Biological Assessment

Equistar Chemicals Channelview Complex

Olefins Expansion Project

Channelview, Harris County, Texas

Prepared for:

Equistar Chemical Company
8280 Sheldon Road, Channelview, TX 77530

AND

U.S. Environmental Protection Agency - Region 6
1445 Ross Avenue, Dallas, TX 75202

Prepared by:

URS Corporation
10550 Richmond Avenue, Suite 155
Houston, TX 77042
(713) 914-6699

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Equistar Chemicals, L.P. (Equistar) owns and operates a chemical manufacturing complex (Channelview Site) located in Channelview, Harris County, Texas. Equistar proposes to expand the Olefins OP-1 and OP-2 Units (project) at the Channelview Site. Construction for the proposed project, associated infrastructure, and auxiliary equipment will take place within the existing facility. No additional earth disturbance will be required outside of existing process areas. The project will include: new cracking furnaces; new decoking pots; selective catalytic reduction (SCR) systems; new equipment components in ammonia service associated with the new SCR system; process sampling analyzers; equipment components in VOC service; and new maintenance, startup, and shutdown (MSS) emissions.

Because the proposed expansion will be a major modification of an existing source, one or more permits are required by the Clean Air Act. This project will require a Prevention of Significant Deterioration (PSD) permit issued by the U.S. Environmental Protection Agency (EPA) for greenhouse gas (GHG) emissions. Issuance of that permit will be a Federal action and one requirement triggered by that action is consideration of impacts to threatened and endangered species, and impacts to critical and essential habitat. A part of that process can be the preparation of a Biological Assessment (BA) for the project. Equistar has retained the services of URS Corporation (URS) to assess the project's Action Area for federally-protected species and/or their potential habitat and to provide an evaluation of the project's likelihood to jeopardize the continued existence of listed species.

Federally-protected species considered in this BA include: Texas prairie dawn, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, Houston toad, red-cockaded woodpecker, whooping crane, smalltooth sawfish, Louisiana black bear, and red wolf. This BA includes a pedestrian protected species habitat evaluation of the portions of the Channelview Site potentially impacted by the project, and an evaluation of potential environmental impacts based on air quality modeling results, construction information, and Texas Pollutant Discharge Elimination System (TPDES) information provided by Equistar.

Trinity Consultants (2012) completed detailed pollutant emission calculations for the project in accordance with the Air Permit Amendment Application requirements. Trinity Consultants also performed dispersion modeling of air pollutants that will be emitted by the proposed project in accordance with the PSD Permit requirements. Dispersion models indicate that no ground level concentrations of criteria air pollutants would exceed significant impact levels (SIL) outside of the Channelview Site as a result of the proposed project. Within the Channelview Site, only particulate matter (PM) and carbon monoxide (CO) are predicted by dispersion modeling to exceed the SIL.

The Action Area was defined by the following parameters: 1) areas where construction activities would occur within the Channelview Complex; 2) areas where criteria air pollutants exceed significant impact levels (SIL); and 3) the wastewater effluent drainage channel and dilution area within the receiving water body, a portion of the San Jacinto River Tidal adjacent and downstream of the Channelview Complex boundary (Figure 3). The Action Area includes maintained grasses, mixed woodland, and

process areas (fill or concrete) within the existing facility. The Action Area includes maintained grasses, mixed woodland, and process areas (fill or concrete) within the existing facility.

The proposed construction of the Olefins Expansion Project will have no effect on federally-protected species because there is no suitable habitat within the project area. Similarly, air emissions and wastewater effluent resulting from the operation of the proposed expansion will have no effect on federally-protected species; available data and site visits do no indicate the presence of federally-protected species or their preferred habitat within the Action Area. Based on the information gathered for this BA, URS recommends the following determinations:

Protected Species	Classification- Reason for Evaluation	Determination of Effect
Texas Prairie Dawn	Listed by United States Fish and Wildlife Service (USFWS) as Endangered in Harris County	No effect
Green Sea Turtle	Listed by USFWS and National Marine Fisheries Service (NMFS) as Threatened, possibly occurring in San Jacinto Bay.	No effect
Hawksbill Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.	No effect
Kemp's Ridley Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.	No effect
Leatherback Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.	No effect
Loggerhead Sea Turtle	Listed by USFWS and NMFS as Threatened, possibly occurring in San Jacinto Bay.	No effect
Houston Toad	Listed by the Texas Parks and Wildlife Department (TPWD) as Endangered in Harris County	No effect
Red-cockaded Woodpecker	Listed by the TPWD as Endangered in Harris County	No effect
Whooping Crane	Listed by the TPWD as Endangered in Harris County	No effect
Smalltooth Sawfish	Listed by the TPWD as Endangered in Harris County	No effect
Louisiana Black Bear	Listed by the TPWD as Threatened in Harris County	No effect
Red Wolf	Listed by the TPWD as Endangered in Harris County	No effect

1.0 Introduction

Equistar Chemicals, L.P. (Equistar) owns and operates a chemical manufacturing complex (Channelview Site) located in Channelview, Harris County, Texas. Equistar proposes to expand the Olefins OP-1 and OP-2 Units (project) at the Channelview Site (Figure 1). The project will include: new cracking furnaces; new decoking pots; selective catalytic reduction (SCR) systems; new equipment components in ammonia service associated with the new SCR system; process sampling analyzers; equipment components in volatile organic compound (VOC) service; and new maintenance, startup, and shutdown (MSS) emissions. Because the proposed expansion is a major modification of an existing source, one or more permits are required by the Clean Air Act. Specifically, the proposed project will require a Prevention of Significant Deterioration (PSD) permit for greenhouse gas (GHG) emissions issued by the U.S. Environmental Protection Agency (EPA). Issuance of a GHG permit would be a Federal action, which triggers consultation with the US Fish and Wildlife Service (USFWS). This Biological Assessment (BA) was prepared to comply with Section 7 of the Endangered Species Act (ESA) and to facilitate coordination with USFWS. Equistar has retained the services of URS Corporation (URS) to assess the Project Site for federally-protected species and/or their potential habitat and to provide an evaluation of the project's likelihood to jeopardize the continued existence of listed species.

1.1 Project Description

1.1.1 Facility Location and Description

The proposed project is located approximately 1 mile southeast of the intersection of US-90 and Sheldon Road (Figure 1). The site is located on the Highlands and Jacinto City United States Geological Survey (USGS) Quads, at 29.833° north latitude and 95.117° west longitude.

The Channelview Site is broken up into two operating areas and each area operates under a unique Texas Commission on Environmental Quality (TCEQ) Regulated Entity Number (RN) and Customer Number (CN):

- North Plant operated by Equistar Chemicals, LP (RN100542281, CN600124705), and
- South Plant operated by Lyondell Chemical Company (RN100633650, CN600344402).

For the purpose of federal regulatory applicability, the North and South Plants are contiguous and under common control and hence considered as one site. The Channelview North Plant is authorized to produce a wide variety of petrochemicals. Construction of the proposed project would occur in the North Plant. The North Plant includes two Olefins Production Units and each is authorized by a separate NSR permit: OP-1 (NSR Permit No. 1768) and OP-2 (NSR Permit No. 2933).

1.1.2 Project Purpose

The purpose of the project is to expand the existing Equistar olefins manufacturing facility by adding two cracking furnaces immediately adjacent to the existing cracking furnaces currently in operation at the Channelview Site (Figure 2).

The proposed expansion of OP-1 will include the following changes:

- One new cracking furnace (emission point number [EPN]: EF3419);
- One new decking pot (EPN: EOP1DECOKE2);
- A SCR system for the new cracking furnace;
- New equipment components in ammonia service associated with the new SCR system (EPN: EFUGNH3);
- A group of new process sampling analyzers (EPN: EOP1ANALY);
- A group of new equipment components in VOC service (EPN: EOP1FUGEXP);
- New MSS emissions associated with the periodic clean-out of the new proposed process vessels.

The proposed expansion of OP-2 will include the following changes:

- One new cracking furnace (EPN: EF4419);
- One new decking pot (EPN: EOP2DECOKE2);
- A SCR system for the new cracking furnace;
- A group of new process sampling analyzers (EPN: EOP2ANALY);
- A group of new equipment components in VOC service (EPN: EOP2FUGEXP);
- New MSS emissions associated with the periodic clean-out of the new proposed process vessels.

1.1.3 Construction Information

Construction of the proposed project, associated infrastructure, and auxiliary equipment will take place within the existing facility. No additional earth disturbance will be required outside of existing process areas. The locations of new construction and modifications to the existing facility required for the proposed project are shown on Figure 2. Construction is scheduled for March 2013 to March 2014.

Construction Equipment Required

Equipment required to complete the construction activities and their estimated schedule is listed below:

- 2 - Large Cranes (200 tons) - 45 weeks
- 2 - Small Cranes (30-40 tons) – 45 weeks
- 2 – Carry Deck Cranes – 45 weeks
- 12 - Welding Machines and Generators – 45 weeks
- 2 - Fork Trucks -45 weeks
- 6 – Man Lifts – 45 weeks
- 4 – Air compressors – 45 weeks
- 2 - Excavators – 15 weeks
- 4 - Back Hoes – 15 weeks
- 2 - Cement Pump Trucks – 12 weeks
- 8 - Pick Up Trucks - 45 weeks
- 6 – Gator Personnel Vehicles – 45 weeks

1.1.4 Operations

Each Olefins Production Unit contains cracking furnaces, fractionation columns, compressors, pumps, catalytic reactors, heat exchangers, storage tanks, a cooling tower, a flare, and numerous equipment components in various forms of liquid and gas service. Each Olefins Production Unit uses hydrocarbon feedstocks to produce lighter olefinic and aromatic hydrocarbons via 'cracking' using steam pyrolysis and product recovery by various fractional purification methods.

The process effluent from the furnaces is quenched and scrubbed with water. Pyrolysis gasoline is removed as a product during water scrubbing. The quenched gases are compressed, dried, and cooled prior to beginning a series of purification/ distillation steps. A hydrogen rich stream from the final chilling step is further purified in a pressure swing absorber to produce hydrogen product.

The purification section consists of a series of distillation columns that separate the process gas stream into acetylene, ethylene, propylene, mixed C4s, and pyrolysis gasoline products. Ethane and propane recovered during distillation and separation are recycled as feedstock into the pyrolysis furnaces. Periodically, coke (primarily carbon) deposits in the furnace tubes must be removed.

The project will tie into existing feedstock and product pipelines and utilities located within the Channelview Plant. No additional pipelines, storage, or other infrastructure will be installed for the project. In addition, the project will not result in an increase of ship traffic to the Channelview Plant.

Water Use

The source of the Channelview Site's water is Lake Houston. Equistar estimates the increase in fresh water intake to be 0.15 MGD for the project as well as an equivalent resulting effluent discharge. The proposed project is not expected to change the characteristics of the discharge water.

Noise Levels

Equistar project engineers estimate that noise levels during construction should be comparable to noise levels from maintenance activities that currently take place at the plant. The new equipment should not alter the pre-existing noise exposure at the site.

1.2 Regulation of Air Quality and Emission Controls

1.2.1 Regulation of Air Quality

The Clean Air Act requires air quality standards be maintained to protect public health and the environment. These standards are the National Ambient Air Quality Standards (NAAQS) and are regulated by the EPA. Ambient air is the air to which the general public has access, as opposed to air within the boundaries of an industrial facility. The NAAQS are concentration limits of pollutants in ambient air within specific averaging time. The averaging time is the time period over which the air pollutant concentrations must be met to comply with the standard. The NAAQS are classified into two categories: primary and secondary standards. Primary standards are set to protect public health, including "sensitive" populations. Secondary standards are set to protect public welfare, including the environment.

The EPA sets NAAQS for six principal air pollutants, also referred to as criteria air pollutants. These six criteria air pollutants are nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), and lead (Pb). A geographic area whose ambient air concentration for a criteria pollutant is equal to or less than the primary standard is an attainment area. A geographic area with an ambient air concentration greater than the primary standard is a nonattainment area. A geographic area will have a separate designation for each criteria pollutant.

The Clean Air Act also requires the EPA to establish regulations to prevent significant deterioration of air quality in attainment areas. The EPA established PSD Increments to satisfy this requirement. A PSD Increment is a measure of the maximum allowable increase in ambient air concentrations of a criteria pollutant from a baseline concentration after a specified baseline date. A Significant Impact Level (SIL) is a concentration that represents a *de minimis*, or insignificant, threshold applied to PSD permit applicants. The SIL is a measurable limit above which a source may cause or contribute to a violation of a PSD Increment for a criteria pollutant. Before a PSD permit can be issued, the applicant must demonstrate that the proposed emissions from a project will not cause or contribute to a violation of a NAAQS or to an increase above a PSD Increment for each pollutant emitted in significant amounts by the project.

1.2.2 Emission Controls

Per 30 TAC §116.111(a)(2)(c), 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. The Channelview Site is in a nonattainment area for ozone. The net emissions increases resulting from the changes described above triggered PSD review for NO_2, CO, PM with aerodynamic diameter less than ten microns (PM_{10}), and particulate matter with aerodynamic diameter less than 2.5 microns ($PM_{2.5}$). The net emissions of SO_2 associated with the project did not trigger PSD review; however, per request by TCEQ, an air dispersion modeling analysis was performed to demonstrate that the SO_2 emissions from the project will not cause or contribute to a violation of the applicable National Ambient Air Quality Standards (NAAQS).There are no potential Pb emissions from the facility, and therefore Pb will not be addressed elsewhere in this document.

Equistar will utilize BACT to control emissions from the project and thus minimize impacts to the surrounding environment to the maximum extent practicable. Equistar has selected TCEQ BACT guidance for each of the criteria pollutants. Details of the selection can be found in the TCEQ and EPA permit applications for this project. The following control technologies were selected for the listed pollutants:

Furnace emissions:

- NO_x Selective catalytic reduction
- NO_2 Low-NO_x burners
- CO Good combustion practices
- PM Good combustion practices
- VOC Good combustion practices

Decoke emissions:

- PM Dual cyclone
- CO Minimize coke formation and follow decoking procedures

Cooling tower emissions:

- PM Drift eliminators

1.2.3 Wastewater

Equistar is authorized to treat and discharge wastes from the Channelview Site under Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0000391000. Four existing outfalls for the North Plant discharge through man-made drainage ditches into Wallisville Gully, thence into the San Jacinto River Tidal in Segment Number 1001 of the San Jacinto River Basin. Outfall #001 is permitted to release process wastewater, cooling tower blowdown, boiler blowdown, demineralizer/regeneration water, first flush stormwater, and miscellaneous flows. Outfalls #002, #003, and #004 are permitted to discharge stormwater. Outfalls #001 and #002 discharge process wastewater and stormwater, respectively, from the proposed project. The existing outfalls are subject to effluent limitations, monitoring requirements, and other conditions as described in the permit. The proposed Olefin 1 expansion project has an estimated increase in discharge of 0.07 MGD, and Olefins 2 expansion project has an estimated increase in discharge of 0.08 MGD, as described in Section 1.1.4. Water quality at the outfalls is currently maintained within all TPDES permit limits.

If ancillary areas are disturbed in support of the construction project, structural controls may be used to protect surrounding areas from impacted surface runoff. Runoff from within the site is directed through a series of onsite ditches and weirs before discharge through permitted outfalls. Additional erosion control measures (silt fence, sandbags) may be used if excess erosion and/or sedimentation are observed during the construction phases. Re-vegetation is not a concern since the site is a heavy industrial site consisting of caliche or concrete-paved surfaces.

The Equistar facility currently has an Oil and Hazardous Materials Spill Prevention, Control, and Countermeasure Plan and Stormwater Pollution Prevention Plans (SWPPPs) in place and the facility employees are trained to implement these plans. These plans will be utilized during construction, operations, and maintenance of the proposed additional furnaces. Best Management Practices will be utilized in accordance with Section 401 of the Clean Water Act Chapter 279 of the Texas Water Code and as prescribed in the Equistar SWPPPs.

1.3 Purpose of the BA

This BA is a complete evaluation of the potential environmental impacts the proposed project may have on federally-protected species and/or their potential habitat. Protected species evaluated in this document include threatened and endangered, species.

The purpose of this BA is to research, evaluate, analyze, and document the potential for direct and indirect effects, interdependent and interrelated actions, and cumulative effects on federally-protected species as a result of the proposed project. Specifically, the BA considers potential temporary impacts

from construction activities and permanent impacts from the additional air emissions and water discharges that will result from the project. An Action Area of potential impact has been defined is shown in Figure 3. This BA includes a pedestrian protected species habitat evaluation of the proposed construction area and areas of potential habitat within the Action Area; and an evaluation of potential environmental impacts based on air quality modeling results, construction information, operation information, and TPDES information provided by Equistar.

The conclusion of this BA will include a recommended determination of effect on federally-protected species and their habitat. Three possible determinations offered by the US Fish and Wildlife Service (USFWS) for the purpose of Biological Assessments and Evaluations are described below :

1. No effect – A "no effect" determination means that 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.
2. May affect, not likely to adversely affect – A "may affect, not likely to adversely affect" 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 effects 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.
3. May affect, likely to adversely affect - A "may affect, likely to adversely affect" 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.

1.4 Action Area

The Action Area of potential effect has been defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" according to federal regulation (50CFR 402.2). For the basis of this BA, the project's Action Area was defined by the following parameters: 1) areas where construction activities would occur within the Channelview Complex; 2) areas where criteria air pollutants exceed significant impact levels (SIL); and 3) the wastewater effluent drainage channel and dilution area within the receiving water body, a portion of the San Jacinto River Tidal adjacent and downstream of the Channelview Complex boundary (Figure 3).

Although the proposed project will require both new construction and modification to existing process units, physical ground disturbance will be limited to the construction of the proposed Olefin Expansion Site. Equistar has also identified several areas of the Channelview Site that will be used temporarily during construction of the proposed project, such as: a new equipment laydown, construction material laydown, project parking area, and project blast resistant building (brb) locations. As these areas would be utilized during the construction phase of the project, they are included in the project's Action Area.

The analysis of protected species likely to be affected by the proposed project focused on impacts within the Project's Action Area. The Action Area (139.86 acres) is approximately 134.19 acres of land and 5.67 acres of aquatic environment. The Action Area includes process areas (fill or concrete), maintained grassland habitat, mixed woodland habitat, and riverine habitat. A significant portion of these habitats has historically been constructed, manipulated, or otherwise impacted by industrial activities.

2.0 Existing Conditions

2.1 General Environmental Information

This section provides applicable environmental characteristics for the general region in which the project is located.

2.1.1 General Region Information

According to the United States Department of Agriculture (USDA) Major Land Resource Area nomenclature, the proposed Project Site is located within the Gulf Coast Prairies and Marshes eco-region of Texas which is in the Gulf Coastal Plain physiographic province of North America (USDA 2012). This region borders the Gulf Coast within the state of Texas. The majority of the river basins of Texas drain towards the Gulf of Mexico and ecoregion receives more rainfall than other ecoregions in Texas. The Gulf Coast influence creates multiple dynamic ecosystems within this ecoregion including bays, estuaries, salt marshes, freshwater wetlands, tidal flats, marshes, and swamps. Hardwood bottomlands, prairies, and oak mottes are common throughout this region. These ecosystems are home to an abundance and variety of wildlife including mammals, birds, reptiles, amphibians, fish, and invertebrates. This region is prime wintering grounds for migratory birds. The bays and estuaries are invaluable breeding grounds and fish hatcheries.

2.1.2 Air Quality

The Channelview Site is in a nonattainment area for ozone. The net emissions increases resulting from the changes described above triggered PSD review for NO_x, CO, PM_{10}, and $PM_{2.5}$. The net emissions of SO_2 associated with the project did not trigger PSD review; however, per request by TCEQ, an air dispersion modeling analysis was performed to demonstrate that the SO_2 emissions from the project will not cause or contribute to a violation of the applicable NAAQS. There are no potential Pb emissions from the facility, and therefore Pb will not be addressed elsewhere in this document.

2.1.3 Land Use

Because of the abundant water resources, the rich soils, and the proximity to the coast, most of the native coastal prairie has been developed for commercial, industrial, or residential use; or is now planted pastureland for beef cattle grazing or cropland for rice, sugarcane, forage, and grain crops. Much of Harris County is part of the developed Houston metropolitan area. These land uses have reduced and fragmented the protected species habitat throughout the region. The proximity and access to the Gulf of Mexico through the Houston-Galveston Navigation Channel make Harris County one of the nation's most important locations for deepwater transport and industrial development, particularly in the petrochemical industry.

The land use within the area that would be directly impacted by construction of the proposed project is currently industrial development. The National Land Cover Database (NLCD) indicates that the most common land cover classes within the property boundary of the Channelview Site are developed open space, and developed low/medium/high intensity (Fry et al. 2011). The northern and east-central portions of the property near the San Jacinto River and Muleshoe Lake are classified as primarily woody wetlands, with upland deciduous and evergreen forests. The western and northwestern portions of the property are classified primarily as grassland/herbaceous. The most common land cover types within one mile of the property boundary of the Channelview Site are developed (approximately 35%, open space and low/medium/high intensity developed), open water (approximately 20%, San Jacinto River and associated bays), woody wetlands (approximately 15%), and grassland/herbaceous (approximately 15%). The areas to the north and west are primarily industrial development, some residential areas are present to the south, and the east is dominated by undeveloped low-lying areas near the San Jacinto River (Figure 4).

2.1.4 Climate

According to the World Media Group (2012), the mean annual precipitation in Harris County ranges between 37 - 58 inches. The mean annual growing season is 250 days. The average low temperature is 42°F and the average high temperature is 92°F. Prevailing winds are from the south with an average speed of 11.8 miles per hour. Average humidity is 74 percent with a higher average humidity at night of 91 percent.

2.1.5 Topography

Harris County has generally low and flat terrain. The topography of the project area is flat, but is located near the San Jacinto River which has a steep shoreline. The elevation of the project area is approximately 40 feet above sea level (Figure 5). Drainage is generally to the east into the San Jacinto River.

According to the Federal Emergency Management Agency (FEMA) flood insurance rate map, the majority of the Channelview Site property is located outside of the designated 100-year floodplain (Panel Number 48201C0730L; Revised June 18, 2007); however, the eastern and northeastern portions of the property are within the 100-year floodplain, and partially within the floodway. Project construction areas are outside of the 100-year floodplain. FEMA floodplain designation is demonstrated in Figure 6.

2.1.6 Geology

The specific geologic formation found in the area is the Beaumont Formation from the Cenozoic Era. The geologic units found within and surrounding the proposed project area are Beaumont Formation, areas predominantly clay (Qbc) and Beaumont Formation, areas predominantly sand (Qbs). The following are the descriptions of the geologic units provided by the USGS (USGS 2012):

> Beaumont Formation, areas predominantly clay is described as light- to dark-gray and bluish- to greenish-gray clay and silt, intermixed and interbedded; contains beds and lenses of fine sand, decayed organic matter, and many buried organic-rich, oxidized soil zones that contain

calcareous and ferruginous nodules. The formation is very light gray to very light yellow-gray sediment cemented by calcium carbonate present in varied forms, veins, laminar zones, burrows, root casts, and nodules. Locally, small gypsum crystals present. It includes plastic and compressible clay and mud deposited in flood basins, coastal lakes, and former stream channels on a deltaic plain. Disconformably overlies Lissie Formation. Thickness 5-10 meters (m) along north edge of outcrop; thickens southward in subsurface to more than 100 m.

Beaumont Formation, areas predominantly sand is described as yellowish- to brownish-gray, locally reddish orange, very fine to fine quartz sand, silt, and minor fine gravel, intermixed and interbedded. It includes stream channel, point-bar, cravasse-splay, and natural levee ridge deposits, and clayey fill in abandoned channels. Forms poorly defined meander-belt ridges and pimple mounds aligned approximately normal to coast and 1-2 m higher than surround interdistributary silt and clay. Channel fill is dark brown to brownish-dark-gray, laminated clay and silt, organic -rich. Includes marine delta-front sand, lagoonal clay, and near-shore marine sand beneath and landward of bays along the coast. Interfingers with the interdistributary facies of Beaumont Formation and rests disconformably on Lissie Formation. Thickness 3-10 m on outcrop; thickens in southeastward in subsurface to more than 100 m.

2.1.7 Soils

The USDA Natural Resources Conservation Service (USDA-NRCS) soil units mapped within and surrounding the proposed project area are listed and described below in Table 1 (USDA-NRCS 2004).

Table 1 – USDA NRCS Soil Units

NRCS Map Unit Symbol	NRCS Map Unit Name	USDA Classification				NRCS Hydric Soil
		Depth	Drainage	Permeability	Landform	
Ad	Addicks loam	Deep	Poorly drained	Moderate	Coastal prairies	Partially hydric
Ak	Addicks-Urban land complex	Deep	Poorly drained	Moderate	Upland prairies	Partially hydric
Am	Aldine very fine sandy loam	Deep	Somewhat poorly drained	Very slow	Coastal plains	Not hydric
AtB	Atasco fine sandy loam – 1 to 4 percent slopes	Deep	Moderately well drained	Very slow	Coastal plains	Not hydric
Ba	Beaumont clay	Deep	Poorly drained	Very slow	Upland prairies	Partially hydric
Bd	Bernard clay loam	Deep	Somewhat poorly drained	Very slow	Upland prairies	Partially hydric
Be	Bernard-Edna complex	Deep	Somewhat poorly drained	Very slow	Upland prairies	Partially hydric
Bg	Bernard-Urban land complex	Deep	Somewhat poorly drained	Very slow	Upland prairies	Not hydric
Ge	Gessner loam	Deep	Poorly drained	Moderate	Coastal	Partially

NRCS Map Unit Symbol	NRCS Map Unit Name	USDA Classification				NRCS Hydric Soil
		Depth	Drainage	Permeability	Landform	
					prairies	hydric
Ha	Harris clay	Deep	Very poorly drained	Very slow	Coastal marshlands	Partially hydric
Hf	Hatliff loam	Deep	Moderately well drained	Moderate	Forested stream floodplains	Not hydric
Ka	Kaman clay	Deep	Poorly drained	Very slow	Bottom lands	Partially hydric
LcA	Lake Charles clay, 0 to 1 percent slopes	Deep	Moderately well drained	Very slow	Upland prairies	Not hydric
Lu	Lake Charles-Urban land complex	Deep	Moderately well drained	Very slow	Upland prairies	Not hydric
Md	Verland silty clay loam	Very deep	Somewhat poorly drained	Very slow	Coastal uplands	Partially hydric
Oa	Ozan loam	Deep	Poorly drained	Slow	Depressions	Partially hydric

2.1.8 Water Resources

The Channelview Site is immediately west of the San Jacinto River. The San Jacinto River flows into Galveston Bay approximately 20 river miles to the southeast of the project area. Galveston Bay is a large estuary connected to the Gulf of Mexico. The proposed Project Site is located within the Buffalo-San Jacinto Watershed (hydrologic unit code 12040104), near its boundary with the North Galveston Bay Watershed (EPA 2012).

The Texas Parks and Wildlife Department (TPWD) do not identify any designated Ecologically Unique River and Stream Segments within the Channelview Site (TPWD 2012a). The proposed Project Site is approximately 5 miles southeast of Carpenters Bayou. Carpenters Bayou is classified as an Ecologically Unique River and Stream Segment for its biological function, described as: cypress swamps and extensive fringe wetlands display significant overall habitat value.

The National Wetlands Inventory indicates the presence of wetlands and waters within the Channelview Site property boundary as described in Table 2. The majority of the forested/shrub wetlands are located on the north and east portions of the site. Areas classified as freshwater emergent wetlands are located in the east-central and west-central portions of the property, as well as near the southern boundary. The portion of the San Jacinto River in the southeast corner of the site near the docks is classified as an estuarine and marine deepwater feature. The freshwater pond features are primarily facility detention basins. Muleshoe Lake in the northeastern corner of the site makes up the feature classified as a lake. The San Jacinto River along the eastern boundary of the site is classified as a riverine feature. Estuarine

and marine wetlands are identified in the southeastern corner of the site (USFWS 2012a; Figure 7). A forested wetland is identified by the NWI within the Action Area, which is described in Section 1.4.

Table 2 – National Wetland Inventory Data

NWI Wetland/Water Type	Acres
Freshwater Forested/Shrub Wetland	393
Freshwater Emergent Wetland	117
Estuarine and Marine Deepwater	29
Freshwater Pond	29
Lake	24
Riverine	12
Estuarine and Marine Wetland	3
Total	**607**

2.1.9 Vegetation

Historically, the native plant community of the region was Coastal Prairie, which is a tall grass prairie with scattered trees. Most of the native coastal prairie is now pastureland, cropland, or residential, urban, commercial, and industrial development. The project area has been heavily developed. The NLCD classifies the project area as primarily Developed High Intensity, Developed Medium Intensity, Developed Low Intensity, and Developed Open Space. The most common types of vegetation identified by the NLCD within one mile of the property boundary are woody wetlands and grassland/herbaceous (Multi-Resolution Land Characteristics Consortium 2012).

2.2 Protected Species

2.2.1 Threatened or Endangered Species List

The USFWS and the National Oceanic and Atmospheric Administration - National Marine Fisheries Service (NOAA-NMFS) regulate the ESA of 1973. “The purpose of the ESA is to protect and recover imperiled species and the ecosystems on which they depend.” Imperiled species specifically includes those listed by the USFWS as threatened or endangered. Candidate species are those “the USFWS has enough information to warrant proposing them for listing but is precluded from doing so by higher listing priorities.” Candidate species are not specifically protected by the ESA, but will be included for the purposes of this BA.

Section 9 of the ESA prohibits the “take” of threatened and endangered species. "Take" is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." “Harm” is defined as “an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.”

The USFWS lists only one threatened or endangered species within Harris County (USFWS 2012b): Texas prairie dawn (*Hymenoxys texana*). The TPWD lists an additional six species with federal threatened or endangered species status in Harris County (TPWD 2012b): Houston toad (*Bufo houstonensis*), red-

cockaded woodpecker (*Picoides borealis*), whooping crane (*Grus americana*), smalltooth sawfish (*Pristis pectinata*), Louisiana black bear (*Ursus americanus luteolus*), and red wolf (*Canis rufus*). Preliminary consultation with NMFS indicated the potential for sea turtles to occur in the region. Therefore, the following five additional species will be evaluated: green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricate*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), and loggerhead sea turtle (*Caretta caretta*).

2.2.2 Threatened or Endangered Species Descriptions

Texas Prairie Dawn (Hymenoxys texana)

The Texas prairie dawn is federally listed as an endangered species. It is a small, tap-rooted, annual plant with extant populations known only from western Harris County and extreme eastern Fort Bend County, west of the city of Houston, Texas (USFWS 1989, Poole et al. 2007). The Texas prairie dawn is found in small, sparsely vegetated areas, described a slick spots, on the lower sloping portion of pimple (mima) mounds or on the level land around the mound's base. The soils that comprise the pimple mounds are sandier than the soils of the surrounding flat areas and are sticky when wet, and powdery when dry. The Texas prairie dawn flowers from late February to early April, and may be the dominant plant in its microhabitat in late winter and early spring. Plants may be senescent during the summer. According to the USFWS recovery plan, the primary threat to the Texas prairie dawn is habitat destruction owing to housing development and roadway construction in western and northwestern Harris County.

Green Sea Turtle (Chelonia mydas)

The green sea turtle can grow to 4 feet in length and reported weights vary from 350-850 pounds. The carapace is smooth and keel-less, and the color varies with shades of black, gray, green, brown, and yellow. Adults are herbivorous. Hatchlings are omnivorous.

Green sea turtles occupy three ecosystems according to life stage: terrestrial zone, neritic zone, and oceanic zone. The terrestrial zone is occupied briefly during nesting and hatching activities. Hatchlings move out to the oceanic zone until their carapace reaches approximately 20-25 centimeters in length. Juveniles and adults primarily occupy benthic feeding grounds in shallow, protected waters. Preferred feeding grounds include pastures of sea grasses and/or algae.

Green sea turtles have a worldwide distribution in tropical and subtropical waters. The nesting season in the southeastern US is June through September. Nesting is nocturnal and occurs in 2, 3, or 4-year intervals. Females nest an average of 5 times per season at 14 day intervals. Hatchlings typically emerge at night. Approximately 200 to 1,100 females are estimated to nest on US beaches. Nesting occurs on high energy oceanic beaches, primarily on islands with minimal disturbance. Green turtles return to the same nesting site and are known to travel long distances between foraging areas and nesting beaches.

Breeding populations of green sea turtles in Florida and on the Pacific coast of Mexico are federally listed as endangered; all other populations, including those on the Texas coast, are listed as threatened (NMFS 1991). Green sea turtles have been observed foraging within Galveston Bay, which is approximately 42 miles south of the site, as recently as 2012. These sea turtle species utilize the area for seasonal foraging (Galveston Bay Estuary Program [GBEP] 2004).

Hawksbill Sea Turtle (Eretmochelys imbricate)

The USFWS describes the hawksbill sea turtle as a small to medium-sized marine turtle with a reddish-brown carapace. The head is relatively small with a distinctive hawk-like beak. The adult hawksbill is commonly 2.5 feet in length and weighs between 95 to 165 pounds.

Hawksbill hatchlings live in a pelagic environment, specifically in the weed lines that accumulate at convergence zones. Juveniles will return to a coastal environment when their carapace reaches approximately 20-25 centimeters in length. Juveniles and adults will spend most of their time in their primary foraging habitat, coral reefs. The hawksbill feeds primarily on sponges.

Hawksbill turtle nesting occurs sometime between April and November. Nesting is nocturnal and occurs every 2 to 3 years, 4 to 5 times per season, approximately every 14 days. Preferred nesting habitat includes low and high energy beaches in tropical oceans. Nesting habitat is often shared with green sea turtles. Hawksbills can traverse beaches limited to other species of sea turtles with their ability to traverse fringe reefs. Hawksbills have a tolerance for a variety of nesting substrates and often build their nests under vegetation.

The USFWS lists the hawksbill sea turtle as endangered. The hawksbill is found in tropical and subtropical waters of the Atlantic, Pacific, and Indian Oceans. Hawksbills are typically associated with rocky areas and coral reefs in water less than 65 feet. Mexico is now considered the most important region for hawksbills in the Caribbean yielding 3,000 to 4,500 nests/year. The Hawksbill is an occasional visitor to the Texas coast (NMFS 1993). Hawksbill sea turtles' favored habitat is coral reefs and they are not known to occur within Galveston Bay (GBEP 2004a).

Kemp's Ridley Sea Turtle (Lepidochelys kempii)

The Kemp's ridley sea turtle is considered the smallest sea turtle with an olive-gray carapace and a triangular shaped head and a hooked beak. Adults can grow to about 2 feet in length and weigh up to 100 pounds. This turtle is a shallow water benthic feeder with a diet consisting primarily of shrimp, jellyfish, snails, sea stars, and swimming crabs.

Kemp's ridleys, similar to loggerhead sea turtles, occupy three ecosystems according to life stage: terrestrial zone, neritic zone, and oceanic zone. The terrestrial zone is occupied briefly during nesting and hatching activities. Hatchlings move out to the oceanic zone for an average of 2 years. Juveniles and adults primarily occupy the neritic zone (nearshore marine environment).

Most nesting occurs on the eastern coast of Mexico, however a small number consistently nest at Padre Island National Seashore in Texas and various other locations along the Gulf and lower Atlantic coasts. Nesting occurs from May to July during daylight hours. Large numbers of females emerge for a synchronized nesting event referred to as "arribada". Arribadas are thought to be caused by female pheromone release, offshore winds, and/or lunar cycles. Females nest up to 4 times per season at intervals of 10 to 28 days. The preferred nesting beaches are adjacent to extensive swamps or large bodies of open water.

The Kemp's ridley sea turtle is listed as endangered by the USFWS. The Kemp's ridley turtles range includes the Gulf coasts of Mexico and the US, and the Atlantic coast of North America as far north as Nova Scotia and Newfoundland (NMFS 2010). Kemp's ridley sea turtles have been observed foraging within Galveston Bay, which is approximately 42 miles south of the site, as recently as 2012. They are known to utilize the area for seasonal foraging (GBEP 2004a).

Leatherback Sea Turtle (Dermochelys coriacea)

The leatherback sea turtle is the largest sea turtle. The adult leatherback can get up to 8 feet in length and up to 2000 pounds. The turtle lacks a "normal" turtle shell and is covered by firm, rubbery skin that is approximately 4 inches thick. Coloration is predominantly black with varying degrees of pale spotting; including a notable pink spot on the dorsal surface of the head in adults. Their diet is primarily jellyfish and salp, but it is also known to feed on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae, and floating seaweed.

Leatherbacks are highly migratory and the most pelagic of all sea turtles. Females prefer high energy, sandy beaches with vegetation immediately upslope and a beach sloped sufficiently so the crawl to dry sand is not too far. Preferred beaches have deep, unobstructed oceanic access on continental shorelines.

In the United States, nesting occurs from March to July. Females nest on average 6 times per season at 10 day intervals. Most leatherbacks return to their nesting beaches at 2 to 3- year intervals.

Distribution is worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. The leatherback is also found in small numbers as far north as British Columbia, Newfoundland, and the British Isles and as far south as Australia and Argentina. The leatherback has a small presence in the US with most nesting occurring on the Florida east coast, Sandy Point, US Virgin Islands, and Puerto Rico (NMFS 1992).

The leatherback sea turtle is listed as endangered by the USFWS. Leatherback sea turtles are most commonly found in deep water habitats and are not known to nest in Galveston Bay (USFWS 2012c). Leatherback sea turtles would not be expected to utilize habitat in the vicinity of the project.

Loggerhead Sea Turtle (Caretta caretta)

The loggerhead sea turtle is a reddish-brown marine turtle characterized by a large head with blunt jaws. Adults can be up to 500 pounds and 4 feet in length. Adult loggerheads feed on jellyfish, floating egg clusters, flying fishes, mollusks, crustaceans, and other marine animals.

Loggerheads occupy three ecosystems according to life stage: terrestrial zone, neritic zone, and oceanic zone. The terrestrial zone is occupied briefly during nesting and hatching activities. Hatchlings move out to the oceanic zone until their carapace reaches approximately 40-60 centimeters in length. Juveniles and adults primarily occupy the neritic zone (nearshore marine environment).

The nesting season in the US is May through August. Nesting occurs every 2 to 3 years and is mostly nocturnal. Females can nest up to 5 times per season at intervals of approximately 14 days. Hatchling

emergence is mostly nocturnal. Loggerheads nest on oceanic beaches between the high tide line and dune fronts and occasionally on estuarine shorelines with suitable sand. Females prefer narrow, steeply sloped, coarse-grained beaches.

The loggerhead sea turtle is listed as threatened by the USFWS. Distribution of the loggerhead includes the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Although the majority (~80%) of the US nesting activity occurs in south Florida, loggerheads nest along the Gulf and Atlantic coastlines from Texas to Virginia. Loggerheads are considered an occasional visitor to Texas (NMFS 2008). Loggerhead sea turtles have been observed foraging within Galveston Bay, which is approximately 42 miles south of the site, as recently as 2012. These sea turtles utilize the area for seasonal foraging (GBEP 2004a).

Houston Toad (Bufo houstonensis)

Houston toad adults can reach 3.5 inches in length. Their coloration can vary from light brown to gray and tend to show small dark spots on the ventral side. Males are identified by a darkened throat patch that can appear blue when inflated. Adults and juveniles are insectivorous.

Houston toad adults burrow in deep sandy soils that support loblolly pine (*Pinus taeda*), yaupon (*Ilex vomitoria*), post oak (*Quercus stellata*), blue jack or sandjack oak (*Quercus incana*), and little bluestem (*Schizachyrium scoparium*) during winter and summer seasons. Temporary pools of water must be available for breeding.

Houston Toads breed from January to June. Males reach sexual maturity after 1 year, and females become sexually mature after 2 years. Females can lay several thousand eggs that are fertilized externally by males. Eggs hatch within 7 days. Toadlets are approximately 0.5 inch long and metamorphose within 15-100 days. Timing depends on the magnitude of predatory threat, water temperature and pond desiccation rates.

Houston toads are federally listed as endangered and have been extirpated across the Houston area (Harris, Fort Bend, and Liberty Counties) since the 1960s after undergoing severe drought and massive habitat loss/ conversion (USFWS 2012d). Bastrop and Burleson Counties have been designated critical habitat, 42 FR 27009 27011.

Red-cockaded Woodpecker (Picoides borealis)

Red-cockaded woodpeckers can grow to 7 inches in length with a wingspan of about 15 inches. Typical coloration consists of a distinguished black cap and nape with large white cheek patches. Black barring with white horizontal stripes can be readily identified on the back. They are primarily insectivorous with the occasional consumption of fruits.

Red-cockaded woodpeckers occupy mature pine forests with preference for longleaf pines (*Pinus palustris*). It takes approximately 1–3 years to fully excavate a cavity. A typical group territory ranges from 125–200 acres, which is related to habitat suitability and population density.

Red-cockaded woodpeckers are territorial, cooperative breeders. Only one pair will breed each year from a group of 3–9 members. They nest from April through June. Females generally lay 3–4 eggs which incubate for 10–12 days. Nestlings will remain in the cavity for approximately 26 days.

Red-cockaded woodpeckers are federally listed as endangered. There are approximately 6,000 groups left. They can be found in eleven states extending from Florida to Virginia and west to southeast Oklahoma and eastern Texas (USFWS 2012d). This is representative of approximately 1% of their historical range in the United States due to the replacement of old-growth forests and the suppression of periodic fires.

Whooping Crane (Grus americana)

The whooping crane can approach 5 feet in height with a wingspan of 8 feet. Adults are snowy white with black primary feathers and a bare red face and crown. The bill is typically a dark olive-gray that becomes lighter during breeding season. Immature cranes have a reddish coloration that appears mottled by the growing white feather bases. Whooping cranes are insectivorous, carnivorous, and frugivorous.

Whooping cranes occupy saltmarshes during the winter and poorly drained wetlands in the summer. Whooping cranes migrate in September and reach wintering grounds by October or November (USFWS 2012d).

Whooping cranes are monogamous and return to the same breeding territory. Adults reach sexual maturity at 4-5 years of age. Nests are constructed from sedges, bulrushes, and cattails. Females lay 1-3 eggs in April and May. Eggs incubate for 30 days. Typically, only one chick survives.

Whooping cranes are federally listed as endangered as a consequence of hunting, low genetic diversity, human disturbance and loss of critical wetland habitat. Colorado, Idaho, Kansas, Nebraska, New Mexico, Oklahoma, and Texas have been designated critical habitat. The historic range extended from the Arctic coast to south-central Mexico. Currently there are two distinct migratory populations (USFWS 2012d). One population winters along the southeastern United States and summers in central Wisconsin. The other group winters along the Gulf Coast of Texas at Aransas National Wildlife Refuge and summers in northwestern Canada. Small, non-migratory populations are located in central Florida and coastal Louisiana.

Smalltooth sawfish (Pristis pectinata)

The smalltooth sawfish can grow to 20 feet in length. The long, flat snout lined with pairs of teeth is a defining characteristic. Smalltooth sawfish feed primarily on fish and occasionally on crustaceans.

The smalltooth sawfish typically inhabit sheltered bays and shallow banks of estuaries (National Oceanographic and Atmospheric Administrations (NOAA) 2011). Lagoons, bays, mangroves, and shallow reefs are suitable habitat types. Habitat can include a wide range of salinity, temperature, and depth. The smalltooth sawfish reaches maturity after approximately 10 years. Females are ovoviviparous and produce litters of 17 pups.

The smalltooth sawfish is federally listed as endangered due to habitat conversion and bycatch. It is extirpated from large areas of its range. The historical distribution in the United States extended along the shores from Texas to New York (NOAA 2011). Charlotte Harbor Estuary Unit and the Ten Thousand Islands/ Everglades Unit are designated critical habitat, 74 FR 45353.

Louisiana Black Bear (Ursus americanus luteolus)

The Louisiana black bear can reach 7 feet in height. Typically, males can weigh up to 400 pounds, and females weigh up to 200 pounds. They have long black hair and a short tail. Their muzzle is yellowish-brown with an occasional white patch on the lower throat and chest. They have a distinguishable long, narrow cranium and proportionally large molar teeth. Juveniles and adults are omnivorous.

Louisiana black bears occupy high-quality, productive bottomland forests. Important habitat characteristics include escape cover, travel corridors, den sites, and minimum human disturbance (USFWS 2012e). During the winter, hollow trees, brush piles, and ground nests are utilized as den sites.

Females reach sexual maturity around 3-5 years. Louisiana black bears give birth to 1-3 cubs in winter. Cubs have their first emergence from the den in spring, and they den with the mother through their first winter.

Louisiana black bears are federally listed as threatened and have been extirpated throughout much of their range (USFWS 2012d). Louisiana river basins are designated critical habitat, 74 FR 10350 10409. Human encroachment, habitat fragmentation, and hunting have contributed to the population decline.

Red Wolf (Canis rufus)

The red wolf can reach 65 inches in length including the tail. Coloration is typically brown with some buff coloration. The tail is black-tipped. This species can weigh between 45-80 pounds and are primarily carnivorous.

The red wolf occupies wetlands, pine forests, upland shrublands, and crop lands. Wooded areas are required for denning and pup rearing. Hunting corridors extend along edge interface habitat. A pack consists of 7 animals with an alpha pair. A specific home range is actively defended.

The red wolf becomes sexually mature after 2 years. Breeding season occurs from January to March. An alpha female will normally produce a litter size of 5 pups once a year. First emergence from the den occurs when the pups are at least 4 weeks old and begin to hunt after 12 weeks. Hybridization has occurred with coyote (*Canis latrans*).

The red wolf is federally listed as endangered and has been extirpated from the historical range in the south central Texas area extending to Florida, and north to south central Maine. The current range extends from North Carolina to Tennessee and along the south eastern states. Predator control alongside fragmentation and loss of habitat has critically suppressed populations of red wolves.

2.2.3 Other Protected Species and Habitat

Designated Critical Habitat

The nearest critical habitat designated by the USFWS is on the Bolivar Peninsula and Galveston Island, approximately 30 miles south-southeast of the project area. These shoreline areas are designated critical habitat for piping plovers (USFWS 2012f).

2.2.4 Texas Natural Diversity Database Results

A records review of the Texas Natural Diversity Database (TXNDD) was completed for the proposed project area and surrounding areas by the TPWD on April 5, 2012. One element of occurrence (EO) is located within the proposed project area, threeflower broomweed (*Thurovia triflora*). Threeflower broomweed is listed as rare both in Texas and globally, but is not on the state or federal endangered species list. According to the TXNDD database, no federally-protected species are recorded within the project area. EO data are demonstrated in Figure 8.

2.2.5 Protected Species Evaluated

Protected species evaluated in this document include threatened and endangered species. Table 3 summarizes all the species considered in this BA.

Table 3 - Federally Protected Species Evaluated in the BA

Protected Species- Common Name	Classification- Reason for Evaluation
Texas Prairie Dawn	Listed by USFWS as Endangered in Harris County
Green Sea Turtle	Listed by USFWS and National Marine Fisheries Service (NMFS) as Threatened, possibly occurring in San Jacinto Bay.
Hawksbill Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.
Kemp's Ridley Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.
Leatherback Sea Turtle	Listed by USFWS and NMFS as Endangered, possibly occurring in San Jacinto Bay.
Loggerhead Sea Turtle	Listed by USFWS and NMFS as Threatened, possibly occurring in San Jacinto Bay.
Red-cockaded Woodpecker	Listed by TPWD as Endangered in Harris County.
Whooping Crane	Listed by TPWD as Endangered in Harris County.
Smalltooth Sawfish	Listed by TPWD as Endangered in Harris County.
Louisiana Black Bear	Listed by TPWD as Threatened.
Red Wolf	Listed by TPWD as Endangered.

3.0 Protected Species Habitat Evaluation and Analysis

URS completed a protected species habitat evaluation on August 1, 2012 to determine if habitat within the Channelview Site was likely to support any of the federally protected species potentially occurring in Harris County. The majority of the Action Area (as defined in Section 1.4) is in active industrial use. In-use process areas and other filled portions of the facility would not provide habitat and were not included in the survey. The field evaluation included a pedestrian survey of the portions of the Action Area that could provide potential habitat. Photographs of the proposed Action Area, the proposed construction sites, and stormwater and wastewater outfalls are included as Appendix A, and an aerial photo of the Action Area is included as Figure 3.

3.1 Habitats Observed

Land use and habitat types within the Action Area include maintained grasses and mixed woodland, and riverine. A significant portion of these habitats have historically been constructed, manipulated, or otherwise impacted by industrial activities. Approximately 5.67 acres of the action area consists of aquatic environments, and approximately 134.19 acres of the Action Area is concrete, caliche, or asphalt. The project would also utilize existing construction material laydown areas and brb locations. These areas would be utilized during the construction phase of the project and are comprised of previously cleared and maintained areas consisting of caliche and crushed aggregate surfaces. No vegetation currently exists in the proposed furnace area and construction laydown areas. The existing process areas do not possess habitat with the potential to support any federally-protected species and were not evaluated.

Maintained Grasses – Areas of maintained grasses were observed near the western edge of the Action Area, and smaller areas occurred throughout. Most of these areas appear to be mowed at least monthly or bi-weekly. Dominant species observed were primarily grasses such as Bermuda grass *(Cynodon dactylon*) and bahiagrass *(Paspalum notatum*). Because of the frequent disturbance and low diversity of plant species, the observable quality of this habitat is low.

Mixed woodland – This habitat consists of a small fragment of forest, found in the northwest corner of the Action Area. Due to the relatively small size and location of the wooded area in a highly modified landscape, it is dominated by species typical of previously disturbed areas. Dominant species include Chinese tallow (*Triadica sebifera*), hackberry *(Celtis laevigata*), Canada goldenrod (*Solidago canadensis*), yaupon (*Ilex vomitoria*), and great ragweed *(Ambrosia trifida*). This area is identified by the NWI as a forested wetland; however, the observed dominant species are typical of upland forests. The observable quality of this habitat is low, based on habitat fragmentation, presence of invasive plant species, and adjacent disturbance.

Riverine – One area of riverine habitat was observed. This area is located on the northeast portion of the property, where the facility's stormwater drainage ditches flow into a more natural stream, which flows east to Upper San Jacinto Bay just south of the dock. This stream flows through a forested area out to open water – plant species found in these habitats are similar to those listed for open water habitat.

Site access was limited at the mouth of the river, but the shoreline appears to be predominantly in a natural state that supports wetland vegetation. The observable quality of this habitat is moderate. The riverine habitat area has the potential to support migratory birds, bald or golden eagles, some sea turtles, bottlenose dolphins, and other wildlife.

4.0 Assessment of Air Quality

The air quality analysis to demonstrate compliance with NAAQS PSD Increments is performed using computer models to simulate the dispersion of the emitted pollutants into the atmosphere and predict ground level concentrations at specified receptor locations in the area around the source of emissions. If the modeled concentration for a given pollutant and averaging period is less than the EPA-specified SIL, the project is determined to have no significant impact on ambient air quality and no further analysis is required for that pollutant and averaging period. If the SIL is predicted by the model to be exceeded for a given pollutant, further modeling of the project emissions combined with existing emission sources in the area is required to estimate total ambient concentrations. The modeling must demonstrate that the total concentration, including an appropriate background, does not exceed the applicable NAAQS and PSD Increment.

4.1 Estimated Total Annual Emission Rate Overview

Trinity Consultants (2012) completed detailed pollutant emission calculations for the project in accordance with the Air Permit Amendment Application requirements. This BA does not include detailed estimated emission rates. Estimated emission rates and descriptions of emission calculation methods have been provided to the EPA in both the GHG PSD permit application and the TCEQ NSR/ PSD permit application. Both are available upon request.

A summary, provided by Trinity Consultants, of the total estimated annual emission for PSD pollutants that would be emitted by the project are provided in Table 4 and Table 5.

Table 4 - Emission Point Summary for Olefins OP-1

Emission Point Name	Air Pollutant Name	Air Pollutant Emission Rate (Tons per year)
OP-1 Cooling Tower	VOC	19.87
	PM	8.28
	PM_{10}	4.14
	$PM_{2.5}$	4.14
OP-1 Fugitives	VOC	2.01
OP-1 NH3 Fugitives	NH_3	0.94
Decoke Vent 2	CO	59.60
	VOC	0.02
	PM	0.10
	PM_{10}	0.10
	$PM_{2.5}$	0.10

Waste Caustic Tank 34E12	VOC	0.62
Slop Oil Storage Tank 38008	VOC	1.52
Wastewater Storage Tank 38009	VOC	1.76
Wastewater Storage Tank 38010	VOC	1.91
Wastewater Storage Tank 38011	VOC	3.81
OP-1 Heater	NO_x	25.71
	CO	148.38
	SO_2	1.54
	VOC	2.57
	PM	17.00
	PM_{10}	17.00
	$PM_{2.5}$	17.00
	NH_3	11.78
MSS Vessel	VOC	0.05
Analyzers	VOC	0.13

Table 5 - Emission Point Summary for Olefins OP-2

Emission Point Name	Air Pollutant Name	Air Pollutant Emission Rate (Tons per year)
OP-2 Heater	NO_X	25.71
	CO	148.38
	SO_2	1.54
	VOC	2.57
	PM	17.00
	PM_{10}	17.00
	$PM_{2.5}$	17.00
	NH_3	11.78
OP-2 Cooling Tower	VOC	22.71
	PM	9.47
	PM_{10}	4.73
	$PM_{2.5}$	4.73
Decoke Vent 2	CO	59.60
	VOC	0.02
	PM	0.10
	PM_{10}	0.10
	$PM_{2.5}$	0.10
OP2 Fugitives	VOC	2.01
Waste Caustic Tank 4455	VOC	0.62
Slop Oil Storage Tank 48008	VOC	1.52
Wastewater Tank 48009	VOC	1.76
Wastewater Tank 48010	VOC	1.91
Wastewater Tank 48011	VOC	3.81

Emission Point Name	Air Pollutant Name	Air Pollutant Emission Rate (Tons per year)
MSS Vessel	VOC	0.05
Analyzers	VOC	0.13

Emissions resulting from gasoline and diesel-fueled vehicles and equipment during construction and maintenance are considered negligible. The project will not require a significant increase in vehicle and equipment use compared to current daily emissions for the facility.

4.2 Area of Impact Dispersion Modeling

Trinity Consultants performed dispersion modeling of the proposed emissions of air pollutants from the proposed project in accordance with the PSD Permit requirements. According to the EPA (2007), "dispersion modeling uses mathematical formulations to characterize the atmospheric processes that disperse a pollutant emitted by a source." This section provides the methods and results of the dispersion modeling. The results of the modeling are provided as a summary of the maximum predicted concentrations. The project is subject to PSD review for NO_2, CO, PM_{10}, and $PM_{2.5}$. In addition, per request by TCEQ, an air dispersion modeling analysis was performed to demonstrate that the SO_2 emissions from the project will not cause or contribute to a violation of the applicable NAAQS.

A Modeling Effects Review Applicability (MERA) analysis State Effects Evaluation was performed by Trinity Consultants using modeling analysis consistent with current TCEQ and EPA guidelines. The analysis included an evaluation of 132 compounds. The analysis indicated that all compounds evaluated would be below 10% of the effects screening level, indicating that no further modeling analysis was required.

4.2.1 Methods

This section discusses air quality modeling, monitoring, presentation of these data, and how background concentrations were obtained. If the SIL was exceeded for a pollutant, a NAAQS and/or PSD Increment analysis was performed, and the appropriate background concentrations presented in this section were added to the modeling results to demonstrate compliance with the NAAQS primary and secondary standards and PSD Increments considering SIL concentrations (Table 6). The modeling methods were provided by Trinity Consultants.

Table 6 – Standards for Comparison with Modeling for Criteria Pollutants

Pollutant	Regulation	Averaging Period	Modeling *De minimis* (µg/m^3)	Standard (µg/m^3)
SO_2	Chapter 112	30-min	20.4	1021.0
	NAAQS	1-hr	7.8	195.0
		3-hr	25.0	1300.0
		24-hr	5.0	365.0
		Annual	1.0	80.0
	PSD Increment	3-hr	25.0	512.0

Pollutant	Regulation	Averaging Period	Modeling *De minimis* (µg/m^3)	Standard (µg/m^3)
		24-hr	5.0	91.0
		Annual	1.0	20.0
	PSD Monitoring	24-hr	13.0	N/A
NO_2	NAAQS	1-hr	7.5	188.7
		Annual	1.0	100.0
	PSD Increment	Annual	1.0	25.0
	Monitoring	Annual	14.0	N/A
CO	NAAQS	1-hr	2000.0	40,000.0
		8-hr	500.0	10,000.0
	PSD Monitoring	8-hr	575.0	N/A
PM_{10}	NAAQS	24-hr	5.0	150.0
	PSD Increment	24-hr	5.0	30.0
		Annual	1.0	17.0
	PSD Monitoring	24-hr	10.0	N/A
$PM_{2.5}$	NAAQS	24-hr	1.2	35.0
		Annual	0.3	15.0
	PSD Increment	24-hr	1.2	9.0
		Annual	0.3	4.0
	PSD Monitoring	24-hr	4.0	N/A

The model parameters specified for the modeled location, such as meteorological data, rural versus urban dispersion coefficients, and receptor grid are discussed below. Modeling was performed using the regulatory default options, which include stack heights adjusted for stack-tip downwash, buoyancy-induced dispersion, and final plume rise. Ground level concentrations occurring during "calm" wind conditions are calculated by the model using the calm processing feature. Regulatory default values for wind profile exponents and vertical potential temperature gradients are used since no representative on-site meteorological data are available. As per EPA requirements, direction-specific building dimensions are used in the downwash algorithms.

AERMOD

Modeling was performed using the AMS/EPA Regulatory Model (AERMOD) (version number 12060). The AERMOD model was chosen because it is approved by the EPA as a Preferred/Recommended model and is approved by the TCEQ modeling staff.

AERMOD is a steady-state plume dispersion model for assessment of pollutant concentrations from a variety of sources. AERMOD determines concentrations from multiple points, area, or volume sources based on an up-to-date characterization of the atmospheric boundary layer. The model employs hourly sequential preprocessed (AERMET) meteorological data to estimate concentrations. The AERMOD model is applicable to receptors on all types of terrain, including flat terrain, simple elevated terrain (below height of stack), intermediate terrain (between height of stack and plume height), and complex terrain (above plume height). In addition, AERMOD provides a smooth transition of algorithms across

these different terrains. Therefore, AERMOD was selected as the most appropriate model for the air quality impact analysis for the proposed facility.

AERMAP

AERMOD uses advanced terrain characterization to account for the effects of terrain features on plume dispersion and travel. AERMOD's terrain pre-processor, AERMAP, imports digital terrain data and computes a height scale for each receptor from National Elevation Database (NED) data files. A height scale is assigned to each individual receptor and is used by AERMOD to determine whether the plume will go over or around a hill.

Building Wake Effects

The emission sources are evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if stack discharges might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of turbulence that are greater than if the building was absent.

Direction-specific building dimensions and the dominant downwash structure parameters used as inputs to the dispersion models was determined using the BREEZE-WAKE/BPIP software, developed by Trinity Consultants, Inc. This software incorporates the algorithms of the EPA-sanctioned Building Profile Input Program with PRIME enhancement (BPIP-PRIME), version 04274. BPIP-PRIME is designed to incorporate the concepts and procedures expressed in the GEP Technical Support document, the Building Downwash Guidance document, and other related documents.

The output from the BPIP-PRIME downwash analysis lists the names and dimensions of the structures, and the emission unit locations and heights. In addition, the output contains a summary of the dominant structure for each emission unit (considering all wind directions) and the actual building height and projected widths for all wind directions. This information is then incorporated into the data input files for the AERMOD air dispersion model.

Terrain

The Channelview Site is located due east of Houston, Texas just north of Interstate 10 in Harris County. The terrain surrounding the Channelview North Plant varies in elevation from 0 feet (0 meters) to 160 feet (49 meters) within 50 km of the Plant. The average elevation at the Channelview North Plant is approximately 40 feet (12.19 meters) above mean sea level.

The receptor terrain elevations input into AERMAP are the highest elevations extracted from United States Geological Survey (USGS) Seamless database. The data extracted was 1 arc second (30 m) data for the Houston area. For each receptor, the maximum possible elevation within a box centered on the receptor of concern and extending halfway to each adjacent receptor was chosen. This is a conservative technique for estimating terrain elevations in that it ensures that the highest terrain elevations are accounted for in the analysis. Source and building elevations are extracted in the same manner, using interpolated elevation values.

Receptor Grid

In the air quality dispersion modeling analysis, the modeled ground-level concentrations were determined within four main Cartesian receptor grids. These four grids cover a region extending at least 25 kilometers (km) beyond the Channelview Site sources. The grids are defined as follows:

- The "fence line grid" is a discrete receptor grid with the receptors spaced at 25-meter (m) intervals along the Equistar property line.
- The "fine grid" contains 100-m spaced receptors extending at least 1 km from the sources under consideration, excluding the receptors within the fence line grid.
- The "medium grid" contains 500-m spaced receptors extending 5 km from the sources under consideration, excluding the receptors within the fence line and fine grids.
- The "coarse grid" contains 1-km spaced receptors extending at least 10 km from the sources under consideration, excluding the receptors in the fence line, fine, and medium grids. If the sources have a significant impact beyond 10 km, a receptor grid extending up to 25 km will be used.

Meteorological Data

The meteorological data used in the models includes observed hourly wind speed, wind direction, temperature and numerous other parameters. This data is used, along with other inputs, by the models to determine the dispersion of the emissions from sources in the model input.

Monitoring Stations

The EPA and TCEQ track air quality and pollutant emissions with the use of monitoring stations in various locations. Table 7 presents background concentrations for NO_2 and $PM_{2.5}$. The NO_2 measurements were recorded at the Channelview monitoring station, located within 1 mile of the Project Site. The $PM_{2.5}$ measurements were recorded at the Baytown monitoring station, located approximately six miles southeast of the Project Site. The ambient monitoring data was obtained from the Texas Air Monitoring Information System web interface. These values represent the existing ambient air quality concentrations (TCEQ 2012b).

Table 7 – Criteria Pollutant Monitoring Data Summary

Pollutant	Monitor ID	Site Name	Year	Data Points	98th percentile	Average
NO_2 Hourly (ppb)	482010026	Channelview	2009	8478	31.03	8.82
			2010	7688	32.74	10.10
			2011	8376	32.93	9.52
$PM_{2.5}$ 24-Hour ($\mu g/m^3$)	482010058	Baytown	2009	61	21.00	10.93
			2010	59	27.60	10.86
			2011	43	23.20	12.60

4.2.2 Results

Table 8 shows the maximum predicted concentrations due to the project for each pollutant and averaging period. Note: These are not total ambient concentrations. These are predicted increases in ground level concentrations due to new emissions from the proposed project.

Table 8 – Maximum Predicted Concentrations

Pollutant	Averaging Period	Highest Modeled Concentration (µg/m^3)	Modeling Significance Level (µg/m^3)	Significant?
CO	1-hour	873.74	2,000.0	No
	8-hour	369.99	500.0	No
PM_{10}	24-hour	1.19	5.0	No
$PM_{2.5}$	24-hour	1.19	1.2	No
	Annual	0.29	0.3	No
NO_2	1-hour	2.11	7.5	No
	Annual	0.05	1.0	No
SO_2	1-hour	0.165	7.8	No
	3-hour	0.125	25.0	No
	24-hour	0.061	5.0	No
	Annual	0.008	1.0	No

The SIL is a level set by the EPA, below which, modeled source impacts would be considered insignificant. The highest modeled concentration value is the maximum ground level concentration outside (or along the boundary between the North Plant and South Plant) of the Channelview Site property boundary predicted by the model for each pollutant and averaging period resulting from this project. If a highest modeled concentration value is less than the SIL, the modeled source impacts are considered insignificant and are not considered to cause or contribute to a violation of a NAAQS or PSD Increment for that pollutant and averaging period. If a highest modeled concentration is greater than the SIL, additional analysis is required to demonstrate that the project would not cause or contribute to a violation of the NAAQS or PSD Increment for that pollutant and averaging period.

4.2.3 Conclusions

All of the project highest modeled concentration values are less than the SIL. Therefore, the source impacts are considered insignificant based on stringent limits set to protect the most sensitive human populations. Due to this predicted lack of significant impact to sensitive human populations, the source impacts are not expected to significantly impact federally-protected species outside of the Channelview Site. Therefore, only impacts to protected species within the Channelview Site from potential changes to air quality are considered.

4.3 Modeling within Channelview Site

Additional modeling was conducted to determine if any criteria pollutant might exceed SILs within the boundaries of the Channelview Site. The results are shown in Figure 9. PM and CO are predicted to

exceed SILs within the property boundary. Impacts to protected species from air quality impacts outside of the area determined to exceed SILs are unlikely.

5.0 Assessment of Water Quality

The water quality analysis included dilution modeling to predict the distance at which the effluent concentration would result in a 1% effluent within the ambient environment of the receiving water body (San Jacinto River Tidal) and a toxicity assessment of the chemical constituents discharged from Outfall #001.

5.1 Estimated Discharge Increase

The source of the Channelview Site's water is Lake Houston. Equistar estimates the increase in fresh water intake to be 0.15 MGD for the project as well as an equivalent resulting effluent discharge. The OP-1 is expected discharge will be 0.075 MGD, and OP-2 is expected to discharge 0.082 MGD. The proposed project is not expected to change the characteristics of the discharge water.

5.2 Current and Anticipated Discharge Constituents

The concentrations of permitted chemical constituents in the treated effluent from Outfall 001 are below the authorized levels set forth by a TPDES permit (Table 9 and Table 11). The effluent quality from the proposed project is anticipated to be approximately the same as the current discharge for the following reasons:

1. The increase in flow and organic load are well within the design capacity of our existing treatment facility. As organic load increases, more carbonaceous bacteria grow within the aeration system to biologically treat the organic constituents. The new load will be consistent with what the aeration treatment system currently receives. No new constituents will be added nor sent to treatment.
2. The outfall will continue to meet currently permitted effluent limits, including bio-toxicity limits.

The existing wastewater treatment facility is sufficient to treat the larger volumes of wastewater produced by the proposed project. With the expanded wastewater, the amount of augmentation will be reduced to give similar treatment.

Table 9-Permitted Concentrations vs. Sampled Concentrations from 2010 vs. Anticipated Concentrations

Parameter	Outfall #001 Permitted Concentrations Daily Max (ug/L)	Outfall #001 Effluent Results Max of Samples (ug/L)	Anticipated Outfall #001 Effluent Concentrations (ug/L)
Acenapthene	25.6	<10.0	<10.0
Acenaphthylene	25.6	<10.0	<10.0
Acrylonitrile	103.7	<20.0	<20.0

Parameter	Outfall #001 Permitted Concentrations Daily Max (ug/L)	Outfall #001 Effluent Results Max of Samples (ug/L)	Anticipated Outfall #001 Effluent Concentrations (ug/L)
Anthracene	25.6	<10.0	<10.0
Benzene	59.1	<1.0	<1.0
Benzo (a) anthracene	25.6	<10.0	<10.0
3,4-Benzofluoranthene	26.5	<10.0	<10.0
Benzo (k) fluoranthene	25.6	<10.0	<10.0
Benzo (a) pyrene	26.5	<10.0	<10.0
Bis (2-ethylhexyl) phthalate	121.2	<10.0	<10.0
Carbon Tetrachloride	16.5	<1.0	<1.0
Chlorobenzene	12.1	<5.0	<5.0
Chloroethane	116.5	<5.0	<5.0
Chloroform	20.0	19.0	19.0
2-Chlorophenol	42.6	<10.0	<10.0
Chrysene	25.6	<10.0	<10.0
Di-n-butyl phthalate	24.8	<10.0	<10.0
1,2-Dichlorobenzene	70.9	<5.0	<5.0
1,3-Dichlorobenzene	19.1	<5.0	<5.0
1,4-Dichlorobenzene	12.1	<5.0	<5.0
1,1-Dichloroethane	25.6	<5.0	<5.0
1,2-Dichloroethane	91.7	<1.0	<1.0
1,1-Dichloroethylene	10.8	<1.0	<1.0
1,2-trans Dichloroethylene	23.5	<5.0	<5.0
2,4-Dichlorophenol	48.6	<10.0	<10.0
1,2-Dichloropropane	99.9	<5.0	<5.0
1,3-Dichloropropylene	19.1	<10.0	<10.0
Diethyl phthalate	88.2	<10.0	<10.0
2,4-Dimethylphenol	15.6	<10.0	<10.0
Dimethyl phthalate	20.5	<10.0	<10.0
4,6-Dinitro-o-cresol	120.3	<20.0	<20.0
2,4-Dinitrophenol	53.4	<20.0	<20.0
2,4-Dinitrotoluene	123.8	<10.0	<10.0
2,6-Dinitrotoluene	278.4	<10.0	<10.0
Ethylbenzene	46.9	<5.0	<5.0
Fluoranthene	29.6	<10.0	<10.0
Fluorene	25.6	<10.0	<10.0
Hexachlorobenzene	0.5	<0.5	<0.5
Hexachlorobutadiene	21.3	<10.0	<10.0

Parameter	Outfall #001 Permitted Concentrations Daily Max (ug/L)	Outfall #001 Effluent Results Max of Samples (ug/L)	Anticipated Outfall #001 Effluent Concentrations (ug/L)
Hexachloroethane	23.5	<10.0	<10.0
Methyl Chloride	82.6	<20.0	<20.0
Methylene Chloride	38.6	<20.0	<20.0
Naphthalene	25.6	<10.0	<10.0
Nitrobenzene	29.6	<10.0	<10.0
2-Nitrophenol	30.0	<20.0	<20.0
4-Nitrophenol	53.9	<20.0	<20.0
Phenanthrene	19.1	<10.0	<10.0
Phenol	11.3	<2.0	<2.0
Pyrene	29.1	<10.0	<10.0
Tetrachloroethylene	24.3	<1.0	<1.0
Toluene	34.8	<5.0	<5.0
1,2,4-Trichlorobenzene	60.7	<10.0	<10.0
1,1,1-Trichloroethane	23.5	<5.0	<5.0
1,1,2-Trichloroethylene	23.5	<5.0	<5.0
Trichloroethylene	23.5	<1.0	<1.0
Vinyl Chloride	116.5	<1.0	<1.0

5.3 Area of Impact Dilution Modeling

Dilution modeling was conducted to demonstrate compliance with TCEQ and EPA standards for aquatic life. The analysis was used to estimate the concentration of pollutants discharged into the aquatic environment and predict the area of the plum in the San Jacinto River Tidal. The dilution modeling was used to determine what portions of the aquatic environment to include within the Action Area. Channelview Site background water quality data was not available for Wallisville Gully and San Jacinto River Tidal that included the chemical constituents that are contained within the Channelview Site effluent. TCEQ and USGS databases along with an extensive public search for water quality and sediment concentrations resulted in no comparable data. Because there was no publicly available data concerning the appropriate pollutants characterizing Outfall 001, then a 1% effluent was used as a conservative method to define a return to ambient conditions. The potential exists that the effluent discharge could be lower than ambient conditions and in a sense cleaner than the receiving water body. The plume area includes that area in the San Jacinto River Tidal to a point of 1% effluent; at this point the project is determined to have no significant impact on federally threatened and endangered species. The Action Area includes the wastewater effluent drainage channel, Wallisville Gully, and dilution area within the receiving water body, a portion of the San Jacinto River Tidal along and downstream of the Channelview Site boundary (Figure 3).

5.3.1 Methods

Parameters required for the dilution modeling include the width, depth, and flow rate in the drainage channel and Wallisville Gully, along with the current speed and depth of the San Jacinto River Tidal. Width, depth, and flow rate within the drainage channel were provided by Equistar, based on site observations, aerial photographs, and the average discharge from the January 2011 to December 2011 Discharge Monitoring Reports for the Channelview Site. No recorded data are available that provide Wallisville Gully characteristics. From the USGS topographic map it appears that the gully is about 100 feet wide at 5 feet elevation. To estimate the dilution of the drainage channel into Wallisville Gully, thence into San Jacinto River, data from the TPDES permit, TPDES Renewal Application from 2007, TCEQ database queries, aerial photographs, and the Southern Region Climatic Data Center for the Baytown station was utilized. The San Jacinto River Tidal, in the vicinity of the mouth of the discharge channel, was assumed to be approximately 20 feet deep and 320 feet wide in the model based on average near-shore depths in the area. The river is deep relative to the tidal range (approximately 20 feet deep to 1 foot tide). Therefore, the velocities were considered to be sufficiently representative for this study. The current speed in San Jacinto River was estimated from measured flow and velocity data in the river at a USGS station near the Highway 90 crossing. The Highway 90 Bridge is about 4 miles upstream from confluence of Wallisville Gully. The Oct 19 through Nov. 3 1994 data were collected during a large storm event (100 year +) so it may not be representative of smaller events or non-storm conditions.
Two major stages of mixing can be identified for a waste discharge into a water body, the near-field and the far-field. In the near-field the discharge geometry and flow governs mixing, i.e. the initial momentum and buoyancy of the discharge determine the rate of dilution. In the far-field the effects of the initial momentum and buoyancy have dissipated, and the ambient turbulence and currents determine further mixing. In the far-field mixing can occur during a buoyant spreading phase and a passive diffusion phase. In the buoyant spreading phase the buoyancy tends to damp mixing so mixing is generally small, the plume spreads laterally and thins out vertically. During the passive diffusion phase the plume diffuse in the horizontal and vertical directions. The plume will enlarge and become more dilute. The modeling indicated that the initial width of the plume was assumed to be about 65 feet (~20 m).

There are several length scales that can be calculated that relate to the size of plume to the bending of the jet and the amount of dilution expected in the near-field. However, since the near-field is buoyancy dominated the dilution in the near-field will be small. However, the plume may still spread on the surface of the water and spread across the river. For this reason the dilution in the near-field was ignored and only dilution due to passive diffusion was calculated for the far-field. Jones, Nash, and Jirka (1996) provide relationships that can be used to estimate the size of the plume in the near-field. The edge of the near-field is generally near the source.

The dilution due to passive diffusion can be calculated as:

$$S = \frac{2b_v b_h}{L_m L_Q} \qquad (1)$$

Where b_v and b_h are the width and thickness of the plume. L_m is a length scale related to the distance from shore where the plume becomes bent over, and L_Q is the distance over which the geometry of the discharge is important. When the plume fully occupies the water depth, b_v is replaced by the water depth.

The depth and width of the plume were calculated using the following equations:

$$b_v = \left(\frac{\pi E_z x}{u_a} + b_{vi}^2 \right)^{1/2} \quad (2)$$

$$b_h = \left(\frac{\pi E_y x}{u_a} + b_{hi}^2 \right)^{1/2} \quad (3)$$

$$S = \frac{2\, bvbh}{Qo} * ua \quad (4)$$

Where u_a is the current speed and b_{vi} and b_{hi} are the intial thickness and width, respectively. The vertical and horizontal diffusivities in Column 2 (Table 10), takes into account the friction velocity (u*) and the Darcy-Weisbach friction factor (f) for the river. For the analysis a value of 0.03 was used for the friction factor (f). This is equivalent to the familiar Mannings n value of 0.022. Equation 3 assumes that the discharge in the river is uninfluenced by the shoreline. Since the discharge is a shoreline discharge the principle of superposition results in the concentration in the plume being doubled at any distance x. Dilution is the mass balance between the flow through the plume and the discharge flow rate and is shown in Equation 4.

Based on these calculations and modeling, the Project Site's Action Area was defined.

5.3.2 Results

Using the above relationships, the calculated dilution was conducted for river velocities of 0.5, 1.0, and 2.0 feet/s. In order to determine the reach of the concentrations down the San Jacinto Bay towards potential foraging grounds for species of concern, the velocity, 0.5 feet/s, was used in the dilution modeling. The slower velocity was chosen to identify the Action Area within the San Jacinto River because it would encompass a larger area that could potentially impact higher numbers of species based on area. Due to the speed of the current, the concentrations will be less dilute and be distributed the furthest. The faster velocity of 2.0 feet/s was also considered and would reach 1% effluent in a shorter distance (approximately 197 feet with a plume of 46 feet). This area would become more dilute at a shorter distance due to the rapid current and is entirely encompassed within the Action Area based on the 0.5 feet/s velocity (Figure 3). The initial width of the plume was assumed to be about 65 feet (~20 m). The percent effluent drops to less than 10% of the plume about 16 feet downstream of the discharge and when the plume is about 66 feet wide (Table 10). The plume is less than 5% effluent approximately 59 feet from the discharge when the plume is about 69 feet wide. The plume will flow into deep water within the San Jacinto River; therefore, it is expected to only occupy the top of the water column.

Table 10 - Channelview Site Dilution of Discharge to San Jacinto River Tidal

Assumptions	
Width of Discharge Channel (ft)	25.0
Depth of Discharge Channel (ft)	2.0
Discharge Flow Rate (MGD)	7.2
Temperature of Discharge (^{o}F summer)	91.6
Salinity of Discharge (ppt)	1.2
Current Speed in San Jacinto River (ft/s)	0.5
Depth in San Jacinto River near Discharge (ft)	20.0
Ambient Water Temperature (^{o}F summer)	88.7
Ambient Salinity (summer, ppt)	2.92

Distance From Discharge Point at San Jacinto River (ft.)	Width of Plume (measured from shoreline, ft.)	Bulk Dilution	% Effluent
3.3	65.1	5.1	20%
6.6	65.4	6.9	15%
9.8*	65.6	8.3	12%
13.1	65.8	9.6	10%
16.4	66.0	10.7	9%
19.7	66.3	11.8	8.5%
23.0	66.5	12.7	7.9%
26.2	66.7	13.6	7.3%
29.5	67.0	14.5	6.9%
32.8	67.2	15.3	6.5%
36.1	67.4	16.1	6.2%
39.4	67.6	16.8	5.9%
45.9	68.1	18.3	5.5%
52.5	68.5	19.7	5.1%
59.0	69.0	21.0	4.8%
65.6	69.4	22.2	4.5%
72.2	69.8	23.5	4.3%
78.7	70.3	24.6	4.1%
85.3	70.7	25.8	3.9%
91.8	71.1	26.9	3.7%
98.4	71.5	28.0	3.6%
105.0	72.0	29.1	3.4%
111.5	72.4	30.2	3.3%
118.1	72.8	31.2	3.2%
131.2	73.6	33.3	3.0%
147.6	74.7	35.8	2.8%

164.0	75.7	38.2	2.6%
180.4	76.7	40.6	2.5%
196.8	77.6	42.9	2.3%
229.6	79.6	47.5	2.1%
262.4	81.4	52.0	1.9%
295.2	83.3	56.4	1.8%
328.0	85.1	60.7	1.6%
393.6	88.6	69.2	1.4%
459.2	91.9	77.6	1.3%
524.8	95.2	85.4	1.2%
590.4	98.3	88.2	1.1%
656.0	101.3	91.0	1.1%
820.0	108.5	97.4	1.0%
984.0	115.3	103.5	1.0%
1312.0	127.8	114.7	0.9%

Note: For Column 2, the vertical and horizontal diffusivities were calculated using the following variables:
$E_z = 0.2\ u^*H$; $E_y = 0.6\ u^*H$; $u^* = (f/8)^{0.5} * u_a$; $u_a = 0.5$ ft/s; $H = 20.0$ ft; $Q_o = 11.1$ ft^3/s

For the data used in the analysis E_z and E_y are equal to 0.004 m^2/s and 0.013 m^2/s respectively as shown below.
U* = (0.03/8)^.5 * 0.5 ft/s = 0.031 ft/s
$E_z = 0.2 * 0.031$ ft/s * 20. ft = 0.124 ft^2/s
$E_y = 0.6 * 0.031$ ft/s * 20 ft = 0.372 ft^2/s

Sample Calculation for width and depth of the plume at 3.3 feet distance:

Half width $bv = \left(\frac{\pi * 0.124 \frac{ft^2}{s} * 3.3 ft}{0.5 \frac{ft}{s}} + (0.687 ft)^2\right)^{.5} = 1.74$ ft.

Half width of plume $bh = \left(\frac{(\pi * 0.372 ft^2} {s} * 3.3 ft}{0.5 ft/s} + (32.44 ft)^2\right)^{.5} = 32.6$ ft. (full width = 65.3 ft.)

Dilution $S = \frac{2 * 1.74 ft * 32.6 ft}{11.1 \frac{ft^3}{s}} * 0.5 = 5.11$

The modeling results indicated that the initial width of the plume was assumed to be about 65 feet (~20 m). The percent effluent drops to less than 10% of the plume about 16 feet downstream of the discharge and when the plume is about 66 feet wide. The plume is less than 5% effluent approximately 59 feet from the discharge when the plume is about 69 feet wide. Within 820 feet of the mouth of the drainage channel, the plume will contain 1% effluent, and the width of the plume will have expanded to 108 feet. The plume will flow into deep water within the San Jacinto River; therefore, it is expected to only occupy the top of the water column.

5.3.3 Conclusions

Within 820 feet of mouth of the drainage channel, the plume will contain 1% effluent, and the width of the plume will have expanded to 108 feet. Outside of this plume area, there is little mixing of the effluent with surrounding surface water. In the absence of background water quality information, this 1% effluent concentration in the plume was used to define the Action Area for the aquatic environment

within San Jacinto River Tidal. Due to the deflection of the plume down the river, the conservative Action Area for the San Jacinto River is confined to the portion of the river that is yields 1% effluent concentration.

The dilution modeling used is a conservative model because it assumed that there was no mixing of effluent with surface water neither in the drainage channel nor in Wallisville Gully, and it also assumed that the depth of the San Jacinto River Tidal near the mouth of the discharge channel was only 20 feet deep. In reality, the effluent would be diluted within the discharge channel prior to entering the San Jacinto River. The result of this conservative modeling approach is that the modeling should overestimate the areal extent of the plume in the San Jacinto River Tidal.

As shown in Table 9, the current concentrations within the effluent stream are relatively low in comparison to the permitted levels. These sampled values are taken before the effluent undergoes treatment which will result in a further decrease in concentration levels before being discharged into the San Jacinto River Tidal. Therefore, this dilution model is a conservative view of the maximum concentration dilution.

5.4 Toxicity Assessment

Wastewater that is generated on site and discharged is subject to effluent limitations set in TPDES Permit No. WQ0000391000. Multiple outfalls are utilized by the Channelview Site; however, the proposed project will primarily affect Outfall #001 which is located on the northwest corner of the facility and drains southeast. Outfall #001 is approximately 300 m south of Lyondell Road. The wastewater from Outfall #001 discharges to a non-tidal drainage channel prior to discharging to Wallisville Gully, thence into San Jacinto River Tidal in Segment No. 1001 of the San Jacinto River Basin. The San Jacinto River Tidal is expected to contain aquatic life. Segment No. 1001 is currently listed on the State's inventory of impaired and threatened waters, Texas 2006 Clean Water Act Section 303 (d) list for elevated levels of dioxin, PCBs in fish tissue. The discharge from Outfall #001 does not include these pollutants; therefore, the effluent is not expected to elevate dioxin and PCB concentrations in the impaired segment. Increased levels of permitted chemical concentrations are not expected to be discharged from the affected effluent and will remain within the TPDES limitations. As a result, the proposed project is not anticipated to require an amendment to the existing TPDES Permit (Permit No. WQ0000391000).

Based on a maximum permitted discharge, an assessment of the aquatic life impacts that would be associated with wastewater from the facility was performed using the TCEQ TexTox Menu 10 model. This model is used to calculate effluent discharge limitations to maintain the surface water quality standards based upon the most recent in stream criteria established in 30 Texas Administrative Code (TAC) 302.6 (c) and (d). Numerical water quality criteria were established by the TCEQ for specific contaminants where adequate toxicity information was available and have the potential to adversely impact the water in the state. Applicable criteria were developed in accordance with current EPA guidelines for calculating site-specific water quality criteria. The current permitted water quality discharge limitations were created from the results of a series of effluent sampling as required for the most recent permit amendment. Mixing zone and toxicological assumptions are built into the model.

Potential toxic effects on aquatic life resulting from the wastewater discharge were established by the TCEQ for specific toxic compounds where adequate toxicity information is available and that have the potential for exerting adverse impacts on water in the state. The appropriate criteria for aquatic life protection were derived in accordance with current EPA guidelines for developing site-specific water quality criteria. The average of monthly sampling of total suspended solids (TSS), chemical oxygen demand (COD), ammonia (NH_3), chromium (Cr), copper (Cu), lead (Pb), and nickel were sampled is shown in Table 11.

Table 11 - Channelview Site Parameter Concentrations (ug/L) with Permit Limits in Parenthesis

Parameter	TSS	COD	NH_3	Cr	Cu	Pb	Nickel
(lbs./day)	(7467)*	(14,420)	(434)	(2.54)	(4.10)	(16.6)	(15.0)
(ug/L)	(124,276.01)	(239997.34)	(7223.22)	(42.27)	(68.24)	(276.28)	(249.65)
1/01/11-1/31/11	199.72	1551.83	7.16	0.17	0.50	0.17	0.33
02/01/11-02/28/11	264.30	1284.04	5.99	0.17	0.50	-	-
03/01/11-03/29/11	164.60	1427.00	6.16	0.00	0.33	-	-
04/01/11-04/30/11	199.72	1537.18	6.16	0.17	0.33	-	0.02
05/01/11-05/31/11	179.75	1301.84	3.99	0.17	0.33	0.17	-
06/01/11-06/30/11	251.81	1609.25	5.33	0.17	0.33	-	-
07/01/11-07/31/11	220.03	1413.02	8.65	0.17	0.33	-	-
08/01/11-08/31/11	15.64	273.62	86.88	0.17	0.17	-	-
09/01/11-09/30/11	241.33	1591.61	7.32	0.17	0.17	-	-
10/01/11-10/31/11	171.93	1355.44	7.32	0.17	0.17	-	-
11/01/11-11/30/11	235.17	1604.09	7.66	0.17	0.17	-	-
12/01/11-12/31/11	151.95	1301.68	4.49	0.17	0.17	-	-

Note: lbs/day ÷ MGD ÷ 8.345= mg/L*1000= ug/L
* Sample Calculation =7467 lbs/day ÷ 7.2 MGD ÷ 8.345 * 1000= 199.72 ug/L

The federal guidelines 40 CFR part 133 will standardize the discharge of domestic wastewater, and 40 CFR 414 will regulate the discharge of process wastewater. Discharge limitations of the current TPDES permit will remain the same. The Channelview Site has conducted whole effluent toxicity testing

routinely as a requirement of the permit. The TCEQ has defined unique dilution factors to assess the Outfall #001's drainage channel, Wallisville Gully, and the San Jacinto River Tidal based on applicable discharge volumes, critical low flow, and harmonic mean stream flows. Based on preliminary data for an amended TPDES permit, acute freshwater criterion will be used for assessing the effluent discharge from the end-of-the-pipe for freshwater features, and a marine criterion will be applied in assessments involving the tidal river. The Aquatic Life Surface Water Risk-Based Exposure Limits (SWRBELs) and National Pollutant Criteria Database were used to compare maximum discharge limitations as criteria for aquatic life. Applicable criteria were developed in accordance with current EPA guidelines for calculating site-specific water quality criteria. The Aquatic Organism Bioaccumulation Criteria was used to compare discharge limitations as a criterion for human health consumption of marine fish tissue. The TCEQ used data from the original TPDES permit application to determine current discharge limitations. Effluent dilutions, aquatic organism bioaccumulation, dissolved oxygen, toxicity of aquatic life, toxicity of human health in consumption of marine organisms were modeled using TCEQ guidelines and procedures. As mentioned above, TCEQ will require whole effluent toxicity tests (WET tests) biomonitoring and "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organism, Third Edition" (EPA-821-R-02-014) in order to assess or control potential toxicity. Studies have shown that alternative test organisms used in WET testing are dependable, biological indicators of potential toxic effects and represent listed vertebrate species toxicologically (Mayer et al. 2008; Dwyer et al. 2005; Sappington et al. 2001). Nineteen chronic WET tests have been analyzed for Outfall #001 within 5 years with no demonstration of significant toxicity. Mysid shrimp (*Mysidopsis bahia*) and inland silverside (*Menidia beryllina*) were used in the testing because these species demonstrates the potential for effluent discharges to impact common invertebrate prey species. However, the documentation does not clearly define which dilution factor was used in the test, and the following test showed no significant lethality.

Based on available analytical data screened against calculated water quality-based effluent limitations for the protection of aquatic life, none of the reported data exceeded 70% of the calculated daily average water quality-based limitations for the protection of aquatic life. Therefore, the expected projected discharge which will continue to be below the permitted parameter limitations is believed to be insignificant. Adverse toxicological impacts to aquatic life, including those species in designated essential fish habitat downstream, are not likely to be adversely affected by the proposed Olefin Expansion Project.

6.0 Potential Effects of the Proposed Action

This section presents an analysis of the potential effects of the proposed project on federally-protected species. This analysis is based on total emissions and dispersion modeling data provided by Trinity Consultants. Field survey, background review data, water modeling, and literature review of potential effects of known pollutants on flora and fauna was collected by URS. The following impact sources are included in the analysis:

- Air Quality;

- Water Quality;
- Noise Pollution;
- Infrastructure-Related Disturbance;
- Human-Related Disturbance; and
- Federally-Protected Species and Habitat Effects.

6.1 Potential Air Quality Effects

6.1.1 General Emissions Effects

According to EPA's "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals" (Smith and Levenson 1980), the data presented in Table 6 (Section 4.2.1) indicate the level, at or above which, airborne pollutant concentrations are known to cause significant impacts on flora and fauna. Concentrations at, or in excess of, any of the screening concentrations would indicate that the source emission may have adverse impacts on plants or animals. Pollutant concentrations predicted to be less than or equal to the SILs are expected to have no significant impact on flora and fauna. None of the modeled pollutant concentrations would exceed the SILs at receptors located outside of the Channelview Site; therefore, no significant impacts are anticipated from air pollution offsite. Areas where the SIL would be exceeded within the Channelview Site are shown in Figure 3.

According to a publication focused on the effects of air pollution on biodiversity (Dudley and Stolton 1996), in general, air pollution has a greater impact on lower life forms than higher life forms. Lower life forms that would likely be the first to be impacted would include lichens, bryophytes, fungi, and soft-bodied aquatic invertebrates. Impacts to adult higher life forms are typically the result of secondary impacts to the food chain and reproduction, with the exception of extreme exposure. Potential secondary impacts include acidification, changes in food or nutrient supply, or changes to biodiversity and competition. In general, plant communities are less adaptable to changes in air pollution than animals. Animals typically have the ability to migrate away from unfavorable conditions. Lower order animals, such as amphibians and fish, are known to be impacted by acidification as a result of the subsequent release of metals into water.

6.1.2 Nitrogen

The Nature Conservancy and the Institute of Ecosystem Studies have published two documents that describe the known effects of airborne nitrogen and other airborne pollutants on various ecosystems in the eastern US (Lovett and Tear 2007, Lovett and Tear 2008). Airborne NO_2 is known to be converted into acid particles or acid precipitation. Both forms are deposited onto soils, vegetation, and surface waters.

The potential effects of airborne NO_2 on terrestrial ecosystems are generally long-term effects as opposed to short-term effects. Many soils are buffered against acid inputs; therefore, biodiversity changes are not immediately evident for vegetation species with a longer lifespan. The deposition of nitrogen can result in nitrate leaching, which can cause acidification of soils and surface waters as well as the release of aluminum, calcium, and magnesium (Lovett and Tear 2007). Arthropods with high-calcium needs are some of the animals inhabiting the soil that can be impacted by soil acidification. The

release of aluminum into soil water from nitrate leaching can harm plant roots. The leaching of aluminum into surface waters can be toxic to aquatic plants, fish, and other aquatic organisms (Lovett and Tear 2008). The accumulation of nitrogen can impact plant species competition, thereby impacting plant species composition. Nitrogen accumulation can also lead to nitrogen saturation, which impacts microorganisms, plant production, and nitrogen cycling (Lovett and Tear 2007). Additional potential terrestrial ecosystem effects include reduced forest productivity and increased vulnerability to pests and pathogens (Lovett and Tear 2008).

The potential effects of airborne NO_2 on aquatic ecosystems include acidification and eutrophication. The effects of acidification on water quality, whether introduced by direct acid deposition or leaching from adjacent terrestrial ecosystems, include increased acidity, reduced acid neutralization capacity, hypoxia, and mobilization of aluminum (Lovett and Tear 2007). Stream and lake acidification can be chronic or episodic and both can be damaging. In general, larger aquatic ecosystems have a greater buffering capacity than smaller systems. Increased acidity can reduce dissolved organic carbon and increase light penetration and visibility through the water column. Increased light penetration can result in increased macrophyte and algal growth. Increased visibility can alter the predator-prey balance. Eutrophication is the over enrichment of nutrients into an aquatic system, which can result in excess algal growth. The decomposition of the excess algae can result in a decrease in dissolved oxygen, which can be harmful to fish and other aquatic organisms. Wetlands, estuaries, bays, and salt marshes are generally less impaired by acid deposition than other aquatic ecosystems. However, they are subject to eutrophication. Increased nitrogen in salt marshes often results in increased plant growth (Lovett and Tear 2008).

6.1.3 Particulate Matter

PM is not a single pollutant, but a heterogeneous mixture of particles differing in size, origin, and chemical composition. Since vegetation and other ecosystem components are affected more by particulate chemistry than size fraction, exposure to a given mass concentration of airborne PM may lead to widely differing plant or ecosystem responses, depending on the particular mix of deposited particles. Though the chemical constitution of individual particles can be strongly correlated with size, the relationship between particle size and particle composition is also quite complex, making it difficult in most cases to use particle size as a surrogate for chemistry. PM size classes do not necessarily have specific differential relevance for vegetation or ecosystem effects (Whitby 1978; EPA 1996). Nitrates and sulfates are the PM constituents of greatest and most widespread environmental significance. Other components of PM, such as dust, trace metals, and organics can at high levels affect plants and other organisms. Particulate nitrates and sulfates, either individually, in combination, and/or as contributors to total reactive nitrogen deposition and total deposition of acidifying compounds, can affect sensitive ecosystem components and essential ecological attributes, which in turn, affect overall ecosystem structure and function (EPA 2005).

PM levels in the U.S. “have the potential to alter ecosystem structure and function in ways that may reduce their ability to meet societal needs” (EPA 2005). Currently, however, fundamental areas of uncertainty preclude establishing predictable relationships between ambient concentrations of PM and associated ecosystem effects. One source of uncertainty hampering the characterization of such

relationships is the extreme complexity and variability that exist in estimating particle deposition rates. Since it is difficult to predict the rate of PM deposition, and thus, the PM contribution to total deposition at a given site, it is difficult to predict the ambient concentration of PM that would likely lead to the observed adverse effects within any particular ecosystem (EPA 2005).

The U.S. EPA Criteria Document provides a comprehensive review of PM toxicity (EPA 2004). Potential direct air-to-leaf effects of PM on vegetation to some extent depend upon particle size and composition, although well-defined dose-response curves observed for gaseous phytotoxins (e.g., ozone and sulfur dioxide) have not generally been observed for PM. A notable exception has been adverse effects on foliation observed in the vicinity of cement production facilities, for which particulate emissions are highly caustic. For emissions from the proposed project, PM composition per se is not likely to harm endangered plant species (with respect to direct foliar damage).

6.1.4 Fugitive Dust

Dust will be emitted during construction of the project. This emission will be minimal and will last a few days. Dust emissions are expected to be negligible after initial land-disturbing activities are completed.

6.2 Potential Water Quality Effects

6.2.1 Atmospheric Deposition over Surface Waters and Watersheds

Modeling results indicate that a very low concentration of airborne pollutants would be expected over surface waters; therefore, it is reasonable to assume the emission resulting from the expansion project will not likely affect surface water pH from airborne nitrogen. Based on the background research described above in Section 6.1, the potential effects on the aquatic habitat within the Action Area from NO_2 emissions include indirect, long-term effects, such as acidification or eutrophication. Acidification can be caused by direct acid deposition or leaching from adjacent terrestrial systems. Eutrophication is caused by the over enrichment of nutrients, such as nitrogen, into a system. Due to the small modeled increase in concentration of pollutants over surface waters as a result of the proposed project, eutrophication is not expected to occur as a result of the proposed project. Similarly, acidification, resulting from deposition or leaching is not expected to occur as a result of the proposed project.

PM can also provide reactive nitrogen to the ecosystem, which would have impacts similar to NO_2, as described above. The area of impact for PM is limited to the SIL exceedance area (Figure 9), which does not include surface water and provides low-quality wildlife habitat. No alterations to pH of surface water, acidification, or eutrophication as a result of PM emissions are anticipated.

6.2.2 Waste Water Discharge

As described in Section 0, Equistar estimates approximately 0.07 MGD increase in treated effluent discharge and water use for the proposed OP-1. The proposed OP-2 is expected to increase the treated effluent discharge to 0.08 MGD. The estimated increase in water intake will be equivalent to the estimated increase in discharge (0.15 MGD). The project is not expected to change the characteristics of this water. Lake Houston is managed to provide water for the City of Houston and surrounding counties, as well as for industrial use; no impacts are anticipated due to the estimated withdrawal for the project.

6.2.3 Mass Loading

The estimated increase in treated effluent discharge from Outfall #001 will result in minor increases in pollutant mass loading to the receiving water resulting in additional elements discharged into the surrounding environment. However, the relative toxicity is expected to be negligible, and the existing permit will not result in a deficiency of the Texas Surface Water Quality Standards.

6.2.4 Temperature

Temperature is independent of both concentration and mass loading parameters. The water temperature of Outfall #001 effluent is affected by raw water temperature, ambient air temperature, and physical limitations of the cooling tower. Due to its consistency with maintaining relatively close to ambient temperature (72^{o}F), a temperature limit was not issued in the TPDES permit. Respectively, the summer months will result in the highest average discharge temperatures. Although the Project will increase the treated effluent discharge volume from Outfall 001, the increase in effluent temperature is expected to be negligible and will not be an impairment of Texas water quality standards.

6.2.5 Chemical Concentrations

Wastewater that is generated on site is discharged subject to effluent limitations set in TPDES Permit No. WQ0000391000. Wastewater from the project would be discharged at Outfall #001 which is located on the northeastern corner of the North Plant. Stormwater from the project would be discharged at Outfall #002, which is located to the south of Outfall #001. The treated process wastewater from Outfall #001 and stormwater from Outfall #002 flows through independent drainage ditches into Wallisville Gully, thence into the San Jacinto River Tidal in Segment Number 1001 of the San Jacinto River Basin. The San Jacinto River Tidal is classified as having aquatic life. Segment No. 1001 is currently listed on the State's inventory of impaired and threatened waters, Texas 2006 Clean Water Act Section 303 (d) list for elevated levels of dioxin, polychlorinated biphenyls (PCBs), and pesticides in fish tissue. The discharge from the outfalls does not contain these specific compounds and is not expected to elevate dioxin and PCB concentrations in the impaired segment. Increased levels of the chemicals permitted by the TPDES Permit are expected to be discharged due to the proposed project, but the total concentrations are expected to remain within the permitted limits. The increased polycyclic aromatic hydrocarbons (PAHs) and other semivolatile organic compounds (SOCs) have the potential to persist within the aquatic environment, and most compounds do not break down easily in water. The increased VOCs have the potential to infiltrate soils and reach groundwater, and this group of chemicals tends to have low-to-medium water solubility. The increased heavy metal concentrations have the potential to accumulate in sediment and organic matter. All effluent discharge levels will remain within the TPDES limitations. The federal guidelines 40 CFR Part 414 will regulate the organic chemicals, plastics, and synthetic fibers being discharged. Effluent sampling techniques will be conducted in accordance with 40 CFR Part 136.

Discharge limitations for the proposed project will remain the same as existing discharges from the Channelview Site within the current TPDES permit. The Channelview Site has currently been implementing whole effluent toxicity testing for Outfall #001 using Mysid shrimp (*Mysidopsis bahia*), which demonstrates the potential for effluent discharges to impact common invertebrate species. The TCEQ has defined unique dilution factors to assess the Outfall #001's effluent, Wallisville Gully, and San Jacinto River Tidal based on applicable discharge volumes, critical low flow, and harmonic mean stream

flows. Based on the 2008 TPDES permit, freshwater criterion will be used for assessing the effluent discharge from Outfalls #001 and #002. There was no mixing zone identified for these outfalls into the intermittent stream. Discharge limits were set for the TPDES permit based on TCEQ's TexTox Menu 10. The Aquatic Life Surface Water Risk-Based Exposure Limits (SWRBELs) and National Recommended Water Quality Criteria were used to assess the majority of the maximum discharge limitations as criteria for aquatic life. Some compounds did not have specified criteria; therefore, discharge limits were based on derivations from available data, lowest observed effects level, and utilizing an acute-to-chronic ratio of 10:1. The TCEQ used data from the original TPDES permit application to determine current discharge limitations. Effluent levels were within the discharge limitations based on the state criteria and current EPA criteria for aquatic life, and dilution of any toxic components within the effluent will occur before reaching suitable habitat for protected species. The expected quality of the discharged water is therefore not expected to cause adverse impacts to federally-protected species.

If permit levels are exceeded, there is a chance that wastewater effluent could be toxic to small aquatic life within the San Jacinto Tidal River. These animals serve as prey for larger species, which in turn may ingest toxins through small prey consumption. Biomagnification of potentially harmful toxins by accumulating higher chemical concentrations at higher trophic levels through consumption of contaminated food sources has the potential to occur. According to preliminary information, the TCEQ will require whole effluent biomonitoring once per quarter using "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organism, Third Edition" (EPA-821-R-02-014) in order to assess or control potential toxicity. This monitoring will allow the Channelview Site to adjust processes and reduce downstream toxicity if effluents exceed permit limitations. Any potential toxic levels in the effluent will be reduced through mixing and dilution before reaching suitable protected species habitat downstream. Based on the monitoring program and dilution that would occur, no impacts to federally-protected species are expected to occur from toxic compounds in effluent from the project.

If ancillary areas are disturbed in support of the construction project, structural controls may be used to protect surrounding areas from impacted surface runoff. Runoff from within the site is directed through a series of onsite ditches and weirs that manage the water according to the SWPPPs. Construction would be done on previously filled sites, so the potential for runoff is minimal. No impacts to water quality are anticipated due to construction runoff.

6.3 Noise Effects

Equistar project engineers estimate that noise levels during construction should be comparable to noise levels from maintenance activities that currently take place at the Channelview Site. The new equipment should not alter the pre-existing noise exposure at the site. No noise effects to wildlife are expected as a result of the infrastructure construction or operations of the project. Although sharp noises can alter the behavior of protected species, equipment at the Channelview Site creates a steady noise that is unlikely to greatly alter behavior patterns. Hearing loss from sustained noise happens from high exposure over many years.

6.4 Infrastructure-Related Effects

The proposed construction sites for the project are within existing process areas surrounded by industrial infrastructure and roadways. No vegetation or potential wildlife habitat will be directly impacted as a result of the infrastructure construction activities.

6.5 Human Activity Effects

Construction and operation of the proposed project will not require significant additional human activity compared to typical maintenance activities that occur at the plant on a regular basis. New construction will occur within existing process areas. No permanent effects to wildlife are expected as a result of the human activity associated with the project.

6.6 Potential Impacts to Federally-Protected Species

The assessment of potential air emission and water discharge impacts to protected species includes the Action Area. The Project Site's Action Area was defined by the following parameters: 1) areas where construction activities would occur within the Channelview Complex; 2) areas where criteria air pollutants exceed significant impact levels (SIL); and 3) the wastewater effluent drainage channel and dilution area within the receiving water body, a portion of the San Jacinto River adjacent and downstream of the Channelview Complex (Figure 3).

6.6.1 Federally-Listed Species

Texas Prairie Dawn

Populations of Texas prairie dawn are known to occur only in western Harris County and extreme eastern Fort Bend County in specific habitat described as small, sparsely vegetated areas associated with pimple (mima) mounds. The proposed project will be constructed in far eastern Harris County, distant from the Texas prairie dawn habitat. The TXNDD does not include any observations of Texas prairie dawn within an approximate 3 mile radius of the Project Site and no Texas prairie dawn habitat was observed within the Action Area during the site reconnaissance. The Texas prairie dawn does not have the potential to occur within the Action Area; therefore, the proposed action would have **no effect** on the Texas prairie dawn.

Sea Turtles

The Action Area includes approximately 1.66 acres of San Jacinto River Tidal, which is potential sea turtle habitat. Consultation with NOAA and USACE Sea Turtle Warehouse (USACE 2013), two species of sea turtles considered for this assessment have been reported within 20 miles downstream of the proposed project's discharge; however, the Sea Turtle Stranding and Salvage Network (STSSN) indicates random occurrences of the Kemp's ridley, loggerhead, and green sea turtles within Harris County (STSSN 2011). Wastewater associated with construction and operation of the expansion project will be treated on site and is not likely to directly impact sea turtles. However, changes in water temperature can alter turtle behavior and pollutants in water can impact sea turtles through contamination of food sources. Turtles are within higher trophic levels and can bioaccumulate the pollutants in levels that could be potentially toxic. The proposed project's effluent will increase in discharge rate only, not in temperature nor concentration levels. No additional ship traffic is anticipated to result from the proposed project. As

discussed below, the proposed action will have no effect on Kemp's ridley, loggerhead, hawksbill, and leatherback sea turtles.

Green Sea Turtle

The San Jacinto River flows into Galveston Bay estuary, approximately 20 river miles to the southeast of the Action Area. The TXNDD and USACE Sea Turtle Warehouse do not identify any observations of green sea turtles in the vicinity (~3 miles) of the Project Site, and no designated critical habitat is located within the San Jacinto River or within the Galveston Bay estuary. However, green sea turtles have been intermittently observed foraging within the Galveston Bay estuary, which is approximately 42 miles south of the site, as recently as 2012. The STSSN did not identify any green turtles stranding or salvaged in Harris County from 1990 to 2012. According to contacts at NOAA, if an effluent stream is warmer than the ambient water temperature, the possibility of attracting resident green sea turtles to the discharge outfall could increase. The effluent will increase in discharge rate only, not in temperature nor concentration levels.

Potential pollutants from deposition and effluent from the proposed project have not been found at levels great enough to impact downstream water quality independently; however, they will contribute to general water quality issues within the greater Galveston Bay area. As such, the project will contribute to cumulative impacts from industrial use in the area. Because this species has not been known to occur within the Action Area, the San Jacinto River Tidal is not preferred habitat, and the effluent concentrations will be negligible, the proposed action would have **no effect** on the green sea turtle.

Hawksbill Sea Turtle

No sources have been found to indicate that hawksbill sea turtles have been observed within the Galveston Bay estuary. The TXNDD does not identify any observations of hawksbill sea turtles in the vicinity (~3 miles) of the Project Site, and no designated critical habitat is located within the Galveston Bay estuary or San Jacinto River. No hawksbill sea turtle strandings are reported in Texas by STSSN from 1990 to 2012. Because this species does not occur within the Action Area, the San Jacinto River Tidal is not preferred habitat, and effluent concentrations will be negligible, the proposed action would have **no effect** on the hawksbill sea turtle.

Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle has been intermittently observed within the Galveston Bay estuary, which is approximately 42 miles south of the site, as recently as 2012. The TXNDD does not identify any observations of Kemp's ridley sea turtles in the vicinity (~3 miles) of the Project Site, and no designated critical habitat is located within or near the Action Area. The STSSN reports 14 Kemp's ridley turtle strandings/salavages in Harris County between 1990 and 2012 with the closes location approximately 15 miles downstream of the proposed project's discharge in the San Jacinto River near Hogg Island in 2009. One random individual was found approximately 20 miles downstream of Equistar-Channelview facility in a western branch of the Houston Ship Channel near multiple industrial facilities. This occurrence indicates a small chance exists that this species could incidentally be found in the Houston Ship Channel. Based on the low saline concentration in the San Jacinto River coupled with barge traffic decreases the

suitability of this habitat for marine turtles. As this species is not known to occur within the Action Area, the San Jacinto River Tidal is not considered preferred habitat, and the project's effluent discharge concentrations will be negligible, the proposed project would have **no effect** on the Kemp's ridley sea turtle.

Leatherback Sea Turtle

The segment of the San Jacinto River near the Action Area does not possess preferred leatherback sea turtle nesting or feeding habitat. The TXNDD does not identify any observations of leatherback sea turtles in the vicinity (~3 miles) of the Project Site, and no designated critical habitat is located within or near the Action Area. Further, no sources have been found to indicate the leatherback sea turtles have been observed within the Galveston Bay estuary. There are no reports of strandings or salvages by this species in Texas by STSSN. NOAA has not reported any leatherback sea turtles near the Action Area. Because this species does not occur within the Action Area, the proposed project would have **no effect** on the leatherback sea turtle.

Loggerhead Sea Turtle

The TXNDD does not identify any observations of loggerhead sea turtles in the vicinity (~3 miles) of the Project Site, and no designated critical habitat is located within or near the Action Area. The STSSN reports one loggerhead sea turtle stranding within Harris County in 1993; it was located approximately 21 miles downstream in Galveston Bay. The portions of the Galveston Bay estuary that are not dredged have the potential for incidental foraging habitat for the loggerhead, and these sea turtles have been intermittently observed within the Galveston Bay as recently as 2012. The STSSN reports one green turtle stranding in Harris County in 1993; the precise location within Harris County is not specified. NOAA has not reported any loggerhead sea turtles near the Action Area. According to available data, the loggerhead sea turtle has not been identified utilizing the San Jacinto River Tidal for foraging and the high levels of industrialization and barge traffic make this use unlikely. Because this species has not been known to occur within the Action Area and the proposed effluent concentrations will be negligible, the proposed project would have **no effect** on the loggerhead sea turtle.

Houston Toad

There have been no reported observations of Houston toads in the vicinity of the Project Site since the 1976, approximately 15 miles southwest of the site. There is no designated critical habitat located within or near the Action Area. Houston toads prefer sandy forests of blackjack oak, yaupon, and little bluestem with temporary pools required for breeding, which are not found within the Action Area. Houston toads are sensitive to air emissions because they respire through their skin. However, because Houston toads have been extirpated from the area and because there is no suitable habitat in the Action Area, the proposed action would have **no effect** on the Houston toad.

Red-cockaded Woodpecker

The Action Area and surrounding areas are not suitable habitat for the red-cockaded woodpecker. According to TXNDD, no sightings have occurred on or within 3 miles of the Action Area.

Red-cockaded woodpeckers prefer open, mature, old-growth pine forests which occur in East Texas. Suitable cavity trees are needed for nesting. The general area has been developed; no old-growth

forests are located within the area. Because there is neither potential habitat nor occurrences within or near the Action Area, proposed action would have **no effect** on the red-cockaded woodpecker.

Whooping Crane

The TXNDD does not identify any observations of whooping cranes in the vicinity (~3 miles) of the Project Site. The Action Area is not located within the migration corridor. No designated critical habitat is located within or near the Action Area. The designated critical habitat for whooping cranes in Texas is the Aransas National Wildlife Refuge, which is located approximately 200 miles from the Project Site. There have been no recorded observations of whooping cranes near the Action Area.

Preferred over-wintering habitat for both adults and juveniles includes estuaries, marshes, bays, and tidal flats, which are not found within the Action Area. Based on available data this species does not occur within or near the Action Area nor has preferred habitat, the proposed action would have **no effect** on the whooping crane.

Smalltooth Sawfish

The smalltooth sawfish feeds on fish and crustaceans, which could be impacted by changes in effluent discharge. Based on the previous discussion (Section 0), the waste water discharge and emission dispersion modeling indicated insignificant increases in concentrations of pollutants in surrounding environments. The TXNDD does not identify any observations of smalltooth sawfish in the vicinity (~3 miles) of the Project Site, and no designated critical habitat is located within or near the Action Area. Because this species has not been known to occur in the vicinity of the Action Area, the proposed action would have **no effect** on the smalltooth sawfish.

Louisiana Black Bear

The TXNDD does not identify any observations of Louisiana black bears in the vicinity (~3 miles) of the project area, and no designated critical habitat is located within or near the Action Area. Preferred habitat of the Louisiana black bear includes bottomland hardwood forests near brackish or freshwater marshes with large areas of undisturbed habitat. The Project Site is not on or near suitable habitat for this species. Because this species has been extirpated from the area and no suitable habitat exists within or near the Project Site, the proposed action would have **no effect** on Louisiana black bears.

Red Wolf

The TXNDD does not identify any observations of red wolves in the vicinity (~3 miles) of the Project Site, and no designated critical habitat is located within or near the Action Area. The Action Area and surrounding areas have been developed; rendering the Channelview Site undesirable habitat for this species. Because this species has been extirpated from the area, the proposed action would have **no effect** on the red wolf.

7.0 Conclusions

This section is a summary of URS's recommended determination of effect for all federally-protected species, a description of any interdependent and interrelated actions, and a description of any anticipated cumulative effects resulting from the proposed project.

The proposed construction of the Olefins Expansion Project will have no effect on federally-protected species because there is no suitable habitat within the construction site. Similarly, air emissions and wastewater effluent resulting from the operation of the proposed expansion will have no effect on federally-protected species; available data and site visits do no indicate the presence of federally-protected species or their preferred habitat within the Action Area.

7.1 Determination of Effect

The recommended determinations of effect for all federally-protected species with the potential to be impacted by the project are summarized in Table 12.

Table 12 – Recommended Determination of Effect for Federally-Protected Species

Protected Species	Determination of Effect
Texas Prairie Dawn	No effect
Green Sea Turtle	No effect
Hawksbill Sea Turtle	No effect
Kemp's Ridley Sea Turtle	No effect
Leatherback Sea Turtle	No effect
Loggerhead Sea Turtle	No effect
Houston Toad	No effect
Red-cockaded Woodpecker	No effect
Whooping Crane	No effect
Smalltooth Sawfish	No effect
Louisiana Black Bear	No effect
Red Wolf	No effect

7.2 Interdependent and Interrelated Actions

The proposed Olefin Expansion Project is limited to the construction and operation activities of the facility as outlined in Section 1.1. Equistar is also proposing to restart the Methanol Unit at the Channelview Site. This would include a refurbished methanol reformer furnace, new cooling tower, and associated new and modified components. This project at the Channelview Site is also currently under review by EPA for potential biological impacts from GHG emissions. No adverse effects to federally-protected species are anticipated as a result of the Channelview Site Methanol Unit Restart Project.

The cumulative effects of both projects have been considered. All construction will be confined to existing, disturbed areas within the property boundaries, expected SIL exceedances will be within disturbed process areas, and the resulting effluent discharge from both projects through Outfall #001 will remain within discharge limitations. Based on this information, the proposed projects are not expected to impact protected species.

7.3 Cumulative Effects

The Project Site is located within an industrial area. Multiple industrial facilities have historically been and continue to be operational within Channelview and Harris County, Texas. The area is likely to experience additional industrial development over time. In addition to the industrial facilities, the

Houston-Galveston Navigation Channel is a constant source of barge and commercial vessel traffic that will continue to have an impact on the surrounding areas in the future. Potential pollutants from deposition and discharge effluent from the proposed project have not been found at levels great enough to impact downstream water quality independently; however, they will contribute to general water quality issues within the greater San Jacinto River and Galveston Bay area. As such, the project will contribute to cumulative impacts from industrial use in the area.

7.4 Conservation Measures

The construction of the proposed project will likely have no direct or indirect impact on federally-protected species habitat.

Equistar plans to utilize the BACT to control emissions and thus minimize impacts to the surrounding environment to the maximum extent practicable. The proposed emissions of each pollutant subject to PSD review are consistent with both the TCEQ BACT guidance and the most stringent limit in the RACT/BACT/LAER Clearinghouse (RBLC); and, are considered to be the top level of control available for the new and modified facilities.

Wastewater discharges will be subject to TPDES permit limitations, which have been designed to be protective of aquatic and marine species. All wastewater will be treated before being discharged into the San Jacinto River Tidal Segment No. 1001. A current Stormwater Pollution Protection Plan (SWPPP) will be employed for further precaution. All wastewater associated with construction and operation of the expansion project will be treated onsite. The project is not expected to produce a substantial wastewater impact.

8.0 List of Preparers

The following individuals contributed to the preparation of this document and are listed below along with their associated role in this project.

Document Preparers

Brian Mehok, CFM
Project Manager
URS Corporation
Houston, Texas

Aaron Boers, Ph.D
Senior Environmental Scientist
URS Corporation
Houston, Texas

Vanessa Pina
Environmental Scientist
URS Corporation
Houston, Texas

Jeff Pollock, Ph.D.
Senior Environmental Scientist
URS Corporation
Houston, Texas

Adam Marchand
GIS Specialist
URS Corporation
Houston, Texas

Phillip Mineart
Water Modeling Specialist
URS Corporation
Oakland, California

Client Contributors

Andrew Lundgren
Environmental Manager
LyondellBasell Global Environmental
Channelview, Texas

Tom Warnement
Senior Environmental Representative
Equistar Chemical Company
Channelview, Texas

Government Contributors

Alfred C. "AC" Dumaual, Ph.D.
U.S. EPA Region 6
Air Permits Section
Dallas, Texas

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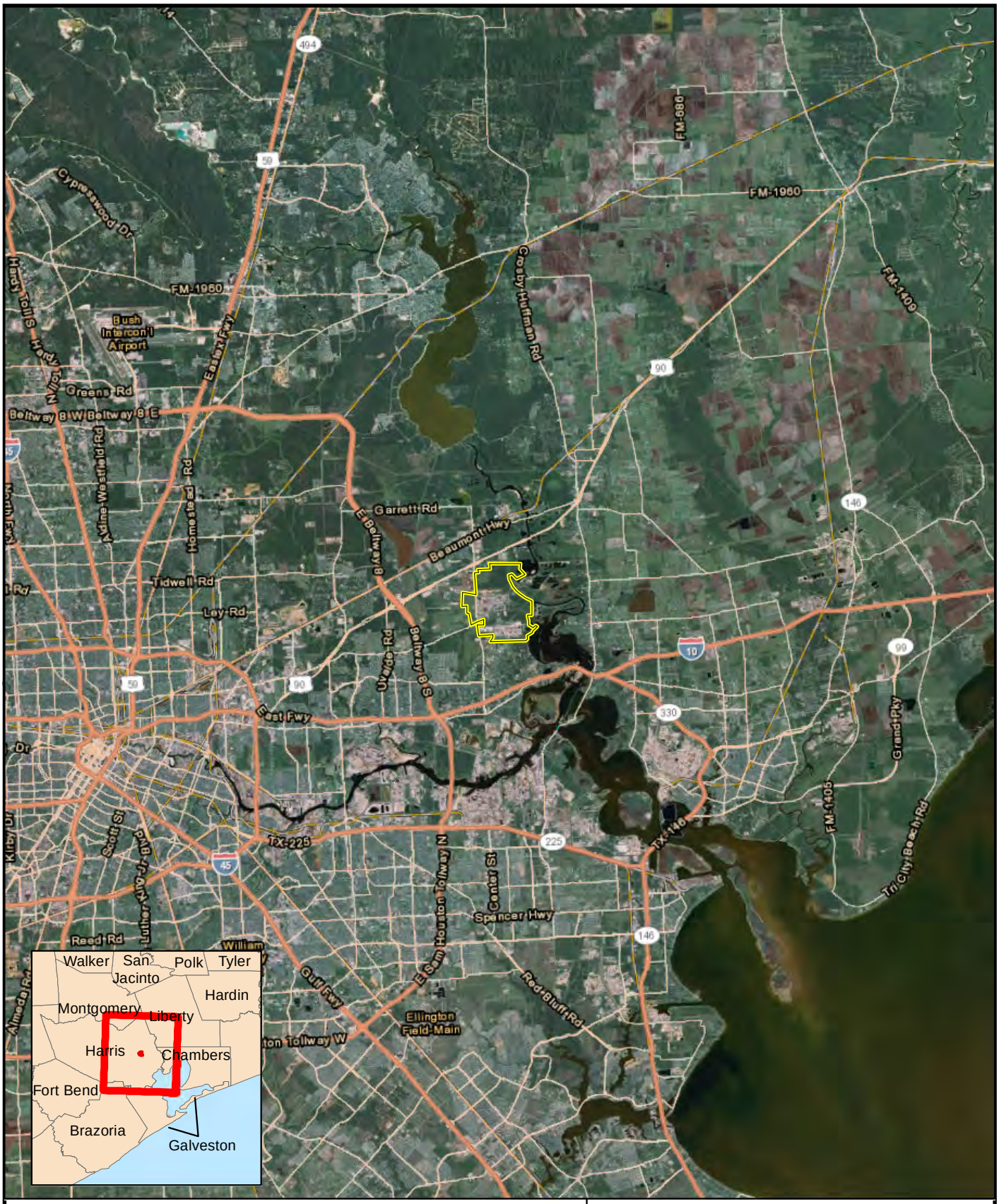
Figures



Equistar - Channelview Site

N

0 2.5 5 Miles

Title:	Vicinity Map
Project:	Biological Assessment Olefins Expansion
Client:	Equistar Chemicals, L.P.
Drawn by: AM	Date: 8/2/2012
Project No.:	25014882
	Figure 1

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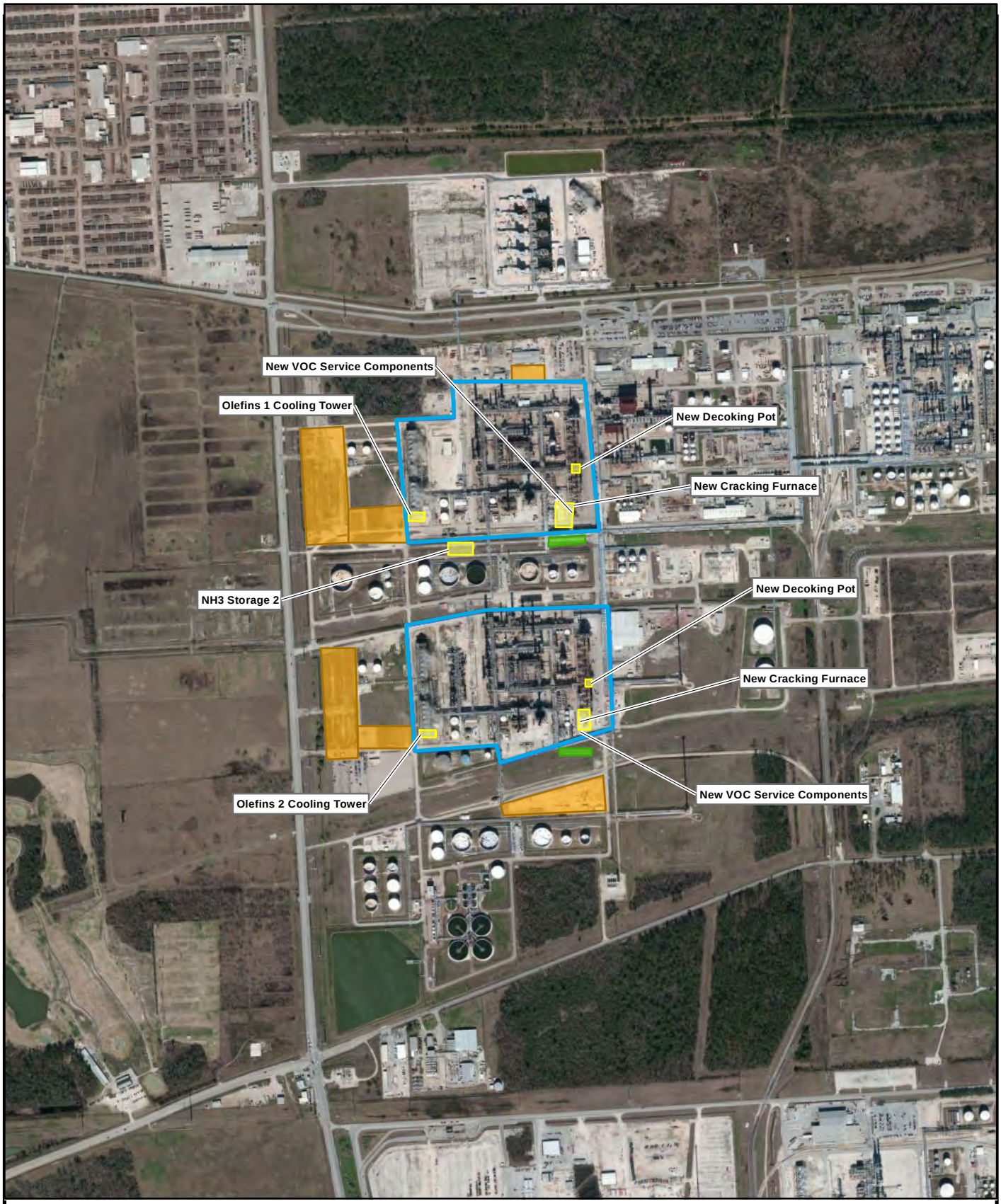

URS

Property Boundary
Olefin Units
Blast Resistant Building Locations
Proposed Construction Limits (Ground Disturbance)
Construction Material Laydown and Extra Workspace (Existing)

N

0 500 1,000 Feet

Title:	Project Area
Project:	Equistar Channelview Olefin Expansion
Client:	Equistar Chemicals, L.P.

Drawn by:	Date:	Project No.:	
AM	12/13/2012	25014882	Figure 2

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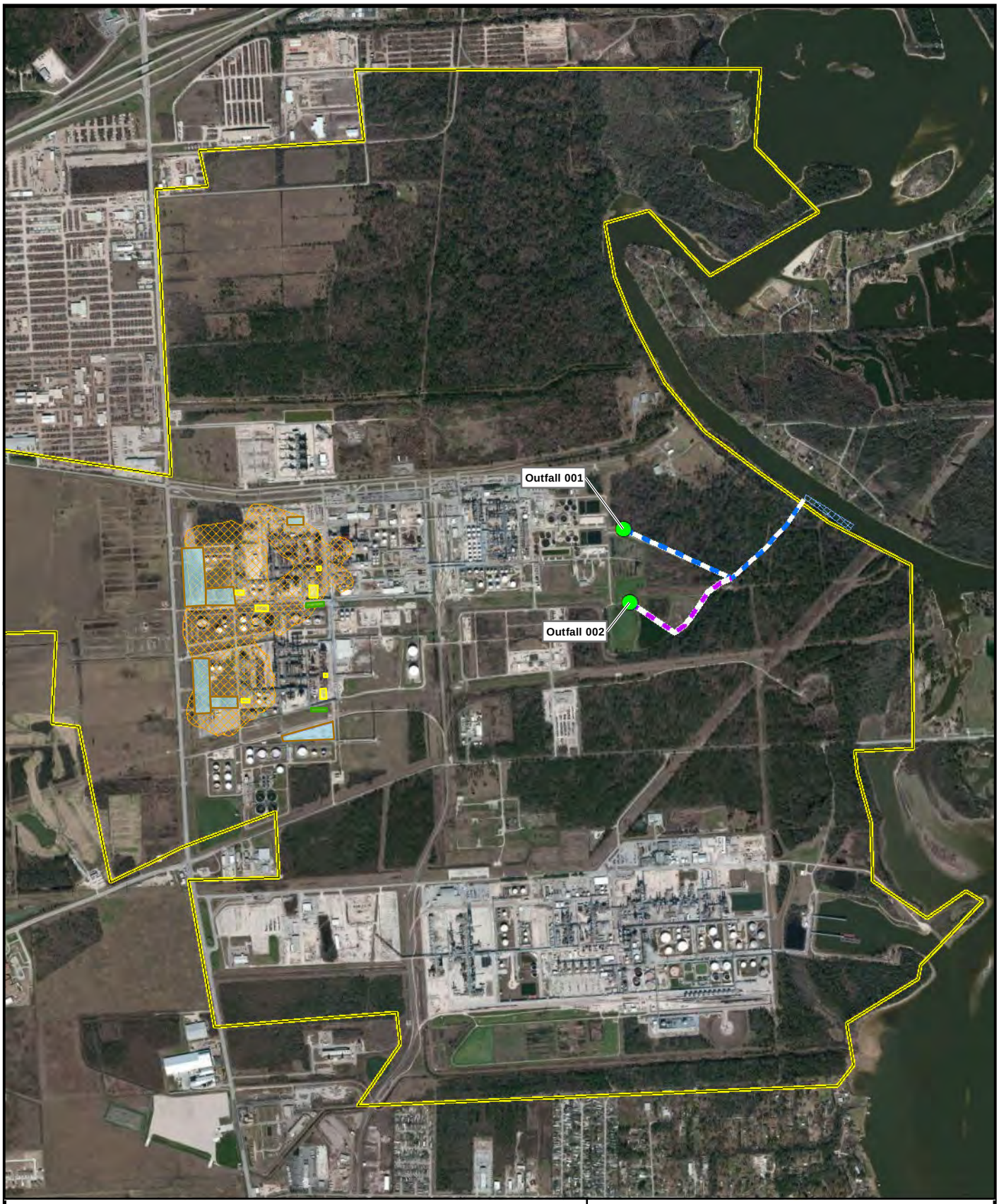

Legend
- Outfall
- Outfall 002 drainage
- Property Boundary

Action Area
- Outfall 001 drainage
- Blast Resistant Building Locations
- Construction Laydown Workspace
- Proposed Construction Limits
- SIL Exceedance Area
- Effluent Dilution Area

N

0 1,000 2,000 Feet

Title: **Action Area Map**

Project: **Biological Assessment Olefin Expansion**

Client: **Equistar Chemicals, L.P.**

Drawn by:	Date:	Project No.:	
AM	1/23/2013	25014882	Figure 3

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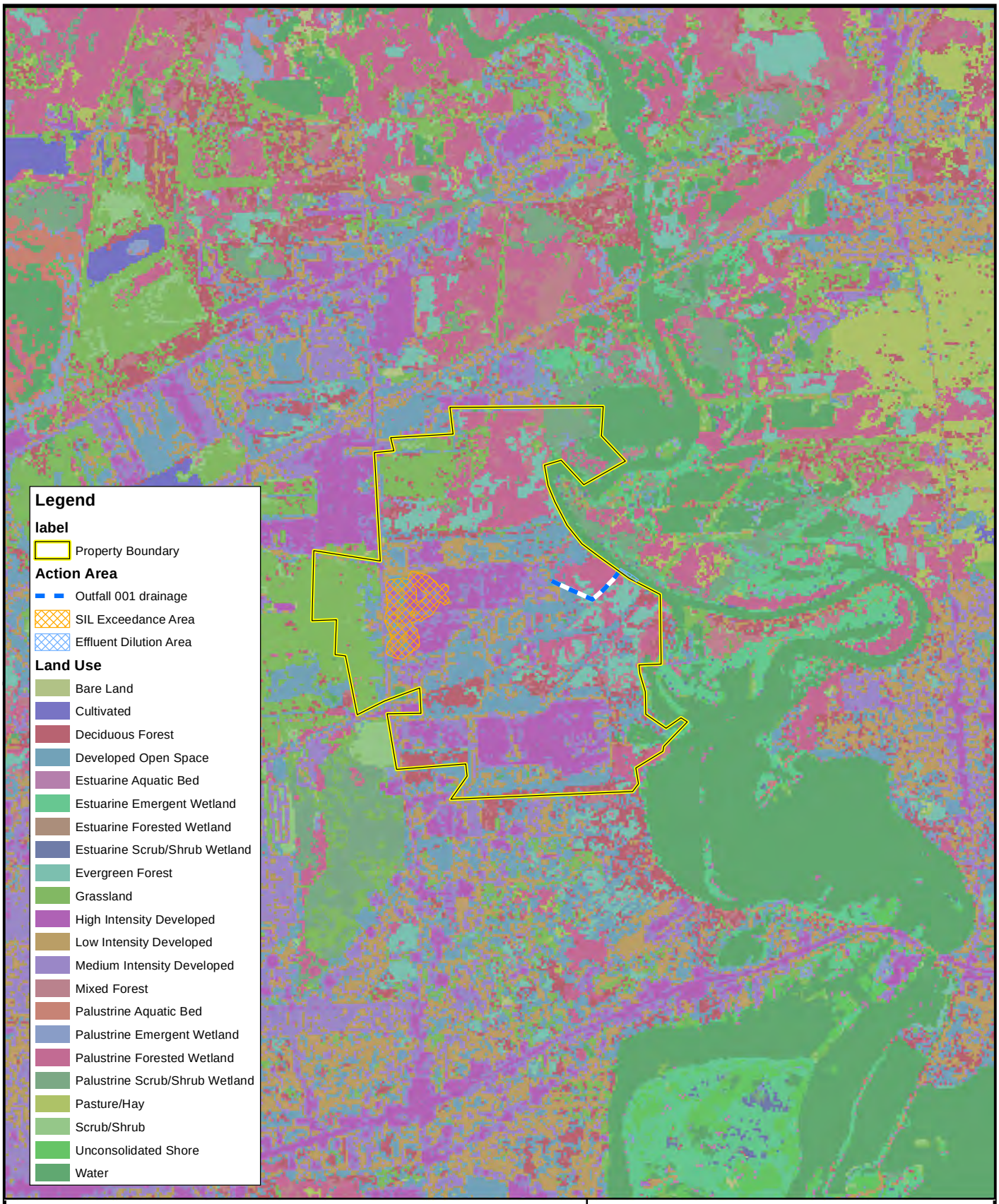

URS

N

0 0.5 1 Miles

Title: **Land Use Map**

Project: **Biological Assessment Olefins Expansion**

Client: **Equistar Chemicals, L.P.**

Drawn by:	Date:	Project No.:	
AM	12/14/2012	25014882	Figure 4

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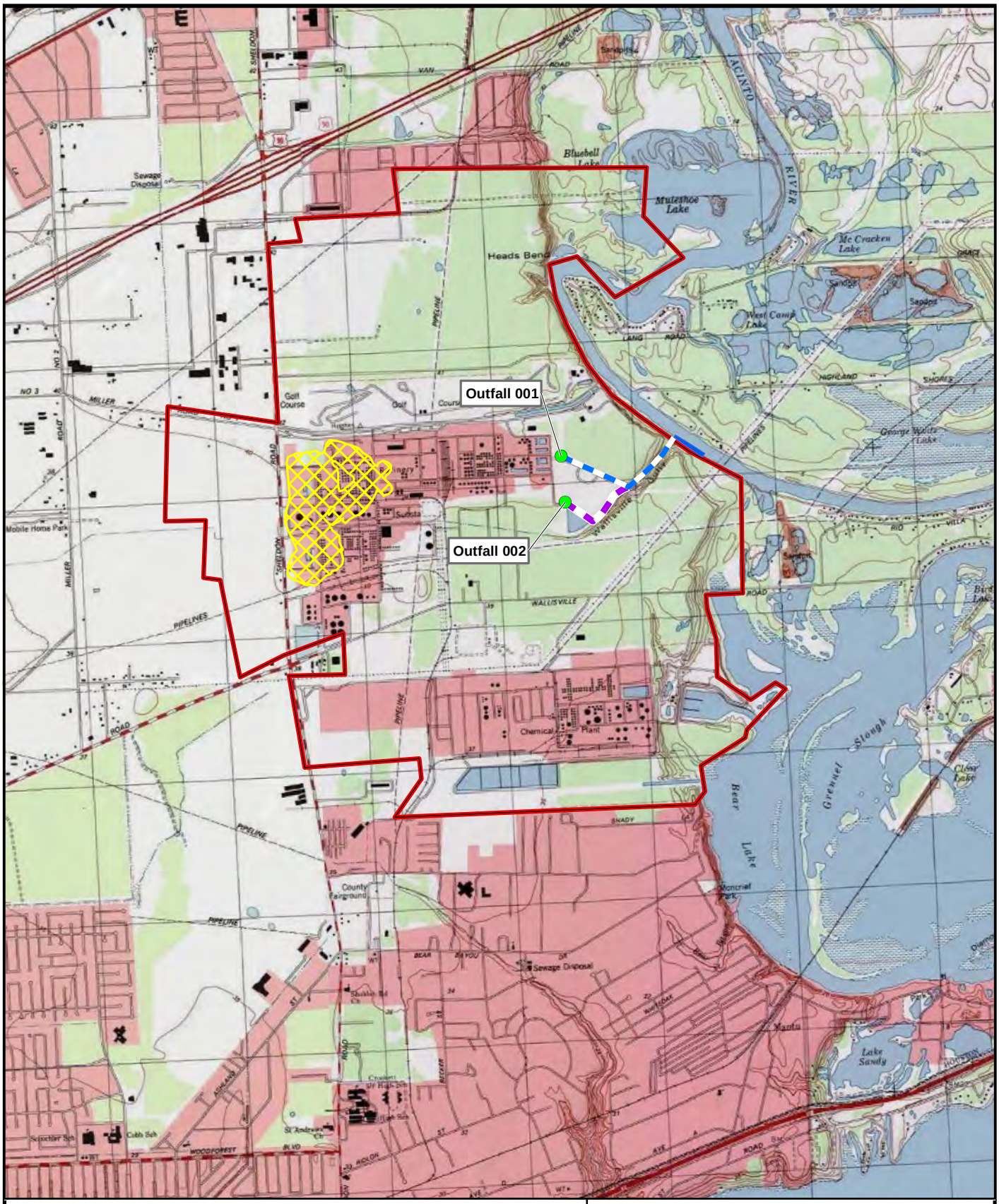

Legend

- Outfalls
- Outfall 002 drainage
- Property Boundary

Action Area

- Outfall 001 drainage
- Effluent Dilution Area
- SIL Exeedance Area

Title:	**Topographic Map**
Project:	**Biological Assessment Olefins Expansion**
Client:	**Equistar Chemicals, L.P.**
Drawn by: **AM** / Date: **12/14/2012** / Project No.: **25014882**	**Figure 5**

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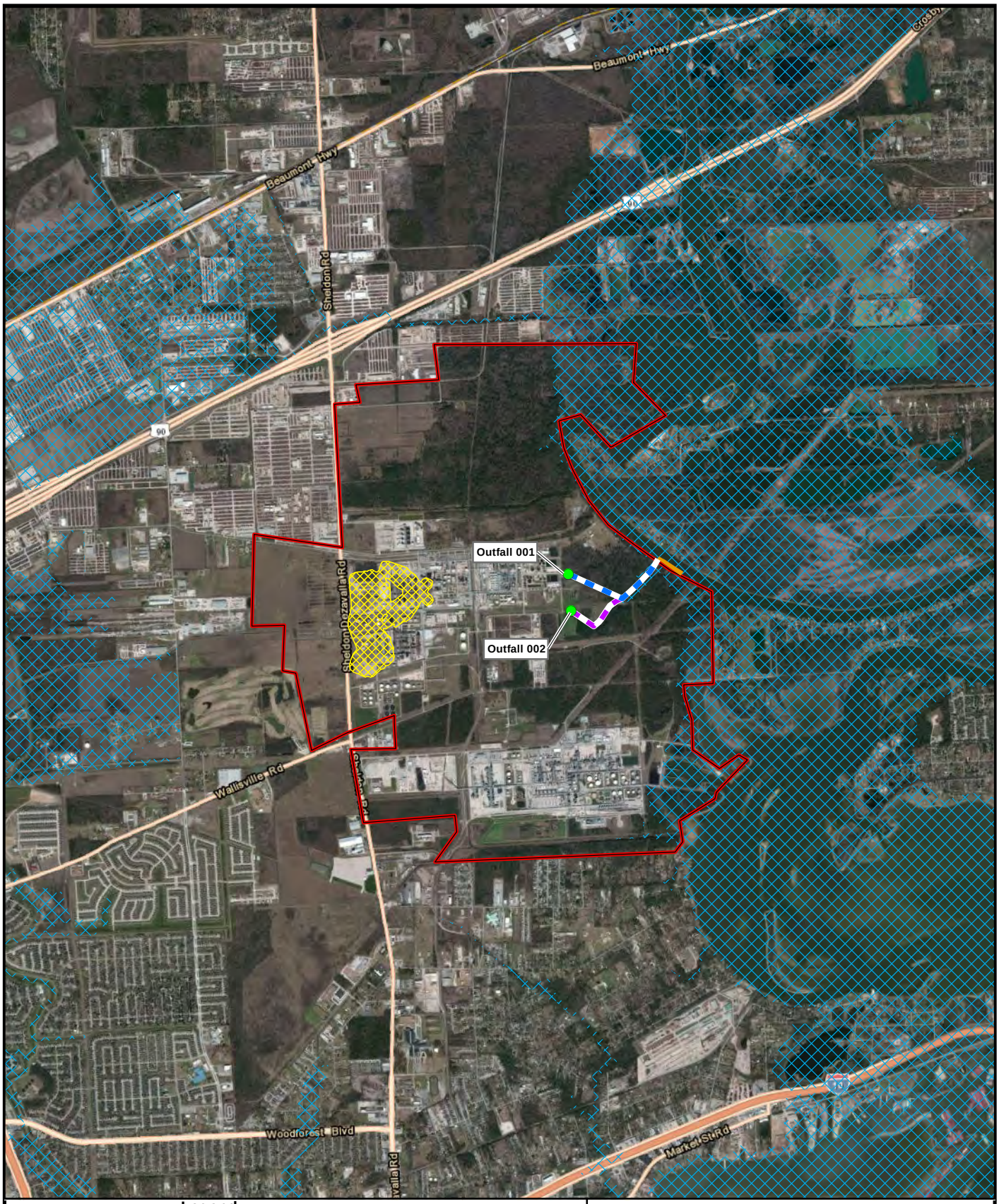

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Legend

- Outfalls
- Outfall 002 drainage
- Property Boundary
- 100 YR Floodplain

Action Area

- Outfall 001 drainage
- SIL Exceedance Area
- Effluent Dilution Area

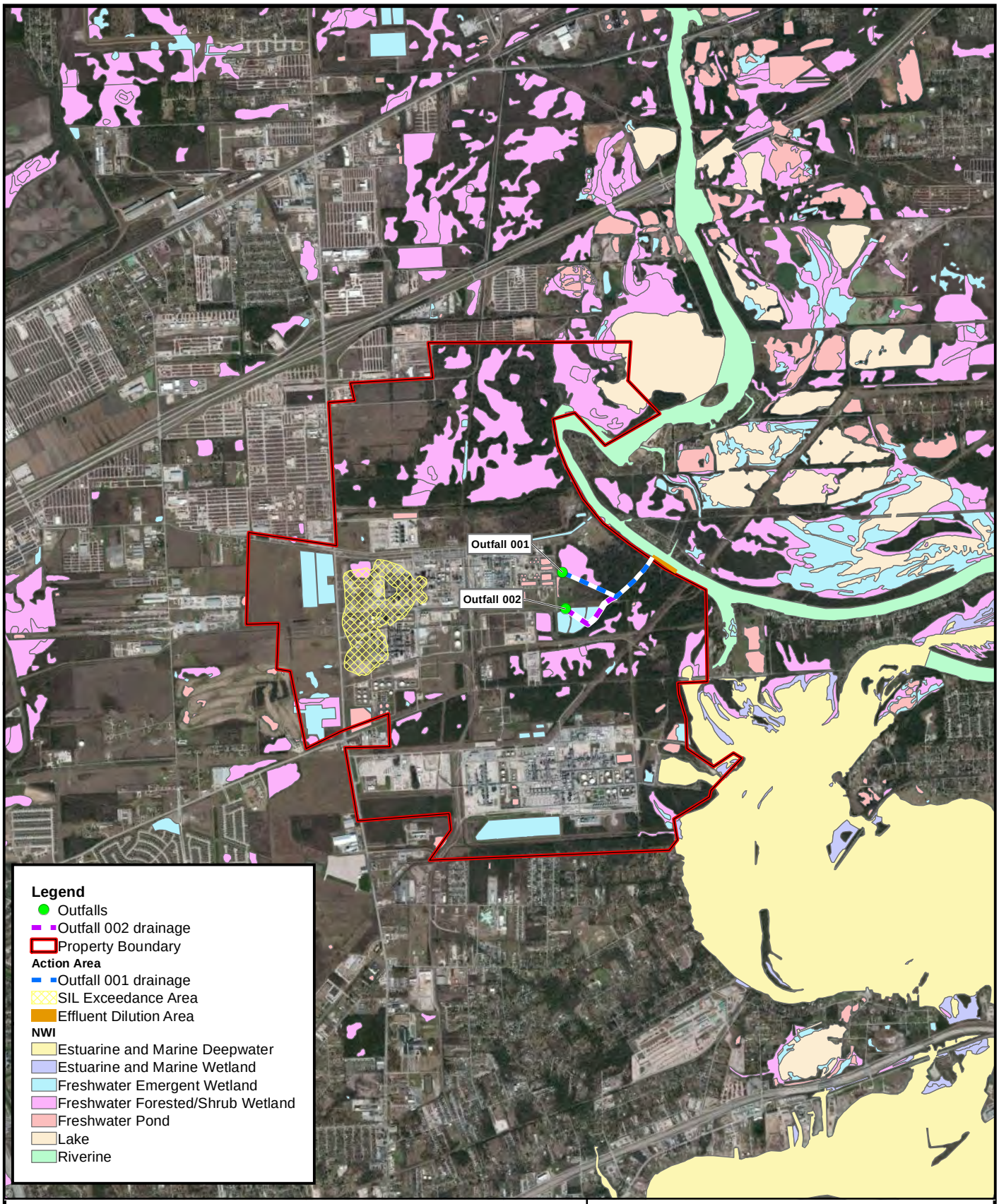
N

0 2,000 4,000 Feet

URS

Title:	**FEMA 100-Year Floodplain Map**
Project:	**Biological Assessment Olefins Expansion**
Client:	**Equistar Chemicals, L.P.**

Drawn by:	Date:	Project No.:	
AM	**12/14/2012**	**25014882**	**Figure 6**



N

0 2,000 4,000 Feet

URS

Title:	National Wetlands Inventory Map
Project:	Biological Assessment Olefins Expansion
Client:	Equistar Chemicals, L.P.

Drawn by:	Date:	Project No.:	
AM	12/14/2012	25014882	Figure 7

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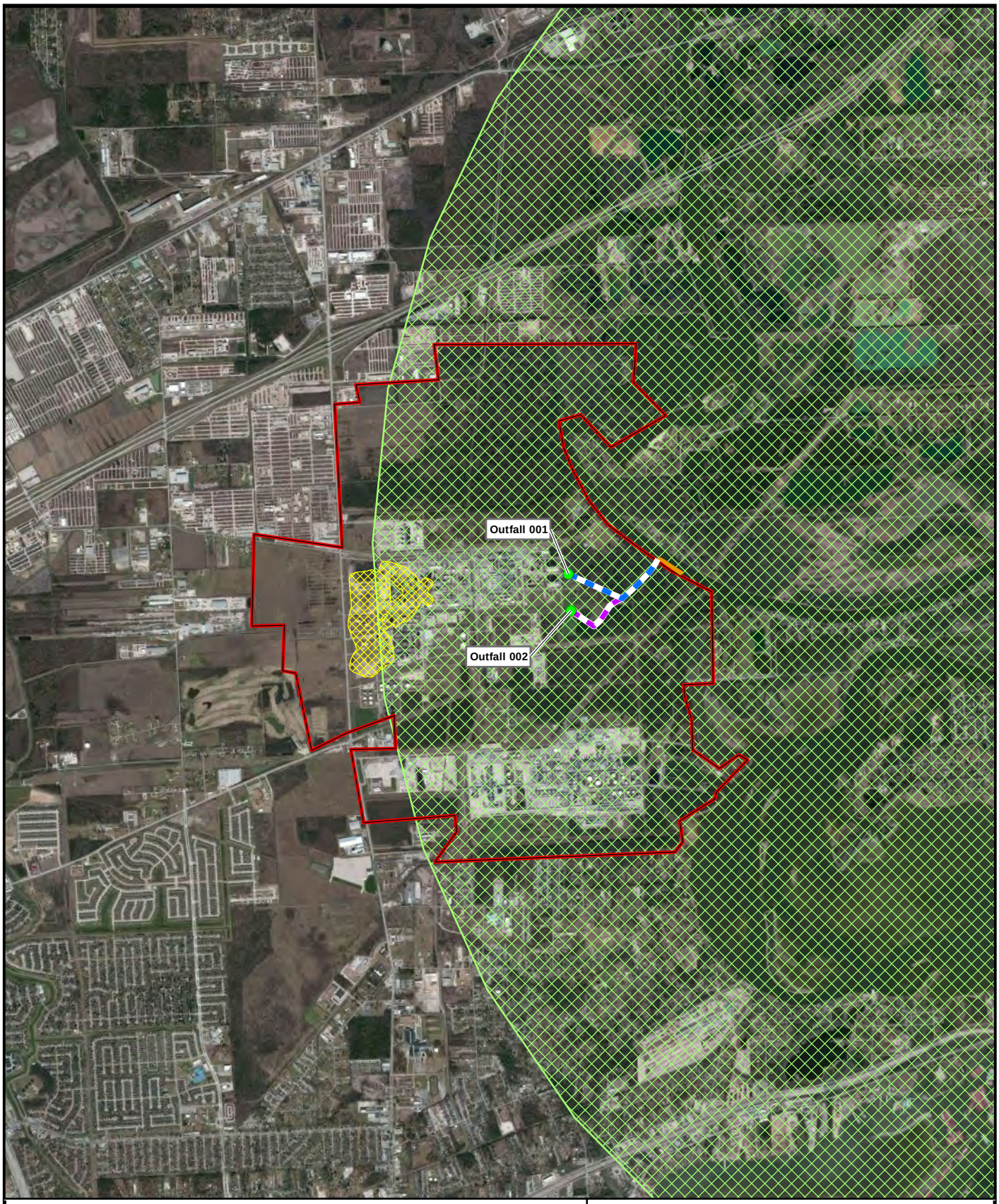

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URS

Legend

- Outfalls
- Outfall 002 drainage
- Property Boundary
- Thurovia triflora

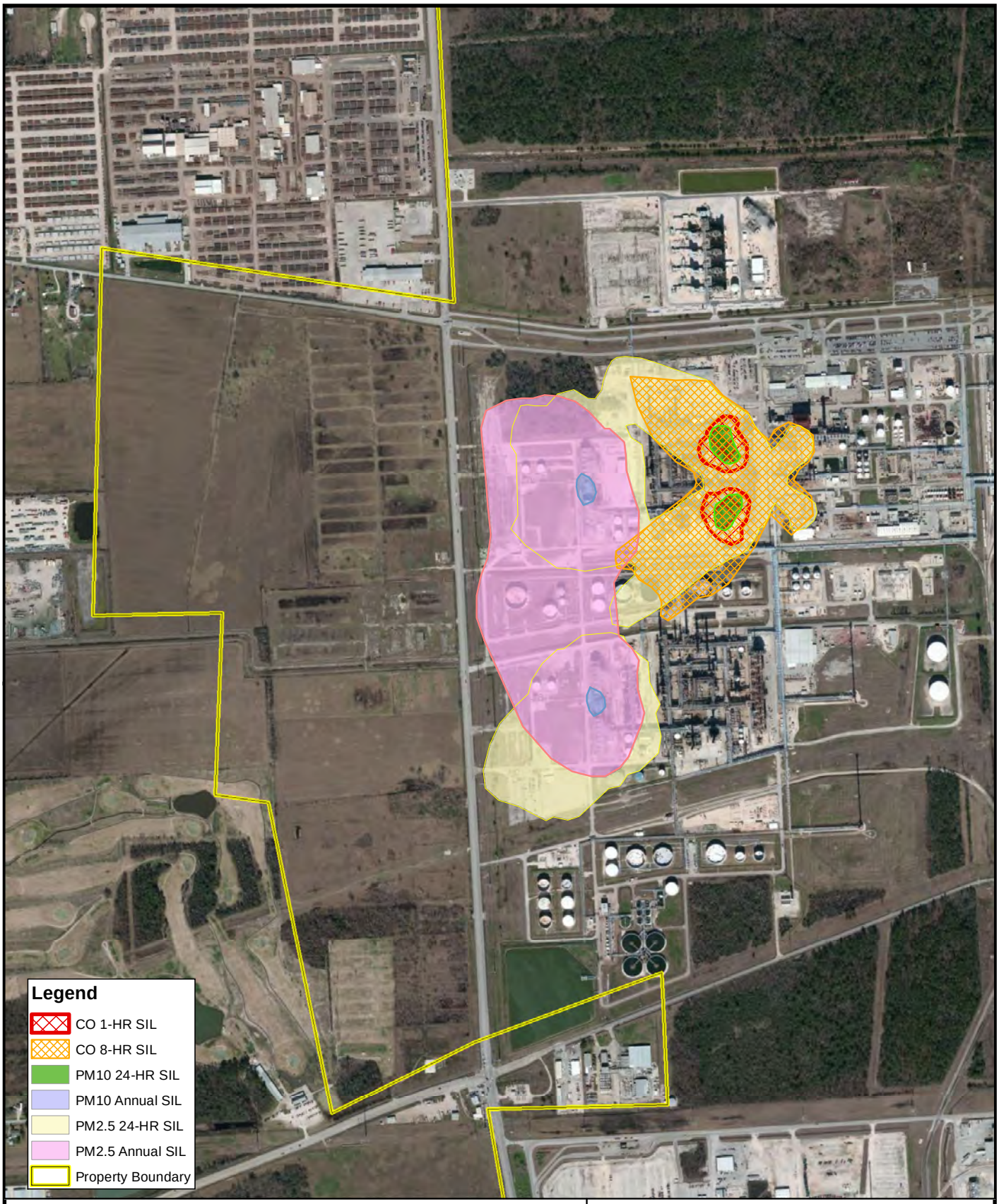
Action Area

- Outfall 001 drainage
- SIL Exceedance Area
- Effluent Dilution Area

N

0 2,000 4,000 Feet

Title:	**Texas Natural Diversity Database Map**
Project:	**Biological Assessment Olefins Expansion**
Client:	**Equistar Chemicals, L.P.**
Drawn by: **AM** / Date: **06/2012** / Project No.: **25014882**	**Figure 8**



URS

Title: **Significant Impact Level Exceedance Map**

Project: **Biological Assessment Olefins Expansion**

Client: **Equistar Chemicals, L.P.**

Drawn by:	Date:	Project No.:	
AM	8/3/2012	25014882	Figure 9

Path: K:\ENV\ENV30\25014882\GIS\MXD\CV-Olefins\Fig. 9_SIL.mxd

Appendix A

Photographic Log

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals	Channelview Olefin Expansion Project	25014882

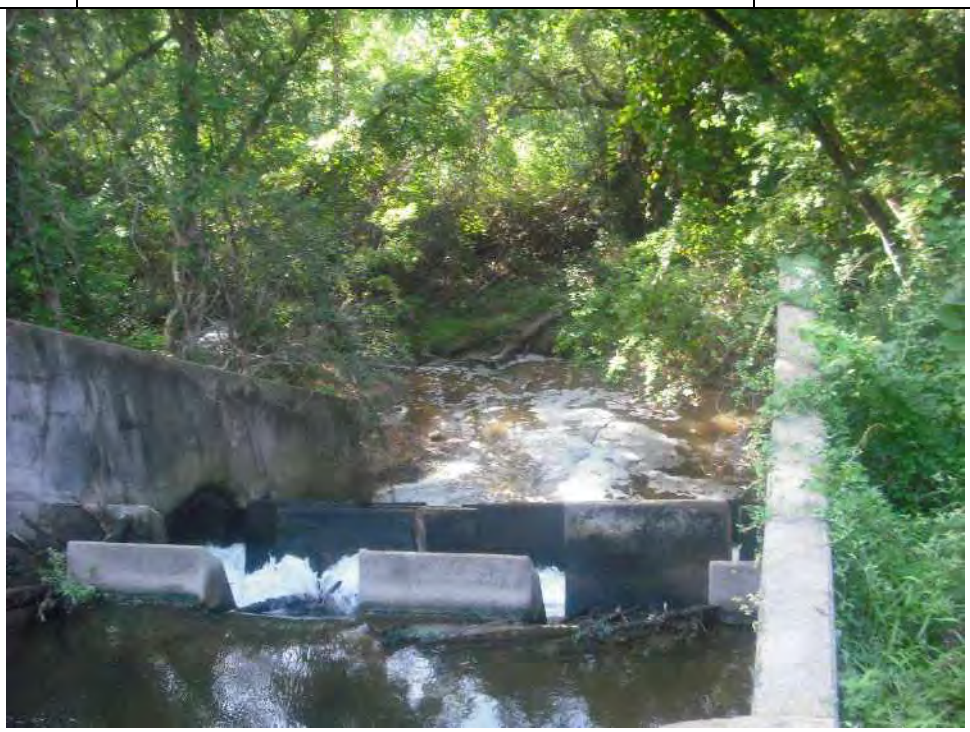
Date	Photo No.
8/1/2012	1

Direction Photo Taken:

NE

Description:

Discharge point, where water from Outfall 001 flows through the ditch in the foreground and enters Wallisville Gully in the background, which flows into the San Jacinto River. Chinese tallow is dominant on the banks, other species include loblolly pine, green ash, and yaupon.



Date	Photo No.
8/1/2012	2

Direction Photo Taken:

SE

Description:

Outfall 001. This outfall is used for treated process wastewater. Chinese tallow is dominant on banks. Other species include sweet gum, loblolly pine, honeysuckle, and poison ivy.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals	Channelview Olefin Expansion Project	25014882

Date	Photo No.
8/1/2012	3

Direction Photo Taken:

Down

Description:

Outfalls 001 and 004. Outfall 004 does not convey water from the project. Outfall 001 is described in photo 1.

Date	Photo No.
8/1/2012	4

Direction Photo Taken:

N

Description:

Location of new furnace to be constructed. The furnace will be located behind the above ground pipes in the foreground on an existing concrete pad or caliche filled area adjacent to existing process units.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals	Channelview Olefin Expansion Project	25014882

Date	Photo No.
8/1/2012	5

Direction Photo Taken:

e

Description:

Forested area to the northwest of the existing facility, near Sheldon Road. See datasheet 1 for a description of the habitat.

Date	Photo No.
8/1/2012	6

Direction Photo Taken:

NE

Description:

Forested area to the northwest of the existing facility. See datasheet 1 for a description of the habitat.

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals	Channelview Olefin Expansion Project	25014882

Date	Photo No.
8/1/2012	7

Direction Photo Taken:

W

Description:

Mowed grassland on western edge of the facility near Sheldon Road. See datasheet 2 for a description of the habitat

Date	Photo No.
8/1/2012	8

Direction Photo Taken:

W

Description:

Location of new furnace to be constructed. The furnace will be located on an existing concrete pad adjacent to existing process units.

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Equistar Chemicals	Channelview Olefin Expansion Project	25014882

Date	Photo No.
8/1/2012	9

Direction Photo Taken:

E

Description:

Outfall 002. This outfall is used for stormwater from the facility. Dominant plant species include Chinese tallow, bahiagrass, loblolly pine, and green ash.