinata*)	NL	E	E
AMPHIBIAN SPECIES (1)			
Houston Toad (*Anaxyrus houstonensis*)	NL	E	NL
SEA TURTLE SPECIES (4)			
Green Sea Turtle (*Chelonia mydas*)	NL	T	T

Table 7 Threatened or Endangered Species Potentially Occurring in Harris County or Galveston Bay

Species Common Name ***(Scientific Name)***	**USFWS Southwest Region County-by-County**	**TPWD Rare Species Federal Status***	**NMFS Listing of Threatened or Endangered Species**
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	NL	E	E
Leatherback Sea Turtle (*Dermochelys coriacea*)	NL	E	E
Loggerhead Sea Turtle (*Caretta caretta*)	NL	T	T
BIRD SPECIES (2)			
Red-cockaded Woodpecker (*Picoides borealis*)	NL	E	NL
Whooping Crane (*Grus americana*)	NL	E	NL
TERRESTRIAL MAMMALS (2)			
Louisiana Black Bear (*Ursus americanus luteolus*)	NL	T	NL
Red Wolf (*Canis rufus*)	NL	E	NL
AQUATIC MAMMALS (1)			
West Indian Manatee (*Trichechus manatus*)	NL	E	NL
PLANT SPECIES (1)			
Texas Prairie Dawn-flower (*Hymenoxys texana*)	E	E	NL

*All 12 of these species are federally protected under the ESA, but the USFWS does not consider any of them, except Texas prairie dawn-flower, as potentially occurring in Harris County. These species are addressed in this assessment because they are included on the TPWD's list for Harris County.
E = endangered; T= threatened; NL = not listed.
Sources: USFWS 2011a; TPWD 2011a; NMFS 2012

The following paragraphs provide the status of each federally listed threatened and endangered species with potential to occur in the Action Area according to current lists from the USFWS and TPWD for Harris County and the NMFS list for the State of Texas. This section focuses solely on the status of each species and does not provide any information on the potential effects of the proposed project on the species. The effect analysis for each species is presented in **Section 5.3.3**.

4.1.1 Smalltooth Sawfish

The North American population of the smalltooth sawfish, an ovoviviparous elasmobranch, was listed as endangered as a distinct population in 2005 (NMFS 2010). This sawfish is a tropical marine and estuarine species that generally inhabits shallow water of inshore bars, mangrove marsh edges, and seagrass beds (NMFS 2010). Historically its range included the Northern and Southwestern regions of the Atlantic Ocean; primarily in the Mediterranean, U.S. Atlantic Coast, and the Gulf of Mexico (NMFS 2010). While there is potential habitat for this fish in Galveston Bay, its presence is unlikely as it primarily inhabits the marine waters of south Florida.

4.1.2 Houston Toad

The Houston toad is a relatively small bufonid (45 to 80 mm snout vent length) with black or brown mottling that forms a zigzag pattern on a background of a cream to purple-gray dorsum. Relative to other toads, thickened postorbital cranial crests are often noted in adult Houston toads. Houston toads also have elongated parotid glands that never touch the postorbital cranial crests (Conant and Collins 1998). The Houston toad is endemic to deep, sandy soils of the Post Oak Savannah of south-central Texas and is currently known from Austin, Bastrop, Burleson, Colorado, Freestone, Lavaca, Leon, and Robertson Counties (Price and Yantis 1993). Within this range, foraging and burrowing habitat for the Houston toad is characterized as pine or post oak woodland or savannah with native bunchgrasses and forbs occupying the open areas and woodland edges. Vegetation found in the habitat of known Houston toad populations include loblolly pine (*Pinus taeda*), post oak (*Quercus stellata*), black-jack oak (*Q. marilandica*), blue-jack or sand-jack oak (*Q. incana*), yaupon (*Ilex vomitoria*), and little bluestem (*Schizachyrium scoparium*) (TPWD 2011c).

The Houston toad requires lentic bodies of water that persist for at least 60 days during the breeding season (generally February–June) for egg laying and tadpole development. These aquatic habitats may include ephemeral rain pools, flooded fields, blocked drainages of upper creek reaches, wet areas associated with seeps or springs, or more permanent ponds such as stock impoundments with shallow water habitats. These features should be located within 0.5 to 0.75 of a mile of the toad's hibernation/foraging habitat (USFWS 1984). Geology appears to be important in the distribution of the Houston toad. Extant populations are generally associated with large deposits of deep sands of the Carrizo, Queen City, and Sparta Sands as well as the Recklaw, Weches, Goliad, and Willis Formations. It apparently is a poor burrower but requires a minimum depth of 40 inches of loose friable soil for cover. Populations of the Houston toad are generally associated with specific soil series including: Arenosa, Padina, and Tonkawa fine sands plus a variety of loamy fine sands including Chazos, Silstid, Silawa, and Wolfpen (USFWS 1984). Soils, in conjunction with vegetation and hydrology, are the best indicators of the potential suitability of an area as habitat for the Houston toad. Limiting factors for the presence or absence of the Houston toad include availability of appropriate burrowing, foraging, and breeding sites (shallow aquatic sites) along with food availability and moderate temperatures (USFWS 1984).

The largest known population, with more than 2,000 individuals, occurs in Bastrop County, and new populations have been discovered as far north as Leon County over the past decade, but other known sites have seen population declines and extirpations, including Harris County. The last documented observation of Houston toad from the vicinity of the project area occurred in 1976 approximately 5.0 miles south by southwest of the project area (Texas Natural Diversity Database [TXNDD] 2011).

4.1.3 Green Sea Turtle

The U.S. population of the green sea turtle was federally listed as endangered or threatened (depending on geographic region) under the ESA in 1978. In Texas, the green sea turtle is federally listed as threatened.

Description

The green sea turtle is a large sea turtle whose carapace or shell commonly reaches 3 to 4 feet in length and can weigh over 400 pounds (NMFS/USFWS 1991a, USFWS 2012a). The plastron of these turtles remains a yellow-white throughout their lifespan while the carapace can change in color from black to a variety of shades of gray, green, brown, and black with starburst or irregular patterns (NMFS/ USFWS 1991a).

Life History

Green sea turtles nest on sand beaches where the female digs a hole and deposits as many as 145 eggs (TPWD 2011b). These turtles can lay between 1 and 8 clutches at approximately two-week intervals usually every 2 to 5 years (NatureServe 2012a). Apparently, growth rates and age of maturity vary greatly throughout the species' range, with some sources stating that sexual maturity is reached between 8 and 13 years while others estimate the age of sexual maturity to range from 20 to 50 years (NMFS/USFWS 1991a, TPWD 2011b, NatureServe 2012a). Along the Gulf of Mexico, most nesting activity occurs between June and August (TPWD 2012a).

The green sea turtle is the only herbivorous sea turtle, with seagrasses and algae being the primary components of their diet (Coyne 1994). However, some sources report that small amounts of sponges, crustaceans, sea urchins, mollusks, and other animal foods may also be eaten (NMFS/USFWS 1991a, TPWD 2011b). Days are typically spent feeding in seagrass beds while at night these turtles will sleep on shallow bottoms or, at times, out of water on rocky ledges (TPWD 2011b).

Green sea turtle navigation feats are well known, often traveling several thousand miles during migration from nesting areas to feeding grounds (NMFS/USFWS 1991a, TPWD 2011b). Most migration occurs along coasts but some populations are known to cross open ocean (TPWD 2011b). Major nesting areas for the species in the Atlantic include Surinam, Guyana, French Guiana, Costa Rica, the Leeward Islands, and Ascension Island (National Park Service [NPS] 2012a).

Population Dynamics

The green sea turtle is distributed worldwide in tropical and subtropical waters. Along the U.S. Atlantic Coast, populations are found from Texas to Massachusetts (NMFS/USFWS 1991a). The major feeding grounds in these waters occur in Florida where, in the past, these turtles were fished commercially (NMFS/USFWS 1991a). A commercial fishery for the turtles also existed in Texas at the end of the nineteenth century, primarily in Aransas Bay, Matagorda Bay, and the Laguna Madre (NMFS/USFWS 1991a).

Analysis of both historic and recent data indicates that population declines have occurred in all major ocean basins over the past 100 to 150 years, with 48 to 65 percent decline in the number of mature females nesting annually over the same period (NMFS 2012b). In the U.S., nesting occurs primarily along the east coast of Florida, and present estimates range from 200-1,100 females nesting annually (NMFS 2012b).

In Texas, few green sea turtle nests have been documented in the past. For instance, at Padre Island National Seashore only one record (1987) of a nesting green sea turtle existed for many years; however, in the last several years one to six nests have been confirmed on the Texas coast each year (NPS 2012a). No green sea turtle nests have been documented along the upper Texas coast, but these turtles have been observed in Galveston Bay. Between 1980 and 1991 there were four green sea turtles recorded in Galveston Bay (Caillouet et al. 1991). Between 1986 and 2007, one green sea turtle stranding was reported from Harris County (NMFS 2011).

Habitat

Green sea turtles are typically found in shallow waters such as those found in bays and esturaries where seagrass and/or algae are readily available (TPWD 2011b). During migration they can be found in deep waters as they cross sometimes vast stretches of ocean. Open, sandy beaches where there is minimal disturbance are needed for nesting (USFWS 2011b).

Critical habitat has been designated by the NMFS/USFWS for this species. However, all designated critical habitat for this species is located in Puerto Rico.

4.1.4 Kemp's Ridley Sea Turtle

Description

The Kemp's ridley sea turtle is the smallest of all sea turtles averaging about two feet in length and 100 pounds (Campbell 2003). Their nearly round carapace is olive-green or gray with a cream-white or yellowish plastron (USFWS/NMFS 1992). Kemp's ridley sea turtles are chiefly found in the Gulf of Mexico, though immature turtles are known to occur along the Atlantic coast of the U.S. as far north as New England (NPS 2012b). In addition to the primary nesting beach in Tamaulipas, Mexico, Kemp's ridleys also nest along the Texas coast but in smaller numbers (NPS 2012b).

Sexual maturity for females is reached at approximately 12 years of age. Nesting is essentially limited to the beaches of the western Gulf of Mexico, primarily in the state of Tamaulipas, Mexico (USFWS/NMFS 2010). Females arrive at nesting beaches in large groups and emerge to nest simultaneously over a period of several hours or days (Campbell 2003). Unlike other sea turtle species, these nesting events, called "arribadas," occur during the daytime and primarily at one beach, Rancho Nuevo, in Tamaulipas (Campbell 2003, USFWS/NMFS 1992). Nesting activity usually occurs between April and July (NatureServe 2012b).

Kemp's ridleys are shallow-water, benthic feeders with a preference for crab (USFWS/NMFS 1992). However, their diet apparently also consists of shrimp, snails, bivalves, sea urchins, jellyfish, sea stars, fish, and the occasional marine plant (Campbell 2003).

Little is known of post-hatchling Kemp's ridleys movement patterns, though evidently they spend many months as surface pelagic drifters in weed lines of offshore currents (USFWS/NMFS 2010). Although adult Kemp's ridley sea turtles are usually confined to the Gulf of Mexico, an unknown percentage migrates up to thousands of kilometers between nesting beaches and Atlantic coast feeding grounds, as far north as Long Island Sound in New York (NatureServe 2012b).

In addition to the main nesting beach in Tamaulipas, Mexico, Kemp's ridleys were known in the past to occasionally nest on Padre Island, Texas. In an effort to assist in the recovery of this endangered turtle, the governments of the U.S. and Mexico joined together in an attempt to establish a secondary nesting beach at Padre Island National Seashore (NPS 2012b). In 2011, 199 Kemp's ridley nests were found on the Texas coast, the most successful year to date and four times as many as in 2005 (NPS 2012b).

Population Dynamics

The Kemp's ridley sea turtle was abundant in the Gulf of Mexico as few as 50 years ago, with an estimated 40,000 females nesting in a one-day arribada at Rancho Nuevo Beach (USFWS/NMFS 1992). The nesting population at Rancho Nuevo Beach reached an all-time low in 1985 with 702 nests recorded (USFWS/NMFS 1992). Since that time there has been a gradual increase in nesting at the site, and from 2005 to 2009 an average of approximately 5,500 females nest each year at all monitored beaches in the Gulf of Mexico (USFWS 2011c). Similar to this Gulf-wide gradual upward trend, there has been a corresponding increase in nesting in Texas. Over the past 15 years, Kemp's ridley nesting on the Texas coast has risen from nine nests in 1997 to 199 nests in 2011 (NPS 2012b).

Habitat

Kemp's ridley post-hatchlings evidently reside for months in floating drift lines in the pelagic environment (Campbell 2003). Juveniles and adults, on the other hand, primarily inhabit shallow coastal waters of the Gulf of Mexico and the northwestern Atlantic Ocean where they can be found occupying crab-rich areas with sandy or mud bottoms (USFWS/NMFS 1992). Nesting occurs on low sand dunes along ocean beaches, often isolated on the land side by coastal lagoons (USFWS/NMFS 1992).

No critical habitat has been designated by the USFWS for this species.

No Kemp's ridley sea turtle have been documented nesting in Galveston Bay in Harris County, but they do nest nearby on the beaches of Galveston County. According to preliminary data compiled by the National Park Service, 15 Kemp's ridley sea turtle nests were documented on Galveston Island in 2011 (NPS 2011b). In 2010, there were eight Kemp's ridley sea turtle nests documented on Galveston Island and three on Bolivar Peninsula (NPS 2010). These locations are all over 30 miles away from the project area, but it is possible that some individuals could occur in Galveston Bay. Between 1980 and 1991, 16 Kemp's ridley sea turtles were recorded in Galveston Bay (Caillouet et al. 1991). Between 1986 and 2007, seven Kemp's ridley strandings were documented in Harris County, while there were 542 in Galveston County and 17 in Chambers County during the same time period (NMFS 2011).

4.1.5 Leatherback Sea Turtle

The U.S. population of the leatherback sea turtle was federally listed as endangered in 1970 and gained federal protection with the passage of the ESA in 1973.

Description

The leatherback sea turtle is the largest sea turtle in the world, attaining a length of up to 8 feet and weighing more than 1,200 pounds (NPS 2012c, USFWS 2011d). The largest leatherback on record weighed more than 2,000 pounds (NMFS/USFWS 1992). Unlike other sea turtles whose carapace is covered with horny scutes, the carapace of the leatherback is made of tough, oil-saturated connective tissue raised into longitudinal ridges (NMFS/USFWS 1992). The carapace is slate black or bluish-black and the plastron whitish (NPS 2012c).

Life History

Leatherback sea turtles nest throughout the world with the largest concentration of nests occurring on the pacific coast of Mexico (NMFS/USFWS 1992). Females emerge from the sea at night onto sand beaches where they deposit between 70 and 90 normal or yolked eggs (USFWS 2011d). These turtles can lay between five and seven clutches at approximately 10-day intervals during a nest season (USFWS 2011d). Some sources state that sexual maturity may be reached in as little as two or three years in this species, while others estimate sexual maturity to be reached at 16 years (NMFS/USFWS 1992, USFWS 2011d). In the U.S. and Caribbean, most nesting activity occurs between March and July (NMFS/USFWS 1992).

The diet of the leatherback sea turtle consists primarily of various species of jellyfish but may also include tunicates, squid, fish, crustaceans, algae, and floating seaweed (NMFS/USFWS 1992, TPWD 2011d). Adults are highly migratory and are thought to be the most pelagic of all sea turtles, typically only moving into coastal waters during the reproductive season or, occasionally, in pursuit of concentrations of jellyfish (NMFS/USFWS 1992, TPWD 2011d).

Leatherbacks migrate farther and venture into colder water than all other sea turtles, routinely traveling between boreal, temperate, and tropical waters (NMFS/USFWS 1992).

Population Dynamics

In the early 1980s, the worldwide population of nesting female leatherbacks was estimated to be 115,000 (NMFS/USFWS 1992). By 1995, the overall worldwide estimate of nesting females had been revised downward to 34,500 (Atlantic Leatherback Turtle Recovery Team [ALTRT] 2006). However, recent estimates for the leatherback, in the North Atlantic alone, range from 34,000 to 94,000 (USFWS 2011d). The largest Atlantic nesting colonies of leatherbacks are located in French Guiana, Suriname, and Gabon with less dense nesting populations occurring throughout the Caribbean and Brazil (ALTRT 2006). In the continental U.S., Florida is the only state known to support a significant number of nests, with the number of nests varying between 540 and 1,747 nests per year from 2006 to 2010 (USFWS 2011d).

Although a few leatherbacks were recorded in Texas nesting on Padre Island in the 1920s and 1930s, none had been recorded in the state since that period until 2008 when one leatherback nest was discovered at Padre Island National Seashore (NPS 2012c). None have been recorded in Texas since 2008 (NPS 2012c).

Habitat

Leatherback sea turtles nest on high energy, open access, sandy beaches that tend to be adjacent to deep waters (NMFS/USFWS 1992, ALTRT 2006). Leatherbacks, considered the most pelagic of all sea turtles, normally remain in deep waters, often being found along oceanic frontal systems and in areas of deep-water upwellings where they take advantage of high prey productivity (NMFS/USFWS 1992, TPWD 2011d, ALTRT 2006). These turtles are thought to move into shallow, coastal waters only during the reproductive season or, occasionally, in pursuit of concentrations of jellyfish (NMFS/USFWS 1992, TPWD 2011d).

Critical habitat has been designated by the NMFS/USFWS for this species. However, all designated critical habitat for this species is located in the U.S. Virgin Islands.

Although a few leatherbacks were recorded nesting on Padre Island in the 1930s and 1940s, none have been recorded nesting in Texas since and the species is considered a rare visitor to the Texas Gulf Coast. Between 1980 and 1991, two leatherbacks were recorded in Galveston Bay (Caillouet et al. 1991). Between 1986 and 2007, 48 leatherback strandings were documented in Galveston County (NMFS 2011).

4.1.6 Loggerhead Sea Turtle

Life History

Loggerhead sea turtles nest on sand beaches, usually at night, where the female digs a hole and deposits 80 to 125 eggs (NPS 2012d). These turtles can lay between 1 and 7 clutches at approximately two-week intervals usually every 2 to 3 years (USFWS 2012e). Age at sexual maturity is thought to be between 32 and 35 years (NMFS/USFWS 2008, USFWS 2011e). Nesting occurs between April and September with the greatest activity in July and August (USFWS 2012e, TPWD 2011e).

As with other sea turtles, posthatchling loggerheads reside in floating driftlines in the pelagic environment and those from the southeastern U.S. have been known to ride currents all the way to Europe and the Azores and back.

The loggerhead is a carnivorous sea turtle with an extremely varied diet. Adult and sub-adult loggerheads are primarily predators of benthic invertebrates such as mollusks and crustaceans but the list of prey items also includes conchs, sea urchins, sponges, fish, squid, and octopus (NMFS/USFWS 2008, TPWD 2011e). During open sea migration between foraging and nesting areas, which can be of considerable length, loggerheads will also eat such items as jellyfish and floating egg clusters (TPWD 2011e).

Population Dynamics

The loggerhead sea turtle occurs throughout the temperate and tropical regions of the world with U.S. Atlantic waters populations found from Texas to Virginia and, rarely, as far north as New York (NMFS/USFWS 2008). Approximately 90 percent of all U.S. nesting occurs in Florida, especially southeastern Florida (NPS 2012d). The total estimated nesting in the U.S. has fluctuated over the last 20 years between 47,000 and 90,000 nests per year (USFWS 2011e).

In Texas, a few loggerhead sea turtle nests are documented each year. Over the last 10 years, nesting has remained fairly stable at Padre Island National Seashore, with 0 to 6 nests recorded each year (NPS 2012d).

Habitat

Loggerhead females typically select relatively narrow, steeply sloped, coarse-grained beaches for nesting (NMFS/USFWS 2008). As previously mentioned, post-hatchlings spend months floating in drift lines in the pelagic environment foraging within the *Sargassum* weed raft community (NatureServe 2012d). Although habitat selection is not well understood, adults utilize a variety of environments including brackish water of coastal lagoons and river mouths, mud bottoms of sounds, bays, and estuaries, and the often turbid, detritus-laden, muddy-bottomed bays and bayous of the northern Gulf of Mexico (NMFS/USFWS 2008, TPWD 2011e).

No critical habitat has been designated by the USFWS for this species.

The loggerhead sea turtle occurs throughout the temperate and tropical regions of the world with the U.S. Atlantic waters populations found from Texas to Virginia and rarely as far north as New Jersey (USFWS 2011c, TPWD 2011e). Ninety percent of all nesting occurs in Florida with southeastern Florida considered one of the five major loggerhead rookeries in the world (NPS 2012d). A few loggerhead sea turtle nests are documented in Texas each year. Two nests were reported in 2006 on the Bolivar Peninsula in Galveston County (Sea Turtle Nest Monitoring System 2011). Between 1980 and 1991, three loggerheads were recorded in Galveston Bay (Caillouet et al. 1991). Between 1986 and 2007, 462 loggerhead sea turtle strandings were documented in Galveston County, five were documented in Chambers County, and one was documented in Harris County (NMFS 2011).

4.1.7 Red-cockaded Woodpecker

The red-cockaded woodpecker is a small non-migratory black and white woodpecker with prominent white bars on its back creating a ladder pattern. The head is black with white cheek patches, and the chest is dull white with small black spots. “Red-cockaded” refers to small, red ear patches that are usually only visible when the bird is agitated. This is a cooperative breeding species, living in family groups, which generally consist of a breeding pair and one or two helpers. Each group occupies a territory consisting of several cavity trees known as a cluster (Jackson 1994). This species excavates cavities in live pine trees, which often take several years to complete and may be the reason for the cooperative breeding dynamic (USFWS 2003). red-cockaded woodpeckers require open, mature old-growth longleaf or loblolly pine forests with little or no hardwood mid-story. Historically, these pine forests were maintained by fire, which eliminated the hardwood mid-story and promoted native groundcover. Fire suppression has resulted in hardwood mid-story encroachment, which in turn has become the leading cause of red-cockaded woodpecker cavity abandonment (USFWS 2003). Degradation and elimination of old-growth pine forest has limited potential red-cockaded woodpecker habitat to small, isolated fragments. At the time that the red-cockaded woodpecker Recovery Plan was written, it was estimated that the population had been reduced to just 3 percent of what it had been prior to colonization of the New World. Passage of the ESA in 1973 gave federal protection to the species, but populations continued to decline until the 1990s when intensive management resulted in most populations stabilizing and many increasing (USFWS 2003).

The red-cockaded woodpecker once inhabited forests throughout the southeastern U.S. as far north as New Jersey and west to eastern Texas and Oklahoma. The current range extends from Florida to Texas, but is fragmented into isolated islands (USFWS 2003, 2011f). Historic distribution of this species includes Harris County. However, current distribution maps indicate the nearest site that may be occupied is in Montgomery and Liberty Counties north and east of the project area (USFWS 2002).

4.1.8 Whooping Crane

The whooping crane is North America's tallest bird, with a standing height of five feet or more, as well as one of its rarest with fewer than 500 birds in existence. The only self-sustaining wild population is the Aransas-Wood Buffalo population (AWBP) (USFWS 2007), and in March 2010 the total number was estimated at 263 individuals (Whooping Crane Conservation Association 2010). The AWBP nests in Canada at the Wood Buffalo National Park in the summer, and over-winters on the central Gulf Coast of Texas at Aransas National Wildlife Refuge (Canadian Wildlife Service [CWS], USFWS 2007). During migration, these cranes typically stop to rest and feed in open bottomlands of large rivers and marshes but, like other water fowl, may also utilize croplands, playas, and various other aquatic features.

The project area is not located in the migratory path of the whooping crane (CWS, USFWS 2007), and there are no records in or near the project Action Area. There is no habitat for whooping cranes in the Action Area, and there are no documented occurrences of the whooping crane within the Action Area (TXNDD 2011). Whooping cranes generally migrate west of Harris County (http://www.npwrc.usgs.gov/resource/birds/wcdata/tx_fig1.htm). They winter in and around Aransas National Wildlife Refuge, approximately 125 miles southwest of the Project Site. An occurrence of whooping crane in the Action Area would be considered incidental and is very unlikely.

4.1.9 Louisiana Black Bear

Black bears were historically widespread throughout Texas, but are now restricted to remnant populations in mountainous areas of the Trans-Pecos region (Schmidly 2004). The Louisiana black bear, which is one of 16 recognized subspecies of black bear (Hall 1981), was historically found in eastern Texas. It is distinguished from other black bears by its longer, more narrow, and flat skull and by its proportionately large molar teeth (Nowak 1986). This subspecies is now restricted primarily to the Tensas and Atchafalaya River Basins in Louisiana, where its habitat consists primarily of bottomland hardwood timber. The Louisiana black bear is not known to occur in Texas, although potential habitat exists in the eastern part of the state (TPWD 2004).

4.1.10 Red Wolf

The red wolf historically ranged throughout the southeastern United States, from the Atlantic coast to central Texas, and from the Gulf Coast to central Missouri and southern Illinois. Between 1900 and 1920, red wolves were extirpated from most of the eastern portion of their range. A small number persisted in the wild in southeastern Texas and southwestern Louisiana until the late 1970s; however, by 1980 the species was declared extinct in the wild (USFWS 2004). Since then, experimental populations have been reintroduced in North Carolina and Tennessee (USFWS 2004). Red wolves are considered extirpated from Texas.

4.1.11 West Indian Manatee

The West Indian manatee is a large, cylindrically shaped, nearly hairless aquatic mammal (Whitaker 1996). They are uniformly grayish in color and possess paddle shaped forelimbs, no hind legs, and a broad flattened tail. Adults average nearly 10 feet in length and weigh over 2,000 pounds (USFWS 1993).

West Indian manatees live in rivers, bays and coastal areas in tropical and sub-tropical region of the new world from the southeastern coast of the United States to the northern coast of South America (Schmidly 2004). They have occasionally been observed several miles off the Florida Gulf coast. During colder months, manatees concentrate in areas of warmer water and when water temperatures drop too low they migrate to south Florida or form large groups in natural springs and at power plant outfalls. During warmer months they appear to choose areas based on adequate food supply, water depth and proximity to fresh water (USFWS 1993).

Records of manatees in Texas are rare. In fact, neither the USFWS nor NMFS lists this species as potentially occurring in Texas. However, manatees occasionally wander into waters of the Texas Gulf coast and bay systems. A mother and her calf were observed in several locations in west Galveston Bay in September of 1995. Another individual entered the HSC in November of 1995 and was observed at a Houston wastewater treatment plant at Buffalo Bayou and 69th Street (Schiro and Fertl 1995).

4.1.12 Texas Prairie Dawn-flower

Texas prairie dawn-flower, formerly known as Texas bitterweed, is a member of the sunflower family, Asteraceae. This species is an annual forb up to 8 inches tall with small yellow disk flowers (smaller than 0.5 inch in diameter) and minute pale ray flowers that are largely hidden by the bracts surrounding the flower head (Tveten and Tveten 1993). Texas prairie dawn-flowers bloom from March to July and disappear by mid-summer, completing their life cycle in the moist months of early spring to avoid the desiccating summer conditions (USFWS 1989). This species grows in small colonies on sparsely vegetated areas at the base of mima mounds (tiny mounds usually 10 to 50 feet in diameter and fewer than 12 inches high) or other nearly barren areas on slightly saline, fine-sandy compacted soils in open coastal prairie grasslands and are often patchily dispersed among other types of vegetation (USFWS 1989, Tveten and Tveten 1993). This species can also be found in previously disturbed areas that have returned to their natural vegetation with bare spots such as, abandoned rice fields, vacant lots, and pastures where mima mounds have been leveled (USFWS 1989).

Texas prairie dawn-flower is mostly found on nearly level, loamy prairie soils of the Hockley-Gessner and Katy-Aris associations. A few sites have been found on nearly level somewhat poorly drained saline soils of the Narta series. The high soil salinity of these bare spots prevents most plants from growing and reduces the competition for the more salt-tolerant Texas prairie dawn-flower (USFWS 1989). Correll and Johnston (1970) noted that this species was “rare in sandy soils near Hockley and Houston, Harris Co., [and] probably extinct”. However this species has been rediscovered in several locations in western Harris and eastern Fort Bend Counties, within and on the outskirts of Houston (USFWS 1989, TPWD 2011f). Much of the remaining habitat is protected on U.S. Army Corps of Engineers public lands such as Addicks and Barker Reservoirs in western Harris County. Habitat destruction by urban development and road construction is the Texas prairie dawn-flower’s primary threat due to the rapidly developing west and northwest portions of Harris County. This species has never been found on soils disturbed by plowing or other activities that destroy the soil horizon and thus, “any activity that severely disturbs the soil could be a severe threat to this species (USFWS 1989).

Based on an October 2011 query of the TXNDD, the nearest record of the Texas prairie dawn flower is approximately 8 miles from the Action Area. There are no records of the Texas prairie dawn flower in the Action Area (TXNDD 2011). The Texas prairie dawn-flower was reported in three general locations in Texas during the period from 1993-2002. However, none of these populations were recorded in multiple years, and none are within 15 miles of the Action Area. No persistent populations of the Texas prairie dawn-flower are known within 15 miles of the Project Site (TXNDD 2011).

4.2 Designated Federal Critical Habitat

There is no designated critical habitat for any federally listed threatened and endangered species in Harris County (http://criticalhabitat.fws.gov/crithab/).

5.0 EXISTING CONDITIONS AND EFFECTS ANALYSIS

This discussion provides the current status of the species and their habitats in the Action Area in order to provide a context to assess the effects of the proposed action. **Section 5.1** discusses land use/land cover in the Action Area. **Section 5.2** describes the methods used to evaluate conditions and effects. **Section 5.3** presents the results. **Section 5.4** discusses designated critical habitats. **Section 5.5** addresses interdependent and interrelated actions, and **Section 5.6** summarizes the recommended determinations of effect for each of the listed species.

5.1 Land Use in the Action Area

Land use in the Action Area is identified on **Figure 4** and summarized in **Table 8**. The majority of the Action Area is dominated by industrial land use (79%) with a small portion of the area being used for residential development (1%). Surface water (primarily the HSC/AA) makes up approximately 17% of the Action Area, while only 3% of the Action Area is undeveloped.

Table 8 Channel Energy Center Land Use in the Action Area

Land Use	Hectares	Acres	Percent
Industry	1,682	681	79%
Water	360	146	17%
Undeveloped	57	23	3%
Residential	22	9	1%
Total	**2,121**	**859**	**100%**

5.2 Methods

This BA is based on 1) a description of the proposed project; 2) pertinent ecological and physiographic information; 3) air modeling efforts to identify the Action Area; 4) field investigations to determine whether suitable habitat for protected species exists at the Project Site and/or in the Action Area; and 5) a detailed literature review to identify publications that focused on the impacts of air emissions on the protected species of potential occurrence within the Action Area. The following describes the methods used in the literature review (**Section 5.2.1**) and for the habitat assessments conducted in the Project Site and Action Area (**Section 5.2.2**).

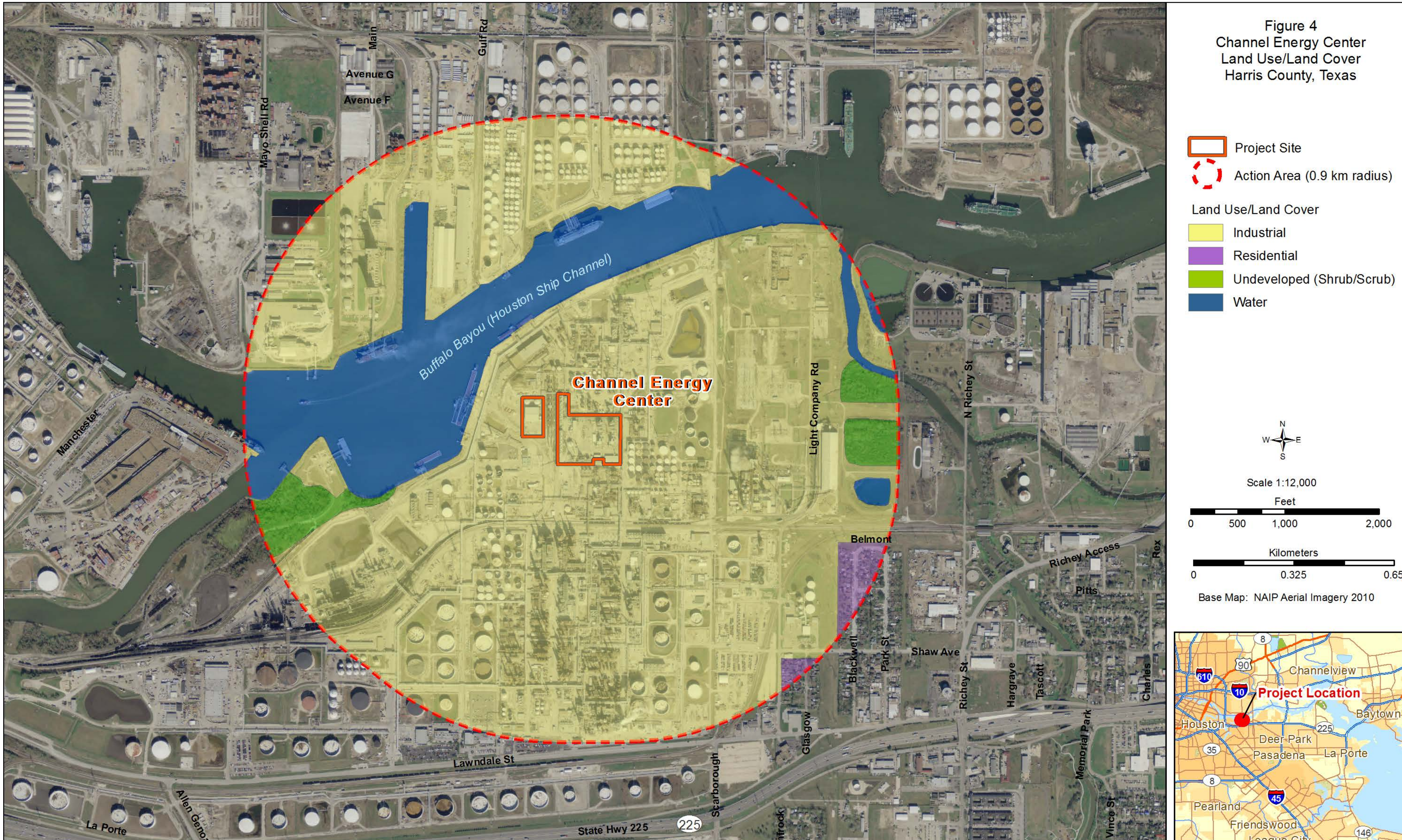
Figure 4
Channel Energy Center
Land Use/Land Cover
Harris County, Texas
Project Site
Action Area (0.9 km radius)
Land Use/Land Cover
Industrial
Residential
Undeveloped (Shrub/Scrub)
Water
Scale 1:12,000
Feet
0 500 1,000 2,000
Kilometers
0 0.325 0.65
Base Map: NAIP Aerial Imagery 2010
Channel Energy Center
Buffalo Bayou (Houston Ship Channel)
Avenue G
Avenue F
Main
Gulf Rd
Mayo Shell Rd
Manchester
Light Company Rd
N Richey St
Belmont
Richey Access
Pitts
Rex
Shaw Ave
Blackwell
Park St
Richey St
Hargrave
Tascott
Charles
Memorial Park
Glasgow
Scarborough
Lawndale St
State Hwy 225
La Porte
Allen Genoa
Vince St
Channelview
Project Location
Baytown
Houston
Deer Park
Pasadena
La Porte
Pearland
Friendswood

5.2.1 Literature Review

The literature review conducted for this BA included:

1. Current lists of threatened and endangered species of potential occurrence in Harris County (from TPWD and USFWS) and Texas (NMFS).

2. A review of the TXNDD of documented rare species and resource occurrences within 15 miles of the Project Site (TXNDD 2011) (Note: The TXNDD database query of 15 miles from the Project Site was used to help determine trends in rare species occurrences in the region for context and does not in any way represent the Action Area, which extends up to 0.9 km from the Project Site).

3. A review of pertinent literature and current information on potential impacts of air emissions on plants, soil, and animals, including threatened and endangered species of potential occurrence in the Action Area, and designated critical habitat.

The purpose of the literature review identified in number 3 above was to evaluate whether any listed species of potential occurrence in the Action Area is known to have a susceptibility to air emissions impacts from a gas-fired power plant. This literature review was conducted by searching the University of Texas at Austin library, as well as online journal databases such as JSTOR and BioOne, to identify literature discussing the potential impacts of air emissions from gas-fired combustion units on federally listed threatened and endangered species within the Action Area. The search was conducted in a three-step process.

The first step was to collect a broad scope of articles that referenced air emissions impacts on wildlife. Search terms such as "emissions" and "natural gas emissions" were entered into the online journal databases, as well as the University of Texas library search engine. The second step narrowed the search topics down to air emissions and threatened and endangered species. The third and final step narrowed the search topics down further to include the specific threatened and endangered species with the potential to occur within the Action Area, as identified by the USFWS, TPWD and NMFS lists:

Taxonomic group (n)	**Species**
fish (1)	smalltooth sawfish
amphibia (1)	Houston toad
sea turtles (4)	green, Kemp's ridley, leatherback, loggerhead
birds (2)	red-cockaded woodpecker, whooping crane
terrestrial mammals (2)	Louisiana black bear, red wolf
aquatic mammals (1)	West Indian manatee
plants (1)	Texas prairie dawn-flower

5.2.2 Habitat Assessment Methods

A three-step approach was utilized in the habitat assessment conducted for this project.

Step 1 – Existing Data
The initial step in the habitat assessment was to identify the species of potential occurrence in the project area, review known occurrences and habitat requirements of each of these species, and determine baseline conditions in the Action Area relative to the species' habitat requirements.

Step 2 – Remote Sensing Assessment
A remote sensing analysis was conducted based on a review of a number of sources including color infra-red and black and white aerial photography, National Resources Conservation Service (NRCS) soil surveys, USFWS National Wetlands Inventory Maps, and U.S. Geological Survey topographic maps. This assessment included identifying the location of specific areas (based on land cover/soils/topographic features and other habitat requirements) that would possibly be considered suitable habitat for the listed species.

Step 3 – Ground Verification of Vegetation Community Signatures
The areas of potential habitat identified in Step 2 were ground-verified (as access allowed), and the signatures were clarified by qualified biologists. The field investigation, conducted on November 2, 2011, by Rick Phillips and Nick Wallisch (endangered species biologists from Blanton and Associates, Inc.), consisted of driving all publicly accessible roads within the Action Area. Although no access was available to private properties within the Action Area, except for the Project Site, public rights-of-way were explored via pedestrian survey and used to observe private tracts with potential for suitable habitat and to assess the potential for occurrence of Texas prairie dawn-flower or other endangered species.

5.3 Results

The following subsections provide background, observations and analysis needed to evaluate the potential for the proposed action to affect the federally listed threatened and endangered species of potential occurrence in the Action Area: **Section 5.3.1** Background Research; **Section 5.3.2** Habitats at the Project Site and in the Action Area; and **Section 5.3.3** Potential for Occurrence and Recommended Determinations of Effect for Federally Listed Species.

5.3.1 Background Research

Review of Species Lists and Known Occurrences
The federal list of threatened or endangered species of potential occurrence in Harris County, as compiled from the most current USFWS and TPWD lists for the county and the NMFS list for Galveston Bay, is provided in **Table 7**. Based on an October 2011 query of the TXNDD, the Texas prairie dawn flower and Houston toad are the only species listed by the USFWS as threatened or endangered known to occur within 15 miles of the Project Site (**Table 7**). None of these records are within the proposed Action Area, and the nearest record is approximately 5 miles from the Action Area. The Texas prairie dawn-flower was reported in three general locations during the period from 1993-2002. However, none of these populations were recorded in multiple years. No persistent populations of the Texas prairie dawn-flower are known within 15 miles of the Project Site (TXNDD 2011). The record of the Houston toad is from 1976. **Table 9** provides a summary of the data provided in the TXNDD element of occurrence reports for federally listed threatened and endangered species within 15 miles of the Project Site.

Table 9 Federally Threatened or Endangered Species Observed within 15 Miles of the Project Site

Species	TXNDD ID #	Observation Date	Distance and Direction from Project Site	Within Action Area?	Notes
Texas Prairie Dawn-flower	5530	4/4/2002	8.0 miles SE	No	Several small Texas prairie dawn-flower populations were discovered near Space Center Blvd. east of Ellington Field.
Texas Prairie Dawn-flower	3393	2/9/1999	12.2 miles N	No	Three to four contiguous small populations were discovered near the intersection of Lake Houston Pkwy and Sam Houston Pkwy.
Texas Prairie Dawn-flower	8139	1993	14.9 miles NNE	No	Two small populations were discovered west of Lake Houston.
Houston Toad	7449	1976	5.0 miles SSW	No	Several were observed until the mid 1970s. Urbanization has since eliminated the habitat.

TXNDD, October 2011

Background Information on Air Quality Effects

An extensive review of the literature did not find any publication that identified impacts of air emissions on any of the threatened or endangered species addressed in this BA. Smith and Levinson (1980) provide a framework for understanding air quality effects on habitat and species for ***terrestrial*** plants and animals, while acknowledging that limited data exist to make quantifiable, deterministic evaluation of real or potential effects. In terms of path of exposure, impacts on plant species may occur through direct absorption (absorption from gas phase or air borne suspensions or aerosols) versus indirect absorption (through root systems after deposition). For animalia, impacts may derive from inhalation, contact or ingestion. In the temporal dimension, effects may be acute (manifesting in a narrow time window after recent exposure) versus chronic (wherein effect may only manifest gradually after prolonged exposure).

It is frequently observed that lower order organisms (insects, bivalves, algaes, lichens) are impacted more acutely and at lower concentrations than vertebrate or higher order plant species living in the same habitat. Nonetheless, higher order organisms are subject to negative impacts on nutrient resources, reproduction, habitat, and biodiversity with long term exposures, often as a result of indirect or chronic effects like acidification or cumulating toxicity, respectively (Smith and Levenson 1980, Dudley and Solton 1996).

Six of 12 species in this BA are found in aquatic habitat. Human perturbation in the nitrogen cycle has mobilized high levels of bioavailable nitrogen from previously bioinaccessible sources, resulting in overstimulation of plant and microorganismal growth in aquatic habitats (eutrophication). Eutrophication ultimately depletes oxygen, lowers pH, and alters species composition in affected habitat. Acidification of waterways through deposition of HNO_3 and H_2SO_4 also mobilizes toxic elements (such as aluminum) that can enter the food chain, damaging lower levels of the food chain as well as becoming bioconcentrated up the food chain. Collectively, such impacts are detrimental for biodiversity and thus wide scale species sustainability (Lovett and Tear 2008).

5.3.2 Habitats at the Project Site and in the Action Area

This section provides a description of the habitats at the Project Site and in the Action Area to provide context to evaluate the potential for occurrence and effects determination for the federally listed species.

Regional Description: The proposed project is located within the Austroriparian Biotic Province, as described by Blair (1950). This biotic province stretches from the Pineywoods of eastern Texas to the Gulf of Mexico and through the southeastern U.S. to the Atlantic Ocean. It is generally characterized by extensive pine and hardwood forests, swamps, marshes, and other hydric communities (Blair 1950, Hatch et al. 1990) that occur because of sandy soils and high annual rainfall. The soils of the Project Site are mapped as Urban Land, although there is no exposed soil at the plant. Other soil types in the Action Area include Ijam Soils, Vamont Clay, Vamont-urban Land Complex, Lake Charles Clay, Lake Charles-urban Land Complex, and Midland Silty Clay Loam (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx) (**Figure 5**). The Project Site and the surrounding Action Area were mapped by the TPWD as Urban (McMahan et al. 1984).

Project Site: The Project Site is a managed area consisting of the existing power plant facility, which is surrounded by an oil refining facility. The Project Site is completely devoid of vegetation. The area is entirely concrete or gravel, and there is no exposed soil on the site.

Action Area: As shown in **Figures 1**, **2**, and **4**, the Action Area consists of various industrial facilities, residential developments, roads, and the HSC (HSC/AA). Natural vegetation within the Action Area is limited to small, scattered, undeveloped tracts. Even the undeveloped tracts show signs of past disturbance. The few patches of woodlands contain native hardwood species such as cedar elm (*Ulmus crassifolia*), post oak (*Quercus stellata*), water oak (*Quercus nigra*), and sugar hackberry (*Celtis pallida*), and non-native species such as Chinese tallow (*Sapium sebiferum*). Common understory species in these woodlands include trifoliate orange (*Poncirus trifoliolata*), yaupon (*Ilex vomitoria*), gum bumelia (*Sideroxylon lanuginosum*), and Chinese privet (*Ligustrum sinense*). Other vegetation in the Action Area consists of various introduced and ornamental species associated with residential and commercial developments. The HSC is a tide-influenced, dredged, brackish/estuarine bayou. Salinity, temperature and current depend on rainfall in the upstream catchment area of the Buffalo Bayou and the tide conditions in the upper Galveston/San Jacinto Bays.

The Houston Ship Channel (HSC)

The HSC is a major physiographic feature of the Action Area. The HSC (**Figure 1**) is a dredged, 15 m deep channel that allows large, sea-going container vessels and tankers to transit between the Gulf of Mexico and the Ports of Houston, Galveston and Texas City. These ports serve the largest petrochemical complex in the United States (Port of Houston Authority, 2006). The HSC runs in two stages, one inland and one marine. The 30-km inland stretch follows the historic course of the downstream section of the Buffalo Bayou, and runs from the Turning Basin (in the city of Houston) to San Jacinto Bay. From its mouth in San Jacinto Bay, the marine section of the HSC runs another 75 km through San Jacinto, Trinity and Galveston Bays to Point Bolivar, where it feeds into the Gulf of Mexico. The deepest points in these shallow bays rarely exceed 3 m outside of the HSC.

The inland HSC is routinely dredged all the way to the Turning Basin in Houston. The upper segment of the inland HSC is classified by the TECQ as Water Quality Segment No. 1007 (Greens Bayou to the Turning Basin). The portion of the HSC/AA contains a 2.0-km long stretch of the HSC that begins approximately 18.8 km from the mouth of the San Jacinto Bay.

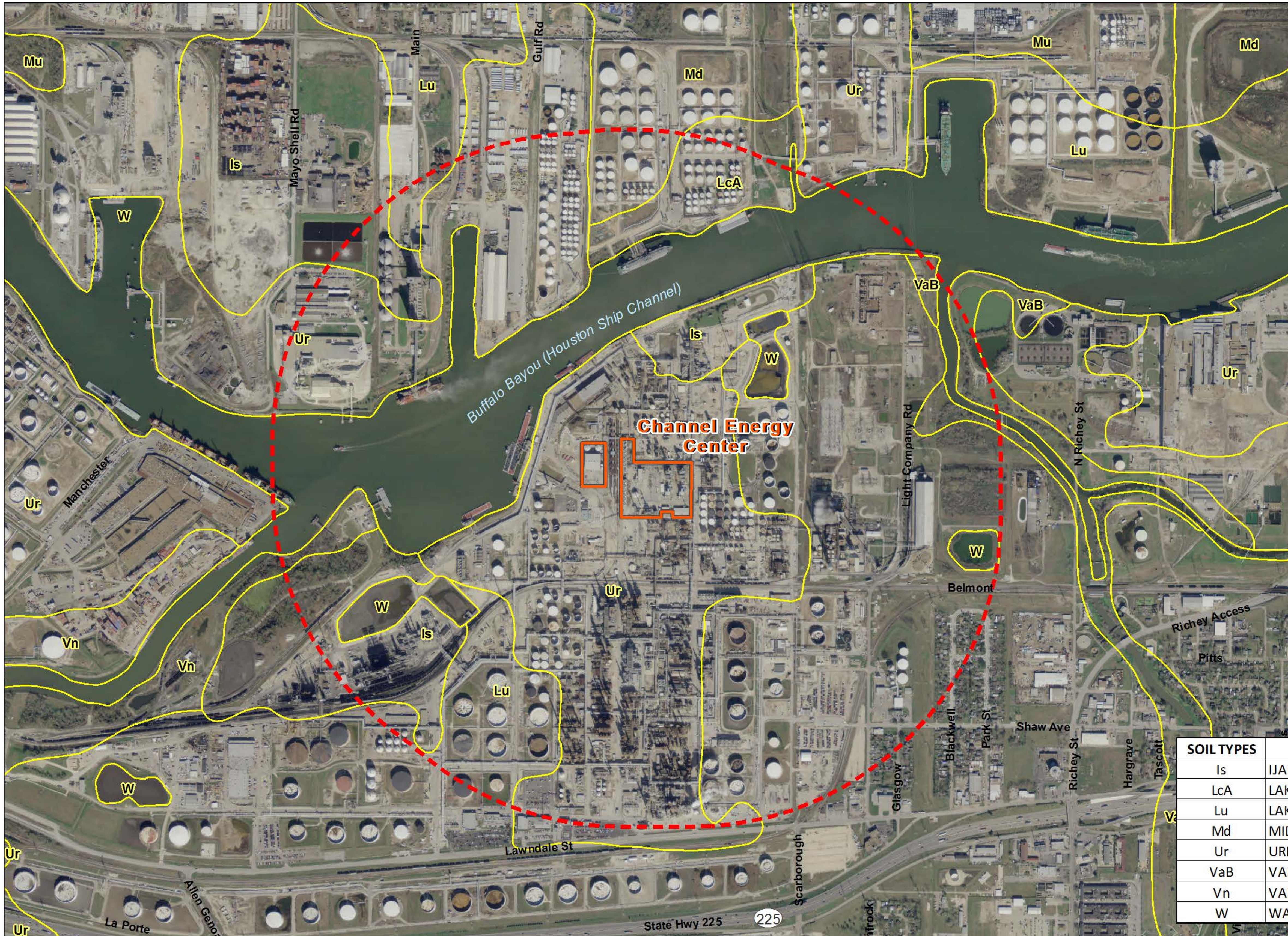

Figure 5
Channel Energy Center
Soils
Harris County, Texas

Project Site

Action Area (0.9 km radius)

NRCS Soils

N
W E
S

Scale 1:12,000

Feet
0 500 1,000 2,000

Kilometers
0 0.3 0.6

Source: U.S. Department of Agriculture, Natural Resources Conservation Service
Base Map: NAIP Aerial Imagery 2010

SOIL TYPES	DESCRIPTION
Is	IJAM SOILS
LcA	LAKE CHARLES CLAY, 0 TO 1 PERCENT SLOPES
Lu	LAKE CHARLES-URBAN LAND COMPLEX
Md	MIDLAND SILTY CLAY LOAM (VERLAND)
Ur	URBAN LAND
VaB	VAMONT CLAY, 1 TO 4 PERCENT SLOPES
Vn	VAMONT-URBAN LAND COMPLEX
W	WATER

The watershed of the HSC comprises extensively developed urban, surburban and industrialized landscapes. Water quality in HSC is among the worst for all sections of the Galveston Bay system, on the basis of contamination by organic and inorganic pollutants (Lester and Gonzalez, 2005, 2008). HSC has Total Maximum Daily Load programs in place for dioxins, polychlorinated biphenyls, and nickel. In addition, sediment levels of mercury and zinc routinely exceed Marine Probable Effects Levels (TCEQ 2004). Salinity in the HSC approaches that of fresh water (TCEQ 2009).

The HSC is routinely dredged, removing forageable prey, and is devoid of sargassum and oyster beds. As such, the biota of the HSC resembles a depleted version of that of the bay waters of the Galveston Bay system (Pullen 1961, 1965). Species tolerant of fresh to brackish salinities, e.g., juvenile brown and white shrimp and blue crab, have been observed in the HSC (Seiler et al. 1991).

5.3.3 Potential for Occurrence and Recommended Determination of Effect for Federally Listed Species

5.3.3.1 Smalltooth Sawfish (Federal Endangered)

Potential to Occur in the Action Area and Potential Effect: There is no preferred habitat for the smalltooth sawfish in the Action Area, and there are no documented occurrences of the smalltooth sawfish in the Action Area (TXNDD 2011). In U.S. waters of the Gulf of Mexico, smalltooth sawfish are virtually completely restricted to south Florida (NMFS 2006). One could theoretically enter the Action Area through the HSC, but any such event would be isolated, unlikely, and very short term. Personal communication with the NMFS Section 7 coordinator indicated that this species is not expected to occur in the Action Area as this species is restricted to South Florida (Personal Communication from Eric Hawk to Don Blanton, April 2012).

Potential Effect: As described above, there is no preferred habitat for the smalltooth sawfish in the Action Area, and furthermore, wastewater discharges (**Sections 2.6, 6.0**), emissions (**Sections 2.3, 3.2.2-3, 6.0**), noise (**Section 2.4**) and dust (**Section 2.5**) resulting from the planned construction and operation would not be expected to have any impact on smalltooth sawfish habitat. In addition, no impact is expected on the smalltooth sawfish by direct effects such as noise, dust or human activities, or by indirect effects such as acidification or eutrophication of aquatic habitats associated with construction and operation of the project.

Recommended Determination of Effect: The proposed action will have no effect on the smalltooth sawfish.

5.3.3.2 Houston Toad (Federal Endangered)

Potential to Occur in the Action Area: There are no documented occurrences of the Houston toad in the Action Area. The USFWS does not consider the Houston toad present in Harris County (**Table 7**). The closest known documented occurrence of the Houston toad is 5 miles south-by-southwest from the Action Area (TXNDD 2011). However, this occurrence record is from 1976, and the habitat has since been eliminated by urban development.

There is no habitat for the Houston toad within the Action Area. The Houston Toad requires deep sandy soils for burrowing, while the Action Area contains clay-based soils (see **Figure 5**). In addition, the Houston toad requires persistent (weeks-months), pooled water for mating and breeding that does not exist within the Action Area.

Potential for Effect: The Houston toad has been documented once in 35 years at a distance of 5 miles from the Action Area. Moreover, as there is no habitat for the Houston Toad in the Action Area the likelihood of the occurrence of this species in the Action Area is discountable (i.e., extremely unlikely to occur). In the extremely unlikely event that a Houston toad were to occur in the Action Area the effects would be expected to be insignificant (i.e., the size of the effects should not reach the scale where take occurs) as evidenced by the following:

1. There are no trace metals associated with the combustion of natural gas in turbines therefore no deposition of trace metals in the Action Area from air emissions is expected to occur.

2. Additional noise will be similar to current conditions (**Section 2.3.3**); dust will be contained during construction by best management practices (**Section 2.3.4**); and, no other effect from associated human activities are expected.

Recommended Determination of Effect: Because the effects of the proposed action are expected to be discountable (i.e., extremely unlikely to occur) and insignificant (i.e., the size of the effects should not reach the scale where take occurs), the recommended determination of effect is that the proposed action may affect, but is not likely to adversely affect, the Houston toad.

5.3.3.3 Green Sea Turtle (Federal Threatened)

Potential to Occur in Action Area: There is no preferred habitat for green sea turtles in the Action Area, and there are no documented occurrences of the green sea turtle in the Action Area (TXNDD 2011). Green sea turtles are found occasionally in Galveston Bay, and between 1986 and 2007 one individual was recorded in Harris County (NMFS 2011). A green sea turtle could theoretically enter the Action Area through the HSC, but any such event would be isolated, unlikely, and very short term.

There is no preferred habitat for green sea turtles in the Action Area. Green sea turtles are pelagic, preferring euhaline, open and coastal marine waters, where they forage by diving to intermediate and deep levels (>30 m) or to the sea floor. Green sea turtles are predominantly herbivourous and forage on seagrass and algae. They may occasionally ingest coelenterates. Green sea turtles are solitary except during mating season and nesting occurs on ocean-facing dune shores. Young (pre-reproductive) green sea turtles migrate to open waters, and are highly adapted for, and dependent on, euhaline conditions. In contrast, the portion of the HSC/AA is a minimum of 18.8 km from the mouth of the San Jacinto Bay, and from there still 75 km from the open waters of the Gulf of Mexico. Salinity in the HSC approaches that of fresh water (TCEQ 2009). The HSC is routinely dredged and devoid of seagrass.

Potential for Effect: Despite its documented presence in the Gulf of Mexico and Galveston Bay, the green sea turtle has not been reported in the Action Area or any portion of the HSC. Moreover, as there is no preferred habitat for the green sea turtle in the Action Area the likelihood of the occurrence of this species in the Action Area is discountable (i.e., extremely unlikely to occur). In the unlikely event that a green sea turtle were to transiently occur in the Action Area the effects would be expected to be insignificant (i.e., the size of the effects should not reach the scale where take occurs) as evidenced by the following:

1. There are no trace metals associated with the combustion of natural gas in turbines therefore no deposition of trace metals in the Action Area from air emissions is expected to occur.

2. The deposition of nitrogen (as nitrate) and sulfur (as sulfate) from air emissions in the portion of the HSC/Action Area are on the order of 10^{-10} and 10^{-11} M, respectively (**Section 3.2.3**), and are not expected to contribute to acidification or eutrophication of the HSC.

3. Wastewater discharges (**Section 2.6**) are expected to be non-toxic and isothermic to current discharges.

4. Additional noise will be similar to current conditions (**Section 2.3.3**); dust will be contained during construction by best management practices (**Section 2.3.4**); and, no other effect from associated human activities are expected.

Recommended Determination of Effect: Because the effects of the proposed action are expected to be discountable (i.e., extremely unlikely to occur) and insignificant (i.e., the size of the effects should not reach the scale where take occurs), the recommended determination of effect is that the proposed action may affect, but is not likely to adversely affect, the green sea turtle.

5.3.3.4 Kemp's Ridley Sea Turtle (Federal Endangered)

Potential to Occur in the Action Area: There is no preferred habitat for Kemp's ridley sea turtles in the Action Area, and there are no documented occurrences of the Kemp's ridley sea turtle in the Action Area (TXNDD 2011). Kemp's ridley sea turtles nest on Galveston Island and are found occasionally in Galveston Bay, and between 1986 and 2007 seven individuals were recorded in Harris County (NMFS 2011). A Kemp's ridley sea turtle could theoretically enter the Action Area through the HSC, but any such event would be isolated, unlikely, and very short term.

There is no preferred habitat for Kemp's ridley sea turtles in the action area. Kemp's ridley sea turtle are pelagic, preferring euhaline, open and coastal marine waters, where they forage by diving to intermediate and deep levels (>30 m) or to the sea floor. Kemp's ridleys are shallow-water, benthic feeders with a preference for crab (USFWS/NMFS 1992). However, their diet apparently also consists of shrimp, snails, bivalves, sea urchins, jellyfish, sea stars, fish, and the occasional marine plant (Campbell 2003). Little is known of post-hatchling Kemp's ridleys movement patterns, though evidently they spend many months as surface pelagic drifters in weed lines of offshore currents (USFWS/NMFS 1992). Kemp's ridley sea turtles are solitary except during mating season. Nesting occurs on low sand dunes along ocean beaches, often isolated on the land side by coastal lagoons (USFWS/NMFS 1992). Kemp's ridley sea turtles are highly adapted for, and dependent on, euhaline conditions. In contrast, the portion of the HSC within the action area is a minimum of 18.8 km from the mouth of the San Jacinto Bay, and from there still 75 km from the open waters of the Gulf of Mexico. Salinity in the HSC approaches that of fresh water (TCEQ 2009). The HSC is routinely dredged, removing forageable prey.

Potential for Effect: Despite its documented presence in the Gulf of Mexico and Galveston Bay, the Kemp's ridley sea turtle has not been reported in the Action Area or any portion of the HSC. Moreover, as there is no preferred habitat for the Kemp's ridley sea turtle in the Action Area the likelihood of the occurrence of this species in the Action Area is discountable (i.e., extremely unlikely to occur). In the unlikely event that a transient Kemp's ridley sea turtle were to occur in the Action Area the effects would be expected to be insignificant (i.e., the size of the effects should not reach the scale where take occurs) as evidenced by the following:

1. There are no trace metals associated with the combustion of natural gas in turbines therefore no deposition of trace metals in the Action Area from air emissions is expected to occur.

2. The deposition of nitrogen (as nitrate) and sulfur (as sulfate) from air emissions in the portion of the HSC/Action Area are on the order of 10^{-10} and 10^{-11} M, respectively (**Section 3.2.3**), and are not expected to contribute to acidification or eutrophication of the HSC.

3. Wastewater discharges (**Section 2.6**) are expected to be non-toxic and isothermic to current discharges.

4. Additional noise will be similar to current conditions (**Section 2.3.3**); dust will be contained during construction by best management practices (**Section 2.3.4**); and, no other effect from associated human activities are expected.

Recommended Determination of Effect: Because the effects of the proposed action are expected to be discountable (i.e., extremely unlikely to occur) and insignificant (i.e., the size of the effects should not reach the scale where take occurs), the recommended determination of effect is that the proposed action may affect, but is not likely to adversely affect, the Kemp's ridley sea turtle.

5.3.3.5 Leatherback Sea Turtle (Federal Endangered)

Potential to Occur in the Action Area: There is no preferred habitat for leatherback sea turtles in the Action Area, and there are no documented occurrences of the leatherback sea turtle in the Action Area (TXNDD 2011). Leatherbacks are rare along the Texas gulf coast; between 1980 and 1991, only two individuals were recorded in Galveston Bay (Caillouet et al. 1991). A leatherback could theoretically enter the Action Area through the HSC, but any such event would be isolated, unlikely, and very short term. However, the incidental occurrence of this species in the Action Area cannot be dismissed.

There is no preferred habitat for leatherback sea turtles in the action area. Leatherback sea turtles sea turtles are pelagic, preferring euhaline, open and coastal marine waters, where they forage by diving to intermediate and deep levels (>30 m) or to the sea floor. The diet of the leatherback sea turtle consists primarily of various species of jellyfish but may also include tunicates, squid, fish, crustaceans, algae, and floating seaweed (NMFS/USFWS 1992, TPWD 2011d). Adults are highly migratory and are thought to be the most pelagic of all sea turtles, typically only moving into coastal waters during the reproductive season or, occasionally, in pursuit of concentrations of jellyfish (NMFS/USFWS 1992, TPWD 2011d). Leatherback sea turtles are solitary except during mating season and nesting occurs on ocean-facing dune shores. Adults are highly migratory and are thought to be the most pelagic of all sea turtles, typically only moving into coastal waters during the reproductive season or, occasionally, in pursuit of concentrations of jellyfish (NMFS/USFWS 1992, TPWD 2011d). Leatherback sea turtles are highly adapted for, and dependent on, euhaline conditions. In contrast, the portion of the HSC within the Action Area is a minimum of 18.8 km from the mouth of the San Jacinto Bay, and from there still 75 km from the open waters of the Gulf of Mexico. Salinity in the HSC approaches that of fresh water (TCEQ 2009). The HSC is routinely dredged, removing forageable prey.

Potential for Effect: Despite its documented presence in the Gulf of Mexico and Galveston Bay, the leatherback sea turtle has not been reported in the Action Area or any portion of the HSC. Moreover, as there is no preferred habitat for the leatherback sea turtle in the Action Area the likelihood of the occurrence of this species in the Action Area is discountable (i.e., extremely unlikely to occur). In the unlikely event that a leatherback sea turtle were to transiently occur in the Action Area the effects would be expected to be insignificant (i.e., the size of the effects should not reach the scale where take occurs) as evidenced by the following:

1. There are no trace metals associated with the combustion of natural gas in turbines therefore no deposition of trace metals in the Action Area from air emissions is expected to occur.

2. The deposition of nitrogen (as nitrate) and sulfur (as sulfate) from air emissions in the portion of the HSC/Action Area, are on the order of 10^{-10} and 10^{-11} M, respectively (**Section 3.2.3**), and are not expected to contribute to acidification or eutrophication of the HSC.

3. Wastewater discharges (**Section 2.6**) are expected to be non-toxic and isothermic to current discharges.

4. Additional noise will be similar to current conditions (**Section 2.3.3**); dust will be contained during construction by best management practices (**Section 2.3.4**); and, no other effect from associated human activities are expected.

Recommended Determination of Effect: Because the effects of the proposed action are expected to be discountable (i.e., extremely unlikely to occur) and insignificant (i.e., the size of the effects should not reach the scale where take occurs), the recommended determination of effect is that the proposed action may affect, but is not likely to adversely affect, the leatherback sea turtle.

5.3.3.6 Loggerhead Sea Turtle (Federal Threatened)

Potential to Occur in the Action Area: There are no documented occurrences of the loggerhead sea turtle in the Action Area or in the HSC (TXNDD 2011). Loggerhead sea turtles occur along the upper Texas gulf coast, and two loggerhead nests were documented on Bolivar Peninsula in Galveston County (more than 60 km from the Action Area) in 2006 (Sea Turtle Nest Monitoring System 2011). Between 1980 and

1991, three loggerheads were recorded in Galveston Bay (Caillouet et al. 1991). Between 1986 and 2007, one loggerhead was documented in Harris County (NMFS 2011; exact location not reported). Because the HSC is connected to the Gulf of Mexico via San Jacinto and Galveston Bays (which do provide preferred habitat), an incidental, isolated occurrence of this species in the Action Area cannot be entirely dismissed.

There is no preferred habitat for loggerhead sea turtles in the Action Area. Loggerhead sea turtles are pelagic, preferring euhaline, open and coastal marine waters, where they forage by diving to intermediate and deep levels (>30 m) or to the sea floor. Loggerheads are carnivores and forage for bottom dwelling molluscs, crustaceans and coelenterates. Loggerheads are solitary except during mating season and nesting occurs on ocean-facing dune shores. Young (pre-reproductive) loggerhead sea turtles migrate to sargassum or other floating off-shore marine vegetation, or oyster bed regions. Loggerheads are highly adapted for, and dependent on, euhaline conditions. In contrast, the portion of the HSC within the Action Area is a minimum of 18.8 km from the mouth of the San Jacinto Bay, and from there still 75 km from the open waters of the Gulf of Mexico. Salinity in the HSC approaches that of fresh water (TCEQ 2009). The HSC is routinely dredged, removing forageable prey, and is devoid of sargassum and oyster beds.

Potential for Effect: Despite its documented presence in the Gulf of Mexico and Galveston Bay, the loggerhead has not been reported in the Action Area or any portion of the HSC. Moreover, as there is no preferred habitat for the loggerhead sea turtle in the Action Area the likelihood of the occurrence of this species in the Action Area is discountable (i.e., extremely unlikely to occur). In the unlikely event that a transient loggerhead were to occur in the Action Area the effects would be expected to be insignificant (i.e., the size of the effects should not reach the scale where take occurs) as evidenced by the following:

1. There are no trace metals associated with the combustion of natural gas in turbines therefore no deposition of trace metals in the Action Area from air emissions is expected to occur.

2. The deposition of nitrogen (as nitrate) and sulfur (as sulfate) from air emissions in the portion of the HSC in the Action Area, are on the order of 10^{-10} and 10^{-11} M, respectively (**Section 3.2.3**), and are not expected to contribute to acidification or eutrophication of the HSC.

3. Wastewater discharges (**Section 2.6**) are expected to be non-toxic and isothermic to current discharges.

4. Additional noise will be similar to current conditions (**Section 2.3.3**); dust will be contained during construction by best management practices (**Section 2.3.4**); and, no other effect from associated human activities are expected.

Recommended Determination of Effect: Because the effects of the proposed action are expected to be discountable (i.e., extremely unlikely to occur) and insignificant (i.e., the size of the effects should not reach the scale where take occurs), the recommended determination of effect is that the proposed action may affect, but is not likely to adversely affect, the loggerhead sea turtle.

5.3.3.7 Red-cockaded Woodpecker (Federal Endangered)

Potential to Occur in the Action and Potential Effect: There is no habitat for red-cockaded woodpeckers in the Action Area, and there are no documented occurrences of the red-cockaded woodpecker in the Action Area (TXNDD 2011).

Recommended Determination of Effect: The proposed action will have no effect on the red-cockaded woodpecker.

5.3.3.8 Whooping Crane (Federal Threatened)

Potential to Occur in the Action Area: There are no documented occurrences of the whooping crane within the Action Area (TXNDD 2011). The USFWS does not consider the whooping crane present in Harris County (**Table 7**). The project area is not located in the migratory path of the whooping crane (CWS, USFWS 2007). Whooping cranes generally migrate west of Harris County (http://www.npwrc.usgs.gov/resource/birds/wcdata/tx_fig1.htm). An occurrence of whooping crane in the Action Area would be considered incidental and is very unlikely.

There is no preferred habitat (extensive open marshland) for whooping cranes in the Action Area. The only self-sustaining wild population is the Aransas-Wood Buffalo population (AWBP) (USFWS 2007) and, as of March 2010, it numbered approximately 263 individuals in total (Whooping Crane Conservation Association 2010). The AWBP nests in Canada at the Wood Buffalo National Park in the summer. It over-winters, 125 miles the south of the Action Area, on the central Gulf Coast of Texas at Aransas National Wildlife Refuge (Canadian Wildlife Service [CWS], USFWS 2007).

Potential for Effect: Despite its documented presence on the coast of the Gulf of Mexico near Corpus Christi, the whooping crane has not been reported in the Action Area or any portion of the HSC. Moreover, as there is no preferred habitat for the whooping crane in the Action Area the likelihood of the occurrence of this species in the Action Area is discountable (i.e., extremely unlikely to occur). In the unlikely event that a transient whooping crane were to occur in the Action Area the effects would be expected to be insignificant (i.e., the size of the effects should not reach the scale where take occurs) as evidenced by the following:

1. There are no trace metals associated with the combustion of natural gas in turbines therefore no deposition of trace metals in the Action Area from air emissions is expected to occur.

2. The deposition of nitrogen (as nitrate) and sulfur (as sulfate) from air emissions in the portion of the HSC in the Action Area, are on the order of 10^{-10} and 10^{-11} M, respectively (**Section 3.2.3**), and are not expected to contribute to acidification or eutrophication of the HSC.

3. Wastewater discharges (**Section 2.6**) are expected to be non-toxic and isothermic to current discharges.

4. Additional noise will be similar to current conditions (**Section 2.3.3**); dust will be contained during construction by best management practices (**Section 2.3.4**); and, no other effect from associated human activities are expected.

Recommended Determination of Effect: Because the effects of the proposed action are expected to be discountable (i.e., extremely unlikely to occur) and insignificant (i.e., the size of the effects should not reach the scale where take occurs), the recommended determination of effect is that the proposed action will have no effect the whooping crane.

5.3.3.9 Louisiana Black Bear (Federal Endangered)

Potential to Occur in the Action Area and Potential Effect: There is no habitat for Louisiana black bears in the Action Area, and there are no documented occurrences of the Louisiana black bear in the Action Area (TXNDD 2011). As described above, there is no preferred habitat for the Louisiana black bear in the Action Area, and furthermore, wastewater discharges (**Sections 2.6, 6.0**), emissions (**Sections 2.3, 3.2, 6.0**), noise (**Section 2.4**) and dust (**Section 2.5**) resulting from the planned construction and operation would not be expected to have any impact on Louisiana black bear habitat. In addition, no impact is expected on the Louisiana black bear by direct effects such as noise, dust or human activities, or by indirect effects such as acidification of habitat associated with construction and operation of the project.

Recommended Determination of Effect: The proposed action will have no effect on the Louisiana black bear.

5.3.3.10 Red Wolf (Federal Endangered)

Potential to Occur in the Action Area and Potential Effect: Red wolves have been extirpated from Texas.

Recommended Determination of Effect: The proposed action will have no effect on the red wolf.

5.3.3.11 West Indian Manatee (Federal Endangered)

Potential to Occur in the Action Area: As described above, there is no preferred habitat for the West Indian manatee in the Action Area, and furthermore, wastewater discharges (**Sections 2.6, 6.0**), emissions (**Sections 2.3, 3.2, 6.0**), noise (**Section 2.4**) and dust (**Section 2.5**) resulting from the planned construction and operation would not be expected to have any impact on West Indian manatee habitat. In addition, no impact is expected on the West Indian manatee by direct effects such as noise, dust or human activities, or by indirect effects such as acidification or eutrophication of aquatic habitats associated with construction and operation of the project.

However, the potential for the incidental occurrence of a West Indian manatee in the Action Area cannot be dismissed entirely.

Recommended Determination of Effect: The proposed action may affect, but is not likely to adversely affect, the West Indian manatee.

5.3.3.12 Texas Prairie Dawn-flower (Federal Endangered)

Potential to Occur in the Action Area: There is no habitat for Texas prairie dawn-flower in the Action Area, and there are no documented occurrences of the Texas prairie dawn-flower within the Action Area (TXNDD 2011). There are few remnants of native vegetation within the Action Area as it is highly industrialized (**Table 10**). The areas that are not industrial or residential in nature are identified on polygons 5, 10, and 11 on **Figure 6**. However, these areas are brush- and tree-covered and not the open prairie grasslands where this species is typically found.

Table 10 Channel Energy Center Land Use/Land Cover

LULC Polygon #	Photo #	Land Use/ Land Cover	Acres	Comment
1	6,7,8	Industrial	236.5	Various industrial activities (milling, petroleum tanks, electric lines)
2		Water	172.8	
3		Industrial	3.0	
4		Industrial	4.7	
5		Shrub/Scrub	18.4	
6	1, 4, 5	Industrial	658.2	(1) Railroad and electric lines going into petro-chemical complex. (4) Disturbed open space near ship channel. (5) Petro-chemical complex.
7	3	Residential	5.1	Neighborhood adjacent to petro-chemical complex.
8		Residential	25.4	
9		Water	2.3	
10		Shrub/Scrub	6.9	
11		Shrub/Scrub	5.8	
12		Water	6.8	
13	2	Industrial	22.8	Bayou cutting through corner of Action Area. Multiple power lines crossing. Pipelines attached to bridge.

All documented occurrences of Texas prairie dawn-flower in eastern Harris County were in the Bernard Clay Loam and Addicks Loam soil types. These two soil types do not occur in the Action Area (**Figure 5**). The nearest documented occurrence of Texas prairie dawn-flower is from 2002 approximately 8.0 miles southeast of the Project Site. All of the undeveloped open areas in the Action Area are managed or disturbed, and there was no evidence of Texas prairie dawn-flower habitat. Photos of the Action Area are included in **Appendix 1**; **Figure 6** serves as a location index for these photos.

Potential Effect: As described above, there is no preferred habitat for the Texas prairie dawn-flower in the Action Area, and furthermore, wastewater discharges (**Sections 2.6, 6.0**), emissions (**Sections 2.3, 3.2, 6.0**), noise (**Section 2.4**) and dust (**Section 2.5**) resulting from the planned construction and operation would not be expected to have any impact on Texas prairie dawn-flower habitat. In addition, no impact is expected on the Texas prairie dawn-flower by direct effects such as noise, dust or human activity, or by indirect effects such as acidification of habitats associated with construction and operation of the project. However, because of the limitations of accessing private lands, a 100% pedestrian survey could not be conducted in the Action Area. Therefore, the potential for the incidental occurrence of a Texas prairie dawn-flower in the Action Area cannot be dismissed entirely.

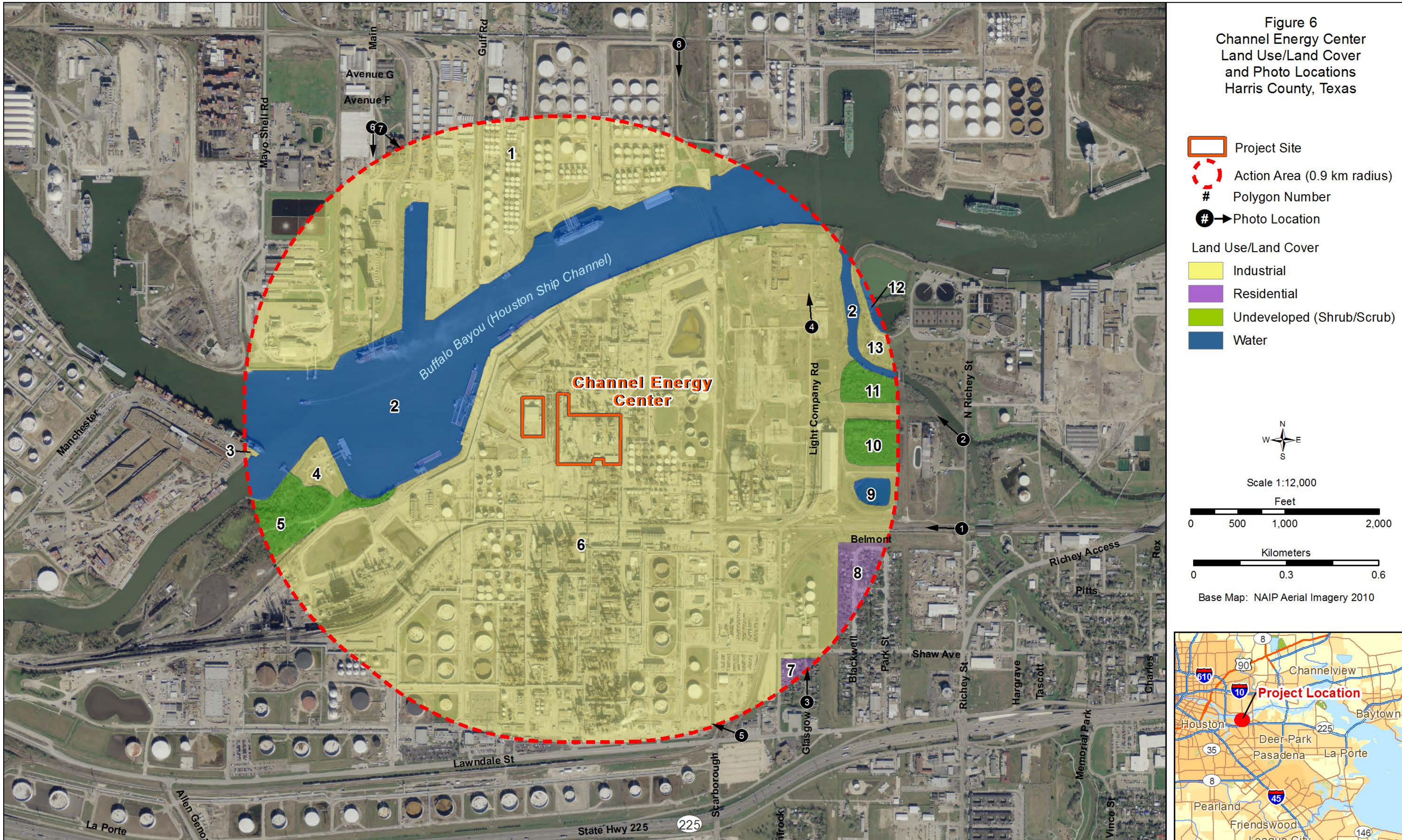

Figure 6
Channel Energy Center
Land Use/Land Cover
and Photo Locations
Harris County, Texas

Recommended Determination of Effect: The proposed action may affect, but is not likely to adversely affect, the Texas prairie dawn flower.

5.4 Designated Federal Critical Habitat

There is no designated critical habitat for any federally listed threatened and endangered species in Harris County. Therefore, the project would not affect any designated critical habitat.

5.5 Interdependent and Interrelated Actions

The proposed project is limited to the construction and operation of the new 180-megawatt natural gas-fired combined-cycle cogeneration unit at the existing location of the Channel Energy Center on State Highway 225 in, Houston, Harris County, Texas. No additional interdependent or interrelated actions are proposed at this time.

5.6 Recommended Determination of Effects for Federally Listed Species

A summary of the Recommended Determination of Effect for each of the federally listed species identified by the USFWS, TPWD, and NMFS is presented below.

Table 11 Summary of Determinations of Effect

Federally Listed Species	Agency That Listed Species "Of Potential Occurrence"	Recommended Determination of Effect
Smalltooth Sawfish	TPWD/NMFS	No effect
Houston Toad	TPWD	May affect, but is not likely to adversely affect
Green Sea Turtle	TPWD/NMFS	May affect, but is not likely to adversely affect
Kemp's Ridley Sea Turtle	TPWD/NMFS	May affect, but is not likely to adversely affect
Leatherback Sea Turtle	TPWD/NMFS	May affect, but is not likely to adversely affect
Loggerhead Sea Turtle	TPWD/NMFS	May affect, but is not likely to adversely affect
Red-cockaded Woodpecker	TPWD	No effect
Whooping Crane	TPWD	No effect
Louisiana Black Bear	TPWD	No effect
Red Wolf	TPWD	No effect
West Indian Manatee	TPWD	May affect, but is not likely to adversely affect
Texas Prairie Dawn-flower	USFWS/TPWD	May affect, but is not likely to adversely affect

6.0 CONSERVATION MEASURES

The proposed facility will utilize appropriate technologies to control emissions and avoid and/or minimize potential impacts to the environment and its associated habitats. The corresponding technologies to be utilized are discussed below.

Air Emissions

NO_x Emissions

Dry low NO_x (DLN) combustors and Selective Catalytic Reduction (SCR) technology will be used to control NO_x emissions to 2.0 parts per million by volume, dry basis (ppmvd) corrected to 15% O_2, on a three hour rolling average, except during periods of startup/shutdown. This meets Lowest Achievable Emissions Rate (LAER) requirements for the nonattainment new source review air permit for NO_x emissions from the cogeneration unit.

CO Emissions

Channel Energy Center will minimize CO emissions though both hardware design and operating procedures. Good combustion practices will allow CO emissions to meet a limit of 4 ppmvd corrected to 15% O_2, 24- hour rolling average, except during periods of steam injection power augmentation and startup/shutdown. Steam injection power augmentation will be limited to 500 hours year. The proposed CO emissions from the cogeneration unit meet BACT requirements for the air permit.

Volatile Organic Compound (VOC) Emissions

The use of gaseous fuel and maintenance of optimum combustion conditions and practices will allow VOC emissions to meet a limit of 2.0 ppmvd corrected to 15% O_2, annual average. This limit meets the BACT requirements for the air permit for VOC emissions from the cogeneration unit.

$PM/PM_{10}/PM_{2.5}$ Emissions

Because the cogeneration unit will only fire gaseous fuel, $PM/PM_{10}/PM_{2.5}$ emissions are anticipated to be relatively low. The use of gaseous fuel and the application of good combustion controls meet BACT requirements for the air permit for $PM/PM_{10}/PM_{2.5}$ emissions from the cogeneration unit.

Sulfur Compound Emissions

The formation of SO_2, H_2SO_4 and $(NH_4)_2SO_4$ will be minimized by using pipeline-quality natural gas with a sulfur content not exceeding 5 grains sulfur per 100 standard cubic feet on the short term and 0.25 grains sulfur per 100 standard cubic feet on an annual average. The use of gaseous fuel meets BACT requirements for the air permit for SO_2, H_2SO_4 and $(NH_4)_2SO_4$ emissions from the combustion turbine.

NH_3 Emissions

Channel Energy Center will operate the SCR system in such a manner that ammonia (NH_3) slip (i.e., the emission of unreacted ammonia to the atmosphere) is minimized while ensuring that the NO_x emissions limits are met. Careful control of the ammonia injection system and operating parameters will be maintained to control ammonia slip in the turbine/heat recovery steam generator exhaust stream to levels not exceeding 7 ppmvd on a rolling 24-hour basis and 7 ppmvd on an annual average basis (corrected to 15% O_2). This level of emissions control meets BACT requirements for the air permit for ammonia slip for combined cycle combustion turbines.

Turbine Oil Mist Vent Emissions

The venting of turbine lubrication oil is a minor source of VOC emissions. These emissions will be controlled with the use of oil mist eliminators which will provide 100% control efficiency for particles greater than 3 microns in diameter and 99.7% control efficiency for particles less than 3 microns in diameter. The use of oil mist eliminators meets BACT requirements for the air permit for VOC emissions from these turbine lubrication oil vents.

Fugitive Emissions from Gas and Ammonia Piping Components

Fugitive VOC emissions from piping components will be minimized through the proper design of the fuel delivery and handling system and the use of best operating practices. To ensure that fugitive emissions from the piping components in ammonia service are adequately controlled, Channel Energy Center will follow an audio, visual, and olfactory (AVO) inspection and maintenance program, performing periodic inspections. These measures meet BACT requirements for the air permit for VOC and ammonia emissions from piping components.

Wastewater and Storm Water

Mitigation of Construction Related Impacts to Surface Water

During construction of the proposed additions, Channel Energy Center will follow the TCEQ requirement to obtain a construction storm water permit for the proposed project, if the project triggers that requirement. Regardless of whether a permit is required, the site will employ best management practices to prevent contamination due to storm water runoff, including erosion control and stabilization, minimization of offsite vehicle tracking and dust generation, and other practices as warranted by site-specific conditions. The site will also follow the notification, recordkeeping, and reporting requirements of TCEQ's construction storm water management program.

During construction, there will be no interruptions to the existing facility water and wastewater systems. Compliance with the terms and conditions of the permitted wastewater effluent quality will be maintained.

Mitigation of Operational Impacts to Surface Water

Following completion of the plant expansion, the Channel Energy Center operations will continue as they have prior to the completion of the plant additions. There will be no substantive changes in types or concentration of chemicals used by the facility that potentially become part of the wastewater discharge. Additionally, there are no expected changes in plant operational practices other than a small increase in the volume of wastewater discharged as discussed in **Section 2.6**.

Channel Energy Center utilizes a recirculating cooling process. Heat from the steam thermal cycle is transferred to cooling water from the cooling tower. The heated cooling water releases heat by evaporation. Cooling water lost by evaporation is replaced by makeup to the cooling tower. To the extent possible, water consumption will be minimized, while considering impact to scaling and corrosion in the cooling water system and condenser. In addition, water from area drains and the HRSG blowdown will be recycled to the cooling tower.

Steam is produced in the HRSGs, which is sent through the steam turbine to produce power and condensed in the condenser. The condensate is then returned to the HRSGs to repeat the cycle. As steam production continues, the dissolved and suspended solids in the HRSG drums increase.

Blowdown of the HRSG drums are used to remove the impurities. Makeup water to the HRSGs is required to replace this loss plus other vent losses and leaks. Part of the steam produced by the HRSGs will be exported to Houston Refining for use in their processes.

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Appendix 1

Photos

Photo 1 Railroad and electric lines going into petro-chemical complex

Photo 2 Bayou cutting through corner of Action Area; multiple power lines crossing; pipelines attached to bridge

Photo 3 Neighborhood adjacent to petro-chemical complex

Photo 4 Disturbed open space near ship channel

Photo 5 Petro-chemical complex

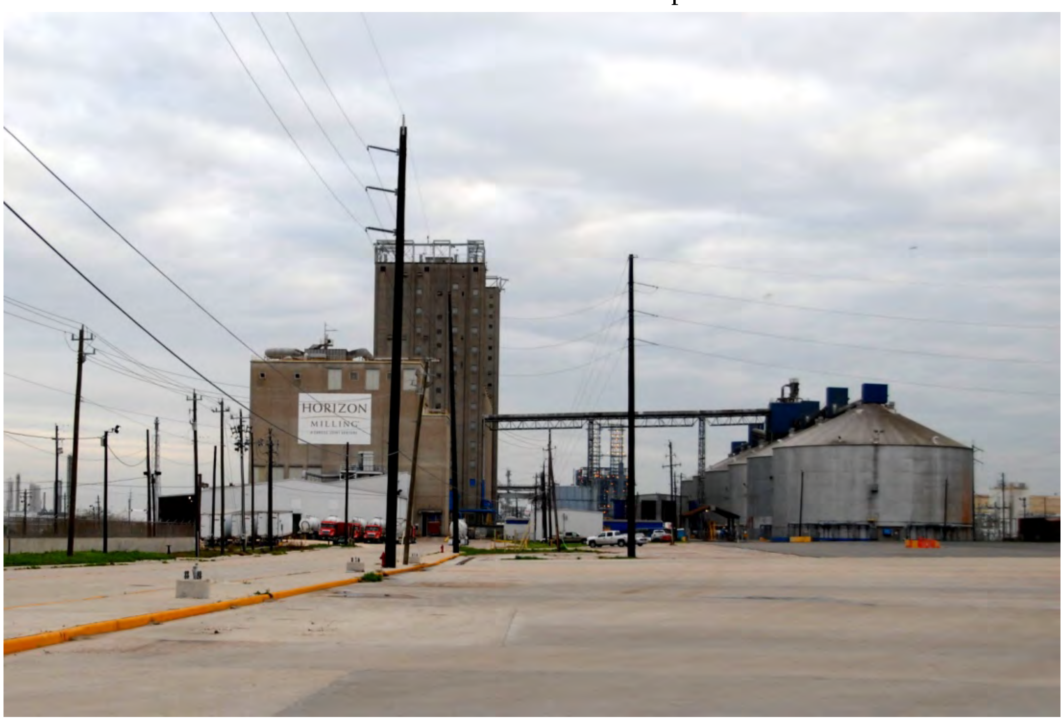

Photo 6 Various industrial activities

Photo 7 Various industrial installations (petroleum tanks, storage containers)

Photo 8 Various industrial installations (petroleum tanks, electric lines)