CHAPTER 3
AFFECTED ENVIRONMENT

Chapter 3 discusses the affected environment associated with the Build Alternatives, the No-Build Alternative, and the No-Action Alternative.

- **Build Alternatives**. The Build Alternatives include the Proposed Action and other Alternatives that would require new rail line construction. The name of each Build Alternative (i.e., the Proposed Action, the Original Taylor Bayou Crossing and Alternatives 1C, 2B, and 2D) is derived from the various proposed new rail alignments and includes both the proposed new rail line segment and the use of trackage rights over UP lines that BNSF either has or can obtain under the UP/SP merger decision. The segments of each Build Alternative that involve new rail line construction are referred to as the Build Segments of that Alternative.

- **No-Build Alternative**. The No-Build Alternative requires no new rail line construction. It would require BNSF to obtain trackage rights from UP over the Strang Subdivision to access the Bayport Loop. These are trackage rights that BNSF cannot obtain under the UP/SP merger decision and that UP has not granted in response to BNSF's request. BNSF would use the same trackage rights over existing UP lines that BNSF would use for the Proposed Action, although under this Alternative BNSF would need trackage rights over a smaller portion of the GH&H line than for the Build Alternatives.

- **No-Action Alternative**. Under the No-Action Alternative, the Applicants would not provide competitive rail service to the Bayport Loop, either by new construction or trackage rights. The shippers in the Bayport Loop would continue to be solely served by UP. The rail operations on the rail lines to and from the Bayport Loop in the Houston area would remain as they are today.

Chapter 3 is arranged in sections that discuss the existing conditions for each environmental resource area. Depending on the nature of the potential effects for an environmental resource area, the discussion may address both the existing rail lines and the Build Segments, only the Build Segments, or only the existing rail line. For example, because the only wetlands effects are those associated with the Build Segments, the wetlands discussion addresses the existing conditions around the Build Segments, but not conditions around the existing rail line.

3.1 RAIL OPERATIONS AND RAIL OPERATIONS SAFETY

3.1.1 Background

The Board recognizes that the Federal Railroad Administration (FRA) has regulatory jurisdiction over rail operations and rail operations safety. SEA consulted with the FRA regarding the existing safety conditions and the effects of the Proposed Action and Alternatives.

The FRA regulates most aspects of railroad safety, including operations, track, signaling, and rolling stock (e.g. locomotives and freight cars) for common carrier railroads that are part of the general railroad system of transportation. The FRA regulations are found at 49 CFR Parts 200 through 299. In addition, individual states oversee public safety, especially with respect to highway/railroad crossings. Several railroad associations, including the Association of American Railroads (AAR), the American Short Line and Regional Railroad Association (ASLRRA), and the American Railway Engineering Maintenance-of-Way Association (AREMA), also develop and establish standards and practices for the industry.

The Federal Railroad Safety Act of 1970 (FRSA) provided the Administrator of the FRA with rulemaking authority over all areas of railroad safety. Subsequently, the FRA issued regulations covering a wide array of safety critical railroad equipment, infrastructure, and procedures and established enforcement tools for railroad companies and employees who violate these regulations.

The FRA regulations specify minimum safety requirements for rolling stock, track, signals, operating practices, and the transport of hazardous materials. Safety requirements address the design and inspection of railroad cars, tracks, and signal systems. Train crews are required to follow safe and appropriate operating rules and the railroads and FRA conduct unannounced service testing of crews regarding operating rules. FRA regulations require that railroads inspect freight cars when they are placed in a train and that they inspect track and signals periodically. Railroad inspection records are reviewed by the FRA for accuracy and thoroughness and are verified by independent inspections. Each railroad's operating rules must comply with FRA requirements and are reviewed by FRA inspectors. FRA enforces U.S. Department of Transportation (USDOT) regulations that require shippers to transport hazardous materials in rail cars designed to transport safely the commodity being carried (49 CFR Parts 171 through 180).

Railroad track safety standards (49 CFR Part 213) are based upon classifications of track that determine maximum operating speed limits, inspection frequencies, maintenance tolerances, record keeping, and other requirements. The higher the class of track, the more stringent the maintenance tolerances, and the faster the allowable maximum operating speed. Higher class track can be operated at lower speeds, so posted speeds are not a totally accurate indication of track class.

The railroads set their desired operating speeds for segments of track by means of timetables or train orders, and are required to maintain those track segments according to FRA geometric and structural standards for specific classes of track that correspond to the desired train speeds. For example, lines that are maintained to Class 3 standards allow a maximum operating speed of 40 mph for freight trains and require track segments to be inspected at least weekly to verify that they meet FRA regulations. The number of daily trains or commodities carried is not a factor in establishing the track class. Railroads may construct the track of jointed or welded rail.

3.1.2.1 Rail Operations Context

Houston has long been an important railroad center. Houston serves as a hub for freight traffic moving to and from the Port of Houston and the Port of Galveston, freight traffic originating and terminating in the Houston area, freight traffic moving through Houston to and from the east, midwest, and west, and freight traffic moving to and from Mexico. Commodities moved into and out of the Houston area consist mainly of petro-chemical products, agricultural products, processed food products, forest products, coal, manufactured goods, construction materials (e.g., cement, aggregates, and structural steel), automobiles, and automobile parts.

During the 1980s and 1990s, five major railroads (Atchison Topeka & Santa Fe, Burlington Northern, Missouri Pacific, SP, and Missouri Kansas Texas) served Houston. Mergers and acquisitions consolidated the railroad industry into fewer, larger railroads. Today, only three major railroads (BNSF, UP, and Kansas City Southern – via the Texas Mexican railway) serve Houston. Before the UP/SP merger, two primary switching and terminal railroads (PTRA and the Houston Belt & Terminal (HB&T)) served Houston. The HB&T was divided between its owners, BNSF and UP, at the time of the merger and is now primarily called the East Belt Subdivision.

Train operations within and through Houston encounter many junctions where one rail line crosses another rail line at-grade and/or where a train can move from one rail line to another. These junctions can become congested when several trains need to pass through within a brief time period. Trackage rights are agreements that authorize one or more railroads to operate trains over specific tracks owned by another railroad. For example, BNSF and UP have trackage rights to operate over tracks owned by PTRA in the vicinity of Pasadena and Deer Park. Trackage rights are another source of congestion on railroad lines in Houston because several trains from different railroads may need to use the same tracks.

To address increasing train congestion, track maintenance needs, and other considerations, in March 1998 UP and BNSF established a jointly operated dispatching center in Spring, Texas. The UP and BNSF dispatchers working at the Spring dispatching center coordinate the movement of trains via the most efficient route available when the traffic over one of their lines, or a line on which they have trackage rights, becomes congested or restricted. This coordinated dispatching can result in daily fluctuations in the number of trains moving over any given rail line in the Houston area.

Train operations in Houston, as is typical for metropolitan areas, involve trains bringing inbound cars into a major railroad yard where the cars are switched into either local trains that directly serve customers or into transfer trains that move the cars to other, smaller yards located closer to customers' facilities. An inbound train also may be operated directly to one of the local, smaller yards in order to avoid the delay of routing cars through a major yard. Once the inbound cars are taken to a local yard, they are switched into local trains that serve the nearby customers. The process is essentially reversed for outbound cars leaving local customers' facilities.

An exception to the normal flow occurs when loaded rail cars are stored in transit. This is common with carloads of plastic pellets and other commodities when the manufacturer must produce a large quantity of one type of product before changing production to another type of similar product. The loaded cars are moved to a railroad storage site where the cars are stored until the manufacturer sells the product. Once the product is sold, the loaded car is moved from storage to the appropriate yard where it is switched into an outbound train for movement to its destination.

The major rail yards located in the Houston area include UP's Englewood and Settegast yards and BNSF's Old South Yard, New South Yard, and Pierce Yard. Smaller, secondary yards include UP's Spring, Dayton, Strang, Basin, Dallerup, and Booth yards, BNSF's East Belt Yard, and PTRA's Manchester, Pasadena, and North Yards.

FRA regulations permit railroads to operate with or without signals on their tracks. The purpose of signal systems is to increase the safety, efficiency, and capacity of a line in handling rail traffic. In general, the more sophisticated the signal system, the more efficiently a rail line can move trains. About half the rail route miles in the U.S. are not equipped with signals and are designated as dark territory.

In dark territory, railroads move trains via "train orders" transmitted from a dispatcher, usually by radio, to the train engineer. Train orders authorize the engineer to occupy a particular section of a railroad identified by physical land marks such as sidings or mile posts. A train may not enter another section of track without permission from a dispatcher. Train orders given in this fashion are often called Track Warrant Control (TWC) rules.

One of the common types of signaling systems is the Manual Block Signal (MBS) system that divides rail lines into segments called "blocks." A dispatcher verifies whether or not a block is occupied by a train, usually by observing indicator lights on a control panel or by radio. The dispatcher allows only one train at a time into any single block through the use of "block signals" (railroad traffic signals) at the beginning of each block.

The Automatic Block Signal (ABS) system also is commonly used. In this signal design, whenever a set of wheels of a train is in a block segment they interrupt or "shunt" the electrical current present in the rails and automatically control the block signals at the beginning of each block indicating the presence of a train. This technique eliminates the need for communication with a dispatcher to obtain or release blocks as trains move over their route.

A third signal system is the Centralized Traffic Control (CTC) system. Under this system, dispatchers establish routes by providing several clear blocks for a train and by controlling signals to indicate clear blocks or diverging movements ahead, thus permitting priority trains (e.g. passenger, high priority cargo) to travel unimpeded. Following or opposing trains will either be preempted from entering the occupied or preempted blocks until they are clear of trains or will be allowed to pass or meet another train stopped in a side track.

Trackage within railroad yards is not under the direct supervision of a dispatcher. The dispatcher and yardmaster coordinate the movement of trains between the yard and the mainline. Trains in yards are limited to "restricted speed," which is defined as the speed at which the train can be stopped within half the range of vision and may not exceed 20 mph. Movement through switches under Yard Limits is usually restricted to 10 mph. "Yard Limits" signs are posted to mark the limits and to warn trains leaving the mainline to look out for other trains.

Block Register Territory is a method of rail operations control in which a train crew must stop and sign a register in order to be authorized to occupy a rail line block. It is usually used on low volume lines, such as a branch line or an industrial lead. Such lines are only occupied by one train at any given time.

The designation "Other than Main Track" operations applies to lines that are not designated as main track, such as branch lines or industrial leads. These lines typically have low or restricted speeds and do not function as primary routes between major rail terminals.

3.1.2.2 Existing Conditions

BNSF is the second largest railroad in the U.S. in terms of total train miles. UP is the largest. The Proposed Action and the Alternatives would involve BNSF operating over UP's rail lines in the Houston area. This section discusses the accident statistics for the major U.S. railroads for context, followed by a discussion of local operations in Houston. The FRA collects accident statistics for all railroads in the U.S. The FRA[1] uses the term accident or incident to refer to events that must be reported by the railroads in accordance with FRA regulations. Reportable accidents or incidents include fatalities, injuries, and illnesses; collisions, derailments, and similar accidents involving the operation of on-track equipment causing reportable damage above an established threshold;[2] and impacts between railroad on-track equipment and highway users at crossings. The FRA further categorizes accidents and incidents depending on whether casualties occurred and on whether movement of on-track equipment (e.g., locomotives, railcars) was involved in the event.[3] It should be noted that, for FRA reporting, the classification of a train accident by type (i.e., collision, derailment, or other) is determined by the first reportable event in the accident sequence. All reports for a single accident must use the same designation. For example, following a derailment if a train strikes a consist (a series of railroad cars that form a train) on an adjacent track, the report for this additional consist will indicate that the accident type was a derailment, not a collision. Accidents involving damage to on-track equipment are only reported by the railroads if they exceed the reporting threshold established by the FRA. USDOT regulations define a release during transportation as any unintentional release of a hazardous material from a package, including a tank. Table 3.1-1 shows the national accident statistics for the top five freight railroads in the U.S. for the years 1999, 2000, and 2001.

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[1] FRA Guide for Preparing Accident/Incident Reports (effective January 1997).

[2] For the year 2002, the FRA's train accident reporting threshold for total damages is $6,700.

[3] The FRA has established the following categories of incidents and accidents:

> <u>Train Accident</u>. Any collision, derailment, fire, explosion, Act of God, or other event involving the operation of on-track equipment (standing or moving) that results in total damages to all railroads involved in the event that is greater than the current reporting threshold established for railroad on-track equipment, signals, track, track structures, and roadbed.
>
> <u>Train Incident</u>. An event involving the movement of on-track equipment that results in a reportable casualty but does not cause reportable damage above the threshold established for train accidents.
>
> <u>Non-train Incident</u>. An event that results in a reportable casualty, but does not involve the movement of on-track equipment nor cause reportable damage above the threshold established for train accidents.

Table 3.1-1
System-Wide Accident Frequencies for Top Five Freight Railroads

Railroad	Total Number of Accidents			Total Train Miles (millions)			Accidents per Million Train Miles		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
Union Pacific	719	758	896	176.43	180.75	172.71	4.08	4.19	5.19
Burlington Northern Santa Fe	481	573	615	162.40	160.58	162.94	2.96	3.57	3.77
CSX	423	484	374	105.28	114.32	108.62	4.02	4.23	3.44
Norfolk Southern	238	275	228	81.77	95.78	89.95	2.91	2.87	2.53
Kansas City Southern	79	94	92	8.48	7.94	7.66	9.32	11.84	12.01

Source: Federal Railroad Administration, Office of Safety Analysis (August 1, 2002)

On a more local level, the existing conditions for each of the applicable railroad lines included in the Build Alternatives, the No-Build Alternative, and the No-Action Alternative are discussed below. Figure 2.2-1 and Figure 3.1-1 show the existing rail lines described in the following discussion. SEA reviewed various sources of operations data including system timetables and also conducted field work to observe train operations in the project area. Appendix C contains information pertaining to SEA's analysis of existing rail operations in the Houston area and describes how the information in this section was derived. Appendix C also provides details of SEA's analysis of daily train counts for each of the rail lines discussed in this EIS and explains how the average number of trains per day was calculated. Most of the information on average daily train counts was supplied by UP, in response to a request from SEA. SEA verified the information through consultation with BNSF and PTRA, and through analysis of other sources of rail operations data.[4]

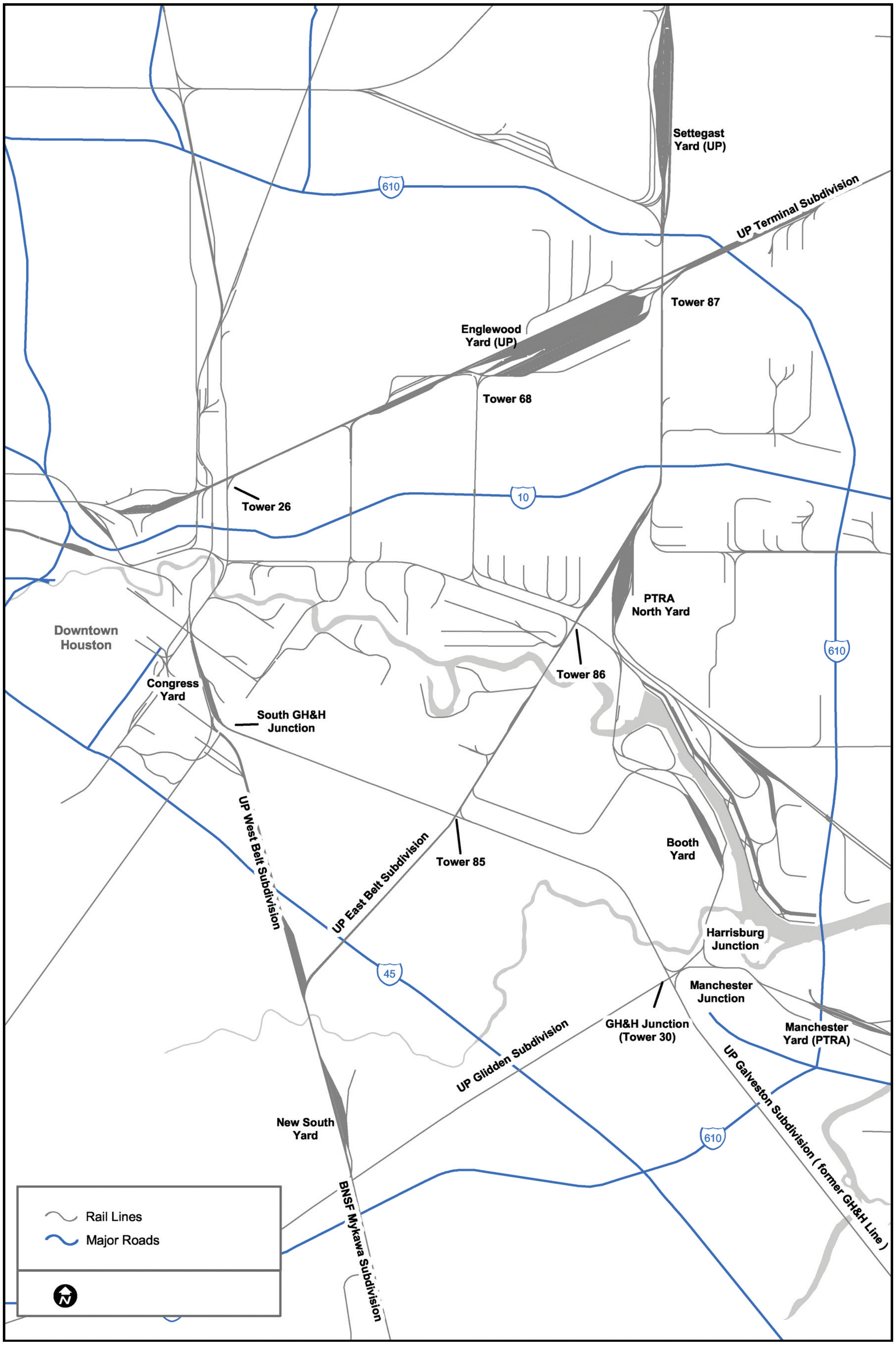
3.1.2.3 Build Alternatives

The Build Alternatives include use of existing UP lines to access the proposed Build Segments near Ellington Field. The Build Alternatives involve operating trains from the CMC Dayton Yard, over UP's Baytown, Lafayette, Terminal, and East Belt Subdivisions, and over UP's GH&H line to the turnouts onto the proposed new lines.

CMC Dayton Yard. The CMC Dayton Yard is owned by the CMC Railroad. The CMC Railroad currently handles storage-in-transit cars and switching for both UP and BNSF. BNSF currently has the use of 1,500 of the 3,000 car spaces in the Dayton Yard. Traffic inbound to

[4] BNSF and UP have also recently agreed to fund a study on rail traffic in and around Harris County and in particular Houston's East End. The study will be conducted by the Texas Transportation Institute and has resulted from a series of Rail Task Force meetings that have included the two railroads, local elected officials, and concerned residents. The study will examine current and future infrastructure needs.

Figure 3.1-1
Existing Rail Lines in Eastern Houston



Dayton Yard generally originates in the Baytown area, Silsbee, and New South Yard in Houston. The outbound traffic generally goes to the Baytown area, to the east via Beaumont and Silsbee, or to New South Yard in Houston, where it is added to trains going to Chicago, the west, or the Pacific Northwest via Temple. Traffic moving through Houston currently travels between Dayton and Temple via the East Belt Subdivision and New South Yard to either the UP Glidden Subdivision or the BNSF Mykawa Line.

UP Baytown Subdivision. From the CMC Dayton Yard, a BNSF train destined for the Bayport Loop would turn north for 2 miles on the UP Baytown Subdivision, to Dayton Junction. The Baytown Subdivision has a maximum operating speed of 10 mph between Dayton Junction and one-half mile south of the CMC Dayton Yard, with train movements governed by Yard Limits. UP and BNSF currently operate an average of 14.9 trains per day over the Baytown Subdivision. The Baytown Subdivision connects with the Lafayette Subdivision at Dayton Junction. The capacity of the line should be at least 18 to 20 trains per day because it is a short length of track and Dayton Yard is configured to avoid delays to through trains.

UP Lafayette Subdivision. The Lafayette Subdivision includes the 25.3-mile segment between Dawes and Dayton Junction. This segment of the line is single track with a CTC system. The maximum operating speed is 60 mph (70 mph for passenger trains). The track is an FRA class 4 track. The posted speed limit between Dayton and Dawes for freight trains varies from 30 mph to 60 mph. The maximum operating speed relative to the 25.3 miles between Dayton Junction and Dawes varies: 0.7 miles is 30 mph, 2.0 miles is 40 mph, 0.3 miles is 50 mph, and 22.3 miles is 60 mph. UP uses this line primarily for westbound trains (the former Missouri Pacific line to the north is used primarily for eastbound trains). BNSF has trackage rights over the Lafayette Subdivision and operates trains in both directions over the line. An average of 20.7 trains per day operate over the trackage, including the Amtrak Sunset Limited passenger train that operates three days per week in each direction. The Lafayette Subdivision connects with the Terminal Subdivision at Dawes. The capacity of the line should be at least 50 trains per day.

UP Terminal Subdivision. The Terminal Subdivision includes the segment between Dawes and Tower 87, a distance of 3.8 miles. The maximum operating speed is 50 mph (FRA class 4 track), except for the 0.6 miles closest to Tower 87 that has a maximum operating speed of 25 mph. There are two main tracks, which are equipped with CTC. BNSF has trackage rights over the Terminal Subdivision and operates trains in both directions. An average of 20.7 trains per day operate over the trackage, including the Amtrak Sunset Limited passenger train. The line connects with the East Belt Subdivision at the east end of Englewood Yard at Tower 87. The capacity of the line should be at least 50 trains per day.

UP East Belt Subdivision. The applicable portion of the East Belt Subdivision consists of approximately 4.7 miles between Tower 87 and Tower 85. The maximum operating speed is limited to 20 mph (FRA class 2 track). There are two main tracks. The line is equipped with CTC. An average of 25.1 trains per day operate over the East Belt Subdivision between Tower 87 and Tower 85. The East Belt Subdivision connects with the GH&H line at Tower 85. The capacity of the line should be at least 36 to 40 trains per day accounting for the junctions at Tower 85 and Tower 87.

GH&H Line (UP Galveston Subdivision). The applicable portions of the GH&H line for the Proposed Action consist of approximately 2.4 miles between Tower 85 and Tower 30 and 13.8 miles between Tower 30 and the north end of Graham Siding. Alternative 1C would use a slightly longer portion of the GH&H line, with its turnout approximately 450 yards southeast of the Proposed Action turnout. Alternatives 2B and 2D would turnout from the GH&H line immediately northwest of Beltway 8 (Sam Houston Parkway), approximately 2.5 miles before the Proposed Action turnout. The GH&H line is a single track mainline with a maximum operating speed limit of 20 mph for the first 7.5 miles south of Tower 85 and a speed limit of 35 mph for the remainder of the distance to Graham Siding. An average of five trains per day operate between Tower 85 and Tower 30. Train operations are governed by CTC between Tower 85 and Graham Siding. An average of 3.4 trains per day operate on the segment of the GH&H line between Tower 30 and Graham Siding. The capacity of the line should be at least 15 to 16 trains per day accounting for junctions at Tower 30 and Tower 85.

3.1.2.4 No-Build Alternative

The No-Build Alternative involves BNSF operating over the Baytown, Lafayette, Terminal, and East Belt Subdivisions and the UP lines in the SH 146 and 225 corridors (Strang Subdivision and Bayport Loop Industrial Lead) to access the Bayport Loop. BNSF currently has trackage rights to operate over the Baytown, Lafayette, Terminal, and East Belt Subdivisions. However, BNSF does not have trackage rights to operate over the Strang Subdivision, Bayport Loop Industrial Lead, or Bayport Loop, and would have to obtain permission from UP to use this rail line to access the Bayport Loop.

The Baytown, Lafayette, Terminal, and East Belt Subdivisions are described above, under the Proposed Action and Build Alternatives.

UP Strang Subdivision. The applicable portion of the UP Strang Subdivision consists of approximately 15.6 miles between UP's Strang Yard and Harrisburg Junction (located just east of Tower 30). The UP line is single track mainline with a maximum operating speed limit of 20 mph. PTRA also has a rail line in the SH 225 corridor, which runs adjacent to the UP line in some places. For the purposes of analysis, SEA split the Strang Subdivision into three segments because of the variations in rail traffic, which operates over each of these segments. The 4.4 mile segment from Tower 30 to Sinco Junction has an average of 13.1 trains per day (including an average of five BNSF trains that access Pasadena Yard and 0.3 BNSF trains that access Barbours Cut) and can accommodate at least 15 to 16 trains per day.

The 1.1 mile segment between Sinco Junction and Pasadena Junction has an average of 20.1 trains per day (including an average of seven PTRA trains) and can accommodate at least 50 trains per day.

The 11.6 mile segment from Pasadena Junction to Strang Yard has an average of 12.1 trains per day (including an average of four PTRA trains and an average of 0.3 BNSF trains per day that access Barbours Cut) and the capacity from Strang Yard to Pasadena Junction ranges from 30 to 50 trains per day (30 from Strang Yard to Deer Park and 50 from Deer Park to Pasadena Junction) and 12.1 trains per day currently operate over the line.

Train operations are governed by Automatic Block Signals between Strang Yard and Deer Park and by CTC between Deer Park and Harrisburg Junction. East of Deer Park Junction, UP has its own track and PTRA has two tracks, one adjacent to the UP track and another that serves several industries to the north. Between Deer Park Junction and Harrisburg Junction, some trackage belongs to UP, some to the PTRA, and some is jointly owned by UP and PTRA. In addition to UP having trackage rights on some PTRA trackage and PTRA having trackage rights on some UP trackage, BNSF also has trackage rights on some UP and PTRA trackage in order to access PTRA's Pasadena Yard and the yard at Barbours Cut.

UP Bayport Loop Industrial Lead. The Bayport Loop Industrial Lead consists of track connecting UP's Strang Yard with the Bayport Loop. Signals are not installed on the UP tracks and trains are operated at restricted speed. An average of 7.4 trains per day operate over UP's Bayport Loop Industrial Lead between the Bayport Loop and Strang Yard and the capacity of the industrial lead is at least 12 to 14 trains per day.

UP Bayport Loop. The Bayport Loop consists of track connecting the industries in the Bayport Industrial District with the Bayport Loop Industrial Lead. Signals are not installed on the Bayport Loop tracks and tracks operate at "Other than Main Track" restrictions. For the purposes of analysis, SEA split the Bayport Loop into two segments due to differences in the lengths of trains operating in each segment. The 3.7 mile north end of the Bayport Loop has an average of 10.5 trains per day. The 2.5 mile south end of the Bayport Loop also has an average of 10.5 trains per day, but these trains average almost half the length of the trains operating in the north end.

3.1.2.5 No-Action Alternative

Under the No-Action Alternative, the Applicants would not gain rail access to the Bayport Loop. The existing rail conditions and safety conditions for the Strang Subdivision and the Bayport Loop Industrial Lead, which would continue to be used under the No-Action Alternative, are described above under the No-Build Alternative.

Currently, UP traffic moving into and out of the Bayport Loop is routed to and from Strang Yard and other UP yards either at Settegast, Englewood, Spring, or Galveston depending upon the origin or destination. Traffic moving to and from the Strang area and the Bayport Loop is switched (cars are added to outbound trains or are removed from inbound trains) at the Strang Yard. Approximately 80 percent of the plastic pellet traffic is stored-in-transit and is routed from Strang Yard to Spring Yard or Galveston. The rest of the outbound Bayport Loop traffic consisting of chemicals and the remainder of the plastic pellets is routed through either Settegast Yard or Englewood Yard or is sent directly to a final destination. Cars that are inbound to the Bayport Loop are mostly empty cars that appear to be routed via Englewood Yard, Baer Junction, Tower 86, Tower 208, Booth Siding, and Harrisburg and Manchester Junctions. The Tower 68 to Harrisburg Junction line is 7.2 miles in length with a maximum speed of 20 mph and a combination of ABS and CTC signaling. The line consists of double track between Tower 68 and Galena Junction (just south of Tower 86).

3.2 HAZARDOUS MATERIALS TRANSPORTATION SAFETY

3.2.1 Background

Several Federal agencies have established requirements for hazardous materials transportation on rail lines, as well as for emergency planning and spill response for hazardous materials. These agencies include the USDOT, USEPA, and the Occupational Safety and Health Administration (OSHA).

USDOT regulations include requirements for shipping and packaging containers for hazardous materials, emergency response information, and training. USDOT's FRA has authority to ensure the safe movement of rail traffic. Regulatory and enforcement powers of FRA are found at 49 CFR 200 through 240. USDOT's Research and Special Programs Administration (RSPA) has established design standards and requirements, found in 49 CFR 171 and 179, for railcars used for the transportation of hazardous materials. These regulations require facilities that build, repair, or ensure the structural integrity of railcars to develop and implement a quality assurance program; railcars to be inspected and tested frequently, including pre-trip inspections; railcars used for transportation of high hazard materials to be equipped, as appropriate, with thermal protection systems (systems that protect a railcar and its contents from exposure to nearby fires) and head protection elements (devices that limit the potential for puncturing the end of a car in an accident); and protective coatings to be used on insulated tank cars. RSPA regulations also include specifications for puncture resistance of railcars used for certain high hazard materials, including materials that are poisonous or toxic if inhaled and those determined by the USEPA to pose health and environmental risks.

USDOT regulates hazardous materials transportation through controls and practices that primarily focus on the source of the risk, regulating the types and the management of containers – such as railcars – that contain hazardous materials, as well as overseeing signaling, train control, and track safety. The FRA considers this approach a more cost effective and efficient way to regulate hazardous materials transportation with the objective of maximizing safety and minimizing the risk of adverse impact to human health and the environment. Thus, Federal regulations do not include requirements for buffer corridors or safe distances along railroad lines with respect to particular types of structures, such as residences, schools, or hospitals. In practice, hazardous materials are routinely transported along rail lines and highways across the U.S. and through areas with all types of land uses, including industrial and residential areas, as well as sensitive environments.

USEPA regulations address spill prevention and cleanup. Most USEPA regulations address only fixed facilities rather than transport activities. However, USEPA regulations in 40 CFR 263, Standards Applicable to Transporters of Hazardous Waste, specify immediate response actions, discharge clean-up, and other requirements for transporters of hazardous waste.

Finally, OSHA regulations in 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, specify emergency response and clean-up operations for releases, or substantial threats of releases, of hazardous substances.

3.2.2 Existing Conditions

The potentially affected environment, relevant to hazardous materials transportation safety, includes areas along and around the existing and proposed rail lines and the existing rail yards described in Chapter 2. SEA identified existing industrial operations and other activities that already involve the storage, transport, and/or use of hazardous materials in the area potentially affected by the implementation of the Proposed Action and Alternatives. SEA focused in particular on the rail transportation of hazardous materials, as well as on existing emergency management capabilities.

SEA used a variety of data sources to identify the existing conditions in the project area, including field work to observe hazardous materials rail traffic. SEA examined information from the USEPA's Toxics Release Inventory (TRI) database to identify the types of hazardous materials currently manufactured, processed, stored, shipped, and received by facilities located in the Bayport Loop. The TRI database lists more than 50 privately-owned facilities located in the Bayport Loop. The facilities listed in the TRI database include several facilities owned and/or operated by different parties on one site that would normally be considered as one chemical plant. Other facilities included in the TRI database are not chemical plants, but other types of operations that also discharge toxic chemicals to air, water, and land in reportable quantities. The Applicants' filing indicates 24 major facilities around the Bayport Loop.

As described in Appendix C, SEA obtained information from UP, BNSF, and PTRA that characterizes the existing rail traffic along the relevant rail lines in the project area (i.e., the Bayport Loop Industrial Lead, Strang Subdivision, the GH&H line, the East Belt Terminal, Lafayette, and Baytown Subdivisions). However, SEA did not have access to comprehensive information that characterizes and identifies all the hazardous materials currently transported along the relevant rail lines in the project area. In order to assess the current conditions in the project area regarding hazardous materials traffic, SEA used several sources of information, including the Board's waybill sample; information provided by UP regarding hazardous materials traffic along the Bayport Loop Industrial Lead, Strang Subdivision, and the GH&H line between Graham Siding and Tower 30; information provided by the Applicants regarding the average amount of hazardous materials transported on BNSF trains in the Houston area; information provided by the Applicants regarding hazardous materials shipped and received by the chemical plants operated by the Applicants' partners in the Bayport Loop; and SEA's field work. The distribution of hazardous materials on different rail lines in the project area was also addressed during consultations with the FRA.

3.2.2.1 Existing Industrial Activities in the Project Area that Handle Large Quantities of Hazardous Materials

The areas along and around the rail lines and yards associated with the Proposed Action and Alternatives, including the No-Action Alternative, include residential, agricultural, commercial, institutional, and industrial uses. The project area contains one of the largest concentrations of the chemical industry in the U.S. The chemical plants located in the project area handle a wide range of chemicals, including many hazardous materials. Hazardous materials are shipped to and from the facilities by pipeline, rail, truck, and barge/ship. Underground pipelines are frequently the preferred means to transport hazardous materials between facilities located in the project area or between those facilities and others located in neighboring industrial areas.

In addition to the facilities listed in the TRI database, SEA identified several other facilities in the area around the Build Segments, west of the Bayport Rail Terminal, that, based on their activities, are likely to handle hazardous materials. These facilities include, among others, the Ellington Field airport; the small wastewater treatment facility adjacent to the airport; the City of Houston Southeast Water Treatment Plant; and the two gas production plants associated with the Clear Lake oil and gas field.

As in any chemical complex, the hazardous materials handled in industrial facilities located in the project area have properties that can lead to potential risks to human health and the environment. These hazardous properties include toxicity, flammability, and reactivity (e.g., explosivity or reactions when exposed to water). The types of chemicals handled by the facilities in the project area range from relatively benign liquids that may be flammable and/or slightly toxic (e.g., various alcohols and solvents) to materials that are poisonous or toxic if inhaled (e.g., ethylene oxide and chlorine) or highly flammable (e.g., propylene oxide). Because pipelines are the preferred means to transport hazardous materials between industrial facilities in the project area and because some chemicals are only transported via truck or pipeline, the set of chemicals that are currently transported by rail to or from these facilities is a fraction of the full set of chemicals handled at the facilities themselves. Some hazardous materials are manufactured and consumed on site with no transportation involved.

Given the relatively close proximity of some residential communities to the industrial facilities that handle hazardous materials in the project area, these residential communities potentially could be adversely affected in the event of a major fire or hazardous materials spill at these industrial facilities or along existing rail lines.

3.2.2.2 Existing Hazardous Materials Rail Traffic in the Project Area

Materials transported via rail to and from the facilities in the Bayport Loop consist primarily of non-hazardous polyethylene and polypropylene plastic resins in pellet form, but also include some hazardous materials. SEA reviewed the Board’s 1999 and 2000 waybill sample for the Bayport Loop. In addition to providing the rail traffic volumes reported in Section 3.1, the waybill sample data indicated that approximately 20 percent of carloads transported to and from the Bayport Loop (i.e., 26 loaded railcars per day out of 129) contained hazardous materials. Current national data suggests that less than 10 percent of all carloads contain hazardous materials on a ton-mile basis (U.S. Census Bureau, 1999) but a figure of 20 percent in the Houston area is consistent with the increased level of chemical activity in the region. As discussed in Section 2.2.1.2, USDOT regulations do not list glycols (which the Applicants anticipate transporting as part of the Proposed Action) as hazardous materials, although glycols are classified by USEPA as hazardous materials. As a result, the waybill sample data for hazardous materials transported to and from the Bayport Loop do not account for transportation of glycols. Therefore, the actual fraction of carloads containing hazardous materials, as defined by USEPA, that is transported via rail to and from the Bayport Loop area is even more likely to exceed 10 percent. Based on available information, SEA could not determine the exact fraction of traffic that carries hazardous materials, but SEA does not expect it to be considerably greater than 20 percent.

During field observations over three 24-hour periods in March and April 2002, SEA observed an average of 79 loaded hazardous materials cars per day operating on the GH&H line near Ellington Field. This equates to 30 percent of the total cars observed during those periods. The petrochemical complex in Texas City, located on the GH&H line south of the project area, generates most of the hazardous materials that are transported along the portion of the GH&H line where the Build Segments would connect. Over two 24-hour periods on the Strang Subdivision, SEA observed an average of 248 loaded hazardous materials cars per day. This equates to 23 percent of the total cars observed during those periods.

Appendix C presents SEA's summary of the information regarding hazardous materials traffic along the relevant rail lines in the project area that SEA used for the analysis of hazardous materials transportation safety. This information includes data provided by UP and BNSF, as well as assumptions that SEA developed to complement the information provided by the railroads. The information presented in Appendix C indicates that between approximately 18 percent and 33 percent of the cars transported along the relevant rail lines in the project area are hazardous materials cars.

Section 4.2.2 presents SEA's summary of its analysis of the train accident and hazardous materials release frequencies, as well as the interval between releases, under existing conditions. Appendix D presents a detailed description of the method and the equations used by SEA to calculate these parameters. Appendix D also presents the underlying assumptions used by SEA and information about the hazardous materials considered in the analysis.

3.2.3 Existing Emergency Management Capabilities

In the event of a hazardous materials release on a rail line or at a yard, a variety of emergency response resources are available, including Federal, state, and local agencies; railroad companies; and shippers/manufacturers of the hazardous materials. Local agencies, such as fire departments and local emergency management agencies, are typically responsible for incident command, assessment, response action, and protective actions for the general population. Railroad companies and shippers coordinate with these local agencies and provide specialized expertise on handling the specific chemicals and the equipment (e.g., the railcars). The notification procedures followed by BNSF in the event of an emergency are described below.

Guidelines established by nationally-recognized bodies assist emergency response service organizations in defining protective action areas. These guidelines typically define a protective action area by a radial distance from the site of the spill or fire (i.e., the "protective action distance"), depending on a number of factors specific to the hazardous chemical released or involved, the actual or potential release size and duration, the surrounding population, and the weather conditions at the time of the incident. These protective distances and areas provide guidance on locations that should be evacuated or within which other precautions such as shelter-in-place (i.e., staying indoors) should be followed in the event of a spill or release. For many of the hazardous materials transported along the existing rail lines in the project area, the recommended protective action distance in the event of a large chemical spill or fire is 0.5 to 1.0 miles. Furthermore, several of the hazardous materials currently being transported in the project area can be toxic if inhaled. In some cases guidelines recommend a protective action distance of over one mile for evacuation or shelter-in-place in the event of an emergency involving a large release of a very toxic material (NAERG, 2000). In order to minimize the need for modeling assumptions and to better reflect what might happen after an accident, i.e., a major evacuation, SEA used these published distances in its evaluation of hazardous materials transportation safety to represent the potential consequences of a release.

As described below, numerous emergency response organizations exist within the project area. They are very familiar with the types of materials that are presently shipped within the Bayport Loop and the project area, and they offer extensive capabilities to deal with events that could occur.

3.2.3.1 Emergency Management Capabilities Associated with Local Agencies and Other Parties

The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, passed in October 1986, makes the management of emergencies associated with hazardous materials in the U.S. a local responsibility and requires localities to develop emergency response plans for responding to chemical emergencies. EPCRA also mandates the establishment of Local Emergency Planning Committees (LEPCs). LEPCs are typically composed of concerned citizens and officials from local government, law enforcement, fire and emergency medical services, hospitals, schools, civic and environmental groups, business and industrial facilities, and the news media. Several LEPCs exist in the area of interest for the Proposed Action and Alternatives, including the Bay Area, La Porte, Deer Park, Pasadena, and City of Houston LEPCs.

As part of their ongoing responsibilities, the LEPCs carry out the following functions that help ensure that the project area is prepared for a hazardous materials incident:

- Conducting annual exercises.
- Developing, reviewing, and updating a local Emergency Response Plan annually.
- Identifying and addressing training needs.
- Evaluating emergency response capabilities.
- Reviewing Federal, state, and local response plans to coordinate with the LEPC planning process.

The objective of the local Emergency Response Plan is to protect the public from chemical accidents, regardless of their origin. Such plans generally include procedures to warn and, if necessary, evacuate the public in case of emergency; coordinate with local agencies, as well as with industry; provide citizens and local governments with information about hazardous materials and accidental releases of hazardous materials in their communities; and prepare public reports on annual releases of toxic chemicals into the air, water, and soil.

The City of Houston has a Hazardous Materials Response Team (HMRT) that handles emergency response to hazardous materials incidents within the City of Houston and that could provide support to fire departments in Harris County. The Channel Industries Mutual Aid (CIMA) is a non-profit organization, in operation since 1955, that combines and coordinates industry and municipal resources in the Houston Ship Channel area to provide mutual assistance in emergency situations. CIMA has established several emergency response plan elements, including a centralized dispatch system for the radio network, a notification database, a multi-casualty incident plan, roadblock committees, and technical advice groups. CIMA maintains agreements with other mutual aid organizations along the Texas/Louisiana coast to provide or receive assistance during major events. CIMA has almost 100 industrial members, including several of the Applicants' partners. The institutional members of CIMA include the cities of Baytown and Houston; the Deer Park, LaPorte, Pasadena, and Seabrook fire departments; the Harris County Constable, Fire Marshal's Office, Office of Emergency Management, and Sheriff's Department; Port of Houston Authority; and USCG.

3.2.3.2 Emergency Management Capabilities within the Railroads

Major railroads, including BNSF, incorporate hazardous materials response capabilities into their incident preparedness plans. In addition to corporate-level emergency response teams, there are regional "Strike Teams" that can be deployed on short notice to provide specialized technical expertise at an incident site. The railroads also maintain numerous pre-approved contracts with firms that can provide a wide range of quick-response services, including environmental monitoring, emergency management, heavy equipment rental and operation, and natural resource assessments. At major fixed facilities (e.g., large rail yards), individual response plans are prepared and drills are conducted to ensure the effectiveness of planned responses.

The railroads and chemical companies also have several joint programs, such as the Transportation Community Awareness and Emergency Response Program (TRANSCAER®), which is related to the American Chemistry Council's Responsible Care® Program. TRANSCAER® is a nationwide effort of the railroads and the chemical industry to assist communities in developing and evaluating emergency response plans.

BNSF's System Hazardous Materials Emergency Response Plan indicates that in the event that an incident potentially involving hazardous materials is reported, the railroad considers it as an emergency until complete information indicates that the situation has been brought under control. According to BNSF's procedures, the initial report of an incident is issued by a train crew or switch crew member and is received by a dispatcher, trainmaster, or yardmaster. In some cases (e.g., if the train crew or switch crew members are incapacitated or if the incident does not involve a train or switching movement), the initial report may come from a local emergency response agency and, in such cases, it would be received directly by BNSF's Resource Operations Center (ROC) or through other BNSF corporate channels. The person receiving the initial report (i.e., dispatcher, trainmaster, yardmaster, or ROC staff member) would in turn notify the BNSF Network Operations Center's Service Interruption Desk (SID) in Fort Worth, Texas. Upon being notified, the ROC and the SID initiate implementation of their respective emergency notification procedures, which involve contacting corporate or contracted hazardous materials and environmental responders, as well as civil emergency responders, if they have not already been notified; relevant BNSF departments; government (i.e., Federal, state, and local) agencies; shippers; and industry associations. All notifications made by the SID are tape recorded for documentation of the notification process. Other major railroads have emergency notification procedures similar to those that BNSF has in place.

3.3 PIPELINE SAFETY

3.3.1 Background

Portions of the Proposed Action and Alternatives, including the No-Action Alternative, would cross or be located near pipelines that carry natural gas and hazardous liquids, including petroleum and petroleum products. Existing pipeline operations could potentially be impacted by existing and future rail lines in several ways. Construction activities associated with the Build Segments would have the potential to compromise the integrity of existing pipelines as a result of damage to a pipeline during excavation and backfill activities. Existing or future rail operations could potentially impact an existing pipeline in the event of an accident, such as a derailment. As a result, this section describes the existing conditions regarding pipelines and the regulatory programs developed for ensuring safe pipeline operation.

The USDOT's Office of Pipeline Safety (OPS) administers the national pipeline safety program under the authority of the Pipeline Safety Act. The Railroad Commission of Texas (RRC) assists the USDOT in implementation of the Federal program and supplements the Federal program with additional requirements in Texas. The USDOT and RRC regulate the design, construction, inspection, testing, operation, and maintenance of pipelines under 49 CFR Parts 192 through 195 and 199, and Title 16, Part 1, Chapters 7 and 8 of the Texas Administrative Code (TAC), respectively. These regulations collectively apply to operators of interstate and intrastate natural gas or hazardous liquid pipelines. Compliance with these regulations is the duty of the pipeline owners/operators to whom they apply. The regulations do not apply to all gas and hazardous liquid pipelines (see 49 CFR 195.1). For example, the regulations do not apply to in-plant piping systems at onshore production, refining, or manufacturing facilities or to pipelines that serve such facilities and are less than one mile in length. RRC inspects regulated pipelines and enforces the applicable regulations.

Pipeline construction and operation is further controlled through consensus standards developed and distributed by the American Society of Mechanical Engineers (ASME), the American Petroleum Institute (e.g., APIRP 1102, Steel Pipelines Crossing Railroads and Highways), and AREMA. In addition, some pipeline owners have additional construction standards that they require be met before they will grant permission for construction over or near their pipelines.

All types of excavation work around pipelines (as well as other types of buried utilities) also is regulated based on the requirements of the Texas Underground Facility Damage Prevention and Safety Act,[5] which establishes requirements for the Texas One Call System. The legislation requires excavators to notify the call center in advance of excavation. The call center in turn

[5] 76th Leg., ch. 62, sec 18.17(a), eff. Sept. 1, 1999.

notifies pipeline and other utility operators of the planned excavation, and they in turn mark the location of their buried equipment to prevent accidental damage.

3.3.2 Existing Conditions

3.3.2.1 Pipeline Locations

Build Alternatives. The Build Alternatives would involve construction of approximately 12.8 to 13.8 miles of new rail line and operation over 49.5 to 52 miles of existing rail line, depending on the Alternative. As part of preliminary engineering activities, the Applicants have identified roughly 300 potential underground pipeline crossings along the Build Segment of the Proposed Action. Approximately 200 of these pipelines are known to transport petroleum, chemicals, or natural gas. Other identified pipelines include water, sewer, or idle or abandoned pipelines. In addition to crossing existing pipelines, part of the new rail line would be located near (and generally parallel to) other underground pipelines. Based on pipeline location information provided by the Applicants and reviewed by SEA, SEA estimated that construction of approximately 0.5 miles of the new rail line for the Proposed Action would occur near (within about 50 feet of) a natural gas pipeline and approximately 1 mile would occur near petroleum or chemical pipelines. For most of the other Build Alternatives, the proximity of pipelines to the Build Segments is generally similar. Proximity to pipelines is somewhat greater for Alternative 1C and somewhat less for Alternatives 2B and 2D. For the route using the Original Taylor Bayou crossing described in Section 2.2.2, on the other hand, construction of approximately 1.7 miles of the new rail line would occur near underground petroleum or chemical pipelines.

In addition to underground pipelines, some aboveground pipeline-related facilities, such as valve stations or pipelines over waterways, also would be located near the Build Segments of the Build Alternatives. SEA estimated that less than 0.1 mile of the Build Segments would be located near these aboveground gas and petroleum/chemical pipeline facilities.

Pipelines are also present at some locations along the existing rail lines that BNSF would use as part of the Build Alternatives. SEA did not examine the location of existing underground pipelines along these existing rail lines in detail because construction would not occur along these existing rail lines as part of the Build Alternatives. SEA did examine the location of aboveground pipelines, including valve stations, pig launchers, and similar facilities, along the existing rail lines and estimated that for the Build Alternatives less than 0.2 mile of these existing rail lines is located near aboveground gas or petroleum/chemical pipeline facilities.

No-Build Alternative. SEA focused consideration of existing pipeline conditions along the route of the No-Build Alternative on aboveground pipelines and not underground pipelines because construction would not be part of this Alternative. Based on visual observations and data compiled by the Applicants and visual observations by SEA, SEA found that aboveground pipelines and related facilities are relatively common along the Strang Subdivision. Examples include locations near the Strang Subdivision crossings of Lawndale Road, N. Richey Street, W. Richey Street, Red Bluff Road, Jefferson Road, and Beltway 8. SEA also found that aboveground pipelines occur in comparatively few locations on other segments of the route. Based on these observations, SEA estimated that aboveground pipelines occur near approximately 0.25 mile of the Strang Subdivision of the No-Build Alternative. For the entire length of the No-Build Alternative, SEA estimated that aboveground pipelines are located near approximately 0.5 mile of the route.

No-Action Alternative. As discussed above for the No-Build Alternative, aboveground pipelines occur at several locations along the Strang Subdivision. Based on the information assembled, SEA estimated that the length of the route that is near aboveground pipelines is approximately 0.4 mile – slightly less than for the No-Build Alternative.

3.3.2.2 Accident Frequencies

To provide baseline information for the analysis of potential impacts of the Proposed Action and Alternatives, SEA examined both rail and pipeline accident statistics to develop estimated accident frequencies. SEA used rail accident information to estimate the frequency for derailments under existing conditions, as described in more detail in Appendix D. SEA also used pipeline accident information to estimate the frequency of pipeline damage resulting from rail accidents and the frequency of pipeline damage by construction activities.

Construction. SEA used data from the OPS to establish a baseline for construction-related pipeline accidents. OPS collects and maintains accident statistics on over approximately 154,000 miles of liquid pipelines and over 1.5 million miles of natural gas pipelines throughout the U. S. The OPS accident data are grouped according to major causes, including corrosion effects, failure of construction materials, incorrect operation of the pipeline, malfunction of controls, and damage from outside forces. Accidents attributed to damage from outside forces are further described as being caused by damage from the operator, natural forces (including mudslide, lightning, frost heave, etc.), or a third party. Nationwide data for the period from 1985 through 2001 include an average of 32 incidents per year (1 per 5,000 miles of pipeline) of damage to hazardous liquid pipelines by third parties (e.g., damage during construction). Data for the same period include an average of 78 incidents per year (1 per 19,000 miles of pipeline) of third-party damage to natural gas pipelines. In more than 60 percent of these incidents, the third-party excavator did not contact the "one call" notification service before conducting excavation activities. Contacts currently are required by Texas law.

Operation. Rail operations can potentially damage a pipeline in the event of a derailment near a pipeline. Table 3.3-1 shows the estimated accident frequency under current conditions for all traffic on existing rail lines that would be used by BNSF as part of the Proposed Action and Alternatives. For the Proposed Action, and Alternative 1C, the second row of the table shows the estimated accident frequency is 0.44 derailments per year. The approach that SEA used to develop these estimates is described in Appendix D. These estimated accident frequencies were determined based on a range of factors, most notably the length of the route or segment, the volume of rail traffic, and the track class and associated train speed. As discussed in Appendix D, SEA's analysis of accident frequencies is based on historical statistics that consider accidents that potentially result in derailments of at least one railcar, even if the accident is classified differently (i.e., according to FRA regulations, a reportable accident is classified based on the initial event - e.g., a collision - although the accident may subsequently have resulted in a derailment).

Table 3.3-1
Estimated Accident Frequency For All Rail Traffic Under Current Conditions for Existing Track That Would be Used by the Proposed Action and Alternatives

Route	Route Length (miles)	Accident Frequency (derailments/year)
No-Build Alternative (all existing track)	63.4	0.86
Proposed Action or Alternative 1C (existing track only)	52	0.44
Alternatives 2B or 2D (existing track only)	49.5	0.43
Existing Route – UP route between Bayport and Tower 85	27.6	0.46

SEA also reviewed data from OPS, FRA, and RRC to estimate the frequency with which derailments result in pipeline damage. Based on review of databases covering the period from 1985 through 2001 and containing more than 1,900 incidents of third-party damage to a pipeline, SEA did not identify any incidents that were directly attributed to a derailment. From other sources, including National Transportation Safety Board (NTSB) reports, SEA identified two incidents in which a train derailment resulted in damage to an aboveground pipeline. In addition, SEA is aware of three instances in which post-derailment activities resulted in damage to underground pipelines. Thus, the chance of a release resulting from pipeline damage caused by a derailment is low, and is lower than the chance of a release from other causes of pipeline failure.

3.4 GRADE CROSSING DELAY AND SAFETY

3.4.1 Background

This section describes the existing traffic delay and safety conditions for highway/rail at-grade crossings affected by the Proposed Action and Alternatives, including the No-Action Alternative. Highway/rail at-grade crossings are hereinafter referred to as grade crossings. The Federal Highway Administration (FHWA) and the FRA have regulatory jurisdiction over safety at grade crossings under the Highway Safety Act (HSA) and the FRSA. The HSA governs the distribution of funds to states for the elimination of hazards at grade crossings. USDOT has promulgated regulations addressing grade crossing safety and provides funding for the installation and improvement of warning devices. All warning devices installed at crossings must comply with FHWA's "Manual on Uniform Traffic Control Devices" (23 CFR Part 646.214 (B)(1)). This manual provides standards for the types of warning devices that must be installed at all grade crossings. FRA has issued regulations under its railroad safety authority that impose minimum standards for grade crossings (49 CFR Parts 234-36). FRA maintains information for each grade crossing, based on information provided by the states and the railroads. FRA and FHWA coordinate research efforts related to grade crossing accidents and solutions to grade crossing problems.

According to the USDOT "Railroad-Highway Grade Crossing Handbook" (FHWA-TS-86-215, 2nd ed., 1986), "jurisdiction over highway/rail grade crossings resides primarily with the states." The states perform on-site inspections and order safety improvements. USDOT maintains oversight and approval of state determinations.

Thus, SEA analyzed grade separation of highway/rail crossings based on USDOT guidelines. These guidelines include consideration of highway classification, average daily traffic, number of trains per day and train speed at grade crossings.

3.4.2 Existing Conditions

SEA reviewed the existing traffic delay and safety conditions associated with the existing rail lines that would be used under the Proposed Action and Alternatives, including the No-Action Alternative. To characterize the existing traffic delay and safety conditions at existing and proposed grade crossings, SEA used several data sources:

- Texas Department of Transportation (TxDOT) information on average daily vehicle traffic volumes at grade crossings;[6]
- UP, BNSF, and PTRA information on trafin traffic; and
- FRA's grade crossing database and Public Crossing Accident Prediction System (PCAPS).

SEA conducted various field observations within the project area and consulted with TxDOT to discuss and identify any existing transportation delay and safety concerns at grade crossings in the project area.

SEA used FRA accident prediction data to characterize the traffic safety at existing grade crossings. The data include the accident history from the past five years and related data inputs to the PCAPS model used to calculate the estimated accident frequency based on existing conditions.

The roads within the project area include Interstate Highways, State Highways (SH), U.S. roads, public access roads, and private roads. The major roads within the project area include Beltway 8, SH 3, SH 225, SH 146, Genoa-Red Bluff Road, Red Bluff Road, Space Center Boulevard, and Bay Area Boulevard. The two Interstate Highways within the project area are I-45 (with a north-south alignment) and I-610 (with an east-west alignment).

3.4.2.1 Proposed Action and Alternatives

Build Alternatives. Because of variations in rail traffic for different segments of existing rail lines that would be used as part of the Build Alternatives, SEA examined the following segments:

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[6] Data from 2001, with the exception of three crossings. SEA also reviewed traffic volume data developed for the Applicants in October 2001 for the area around SH 146 and Port Road. These traffic volume data are similar to the TxDOT data. As a result, use of these data instead of the TxDOT data would not materially change calculated average delay per vehicle.

- Build Segments;[7]
- GH&H line South of Tower 30;
- Tower 30 to Tower 85 (GH&H line);
- Tower 85 to Tower 87 (East Belt Subdivision);
- Tower 87 to Dayton Junction (Terminal and Lafayette Subdivisions); and
- Dayton Junction to CMC Dayton Yard (Baytown Subdivision).

The number of grade crossings and their rail operation characteristics for each of these segments are described in Table 3.4-1. The train speeds shown in Table 3.4-1 indicate the range of speeds at the grade crossings on each rail segment analyzed. SEA used information available from FRA to determine the train speed for each grade crossing for this analysis. Specifically, SEA used the mid-point of the "typical speed range" provided in the FRA Office of Safety Analysis crossing inventory database. (See Appendix F for information on the train speed used for each grade crossing and additional information on the analysis methodology.)

Table 3.4-1
Existing Grade Crossings and Rail Operations for Build Alternatives

Rail Segments	Number of Grade Crossings	Existing Trains (Avg. per day)	Typical Train Speed (mph)
GH&H Line South of Tower 30	23	3.4	15-22.5
Tower 30 to Tower 85	3	5	15-17.5
Tower 85 to Tower 87	9	25.1	11-15
Tower 87 to Dayton Junction	19	20.7	25-57.5
Dayton Junction to CMC Dayton Yard	1	14.9	7.5
Total Crossings	55		

SEA analyzed existing traffic delay and safety conditions for each of the rail segments listed in Table 3.4-1. The existing conditions at the locations of the proposed new grade crossings are also described below. The average delay per vehicle at grade crossings is used to calculate the Level of Service (LOS).[8] LOS is a qualitative measure of road operating conditions and comfort level of passengers and is widely used by transportation professionals to measure effectiveness of

[7] The location of grade crossings would be the same for all of the Build Segments, with the exception of the Taylor Bayou Crossing, which would cross Bay Area Boulevard approximately 1,000 feet northeast of where the alignment for the other Build Segments would cross Bay Area Boulevard.

[8] All references to LOS in this document are to intersection (including grade crossing) LOS, which is measured by average delay per vehicle, rather than by highway segment LOS, which measures qualitative traffic flow and speed conditions.

roadway systems. LOS is defined as ranging from A (best) to F (worst) based on average delay per vehicle. The traffic safety at grade crossings is measured in terms of accident prediction frequency rate, using the accident history from the most recent five years and the average daily traffic served by that grade crossing.

All the existing grade crossings on the GH&H line south of Tower 30 showed the best level of service, LOS A. The average delay per vehicle ranged from 0.5 to 1.3 seconds, and the average crossing delay per stopped vehicle ranged from 1.4 to 3.1 minutes. The annual accident frequency rate for the existing crossings on the GH&H line south of Tower 30 ranged from 0.004 to 0.137. This translates into a range of approximately one accident every 250 years to one accident every seven years.

All the existing crossings between Tower 30 and Tower 85 showed the best level of service, LOS A. The average delay per vehicle ranged from 1.0 to 1.3 seconds and the average crossing delay per stopped vehicle ranged from 1.5 to 1.8 minutes. The annual accident frequency rate for the existing crossings between Tower 30 and Tower 85 ranged from 0.009 to 0.052. This translates into a range of approximately one accident every 111 years to one accident every 19 years.

All the existing crossings between Tower 85 and Tower 87 showed LOS B, except for one crossing that showed LOS C. The average delay per vehicle ranged from 5.6 to 10.2 seconds and the average crossing delay per stopped vehicle ranged from 1.7 to 2.3 minutes. The annual accident frequency rate for the existing crossings between Tower 85 and Tower 87 ranged from 0.011 to 0.099. This translates into a range of approximately one accident every 91 years to one accident every ten years.

All the existing crossings between Tower 87 and Dayton Junction showed the best level of service, LOS A. The average delay per vehicle ranged from 0.8 to 2.8 seconds and the average crossing delay per stopped vehicle ranged from 0.7 to 1.3 minutes. The annual accident frequency rate for the existing crossings between Tower 87 and Dayton Junction ranged from 0.003 to 0.028. This translates into a range of approximately one accident every 333 years to one accident every 36 years.

The existing crossing between Dayton Junction and the CMC Dayton Yard showed LOS B. The average delay time per vehicle is 6.4 seconds and the average crossing delay per stopped vehicle is 2.4 minutes. The annual accident frequency is 0.131. This translates into approximately one accident every eight years.

For the Proposed Action and Build Alternatives, the Applicants plan to build five new grade crossings at Old SH 146, Port Road, SH 146 entrance (northbound) and exit (southbound) ramps, and Bay Area Boulevard. Old SH 146, Port Road, and the SH 146 ramps are two-lane roadways, and Bay Area Boulevard is a four-lane roadway. Average Daily Traffic (ADT) on Old SH 146, Port Road, the northbound entrance and southbound exit ramps for SH 146, and Bay Area Boulevard is 2,460; 4,260; 921; 1,280; and 17,920 vehicles, respectively. There are currently no delays at the points in those roads where the grade crossings would be located, with the exception of minor delays associated with the signalized intersections at Bay Area Boulevard and the ramps for SH 146. Figure 3.4-1 illustrates the new grade crossings.

Overall, for the existing conditions most of the existing grade crossings on the existing rail lines that would be used as part of the Build Alternatives demonstrated a predominantly high LOS and low accident rates. Appendix F provides detailed vehicle delay analysis for existing grade crossings under the Build Alternatives, including the Proposed Action.

No-Build Alternative. For this Alternative, SEA analyzed grade crossings on the Bayport Loop, Bayport Industrial Lead, Strang Subdivision and on the rail segments to CMC Dayton Yard. The number of grade crossings and their rail operations characteristics for each segment of the No-Build Alternative are described in Table 3.4-2.

The existing grade crossings on the Bayport Industrial Lead and in the Bayport Loop (between Strang Yard and ATOFINA on Port Road) showed LOS ranging from A to B. The average delay per vehicle ranged from 1.8 to 6.2 seconds, and the average crossing delay per stopped vehicle ranged from 1.5 to 3.3 minutes. The annual accident frequency rate for the existing crossings on the Bayport Industrial Lead ranged from 0.018 to 0.074. This translates into a range of approximately one accident every 56 years to one accident every 14 years.

All the existing grade crossings on the Strang Subdivision showed the best level of service, LOS A. The average delay per vehicle ranged from 1.5 to 9.3 seconds, and the average crossing delay per stopped vehicle ranged from 1.3 to 2.9 minutes. The annual accident frequency rate for the existing crossings on the Strang Subdivision ranged from 0.0039 to 0.105. This translates into a range of approximately one accident every 256 years to one accident every ten years.

The existing traffic delay and safety conditions for grade crossings from Tower 30 to Tower 85, Tower 85 to Tower 87, Tower 87 to Dayton Junction, and Dayton Junction to CMC Dayton Yard rail segments for the No-Build Alternative are as described above for Build Alternatives.

3.4.2.2 No-Action Alternative

Under the No-Action Alternative, the Applicants would not gain rail access to the Bayport Loop. UP would continue to operate trains out of the Bayport Loop to Strang Yard using the Bayport Loop Industrial Lead. Once in Strang Yard, the Bayport Loop rail cars are usually switched to trains heading to yards in the Houston area (e.g., Settegast, Spring, Galveston, and Englewood) or to trains heading to a destination outside Houston.

After the Bayport Loop rail cars enter Strang Yard it becomes increasingly difficult to track their impacts on grade crossing delay and safety because the Bayport Loop traffic becomes so diffused. Bayport Loop rail cars are switched and added to approximately four trains per day, which leave Strang Yard. The grade crossing delay and safety impacts of these additions to existing trains can be difficult to determine and are likely to be negligible. Therefore, SEA decided to restrict analysis to the Bayport Loop Industrial Lead.

Figure 3.4-1
New Grade Crossings for the Build Alternatives

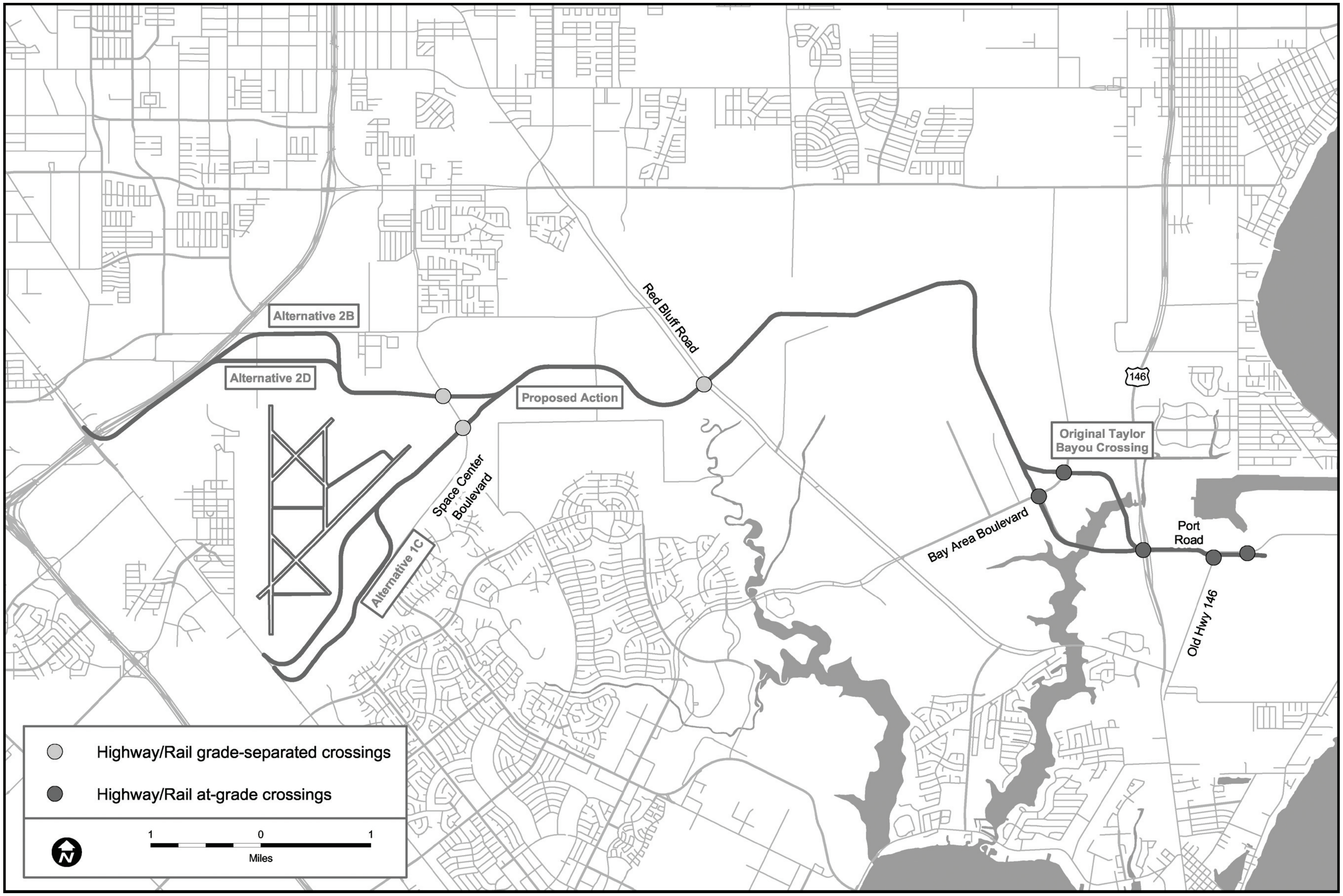


Table 3.4-2
Existing Grade Crossings and Rail Operations for the No-Build Alternative

Rail Segments	Number of Grade Crossings	Existing Trains (Avg. per day)	Typical Train Speed (mph)
Bayport Loop	4	10.5	7.5
Bayport Loop Industrial Lead	1	7.4	10
Strang Subdivision (Yard to Pasadena J.)	11	12.1	10.5-15
Strang Subdivision (Pasadena J. to Sinco J.)	1	20.1	10.5
Strang Subdivision (Sinco J. to Tower 30)	12	13.1	5.5-16.25
Tower 30 to Tower 85	3	5	15-17.5
Tower 85 to Tower 87	9	25.1	11-15
Tower 87 to Dayton Junction	19	20.7	25-57.5
Dayton Junction to CMC Dayton Yard	1	14.9	7.5
Total Crossings	61		

The existing grade crossing delay and safety conditions for the Bayport Loop Industrial Lead are described above under the No-Build Alternative.

3.4.3 Emergency Vehicle Response

Communities within the project area, particularly those communities located on either side of the existing UP lines, require police, fire, and emergency medical services to cross the existing grade crossings when responding to emergencies. The potential exists for emergency vehicles to be delayed at grade crossings, but emergency incidents are often random and unpredictable on an individual basis, complicating efforts to quantify potential delays. Additionally, not all emergencies may require police, fire, or emergency medical services to respond at the same time, and thus it is difficult to determine the needs of all emergency responses and the existing conditions of emergency vehicle delay. There is also the issue of the divergence between the urgency of response time and the usual non-urgency of return time (especially for police and fire services), and the frequent non-round trip nature of response trips (police are often cruising and ambulances may be at non-hospital field locations awaiting emergency calls). These circumstances greatly complicate analysis of existing routing and delay issues. Furthermore, the required emergency services may be located near the incident location, or otherwise may be located where the emergency vehicle need not cross a grade crossing to respond. The highly variable time-sensitivity of emergency patients to treatment and the unpredictability of train traffic through individual crossings make it impractical to characterize emergency vehicle delay separately from overall vehicle traffic and delay.

3.5 NOISE AND VIBRATION

3.5.1 Background

Under the Proposed Action, an increase of two trains per day is projected and increases in rail yard activity are projected to be less than 100 percent. The Proposed Action would not cause a change in intermodal activity. Consequently, no noise analyses would be required for this project with respect to the Board's thresholds for noise impact assessment. Because of the public interest in this project, however, SEA performed a noise analysis to determine if the Proposed Action and Alternatives, including the No-Action Alternative, would result in either of the following conditions:

- An increase in community noise exposure as measured by Day-Night Average Noise Level (L_{dn}) of 3 A-weighted decibels (dBA) or more.

- An increase to a noise level of 65 dBA L_{dn} or greater.

If the estimated noise increase at a location exceeds these criteria, SEA estimates the number of the affected noise-sensitive receptors (i.e., schools, libraries, residences, retirement communities, and nursing homes).

The unit dBA is a measure of noise level used to compare noise from various sources. A-weighting approximates the manner in which the human ear responds to sounds. The L_{dn} represents the energy average of A-weighted sound level over a 24-hour period and includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train pass by between 10 p.m. and 7 a.m. is equivalent to ten similar events during the daytime.

The Noise Control Act, established in 1972, recognized that major transportation noise sources associated with commerce required national uniformity of treatment. Non-uniform treatments, particularly in the case of railroads, could interfere with interstate commerce. USEPA and FRA developed noise regulations (49 CFR 210) in response to the Noise Control Act, which establish noise level limits for individual pieces of railroad equipment. However, these regulations do not address the effects of multiple or cumulative noise events. Other transportation agencies, such as FHWA, Federal Transit Administration (FTA), and FAA have developed noise assessment and mitigation policies which do take into account multiple noise events. These policies, typically based on L_{dn} noise metrics, were developed in response to public concerns over increased noise due to increased transportation activity. SEA's noise regulations address the effects of multiple noise events in a similar fashion to policies developed by other transportation agencies. Railroad noise mitigation includes noise barriers, building sound insulation, directional horns or quiet zones, and changes in land use zoning.

3.5.2 Definition of Railroad Noise

The principal sources of noise that SEA considered in evaluation of rail line segments are wayside train noise and horn noise. Wayside train noise refers collectively to all train-related operational noise adjacent to the right-of-way, excluding warning horn noise. Wayside train noise results from steel train wheels contacting steel rails and from locomotive exhaust and engine noise. The amount of noise created by the wheels on the rails is dependent on the train speed, and the amount of noise created by the locomotive is dependent on the throttle setting. Horn noise occurs in the vicinity of grade crossings to warn motorists and pedestrians of approaching trains.

3.5.3 Existing Conditions

The noise analysis for this project area includes the Proposed Action and Alternatives, including the No-Action Alternative. The train operational data used for the noise analysis are shown in Appendix G. The existing conditions description addresses the Build Segments, because the railroad operations dominate the noise environment on the existing railroads. That existing noise is more fully described in Chapter 4, Environmental Consequences, where the EIS models existing and future noise effects.

3.5.3.1 Ambient Noise Measurements for Build Segments

Portions of the Build Segments would occur in areas that currently do not have train traffic. Therefore, SEA examined whether a 3 dBA increase in community noise would occur by measuring ambient noise for comparison with estimated train noise levels.

SEA selected the noise measurement locations listed in Table 3.5-2 to encompass the project geographically as well as to characterize potential impacts at a variety of noise-sensitive receptors. These locations were selected to measure noise levels at sites in local population centers where noise might be particularly disturbing.

Table 3.5-2
Ambient Noise Measurement Locations

Location Number	Location
1	Sylvan Rodriguez Park
2	Clear Lake Residential Development
3	Baywood Golf Course
4	3527 Bayou Forest (Residential)
5	New Life Community Church
6	Baywood Oaks Residential Development

3.5.3.2 Noise Environment for Build Segments

SEA measured ambient noise in terms of L_{dn} at locations 1 to 6 continuously over a 24-hour period during November 28-29, 2001. The L_{dn}, or Day-Night Average Noise Level, is an energy-average of noise levels over a 24-hour period with a ten decibel penalty for noises occurring between 10 pm and 7 am. This penalty accounts for people's increased sensitivity for noises occurring during nighttime hours.

Location 1, Sylvan Rodriguez Park, is near Ellington Field. During the measurement period at this location SEA observed a number of military aircraft departures. A rain and thunderstorm occurred during these measurements. Other noise sources at this location included distant locomotive warning horns on the GH&H and vehicular traffic on SH 3.

Location 2, Clear Lake Development, is also near Ellington Field. During the noise measurement period at this location, SEA noted a number of military aircraft flights. The rain and thunderstorm also was a noise source at this location.

Location 3, Baywood Golf Course, is near two natural gas plants. During the noise measurement period, SEA noticed low-frequency sound continuously emanating from the plants.

Location 4, 3527 Bayou Forest, is in the Shore Acres residential area. The dominant noise source in this area appeared to be vehicular traffic on SH 146.

Location 5, New Life Community Church, is near Beltway 8 (Sam Houston Parkway). Vehicular noise from the expressway is noticeable at this location. SEA also noted a number of military aircraft flights from Ellington Field as well as what apparently was aircraft run-up noise.

Location 6, Baywood Oaks Residential Development, is adjacent to Genoa-Red Bluff Road. Noise sources at this location included vehicular noise and military aircraft. The two gas plants also sometimes were audible at this location.

3.5.3.3 Ambient Noise Measurement Results for Build Segments

Table 3.5-3 shows the results of the ambient noise measurement program.

A number of Federal agencies and acoustical standards organizations consider 65 L_{dn} to be the dividing line between "unacceptable" and "acceptable" for residential land use. The results in Table 3.5-3 indicate that the existing project area, where track construction and operation is proposed, already exceeds the 65 dBA standard at five out of six measurement locations.

Table 3.5-3
Ambient Noise Measurement Results

Location Number	Location	L_{dn} (dBA)
1	Sylvan Rodriguez Park	70
2	Clear Lake Residential Development	66
3	Baywood Golf Course	70
4	3527 Bayou Forest (Residential)	66
5	New Life Community Church	68
6	Baywood Oaks Residential Development	64

3.6 CLIMATE AND AIR QUALITY

3.6.1 Background

The Board's regulations, found at 49 CFR 1105.7(e)(5), set thresholds for analysis of anticipated effects on air emissions. The Board analyzes air impacts where there is an increase of at least eight trains per day, an increase in rail traffic of at least 100 percent (measured in gross ton miles annually), or an increase in rail yard activity of at least 100 percent (measured by carload activity). When a proposed action affects a non-attainment area, as defined by the Clean Air Act of 1970 (CAA), as is the case here, the Board analyzes air impacts if there is an increase of at least three trains per day, an increase in rail traffic of at least 50 percent, or an increase in rail yard activity of at least 20 percent. For rail construction, only the three trains a day threshold applies. This Proposed Action involves operations over both Build Segments and existing rail lines. The Proposed Action anticipates two trains per day, and would therefore not trigger any environmental thresholds requiring air quality impacts analysis.[9] However, in response to concerns raised over potential impacts to air quality from the Proposed Action, SEA analyzed potential climate and air quality impacts from rail line construction and train operations.

USEPA regulations specify the maximum acceptable ambient concentration level for six types of air pollutants. As defined by the CAA, there are two types of National Ambient Air Quality Standards (NAAQS): primary standards set limits to protect public health, and secondary standards set limits to protect public welfare. The USEPA Office of Air Quality Planning and Standards has set NAAQS for six primary, or "criteria," pollutants: ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), respirable particulate matter (PM), and lead (Pb). The Texas Commission on Environmental Quality (TCEQ) (prior to September, 2002, the Texas Natural Resource Conservation Commission (TNRCC)) has adopted these same standards

[9] Rail operation data dated November 7, 2002, indicate a lower baseline traffic than previously available data. With a baseline of 3.4 trains, an increase of two trains per day on average would constitute a 50 percent increase in gross ton miles. However, the Proposed Action would shift the traffic within the same non-attainment area.

for the State of Texas. The primary and secondary standards are summarized in Table 3.6-1. As the Table shows, the primary and secondary standards are the same for several pollutants and several pollutants have more than one standard. For example, there are two standards for ozone. For a 3-year period, the 1-hour average ozone concentration must not exceed 0.12 ppm on more than 3 days, and the 8-hour average must not exceed 0.08 ppm based on an average of the fourth highest daily maximum value from each of the years.[10]

The Clean Air Act Amendments of 1990 (CAAA) establish for CO, PM, and O_3 areas of attainment/non-attainment based on the severity of each air pollutant. The Houston Galveston Area (HGA) is in attainment for all criteria pollutants except ozone. Ozone is not directly emitted from sources; rather it forms as a result of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) from vehicle and industrial emissions reacting with sunlight in the atmosphere. The CAAA requires that HGA reach attainment of the ozone standard by 2007, and has designated the HGA as a “severe” ozone non-attainment area. For ozone, five classification levels are prescribed by the CAAA based on the severity of the ozone problem, with “severe” as the second most serious designation. Each higher classification requires additional control requirements, enhanced monitoring, offset requirements, and enforcement actions. To meet these standards TCEQ has the responsibility of implementing an ozone reduction strategy, as part of the State Implementation Plan (SIP). The Houston-Galveston SIP (or attainment demonstration plan, submitted to USEPA and adopted on December 6, 2000) identifies the required next steps for HGA to reach attainment.

SEA examined air quality in the project area using data from two sources. SEA used annual summaries of air pollution data obtained from USEPA’s AIR data web site to characterize air quality in the HGA. In addition, SEA used air quality data for criteria pollutants from three air quality monitoring sites in the project area to characterize air quality. The locations of these three monitoring sites are shown in Table 3.6-2 and Figure 3.6-1.

3.6.2 Existing Conditions

3.6.2.1 Climate

SEA relied on current characterizations of the climate in the HGA for information on existing conditions. SEA examined general climate conditions as well as the effects of ozone climatology.

The climate of the HGA can be characterized as marine climate heavily influenced by the Gulf of Mexico. Because of the proximity of Galveston Bay, the area has frequent occurrences of the both ground and advective fogs. The mean annual temperature for the Houston-Galveston region is about 68 degrees Fahrenheit (ºF), with a mean rainfall of 46.1 inches. Summer temperatures average about 93.2ºF, with temperatures above 100.4ºF common, during the months of July and

[10] There currently exists one standard (the 1-hour ozone standard). However, a pending 8-hour ozone standard will eventually replace the current 1-hour standard. The new 8-hour standard was proposed by USEPA in late 1997, but it is unlikely to be fully implemented until 2004.

Table 3.6-1
National Ambient Air Quality Standards (NAAQSs)

Pollutant	Primary Standard (Public Health)			Secondary Standard (Public Welfare)		
	Level	**Averaging Time**	**Form**	**Level**	**Averaging Time**	**Form**
Ozone	0.12 ppm	1-hour	More than 3 days over 3 years	Same as primary standard		
	0.08 ppm*	8-hour	3-year average of annual fourth highest daily maximum	Same as primary standard		
Particulate Matter 10 microns or smaller (PM_{10})	150 µg/m^3	24-hour	3-year average of annual 99th percentiles	Same as primary standard		
	50 µg/m^3	Annual	Not to be exceeded			
Particulate Matter* 2.5 microns or smaller ($PM_{2.5}$)	65 µg/m^3*	24-hour	3-year average of annual averages	Same as primary standard		
	15 µg/m^3*	Annual	3-year average of 98th percentile			
Carbon Monoxide	35 ppm	1-hour	More than once per year	No secondary standard		
	9 ppm	8-hour				
Sulfur Dioxide	0.14 ppm	24-hour	More than once per year	0.55 ppm	3-hour	More than once per year
	0.03 ppm	Annual	Not to be exceeded			
Nitrogen Dioxide	0.053 ppm	Annual	Not to be exceeded	Same as primary standard		
Lead	1.5 µg/m^3	Quarterly	Not to be exceeded	Same as primary standard		

ppm = parts per million; µg/m^3 = micrograms-per cubic meter

* USEPA established new ozone and particulate matter standards in July 1997. However, because of legal questions concerning the authority for setting these standards, no regulatory enforcement actions have occurred.

Source: 40 CFR Part 50

Table 3.6-2
Locations of Air Quality Monitoring Stations in the Project Area

Monitoring Site ID	Site Description and Address	Latitude	Longitude	Responsible Entity
48-201-1039	Houston Deer Park 2 (C35/139), 5414 1/2 Durant Street, Houston	29° 40' 09"	-95° 07' 40"	TCEQ Houston Regional Office
48-201-0062	Houston Monroe (C406), 9726 1/2 Monroe, Houston	29° 37' 33"	-95° 16' 03"	City of Houston
48-201-1035	Clinton (C403/C113/C304), 9525 1/2 Clinton Drive, Houston	29° 43' 59"	-95° 15' 24"	TCEQ Houston Regional Office

August (Carr 1967, St. Clair *et al.* 1975). The average winter temperature is a mild 64.4ºF. Freezes are infrequent and of short duration, with an average of 271 frost-free days per year. Snow, sleet, and freezing rain are quite uncommon.

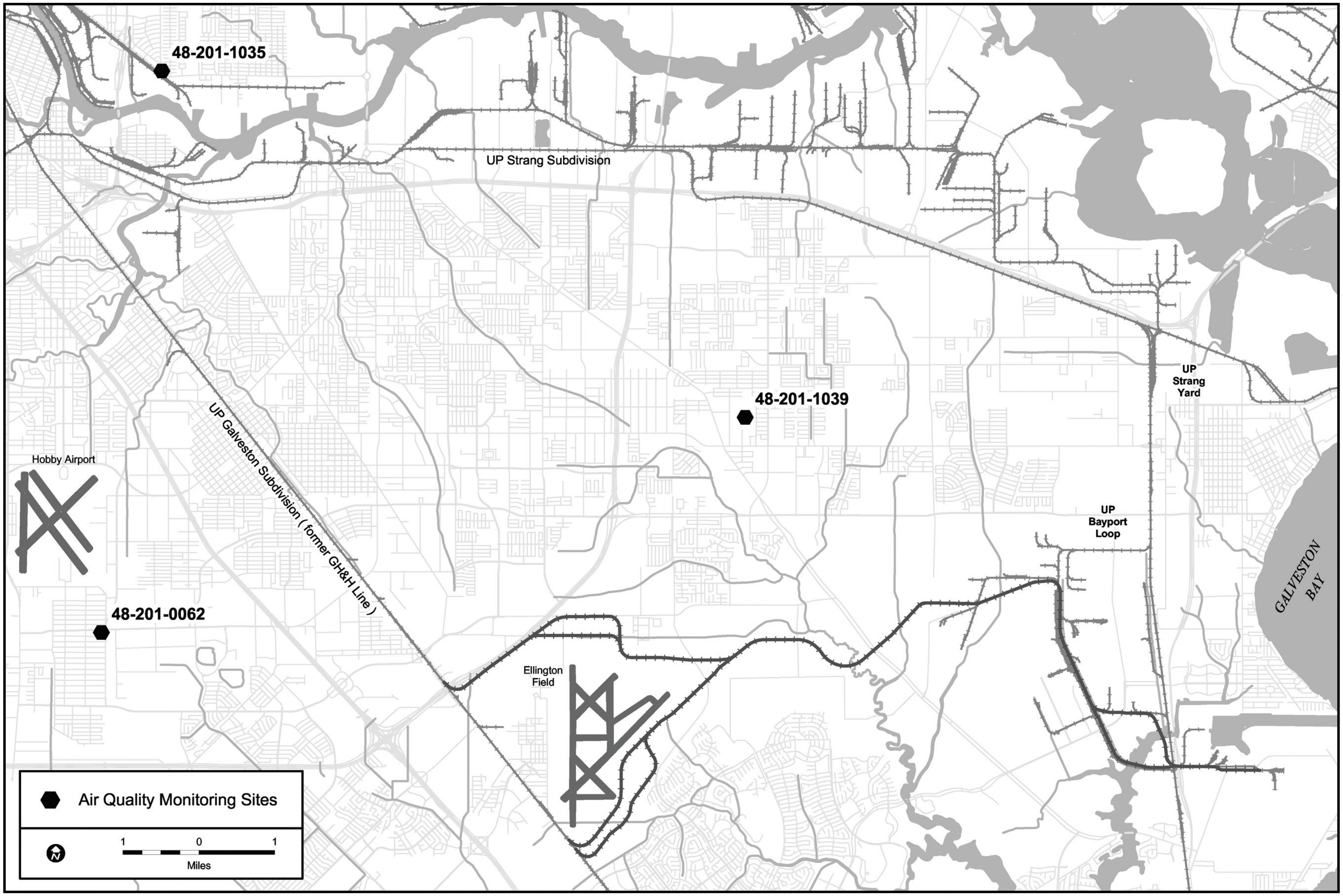
Another effect of the proximity of the Gulf of Mexico is abundant rainfall, which typically varies from 2.8 inches in March to 4.3 inches in December. July to December rainfall is often supplemented by tropical storms. Precipitation is fairly uniform throughout the year. Prevailing winds are usually from the south/southeast, except during the winter months when fast-moving, winter cold fronts bring a more northerly flow of air.

About a quarter of the days per year have clear sky cover during daylight periods, with a high number of clear days in October and November. Cloudy days are relatively frequent from December to May and partly cloudy days are more frequent for June through September. Sunshine averages nearly 60 percent of the possible amount for the year, ranging from 42 percent in January to 67 percent in June.

The year-to-year variability of weather in the HGA is generally considered to be an important cause of the variability in ozone levels. During years when there are a high number of sunny days combined with either stagnant wind conditions or winds that blow out into the Gulf of Mexico in the morning and then back onto the land in the afternoon, the eight-county area sees higher ozone levels and more exceedances of the one-hour standard. Peak ozone levels typically occur in the HGA during the early afternoon period. In the HGA, high concentrations of ozone usually occur between April and October, due to the greater likelihood of the presence of intense solar radiation, low wind speeds, and elevated temperatures during these months.

Elevated ozone levels occur more frequently in Houston and over a longer period of time during the year than in most other cities. The HGA Emissions Inventory indicates higher levels of NO_x and VOCs from industrial sources than in other areas. HGA meteorology is very complex and has a significant impact on ozone formation. The primary meteorological pattern that leads to high ozone concentrations is associated with an orderly clockwise rotation of wind directions each day. Under this pattern, urban and industrial emissions accumulate during the night and early morning as a result of light winds and low mixing heights. Ozone precursors are then often carried out into Galveston Bay, where sunlight generates high ozone levels, which remain

Figure 3.6-1
Locations of Air Quality Monitoring Stations in the Project Area



concentrated (because of the low mixing height over the cooler bay). The afternoon sea breeze then carries the pool of high ozone northwest, back across the city. The generally clockwise veering of wind direction during the day tends to keep ozone in the urban area on most days. Another meteorological pattern in the Houston area results in relatively low ozone. Although the air picks up high concentrations of VOCs and NO_x just as in the primary pattern, the winds are generally persistent, stronger, and do not go through the clockwise directional rotation. In this case, the persistent morning and afternoon winds carry the pool of ozone out of Houston to other areas.

3.6.2.2 Air Quality

Table 3.6-3 summarizes the ambient air quality levels that have been observed for O_3, NO_2, CO, SO_2, and PM at the three monitoring sites for the five most recent complete years available (1996-2000). The available data include annual means for all criteria pollutants, as well as maximum concentration values for the appropriate averaging period. The following section discusses the ambient air quality levels observed in the HGA and at the three selected monitoring sites.

Ozone (O_3)

The HGA has been a severe non-attainment area, second only to Los Angeles in the severity of the ozone problem. During the last 15 years, both ozone maximum concentrations and the number of exceedances in the HGA have generally declined. Further improvement is needed, however, to achieve compliance with the ozone NAAQS. USEPA has not yet issued an attainment or non-attainment designation for HGA for the relatively new 8-hour ozone standard, but a non-attainment designation is expected.

In 1999 (the most recent worst ozone year), ozone exceedances occurred on at least 14 days for at least one of the three nearby monitoring stations. The maximum 1-hour concentration measured at any of the three monitoring sites near the project area was 0.251 ppm. There were 26 days in which at least one of the three monitors detected ozone levels that exceeded the 8-hour standard of 0.08 ppm. The maximum 8-hour concentration measured at any of the three monitoring sites was 0.172 ppm.

Nitrogen Dioxide (NO_2)

HGA is in attainment for NO_2, and the average ambient concentration for the region has remained well below the annual NAAQS of 0.053 ppm, averaged over one year, for the past 15 years. The highest maximum annual average NO_2 concentration measured from 1996 through 2000 at any of the three monitoring sites near the project area was less than half of the standard.

Carbon Monoxide (CO)

HGA is in attainment for CO. From 1996-2000, neither the 1-hour NAAQS (35 ppm) nor the 8-hour NAAQS (9 ppm) was exceeded at any one of the three monitoring sites. The highest

Table 3.6-3
Maximum 1-hour, 8-hour and Annual Average Concentrations for Monitored Criteria Pollutants in the Project Area

Monitoring Site		O_3 (ppm)			NO_2 (ppm)		CO (ppm)			SO_2 (ppm)				PM_{10} (μg/m^3)		$PM_{2.5}$ (μg/m^3)	
		1-hr high	8-hr high	annual mean	1-hr high	annual mean	1-hr high	8-hr high	annual mean	1-hr high	3-hr high	24-hr high	annual mean	24-hr high	annual mean	24-hr high	annual mean
Clinton (C403/ C113/ C304) 48-201-1035	1996	0.15	0.12	0.044	0.17	0.02	7.5	6.7	0.64	0.111	0.074	0.039	0.005	-	-	-	-
	1997	0.168	0.129	0.0455	0.15	0.021	5.4	3.7	0.67	0.185	0.118	0.03	0.0044	137	43.5	-	-
	1998	0.21	0.131	0.0468	0.1	0.023	5.5	4.3	0.67	0.132	0.094	0.033	0.0041	-	-	-	-
	1999	0.231	0.145	0.0556	0.08	0.021	4.7	3.8	0.56	0.113	0.058	0.02	0.0051	-	-	38.3	17.12
	2000	0.201	0.121	0.0458	0.103	0.016	3.9	3.6	0.38	0.237	0.112	0.034	0.0062	110	45.8	39.9	14.26
Houston Monroe (C406) 48-201-0062	1996	0.164	0.108	0.0455	-	-	-	-	-	0.115	0.061	0.024	0.0034	49	-	-	-
	1997	0.197	0.15	0.0523	-	-	-	-	-	0.057	0.038	0.013	0.0029	84	25.8	-	-
	1998	0.23	0.172	0.0516	-	-	-	-	-	0.07	0.04	0.015	0.003	-	-	-	-
	1999	0.159	0.113	0.0571	-	-	-	-	-	0.068	0.033	0.012	0.0032	-	-	36	16.46
	2000	0.17	0.144	0.0497	-	-	-	-	-	0.059	0.035	0.013	0.0025	50	24.6	31	11.28
Houston Deer Park 2 (C35/139) 48-201-1039	1996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1997	0.214	0.128	0.0516	0.09	0.013	7.6	3.8	0.39	-	-	-	-	-	-	-	-
	1998	0.203	0.137	0.0457	0.14	0.011	5	3.3	0.34	-	-	-	-	-	-	-	-
	1999	0.251	0.172	0.0553	0.09	0.012	4.8	2.7	0.64	-	-	-	-	55	20.7	12.7	9.58
	2000	0.185	0.13	0.0528	0.08	0.012	4.8	2.2	0.36	-	-	-	-	40	18.6	42.7	14.31

Source: TCEQ

maximum annual average CO concentrations at these monitoring sites were measured in 1996: 7.6 ppm averaged over 1-hour and 6.7 ppm averaged over 8-hours.

Sulfur Dioxide (SO_2)

In the past ten years, a general reduction has occurred in the maximum observed SO_2 concentration. No exceedances of the NAAQS were observed during 1996-2000 at any of the three nearby monitoring sites. The highest maximum values were observed in 2000. The maximum SO_2 concentration measured 0.237 ppm averaged over 1-hour, 0.118 ppm averaged over 3-hours, 0.039 ppm averaged over 24-hours, and 0.0062 ppm averaged over the year.

Particulate Matter (PM_{10})

The Houston Regional Monitoring Corporation and TCEQ began monitoring PM_{10} in HGA in 1988 and 1990, respectively. Currently, HGA is in attainment for PM_{10}. No exceedances of the PM_{10} standards were observed at any of the three nearby monitors during 1996-2000. In 1997, the highest 24-hour maximum PM_{10} concentration was measured at 137 $\mu g/m^3$. In 2000, the highest annual maximum PM_{10} average was measured at 45.8 $\mu g/m^3$.

Particulate Matter ($PM_{2.5}$)

The Houston Regional Monitoring Corporation and TCEQ began monitoring $PM_{2.5}$ in HGA in 1999. Currently, HGA is not designated as an attainment or non-attainment area for $PM_{2.5}$, as insufficient data have been collected to make that determination. The Houston Monroe and Clinton sites have shown one year in which the annual average concentration has exceeded the standard.

Lead (Pb)

HGA has long been in attainment for Pb. In 1997, because all measurements of Pb at several monitoring sites were near or below the limit of detection (0.01 $\mu g/m^3$), TCEQ and the City of Houston phased out ambient monitoring in the eight-county HGA. One monitoring site maintained by the TCEQ Houston Regional Office still monitors for Pb in Harris County: USEPA site 48-201-1034, Houston East (C1), located at 1262 1/2 Mae Drive. During 1996-2000, the observed Pb levels at this site were well below the quarterly Pb NAAQS of 1.5 $\mu g/m^3$. In 1999, the highest maximum Pb concentration was observed at 0.04 $\mu g/m^3$. None of the three monitoring sites near the project area collected data on Pb levels in the air from 1996 through 2000.

3.7 WATER RESOURCES

3.7.1 Background

The regulatory programs of several Federal, state, and local agencies address water resources. Authorization under Section 10 of the Rivers and Harbors Act of 1899, administered by the USACE, would be required for work in navigable waters. A number of jurisdictional wetlands and jurisdictional waters of the U.S. also would be impacted by the Build Alternatives. Impacts to jurisdictional wetlands and waterways would require approvals under Sections 401 and 404 of the Clean Water Act (CWA). Section 404 of the CWA was established as an amendment to the Federal Water Pollution Control Act of 1972 to maintain the chemical, physical, and biological integrity of the nation's waters. Section 404 established a permit program administered by the USACE for the discharge of dredge and fill material into waters of the U.S. A Section 401 Water Quality Certification from the TCEQ would be granted concurrently with the Section 404 permits from the USACE, provided the project is constructed in accordance with applicable requirements, including Best Management Practices (BMPs) required by the TCEQ. The BMPs would include erosion and sediment controls required during construction and post construction controls for suspended solids.

Section 402 of the CWA would require a Texas Pollutant Discharge Elimination System (TPDES) storm water permit from the TCEQ or General Construction Permit from the USEPA for construction-related storm water discharges.[11] The Applicants would also have to secure a Storm Water Quality Permit from Harris County which requires implementation of BMPs for storm water quality management. In addition, the project must be reviewed for consistency with the Texas Coastal Management Program, which is administered by the Coastal Coordination Council of the Texas General Land Office (GLO). The review and consistency determination is required by the Federal Coastal Zone Management Act of 1972 (CZMA). Easements would also be needed from the Texas GLO for crossings of state-owned tidal waterways. Any impacts or crossings of flood control channels would require approval from the Engineering Division and the Flood Control Division of the Harris County Public Infrastructure Department.

Executive Order 11988 "Floodplain Management" requires Federal Agencies to consider whether a Proposed Action will occur in a floodplain and to consider Alternatives that avoid adverse effects and incompatible development in floodplains. The Executive Order also requires public notification if a proposed action would be located in a floodplain.

Executive Order 11990 "Protection of Wetlands" requires Federal Agencies to "take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in carrying out the Agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use ...." The Executive Order "does not apply to the issuance by Federal agencies of permits, licenses, or allocations to private parties for activities involving wetlands on non-Federal property." The Executive Order is applicable to this project because the Proposed Action would involve a decision by the FAA on a change to the Airport Layout Plan and releasing airport property and both the Proposed Action and Alternative 1C would involve a decision by NASA to grant an easement to cross an access road. The Executive Order requires public notification of plans for new construction in wetlands.

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[11] The TCEQ anticipates assuming the NPDES storm water program for construction related discharges from the USEPA in mid 2003. Therefore, the Applicants would need to secure a permit from the USEPA or TCEQ, depending on which agency administers the program when construction is set to begin.

SEA evaluated the water resources potentially affected by the Proposed Action and Alternatives, including the No-Action Alternative. The resources include surface waters (including intermittent and perennial streams, ponds, and rivers), ground water aquifers, floodplains, and wetlands within the project area. Appendix I provides more detailed information about the applicable regulatory programs and the analysis methodology.

3.7.2 Existing Conditions

3.7.2.1 Groundwater

The lower Gulf Coast of Texas is underlain by the Gulf Coast Aquifer system. This system is characterized by alternating beds of clay, silt, sand, and gravel, and comprises smaller water-bearing units. The sand subunits, which underlie Harris County, are the Chicot and Evangeline Aquifers. The Chicot Aquifer is the shallower unit and extends from near the surface to approximately 500 feet below mean sea level (msl). The Evangeline Aquifer is deeper and extends from approximately 500 feet to 2,200 feet below msl.

The Chicot and Evangeline Aquifers are geologically similar. They are composed of discontinuous deposits of sand, silt, and clay that thicken to the southeast (Williams and Ranzau, 1987). The outcrop area of the formations is approximately parallel to the coastline. The formations dip to the southeast and are confined in the southern and eastern parts of the region (HGCSD, 1998). Neither aquifer is a sole source aquifer in the project area. The Chicot Aquifer is a sole source aquifer in areas of Louisiana (USEPA, undated).

Chicot Aquifer: The Chicot Aquifer lies at depths from near the ground surface to about 500 feet below msl. The conductivity of the Chicot Aquifer is approximately twice that of the Evangeline Aquifer. Its transmissivity (groundwater flow) ranges from 3,000 to 25,000 square feet/day (Meyer and Carr, 1979). The groundwater flow rate is approximately 60 feet/year. Most of the recharge area for the Chicot Aquifer is located in Harris and southern Montgomery Counties. Although the Chicot Aquifer is not a sole source aquifer in the project area, it is the primary source of potable groundwater in southern Harris County, where the Proposed Action and Alternatives are located. Historic over-pumping of the Chicot Aquifer has led to land subsidence and in the past 20 years has led to the use of surface water to meet most of the area's water needs.

Evangeline Aquifer: The Evangeline Aquifer, which underlies the Chicot Aquifer at depths of approximately 500 to 2,200 feet below msl, is typically wedge shaped and has a high sand to clay ratio. The Evangeline Aquifer has a lower conductivity than the Chicot Aquifer. It is more transmissive because of its greater thickness. The primary recharge area of the Evangeline is located north of the Harris-Galveston District boundary in Montgomery and Grimes Counties, which is outside the project area (HGCSD, 1998). The Evangeline Aquifer is noted for high water quality and is considered one of the most productive aquifers in the area.

The U.S. Geological Survey (USGS) has estimated the average annual recharge in outcrops of both aquifers in the Houston area for the 1953-1990 period to be approximately six inches per year. Modeling estimates in 1990 predicted the perpetual annual effective recharge rate of the

Gulf Coast Aquifer System to be 302,700 acre-feet per year, or 270 million gallons per day (MGD).

The top of the zone of saturation (water table) in the Gulf Coast Aquifer System ranges from about 10 to 30 feet below land surface. Water level rises have occurred in the eastern and central regions of the Harris-Galveston Coastal Subsidence District, and significant declines have been noted in the western areas of Harris County. Groundwater withdrawals in the Harris-Galveston Coastal Subsidence District are subject to restrictions mandated by the District's Groundwater Management Plan, which was adopted on April 8, 1992.

Both the Chicot and Evangeline Aquifers have relatively good water quality. After disinfection, the aquifers are of sufficient quality to support most water uses. Both aquifers contain fresh water with less than 1,000 mg/l total dissolved solids (TDS). Groundwater in the project area is protected by the City of Houston's Wellhead Protection Program, which provides standards for all affected well holders. In addition, the TCEQ has a voluntary Wellhead Protection Program, which helps to protect groundwater in the project area (HGCSD, 1998).

3.7.2.2 Floodplains

Southeast Harris County has a substantial floodplain area due to the presence of many rivers and bayous. Most flooding results from tropical storms and hurricanes, with the most recent flood in June 2001, when Harris County experienced severe flooding due to Tropical Storm Allison.

To reduce the escalating costs of flood-related property damage, Congress created the National Flood Insurance Program (NFIP) in 1968. The program, which is administered by the Federal Emergency Management Agency (FEMA), provides flood insurance in communities that agree to implement programs to reduce future flood risks. Harris County joined the NFIP in May 1970, and flood control programs are administered by the Harris County Flood Control District (HCFCD). HCFCD has developed several flood control projects in southeast Harris County. For example, parts of Armand Bayou, Horsepen Bayou, Big Island Slough, and Spring Gully have been channelized to improve drainage and convey flood flows. In addition, several storm water drainage channels have been constructed in the project area.

EO 11988, entitled Floodplain Management, requires Federal agencies to take actions to reduce the risk of flood damage, to evaluate the potential effects of actions they may take or allow in floodplains, and to consider Alternatives to avoid adverse effects. To evaluate the extent to which the Build Alternatives would be located in floodplains, SEA used FEMA Flood Insurance Rate Maps (FIRM), Letters of Map Revision (LOMR), and Conditional LOMR, which have been approved by the local Floodplain Administrator.[12]

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[12] SEA used 1996 FIRM data. Certain FIRM Panels have been revised since that time, becoming effective on April 20, 2000. The 2000 revisions include minor floodplain boundary changes within one FIRM Panel for the project area (Panel 48201C1060 K). The 1996 data were used because the Geographic Information System (GIS) data for the 2000 revisions were unavailable when this analysis was conducted. However, the use of 2000 data would not significantly affect the analysis of floodplain

(continued...)

Figure 3.7-1 shows that the Build Segments of the Proposed Action and Alternatives cross 100-year and 500-year floodplains associated with Horsepen Bayou, Armand Bayou, Spring Gully, Big Island Slough, and Taylor Bayou. Taylor Bayou is the widest waterway traversed by the Build Alternatives, and has the widest 100-year floodplain area in the right-of-way. As shown in Figure 3.7-1, 100-year coastal floodplains are present along the shoreline of Galveston Bay, but are outside the project area.

3.7.2.3 Surface Waters

The project area is located primarily within the San Jacinto-Brazos Coastal Basin, which spans portions of Brazoria, Fort Bend, Galveston and Harris Counties. This basin is described by the HGAC as the flat coastal plain between the San Jacinto and Brazos River Basins. The drainage area of the San Jacinto-Brazos Coastal Basin is approximately 1,440 square miles, and drains toward Galveston Bay in the east and directly to the Gulf of Mexico in the west. The principal tributaries in the basin are Clear Creek, Armand Bayou, Dickinson Bayou, Chocolate Bayou, Bastrop Bayou, and Oyster Creek. The eastern terminus of the project area is located in the drainage basin for the Bayport Channel, which drains directly into Galveston Bay. The northern portion of the project area drains into the Houston Ship Channel (Buffalo Bayou), which ultimately drains into Galveston Bay.

The project area is within the West Galveston Bay watershed of the San Jacinto-Brazos Coastal Basin. This watershed includes 12 rivers and more than 240 lakes (USEPA, 2002). Figure 3.7-2 shows the surface waters in the project area. The surface waters, crossed by the proposed construction include five perennial streams/bayous, two intermittent tributaries, several drainage channels, man-made basins, and no lakes.

The Proposed Action and Alternatives 1C, 2B, and 2D, and the original Taylor Bayou crossing would cross both freshwater and tidal surface waters. The Build Alternatives would cross Horsepen Bayou, Armand Bayou, Spring Gully, and Big Island Slough, two unnamed tributaries to Armand Bayou, several unnamed drainage channels, Taylor Bayou, and man-made flood control channels. None of these surface water bodies are listed on the Draft Year 2002 Summary of Impaired Water Bodies. The list of impaired waterways is developed by the TCEQ as required under Section 303 (d) of the Federal CWA (TNRCC, 2002). However, the Bayport Channel (Segment 2438), portions of Upper Galveston Bay (Segment 2421) and portions of Clear Creek (Segments 1101 and 1102) are listed as impaired water bodies. All of these impaired segments are located downstream of the proposed stream crossings of the Build Alternatives. In addition, the tidal portion of Armand Bayou was included on the 2000 309(d) list for an impairment due to depressed oxygen levels in its upper two miles. None of the surface water bodies in the project area are listed on the National Inventory of Wild and Scenic Rivers. (NPS, 2001) The project area is located within the watershed of Galveston Bay, which is included in the National Estuary Program. The Galveston Bay Estuary Program was established in 1989 and a Comprehensive Conservation and Management Plan (CCMP) called the Galveston Bay Plan was approved by the EPA in 1995.

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[12] (...continued)
impacts because the boundary revisions were minor and applied to a small section of the project area.

Figure 3.7-1
Floodplains

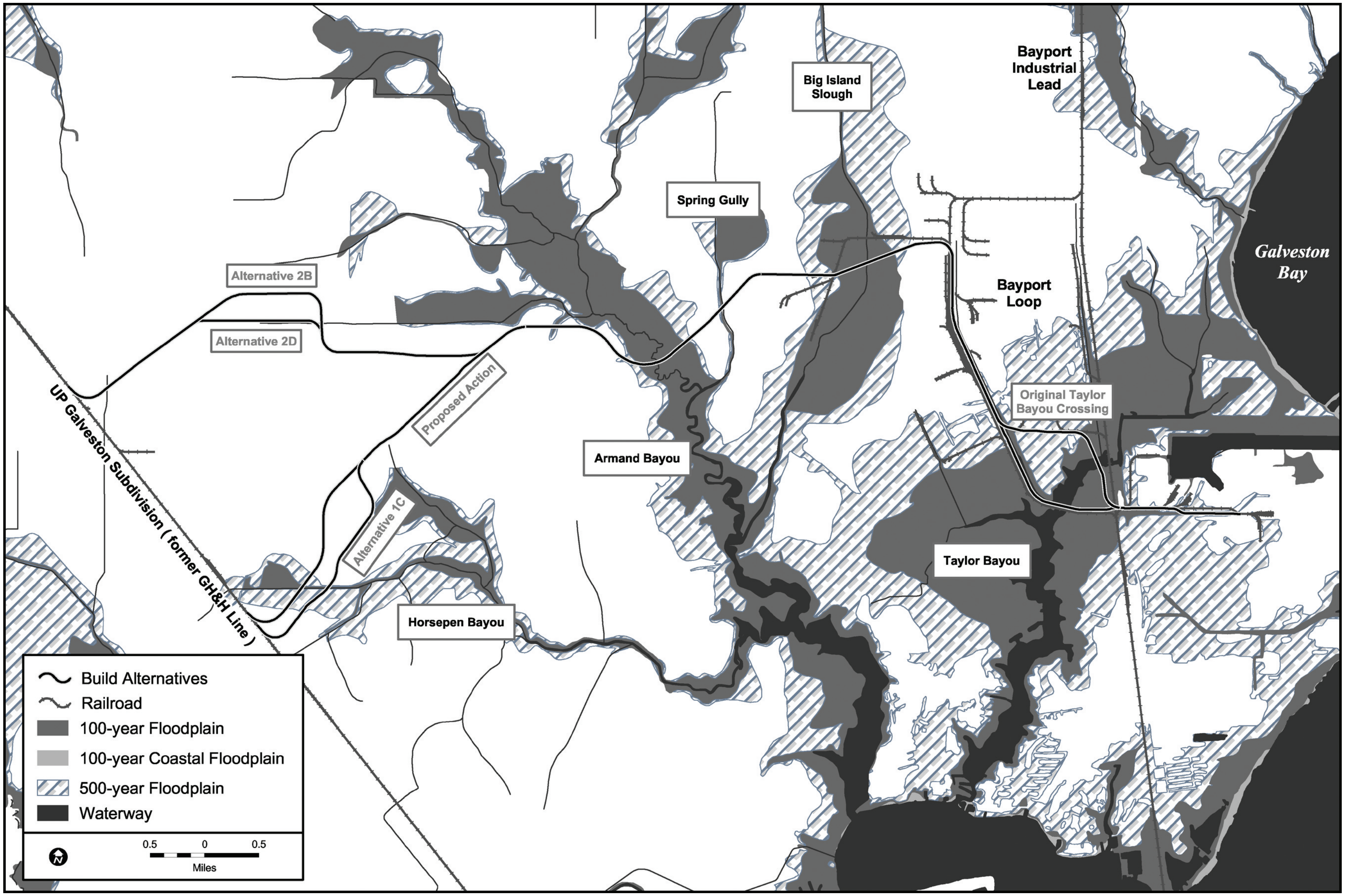
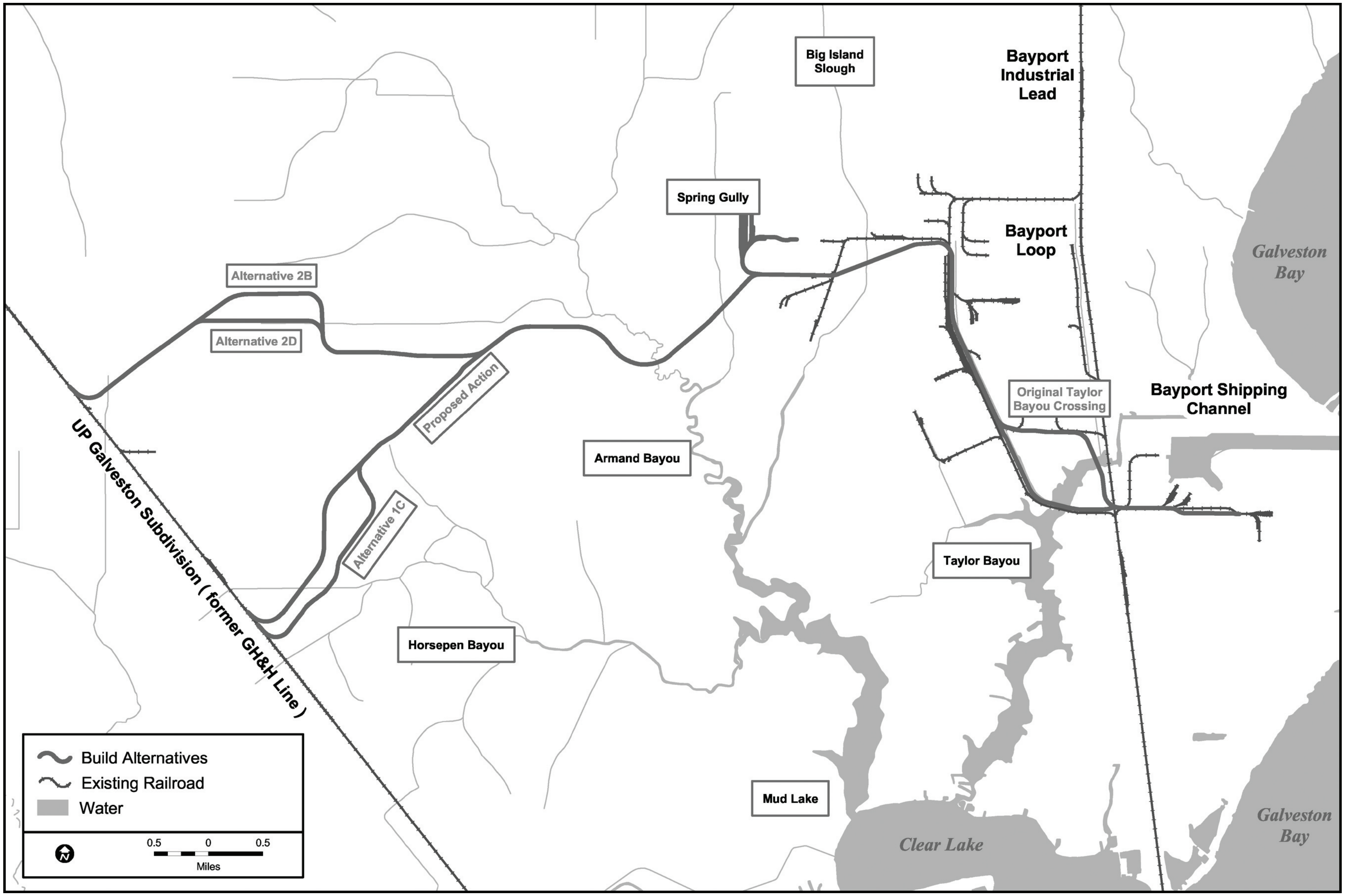


Figure 3.7-2
Surface Water



The No-Build and Build Alternatives would use existing rail lines that cross or are proximal to multiple streams and drainage channels, including 19 unnamed drainage channels and unnamed tributaries, Sims Bayou, Gully Creek and Plum Creek, Brays Bayou, Buffalo Bayou, Hunting Bayou, Greens Bayou, Spring Gully, Carpenters Bayou, Sheldon Reservoir, San Jacinto River, Jackson Bayou, Cedar Bayou, Dayton Canal and East Prong.

Under the No-Action Alternative, UP trains would continue to serve the Bayport Loop from the Strang Subdivision, which crosses or is proximal to multiple streams and drainage channels, including Taylor Bayou, six unnamed drainage channels, Buffalo Bayou, Boggy Bayou, two unnamed tributaries of Boggy Bayou, Vince Bayou, and Sims Bayou.

Horsepen Bayou, Spring Gully, Big Island Slough, and Taylor Bayou have been channelized to improve drainage and flood control. Armand Bayou is the only perennial surface water body in the project area that has not been channelized for most of its length. Drainage channels in the project area are maintained by HCFCD. Additional information about the major surface waters intersected by the Proposed Action and Alternatives is provided below.

Horsepen Bayou is a significant tributary of Armand Bayou that flows east through Clear Lake City and joins Armand Bayou in its tidal reach. The bayou has been channelized and is maintained by HCFCD. The mean width of the channel at its ordinary high water mark is approximately 6 feet. HCFCD maintains a non-jurisdictional drainage channel that flows generally southwest and originates near the north end of Ellington Field. The channel was created in the early 1970s and now includes a large detention basin (HCFCD Detention Basin B504-01-00) south of Ellington Field. The USACE and HCFCD will determine any relevant permitting issues for impacts to this storm water detention basin because it contains wetlands created under Permit Number 21155.

Armand Bayou originates in central Pasadena, 20 miles south of Houston in southeastern Harris County, and runs 10 miles southeast along the eastern edge of the Clear Lake oilfield to its mouth on Mud Lake, just west of Taylor Lake Village. The bayou flows through urban Pasadena into a flat grassy prairie and riparian forest that supports hickory, holly, oak, elm, and ash located to the north and south of the Build Alternatives. Armand Bayou is tidal for approximately 8 miles above its confluence with Clear Lake. The portion of Armand Bayou between Red Bluff Road and Mud Lake is a scenic, relatively undisturbed bayou. Its tidal channel has been designated as the Armand Bayou Coastal Preserve, which is one of four coastal preserves designated by the State. Under the Texas Coastal Preserve Program, the Texas GLO leases the preserve to the TPWD, which manages the water and biological resources. Armand Bayou is listed as a Seasonal and Restrictive Waterway by the Texas Parks and Wildlife Department (TPWD) because of insufficient flow for recreational use under normal conditions and because it could not be classified as a major waterway (TPWD, 2002). However, the Armand Bayou Coastal Preserve is open to non-motorized boats and is regularly used for recreational boat trips (Texas Parks and Wildlife Commission, 1999). Armand Bayou is designated as an Ecologically Significant River and Stream Segment in accordance with the Texas Water Development Board's rules (31 TAC 357.8).

The project area also includes the 2,500-acre Armand Bayou Nature Center, which is located off Bay Area Boulevard and contains coastal prairie habitat, wooded streams, fresh and saline lakes, and wetlands. The property is owned by Harris County and is leased to the Armand Bayou Nature Center as a nature preserve and educational facility. The Armand Bayou Nature Center and the Armand Bayou Coastal Preserve are partners in protecting remnants of the region's wetlands, bottom land forest, and tall grass prairie ecosystems.

The State of Texas has determined that water quality in Armand Bayou (Segments 1113 and 1113-A) is suitable for swimming, wading, and fishing, and that it supports a high quality aquatic ecosystem (TNRCC, 2001). Water quality testing has found that bacteria levels in its upper reaches are occasionally elevated, creating a potential health risk to people who swim or wade in the bayou. In addition, periodic low dissolved oxygen levels have occasionally caused fish kills and impacted other aquatic life. The TCEQ (2002) recently prepared two draft Total Maximum Daily Loading (TMDL) plans for Armand Bayou because of occasional problems with elevated bacteria levels and low dissolved oxygen levels. TCEQ has not established a TMDL allocation because available data do not indicate impairment of the aquatic life community or a pollutant that needs to be controlled.

The Build Alternatives would also cross two unnamed intermittent tributaries to Armand Bayou near the Tejas Gas (Kinder-Morgan) plant.

Spring Gully is a small, channelized perennial tributary of Armand Bayou that runs south from La Porte, Texas, and joins Armand Bayou south of Red Bluff Road. The total length of Spring Gully is less than 3 miles. Its width is approximately 10 feet. Just to the east of Spring Gully, the Build Alternatives would cross open pastureland containing four shallow non-jurisdictional drainage channels. Each of these channels is approximately 3 feet wide and 2 feet deep.

Big Island Slough begins near the intersection of SH 244 and Miller Road in southeastern Harris County and flows about 7 miles to its mouth on Armand Bayou, 3 miles northwest of Clear Lake. Big Island Slough traverses flat, flood-prone grasslands and is a broad river with lush banks and tall trees (TSHS, 2001a). Analysis of historical aerial photographs indicates that Big Island Slough was channelized before 1953. It is now about 20 to 25 feet wide with a narrow riparian buffer and steep slopes.

Taylor Bayou is a tidal water body located north of Clear Lake between Taylor Lake Village and Seabrook. Taylor Bayou begins near the Bayport Channel and flows approximately 3 miles to its mouth at Clear Lake. Tidal marshes exist along most of the banks of the bayou. The tidal marshes, substrate, and water column are designated as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). The portion of Taylor Bayou in the project area has been crossed previously by several roads, rail lines, and pipelines. An abandoned borrow pit is connected to Taylor Bayou to the north of Port Road. This borrow pit includes tidally influenced open water and a wetland fringe. This abandoned borrow pit would be crossed by the Original Taylor Bayou Crossing, but not by any of the other Build Alternatives.

The Build Alternatives would run adjacent to a large HCFCD drainage channel in the Bayport Loop. This channel is tidally influenced through its connection to Taylor Bayou south of Bay Area Boulevard and was determined to be jurisdictional waters of the U.S.

3.7.2.4 Wetlands

The locations of wetlands in the project area were identified using the National Wetlands Inventory (NWI) maps, the National Resource Conservation Service (NRCS) Soil Survey of Harris County, Texas, one meter color infrared digital orthophotography, and an onsite delineation. The Applicants performed field delineation of wetlands and waters of the U.S. along the proposed alignments for their Section 404/401 permit application.[13] The delineation was conducted in accordance with the USACE 1987 Wetland Delineation Manual (USACE, 1987) and subsequent regulatory guidance. The Applicants' delineation was verified by SEA and information from the delineation has been included here. The wetland delineation and jurisdictional determination for the wetlands along the Proposed Action have been field verified by the USACE Galveston District and the confirmation letter will be issued soon.

The Applicants' delineation was performed in accordance with recent guidance from the USACE Galveston regulatory personnel concerning the Supreme Court ruling in *Solid Waste Agency of Northern Cook County* v. *U.S. Army Corps of Engineers*, No. 99-1178 (SWANCC, 2001). As a result of the ruling, isolated wetlands are not generally considered within the jurisdiction of the USACE under Section 404 of the CWA.

Figure 3.7-3 shows the wetlands and wetland types in the project area according to the NWI maps, published by the USFWS. The NWI maps are based on photo interpretation only and therefore are typically used only as a guide. The Build Alternatives would cross and potentially impact both jurisdictional and non-jurisdictional (isolated) wetland areas. The Build Alternatives would intersect a total of about 80 wetlands, including about 20 jurisdictional and about 60 non-jurisdictional wetlands. The wetlands delineated within the right-of-way of the Build Alternatives include tidally influenced wetlands, freshwater wetlands, gilgai habitats (a mosaic of uplands and wetlands), and non-jurisdictional (isolated) wetlands. Figures 3.7-4a and 3.7-4b illustrate the wetland areas delineated within the project area.

The tidally-influenced wetlands exist primarily in the eastern portion of the project area. The typical Cowardin Classification for these wetland areas is Estuarine Intertidal Emergent Persistent Regularly Flooded (E2EM1N) (USFWS, 1992). The dominant vegetation in the tidal wetlands varies according to location, but commonly consists of gulf cordgrass (*Spartina spartinae*), marshy cordgrass (*Spartina patens*), leafy three-square (*Scirpus robustus*), smooth cordgrass (*Spartina alterniflora*), and seacoast sumpweed (*Iva frutescens*).

[13] A small portion of the alignments on the City of Houston's property near the Southeast Water Treatment Plant and NASA facility were not field delineated because right-of-entry to the property was not provided by the City of Houston.

Figure 3.7-3
Wetlands Shown on National Wetlands Inventory Map

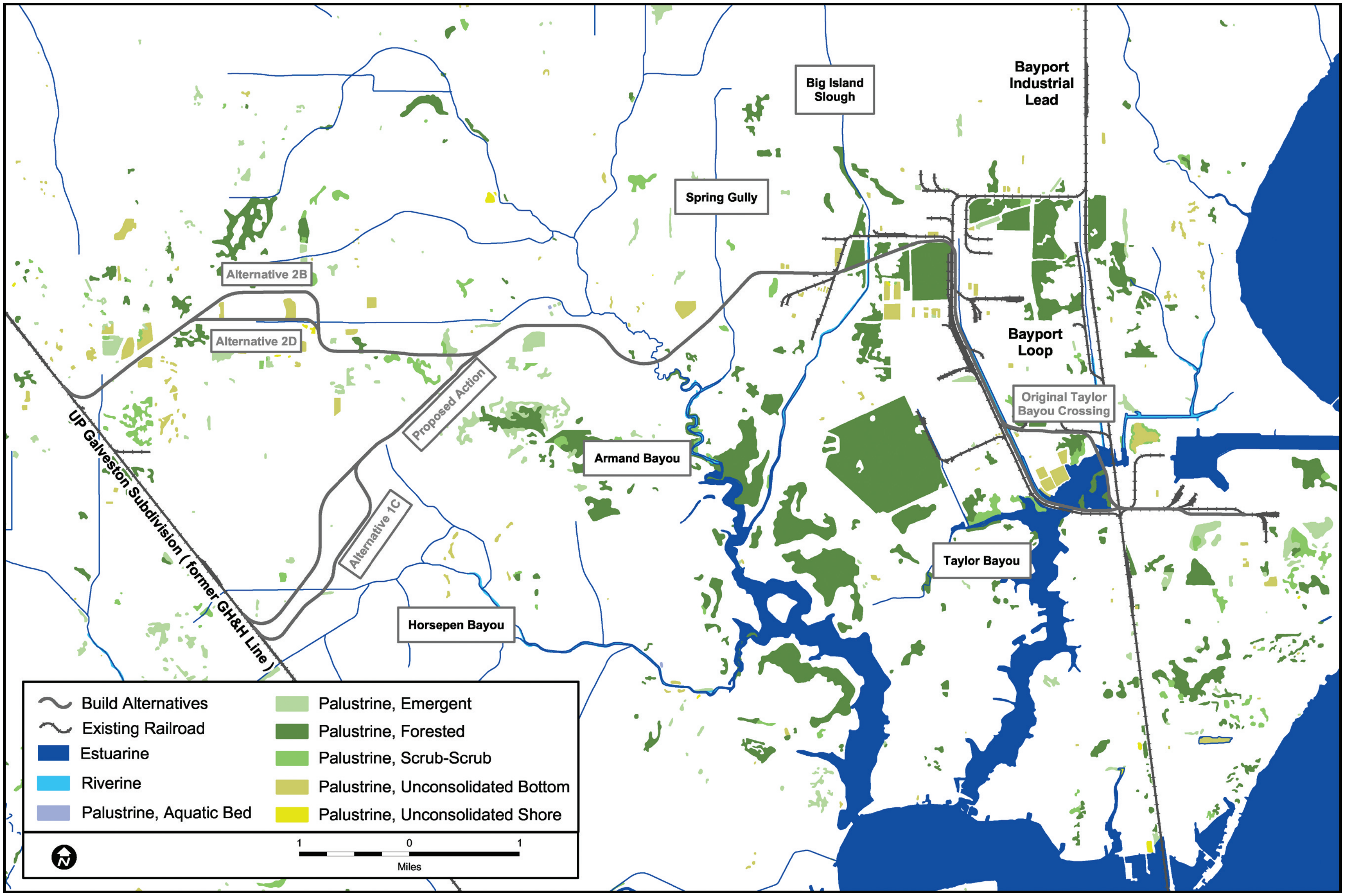


Figure 3.7-4a
Delineated Wetland Areas Along the Right-of-Way for the Build Alternatives

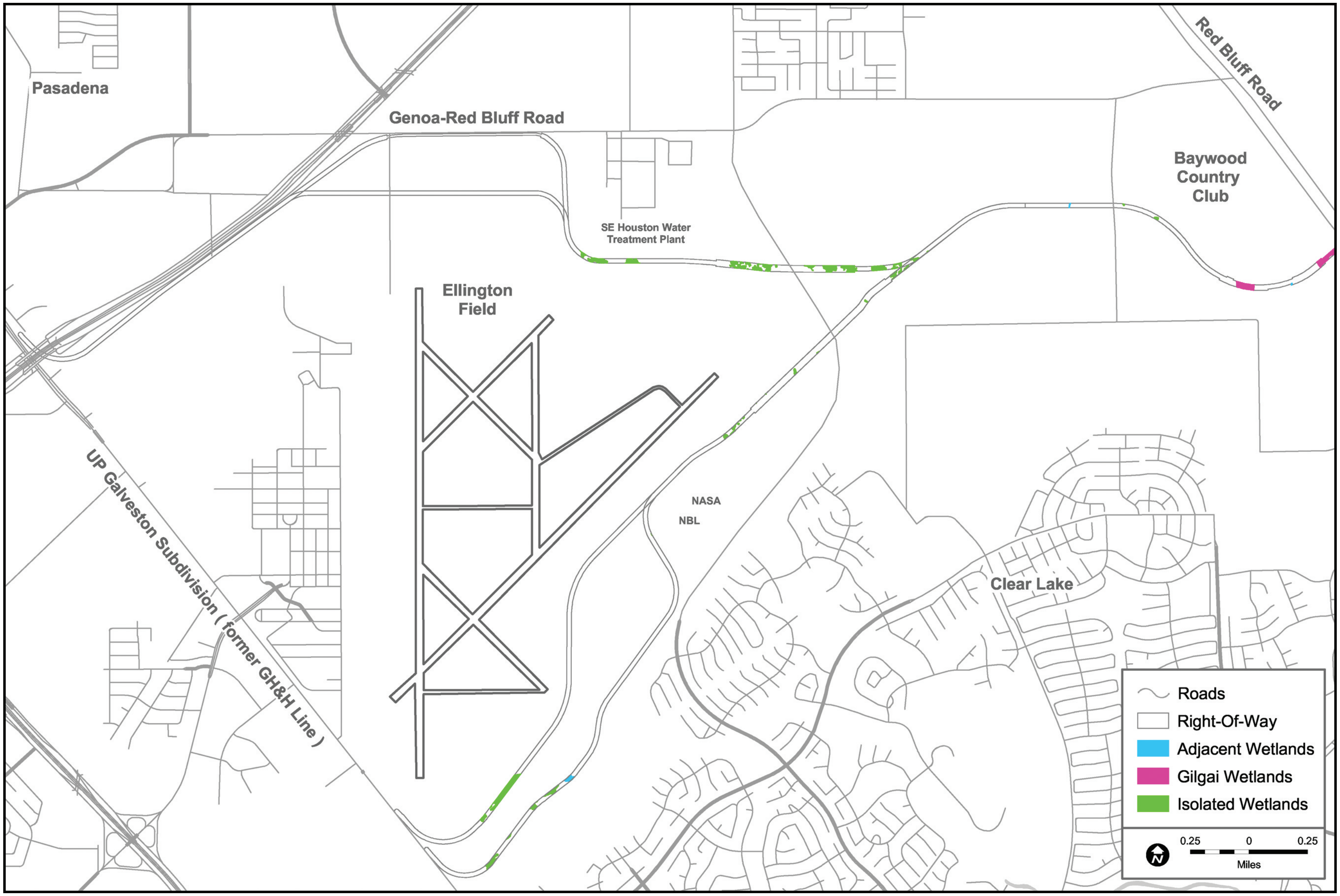
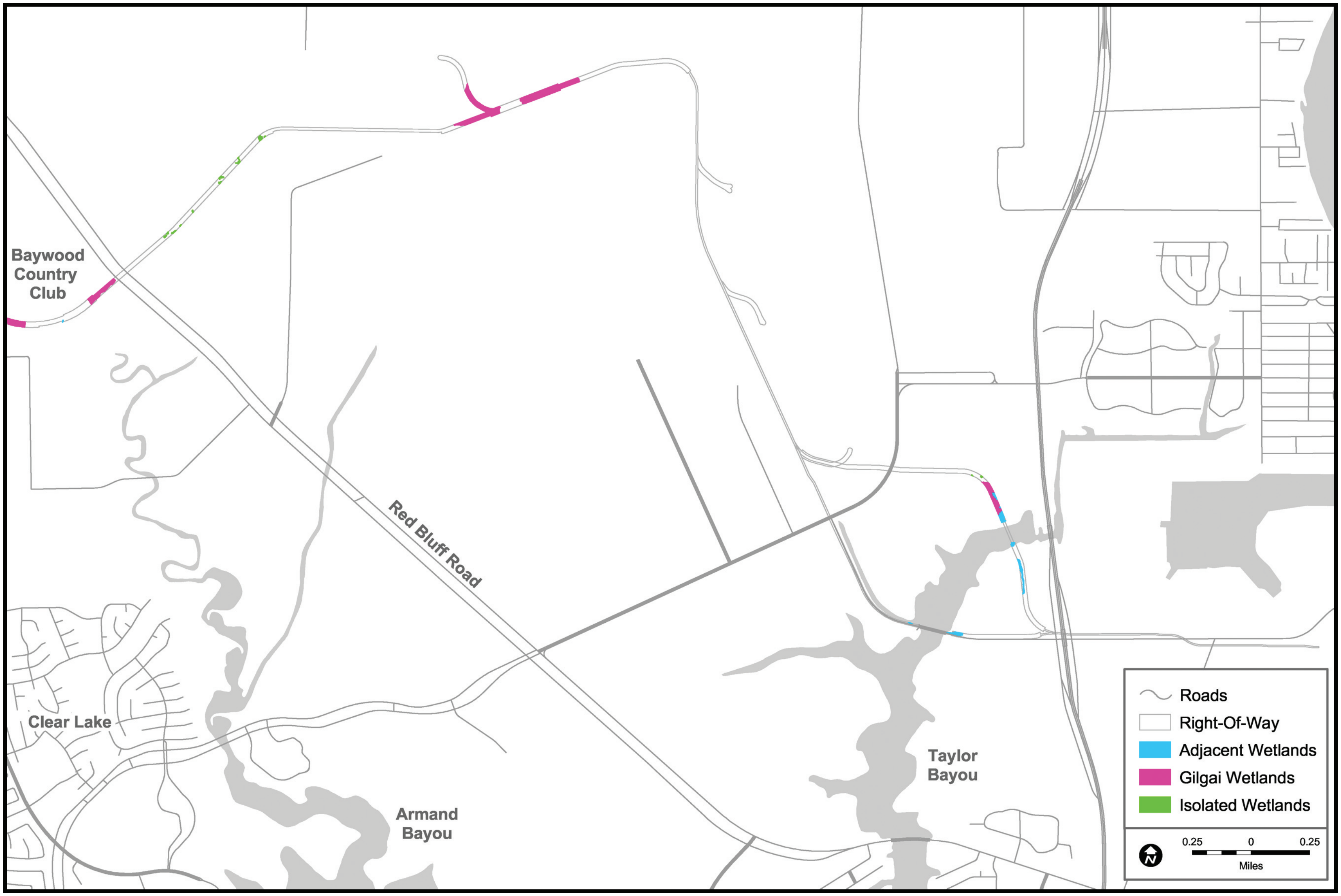


Figure 3.7-4b
Delineated Wetland Areas Along the Right-of-Way for the Build Alternatives



The jurisdictional gilgai habitats are relatively flat areas consisting of a network of small wetland depressions and upland areas interspersed in a mosaic pattern. The typical Cowardin Classification for these wetland areas is Palustrine Forested Broad-leaved Deciduous (PFO1A). The gilgai habitats are located within the 100-year floodplain of Taylor and Armand Bayous and Big Island Slough. The gilgai habitats were identified by the percentage of depressional areas within the site, as recommended by the USACE Galveston District. The dominant vegetation in these areas varies according to location, but commonly consists of willow oak (*Quercus phellos*), water oak (*Quercus nigra*), post oak (*Quercus stellata*), sugar hackberry (*Celtis laevigata*), Alabama supplejack (*Berchemia scandens*), yaupon (*Ilex vomitoria*), narrow wood oats (*Chasmanthium laxum*), basket grass (*Oplisminus hirtellus*), and Chinese tallow (*Sapium sebiferum*).

The non-jurisdictional, isolated wetlands are typically depressional sites in level areas or are isolated due to extensive channelization. The typical Cowardin Classification for these wetland areas is Palustrine Emergent Persistent Semipermanent (PEM1F). The isolated wetlands are commonly found in cleared pasture lands associated with mima mounds and consist of various grasses, sedges, and shrub species. The dominant vegetation varies according to location, but commonly consists of beakrush (*Rhyncospora* Spp.), camphorweed (*Pluchea purpurascens*), fiddle-leaf (*Hydrolea ovata*), rattle bush (*Sesbania drummondii*), and white-top sedge (*Dichromea colorata*).

The Proposed Action and Alternative 1C would cross a 52-acre wetland restoration site that is located near Ellington Field. This wetland restoration site was required by the USACE to compensate for impacts to jurisdictional wetlands from the construction of Space Center Boulevard. Restoration activities recently began on the site, including removal of Chinese tallow trees.

3.8 BIOLOGICAL RESOURCES

3.8.1 Background

SEA evaluated the biological resources potentially affected by the Proposed Action and Alternatives and the No-Action Alternative. The resources evaluated include the dominant plant communities, fish and wildlife resources (including EFH), and endangered, threatened, and rare species. SEA also analyzed the regulatory programs and regulatory approvals that may be involved if one of the Build Alternatives is constructed. Appendix J provides more detailed information about the data sources, methodology, and regulatory programs. Appendix J also includes the EFH Assessment Report submitted by SEA to the NMFS to satisfy the consultation requirements of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

MSFCMA Section 305 (b) requires that Federal agencies consult with the NMFS on all actions that may adversely affect EFH. EFH includes tidal wetlands, submerged aquatic vegetation, the water column, and aquatic substrate that is necessary for spawning, breeding, feeding or growth of species managed by the Generic Amendment for EFH in the Fishery Management Plan of the Gulf of Mexico. In addition, Federal agencies must include measures that are proposed for avoiding, mitigating, or offsetting any adverse impact of the proposed activity on EFH.

Section 7 of the Federal ESA requires the Board to consult with the USFWS and the NMFS and to ensure that any action it authorizes does not jeopardize the continued existence of a Federally-listed species or result in the destruction or adverse modification of designated critical habitat. TPWD regulations prohibit the taking without a permit of any animal species designated by state law as threatened or endangered. TPWD regulations also prohibit commerce in threatened and endangered plants and the collection without a permit of listed plant species from public land.

The Migratory Bird Treaty Act requires that the Applicants consult with the USFWS and possibly secure a permit, if a protected bird species, egg, nest, or bird part is taken by the project. Typically, the USFWS requires a permit for the taking of a raptor nest because they are re-used from year-to-year. Field studies identified a nest of the Northern Caracara that could be impacted by Alternative 2B or 2D. The Applicants have committed to conducting a survey for Northern Caracara nests if either Alternative 2B or 2D is constructed.

3.8.2 Existing Conditions

3.8.2.1 Plant Communities

The project area is located in the Texas Coastal Plain and Gulf Coast Prairie and Marshes Ecological Region. The undeveloped area of this region is relatively level and consists of multiple slow-moving bodies of water that are lined by floodplain forests. Saltwater marshes are common adjacent to the coastal areas and remnant coastal prairies are interspersed with fresh water marshes. Much of the project area has been altered due to agricultural, residential, commercial, industrial, and oil/gas development, plus the ongoing disturbance from feral pigs and cattle.

Historically, the area was covered with coastal grasslands, which were dominated by a variety of grasses, such as carpet grass (*Axonopus affinis*), seep muhly (*Muhlenbergia reverchonii*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), and brownseed paspalum (*Paspalum plicatulum*). The bottomland hardwood forests that existed along the rivers were dominated by a variety of oaks (*Quercus* spp.), sugar hackberry (*Celtis laevigata*), and sweetgum (*Liquidamber styraciflua*).

Currently, the remaining natural areas within the project area consist of bottomland hardwoods, grassland/pasture, marsh/shrub wetland areas, coastal prairie, and Chinese tallow (*Sapium sebiferum*) dominated areas. Portions of the grasslands within the corridors are maintained by mowing or shredding, presumably to control invasive shrubs and Chinese tallow trees. The undeveloped coastal prairie habitat that remains is generally used for grazing and is dominated by a variety of native and non-native species, including Chinese tallow, carpet grass, sumpweed, seep muhly, Bermuda grass (*Cynodon dactylon*), and rattlepod (*Sesbania drummondii*).

Much of the old field/rangeland habitat and coastal prairie has been invaded by the introduction of the Chinese tallow. Although depressional wetlands exist in the project area, many have been affected by Chinese tallow invasion, past drainage activities, development, construction, feral pigs, and cattle.

The forested areas in the vicinity of the proposed project are located predominantly within the 100-year floodplain of Taylor and Armand Bayous and Big Island Slough. The dominant vegetation varies according to location, but commonly consists of willow oak, post oak, and Chinese tallow in the canopy with an understory dominated by yaupon (*Ilex vomitoria*), dwarf palmetto (*Sabal minor*), American beautyberry (*Callicarpa americana*), blackberry (*Rubus* spp.), narrow wood oats, and basket grass. Table 3.8-1 lists the vegetation observed in the project area during the site investigations.

The project area includes a number of different plant communities. Figure 3.8-1 illustrates the main plant communities that were identified within the project area, which are also listed below:

- Bottomland hardwood, including areas invaded by Chinese tallow.
- Improved grassland/pasture.
- Marsh/shrub wetlands.
- Coastal prairie, including areas invaded by Chinese tallow.
- Riverine/riparian.
- Chinese tallow dominated.

The remainder of the project area consists of mixed residential, commercial, and industrial development and related facilities with little to no natural habitat. There are no National Forests, National Parks, or National Wildlife Refuges located in the project area (NPS, 2001). However, the Armand Bayou Nature Center is a 2,500-acre preserve and educational facility that is located to the south of the Build Segments. The land is owned by Harris County but leased to the Armand Bayou Nature Center. The facility includes forest, wetland, and coastal prairie preserves and several areas where native ecosystems are being restored.

3.8.2.2 Fish and Wildlife Resources

The project area includes a number of natural areas that support a variety of mammals, birds, reptiles, amphibians, and aquatic life. Much of the habitat in the project area has been disturbed and fragmented by past agricultural, urban, commercial, industrial, and gas/oil development. The least disturbed forest habitat within the project area is located along Armand Bayou and the 2,500-acre Armand Bayou Nature Center. Table 3.8-2 lists the wildlife species observed during the field investigations.

The wildlife observed in the project area has probably adapted to living in the fragmented habitat that remains in the Houston area. The common wildlife species are mobile and can access and use the available undeveloped areas located in the project area. The streams and bayous in the project area provide aquatic habitat to a variety of fish and other aquatic organisms. Table 3.8-3 lists the aquatic species known to occur or that probably occur in Armand and Taylor Bayous. Many species of birds were observed in the project area that are regulated by the Migratory Bird Treaty Act, which is administered by the USFWS.

Table 3.8-1
Vegetation Observed in the Project Area

Trees

willow oak (*Quercus phellos*)
post oak (*Quercus stellata*)
blackgum (*Nyssa sylvatica*)
yaupon (*Ilex vomitoria*)
Chinese tallow (*Sapium sebiferum*)

Grasses, Sedges, Rushes, and Vines

whitetop sedge (*Dichromena colorata*)
great coneflower (*Rudbeckia maxima*)
cypress swamp sedge (*Carex joorii*)
panic grass (*Panicum hians*)
black seedgrass (*Chloris virgata*)
false fiddle-leaf (*Hydrolea ovata*)
clubrush (*Eleocharis cellulosa*)
prairie cordgrass (*Spartina pectinata*)
cut grass (*Leersia virginica*)
grasslike fimbry (*Fibristylis miliacea*)
rustyseed paspalum (*Paspalum langei*)
carpet grass (*Axonopus affinis*)
short-bristle beakrush (*Rhyncospera corniculata*)
anglestem beakrush (*Rhyncospera caduca*)
centella (*Centella asiatica*)
blazing star (*Liatris acidota*)
blue panicgrass (*Panicum coloratum*)
beaked panicgrass (*Panicum anceps*)
hians panicgrass (*Panicum hians*)
redtop panicgrass (*Panicum rigidulum*)
varible panicgrass (*Dichanthelium commutatum*)
grassleaf rush (*Jncus marginatusi*)
softrush (*Juncus effusus*)
elliott's rush (*Juncus elliotti*)
clustered bushmint (*Hyptis alata*)
purple false foxglove (*Agilinus purpurea*)
eared redstem (*Ammania auriculata*)
poorjoe (*Diodia teres*)
climbing hempvive(*Mikania scandens*)
Missouri ironweed (*Vernonia missourica*)
sesbania (*Sesbania vesicaria*)
sharpscale flatsedge (*Cyperus oxylepis*)
broad-leaf signal grass (*Brachiaria platyphylla*)
justiceweed (*Eupatorium leucolepis*)
signal grass (*Brachiaria reptans*)
common reed (*Phragmites australis*)
seaside goldenrod (*Solidago sempervirens*)
needlegrass rush (*Juncus roemerianus*)
saltmeadow cordgrass (*Spartina patens*)
seashore dropseed (*Sporobolus virginicus*)
trumpet creeper (*Campsis radicans*)
southern dewberry (*Rubus trivialis*)
narrowleaf primrosewillow (*Ludwigia linearis*)
saltmarsh camphor-weed (*Pluchea purpurascens*)
annual saltmarsh aster (*Aster sobulatus*)

Figure 3.8-1
Plant Communities

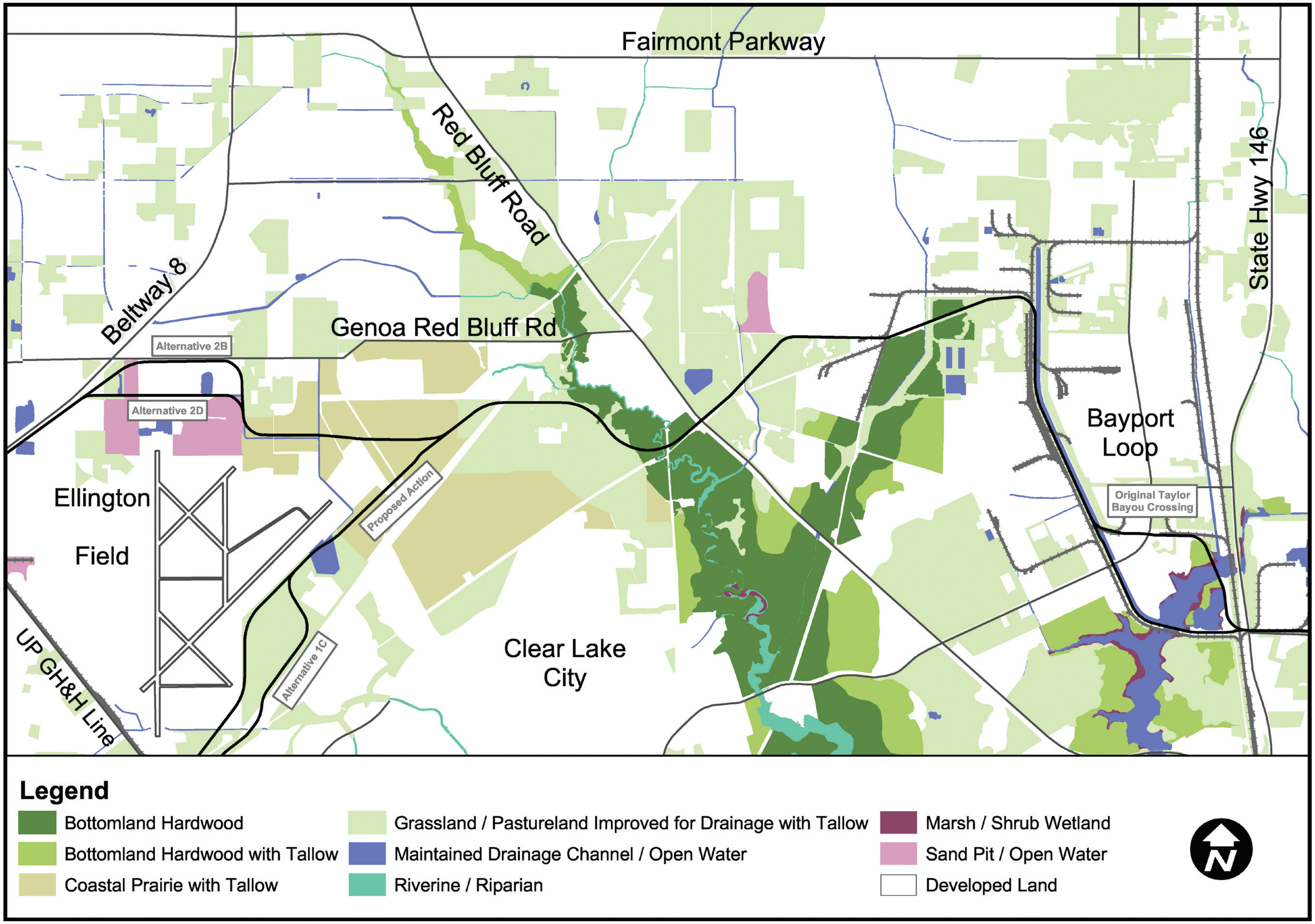


Table 3.8-2
Wildlife Species Observed in the Project Area

Common Name	Scientific Name
coyote	*Canis latrans*
Mexican eagle	*Caracara cheriway*
quail	*Colinus virginianus*
mottle duck	*Anas fulvigula*
white ibis	*Eudocimus albus*
white tail deer	*Odocoileus virginianus*
southern leopard lizard	*Gambelia* Spp.
black racer snake	*Coluber constrictor*
jackrabbit	*Lepus townsendii*
red-tailed hawk	*Buteo jamaicensis*
red-shouldered hawk	*Buteo lineatus*
cattle egret	*Bubuleus ibis*
coopers hawk	*Accipiter cooperii*
kestrel	*Falco sparverius*
swainson's hawk	*Buteo swainsoni*
loggerhead shrike	*Lanius ludovicianus*
alligator	*Alligator mississippiensis*
cardinal	*Richmondena Cardinalis*

Table 3.8-3
Aquatic Species that Occur or Probably Occur in Taylor and Armand Bayous

Fish

gulf killifish (*Fundulus grandis*)
mosquitofish (*Gambusia affinis*)
rough silverside (*Membras martinca*)
Atlantic croaker (*Micropogonias undulates*)
spotted seatrout (*Cynoscian nebulosus*)
bay anchovy (*Anchoa mitchilli*)
red drum (*Sciaenops ocellatus*)
tidewater silverside (*Menidia beryllina*)
grass carp (*Ctenopharyngodon idella*)
European carp (*Cyprinus carpio*)
longear sunfish (*Lepomis megalotis*)
channel catfish (*Ictalurus punctatus*)
bluegill sunfish (*Lepomis macrachirus*)
blue catfish (*Ictalurus furcatus*)
sea catfish (*Arius* sp.)
naked goby (*Gobiosoma bosci*)
ladyfish (*Elops saurus*)
finescale menhaden (*Brevo ortia*)
sheepshead minnow (*Cyprinodon variegates*)
sailfin molly (*Poecilia verlifera*)
gulf pipefish (*Syngnathus scovelli*)
black drum (*Pogonias cromis*)
striped mullet (*Mugil cephalus*)
southern flounder (*Paralichthys lethostigma*)
warmouth (*Lepomis gulosus*)
spot (*Leiostomus xanthurus*)

Crustaceans

white shrimp (*Litopenaeus setiferus*)
brown shrimp (*Farfantepenaeus aztecus*)
grass shrimp (*Palaemonetes pugio*)
blue crab (*Callinectes sapidus*)
mud crab (*Scylla serrta*)

SOURCE: Flora and Fauna of Armand Bayou Nature Center, 2002.

According to the NMFS, a segment of the Build Alternatives would impact EFH associated with Taylor Bayou and its tidal wetlands. Taylor Bayou has EFH for white shrimp, brown shrimp, red drum, and Spanish mackerel (NOAA and Gulf of Mexico Fishery Management Council, 1998). EFH for the species within the project area includes the estuarine emergent and shrub wetlands, open water, and the aquatic substrate.

The juvenile white shrimp is considered very abundant in the Galveston Bay area, which includes Taylor Bayou, from July through March and abundant during the low salinity period from April to June. The adult white shrimp is considered common in the Galveston Bay area from July through March and sparse during the low salinity season from April to June. The spawning season typically occurs in deep water such as the Gulf and extends from March to October. (NOAA and Gulf of Mexico Fishery Management Council, 1998)

The juvenile brown shrimp is considered highly abundant in the Galveston Bay area, which includes Taylor Bayou, from April through October and abundant during the decreasing salinity season from November through March. The adult brown shrimp is considered common in the Galveston Bay area from April through October and rare from November through March. The spawning season is very similar to that of the white shrimp. (NOAA and Gulf of Mexico Fishery Management Council, 1998)

The juvenile and adult red drum are considered common in the Galveston Bay area year round (NOAA and Gulf of Mexico Fishery Management Council, 1998). The spawning season generally occurs from mid-August to mid-October in the Gulf. The eggs hatch within 24 hours and are carried into the bays by tidal and wind current. Larvae are not tolerant of low salinities (Davis, 1990) and therefore are not expected in the project area.

The juvenile and adult Spanish mackerel are considered common in the Galveston Bay area from April through October (NOAA and Gulf of Mexico Fishery Management Council, 1998). The spawning season generally occurs from May to October. The nursery areas are typically in estuaries and coastal waters year round while the larvae are most frequent offshore in water 30 to 300 feet deep. The juveniles are also found offshore and in beach surf, and occasionally in estuarine habitat. The juveniles are not present in the Galveston Bay area from November through March. The adults usually occur along coastal areas out to the edge of the continental shelf and are considered sparse in the Galveston Bay area from November through March.

3.8.2.3 Threatened, Endangered and Rare Species

The USFWS and the TPWD maintain a database of threatened, endangered, and rare species known to occur in Harris County, Texas. SEA reviewed information from the databases and consulted with both agencies to evaluate the potential for the presence of endangered or threatened species and their preferred habitats. Table 3.8-4 lists the Federal and state threatened, endangered, and rare species known to occur in Harris County.

The project area is located outside the geographic range or does not include suitable habitat for most of the listed species. Based on the available information about protected species, site reconnaissance, and consultation with the USFWS and the TPWD, SEA determined that only one of the protected species had the potential to occur in the project area, although some protected species may be occasional visitors and several state rare species may also occur. Digital orthophotography coupled with the wetland delineation, soil survey, and habitat assessment indicated that suitable habitat existed in a portion of the project area for the Texas prairie dawn.

The Texas prairie dawn is a small, singled-stemmed or branching annual sunflower that can reach heights up to 6.0 inches. The plant is listed as endangered at the state and Federal level. The Texas prairie dawn flowers from March to early April and produces a small cluster of yellowish flowers. The seeds are produced from April to May and are cone-shaped and pubescent. The plant occurs in sparsely vegetated areas of fine compacted sandy soils. The Texas prairie dawn is found in poorly drained depressions or saline swales around the periphery of low, natural mima mounds in open grasslands. It can also occur on disturbed soils.

Table 3.8-4
Threatened, Endangered and Rare Species
Known to Occur in Harris County, Texas

Common Name	Scientific Name	Federal Listing	State Listing	Habitat Description
bald eagle	*Haliaeetus leucocephalus*	PDL	T	Coastal areas, rivers or lake shores with large trees, and man-made reservoirs
piping plover	*Charadrius melodus*	T	T	Sandy beaches and lakeshores
reddish egret	*Egretta refescens*		T	Shallow tidal pools
swallow-tailed kite	*Elanoides forficatus*		T	Woodland
white faced ibis	*Plegadis chihi*		T	Freshwater marshes, sloughs, and irrigated rice fields
brown pelican	*Pelecanus occidentalis*	E	E	Islands and spoil banks
white-tailed hawk	*Buteo albicadatus*		T	Prairies, cordgrass flats, oak savannas
whooping crane	*Grus americana*	E	E	Migrant
attwater's greater prairie-chicken	*Tympanuchus cupido attwateri*	E	E	Open prairies w/ thick grass
snowy plover	*Charadrius alexandrus*		R	Barren and scattered vegetated beaches
black rail	*Laterallus jamaicensis*		R	Crop and pastures
wood stork	*Mycteria americana*		T	Mudflats and wetlands
creek chubsucker	*Erimyzon oblongus*		T	Small rivers and creeks of various types
rafinesque's big-eared bat	*Plecotus rafinesquii*		T	Forested regions in hollow trees, crevices behind bark, and under dry leaves
southeastern myotis	*Myotis austroriparius*		R	Forested regions in hollow trees, crevices behind bark, and under dry leaves
plains spotted skunk	*Spilogale putorius interrupta*		R	Forested areas
Houston toad	*Bufo houstonensis*	E	E	Woodlands w/ deep sandy soils
Texas diamondback terrapin	*Malaclemys terrapin Littoralis*		R	Salt marshes
Texas gator snake	*Thamnophis sirtalis annectens*		R	Woodland
gulf salt marsh snake	*Nerodia clarkii*		R	Brackish waters along the coast

Table 3.8-4 (continued)
Threatened, Endangered and Rare Species
Known to Occur in Harris County, Texas

Common Name	Scientific Name	Federal Listing	State Listing	Habitat Description
Texas horned lizard	*Phrynosoma cornutum*		T	Open, arid regions w/ sparse vegetation
smooth green snake	*Liochlorophis vernalis*		T	Dense vegetation
loggerhead sea turtle	*Caretta caretta*	T	T	Gulf and bay system
leatherback sea turtle	*Dermochelys coriacea*	E	E	Gulf and bay system
kemp's ridley sea turtle	*Lepidochelys kempii*	E	E	Gulf and bay system
green sea turtle	*Chelonia mydas*	T	T	Gulf and bay system
Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	E	E	Gulf and bay system
alligator snapping turtle	*Macroclemys temminckii*		T	Deep water of rivers, canals, lakes, and oxbows
timber/canebrake rattlesnake	*Crotalus horridus*		T	Hardwood and mixed hardwood-pine forests, cane fields, and the ridges and glades of swampy areas
coastal gay-feather	*Liatris bracteata*		R	Marsh areas
threeflower broomweed	*Thurovia troflora*		R	Prairie habitat
Texas meadow rue	*Thalictrum texanum*		R	Prairie habitat
Texas windmill-grass	*Chloris texensis*		R	Poorly drained depressions or saline swales around the periphery of low, natural mima mounds in open grasslands
Houston machaeranthera	*Machaeranthera aurea*		R	Poorly drained depressions or saline swales around the periphery of low, natural mima mounds in open grasslands
Texas prairie dawn	*Hymenoxys texana*	E	E	Poorly drained depressions or saline swales around the periphery of low, natural mima mounds in open grasslands

SOURCE: TPWD, 2001 and USFWS, 2001

Note: PDL=Proposed for Delisting, T =Threatened, E=Endangered, R=Rare

As part of their Section 404/401 permit application, the Applicants conducted field surveys for the Texas prairie dawn between April 1 and April 4, 2002, which were verified by SEA. Representatives from the USFWS conducted a field verification of the survey on April 4, 2002. Eighteen populations of the Texas prairie dawn were identified in the project area. The Applicants submitted their report on the results of the surveys to the USFWS and TPWD for review and the report was approved by the USFWS on August 1, 2002.

3.9 TOPOGRAPHY, GEOLOGY, AND SOILS

3.9.1 Background

Rail construction has the potential to impact topography, geology, and soils. Thus, SEA collected information to characterize the existing conditions and evaluate the potential impacts of the Proposed Action and Alternatives.

This section provides a single discussion of the area where new construction would occur for the Proposed Action and Alternatives because much of the topographic, geologic, and soils information is regional and applies to the entire project area. Any variations are noted in the text.

3.9.2 Existing Conditions

3.9.2.1 Topographic Conditions

The project area lies in the southeastern portion of Harris County on level coastal prairie (TSHS, 2001b). The topography of the area is fairly flat, with an overall slope of less than one percent along the Proposed Action and Alternatives. The elevation ranges from approximately 30 feet at the western end of the project area near SH 3, Ellington Field, and Beltway 8 (Sam Houston Parkway) to near sea level at the eastern end near Taylor Bayou and Galveston Bay.

The topography over the entire project area consists of gradual changes in elevation, with the exception of some steeper slopes adjacent to several waterbodies. The wetland areas at the western end of the project area are relatively flat. The steeper slopes exist immediately adjacent to the waterways associated with the Armand and Taylor Bayous, which are the two major waterbodies that intersect the Build Segments. Elevation along the banks of these waterways may change as much as 10 to 20 feet. Because the topographic layout of the area is relatively flat, slope stability is not a major consideration except adjacent to the noted waterbodies.

3.9.2.2 Geologic Conditions

The project area overlays the Beaumont Formation, a geologic unit that was deposited during the Pleistocene era approximately 120,000 to 50,000 years ago. The Beaumont Formation is made up of layers of various types of sediment, mostly mud, sands and silts. Along local streams and bayous, older deposits from the Holocene period are exposed, also consisting of sands, silt, and mud (Bureau of Economic Geology, 1972). The Bureau of Economic Geology (1972) classifies the physical property of the project area as mostly Group I category lands, made up of sediments of Pleistocene age. These areas consist of fine-grained clay and mud soils and substrates that have low permeability and poor drainage. The remaining area, made up of Holocene sediments along the western end of the project area, is classified as Group III lands, which are dominantly clayey sand and silt, and have moderate permeability and drainage.

Below the Holocene sediments are sediments of Tertiary age, deposited more than 1.8 million years ago. Depth to hard bedrock in the area near Houston could be as much as 3,000 feet (Geo Council, 2001).

The Houston area is interlaced with hundreds of miles of faults. USGS has mapped more than 100 separate faults totaling more than 140 miles in length in the area. These faults are typically the surface expression of faults that originate in the subsurface, in Tertiary rock units. Most of these faults are presently inactive or move so slowly that no topographic features that are typical of active faults, such as steep escarpments, have developed on the surface. Fewer than five percent of the faults mapped in the area have scarp heights that exceed 3 feet; nearly all faults in the area have scarp heights between 2 and 3 feet, which is within the range of normal elevation of the local landscape (Verbeek and Clanton, 1978). The faults appear to control regional drainage patterns; streams commonly coincide with surface traces of subsurface faults extrapolated from the subsurface (Kreitler, 1977).

Despite the presence of faults at the surface and in the subsurface, USGS national seismic hazard maps show that seismic or other geologic hazard potential is very low in the project area (Wesson *et al.*, 1996). McClelland Engineers, Inc. (1983) conducted an analysis of geologic faulting in the southeastern Houston area. They noted that the vertical movement of 0.25 to 0.5 inches per year is most common for typical active faults in the area, and that the horizontal movement is typically one-fourth to one-half of the vertical movement. They also noted that any active faults in the coastal area along the Gulf do not present a risk for earthquakes, because the underlying sediments are unconsolidated, or loosely aggregated and not completely cemented into "hard" rocks. The loose soils in the region do not have the same capability to store energy as hard rocks, and thus only "move very small distances at frequent intervals," limiting the potential for substantial mass movement (McClelland, 1983).

Beginning in about the 1930s, fault movement in the area increased dramatically and continued through the mid 1970s. Geologists and other researchers concluded that this fault movement was attributed to subsidence that resulted from large withdrawals from local aquifers and oil reserves (Holzer and Gabrysch, 1987; Kreitler, 1977). Declines in water and hydrocarbon levels from groundwater withdrawals and oil/gas production operations led to subsidence of as much as 10 feet. In 1975, regulations were implemented to control the withdrawal of these fluids from the subsurface. Since that time, subsidence has been greatly reduced. No noticeable subsidence occurred in southeastern Harris County between 1987 and 1995 (Gabrysch and Neighbors, 2000). The reduction in subsidence in the area decreases the threat not only of faulting, but also of inundation and flooding from coastal storms.

3.9.2.3 Soil Conditions

According to the Harris County soil survey map (Texas Natural Resources Information System, 2001), soils along the Proposed Action and Alternatives include the Lake Charles, Beaumont, Bernard, Vamont, Midland (Verland), and Edna series. Lake Charles soils account for approximately 25 to 40 percent of the soils in the project area, and exist mostly along the western end next to Ellington Field and near Armand Bayou. Approximately 25 to 30 percent is composed of Beaumont soils, which cover much of the project area between Armand and Taylor Bayous. The remaining soil series each comprise approximately 5 to 15 percent of the soils, with the Vamont and Edna series immediately adjacent to streams and channels associated with the two bayous.

All of the soil series along the Proposed Action and Alternatives were formed in clayey or thick clayey sediments and have very low permeability. The drainage ranges from poor and somewhat poor for most of the soil series to moderate for Lake Charles soils (USDA, 2001). Relatively shallow aquifers are common in this area; depth to groundwater ranges from approximately 10 to 20 feet below ground surface in Harris and Galveston counties (HGCSD, 1998).

3.10 LAND USE

3.10.1 Background

The NEPA regulations require an analysis of effects on land use, including consistency with existing land use plans, effect on prime agricultural land, and consistency with coastal zone management plans. The project area is located in a coastal zone and SEA therefore must analyze the proposed project's consistency with the Texas Coastal Management Program. The Coastal Coordination Council of the Texas GLO under the authority of the Federal Coastal Zone Management Act of 1972 (CZMA), coordinates the review of consistency certifications. The Farmland Protection Policy Act (PL 97-98; 7 U.S.C. 4201 *et seq.*) requires Federal agencies to evaluate and avoid potential adverse impacts to prime and unique farmland. The NRCS, of the U.S. Department of Agriculture, administers compliance with the Farmland Protection Policy Act. The regulations implementing NEPA require SEA to analyze consistency with local land use plans and zoning regulations.

The FAA has regulatory authority over Ellington Field and its associated Runway Protection Zones and, under 49 U.S.C. 44718 (Structures Interfering with Air Commerce), must review a notice of proposed construction or alteration for activities that could affect navigable airspace. In addition, upon request by the owner of the Ellington Field, which is the City of Houston, to 1) approve a change to the Airport Layout Plan (ALP) to accommodate the Proposed Action Alternative and 2) release the affected airport property from Federal surplus property restrictions and/or the airport owner's obligations under grant assurances contained in grant agreements, FAA would determine whether the ALP approval and release is appropriate pursuant to 49 U.S.C. 47151-47153 (formerly known as the Surplus Property Act), 49 U.S.C. 47107(c)(2)(B), 49 U.S.C. 47107(a)(16), and any other applicable Federal laws, regulations, and applicable FAA Orders. The potential change to the ALP and the release of surplus property only apply to the Proposed Action Alternative.

This section only addresses the Build Segments because the construction of new rail lines has the potential to affect land use.

3.10.2 Existing Conditions

The Houston area, including the Cities of Houston and Pasadena, does not have either zoning regulations or consistent land use designations in place. Therefore, SEA categorized the land use in the vicinity of the Build Segments into several general types, based on Texas GLO classifications and aerial photographs. Historically, much of the land in the project area was coastal prairie habitat used for livestock grazing; however, significant development has occurred in the region over the past several decades. Ellington Field, which is the dominant land use on the western area of the Build Segments, was established in 1917 as a military air base. The petro-chemical plants in the Bayport Loop, which dominate the eastern area of the Build Segments, were developed in the 1950s and 1960s to utilize the byproducts of the ship channel refineries which began developing in the early 20^{th} Century. Livestock grazing and oil and gas development occurred in the areas between Ellington Field and the Bayport Loop. Urban development began filling-in the area from the south toward the middle. The current land use surrounding the Build Segments is mixed, and includes the following: industrial, municipal, residential, oil/gas production fields, agricultural, forest/woodlands, drainage canals, and utility, pipeline, road, and rail corridors. Past alterations in the area, including oil/gas exploration and production, petro-chemical industry growth, residential development, pipeline and electric utility development, drainage improvements, and airport development and expansion, have created physical changes to the original land in a large portion of the area surrounding the Build Segments. Figure 3.10-1 illustrates the existing land use conditions in the project area.

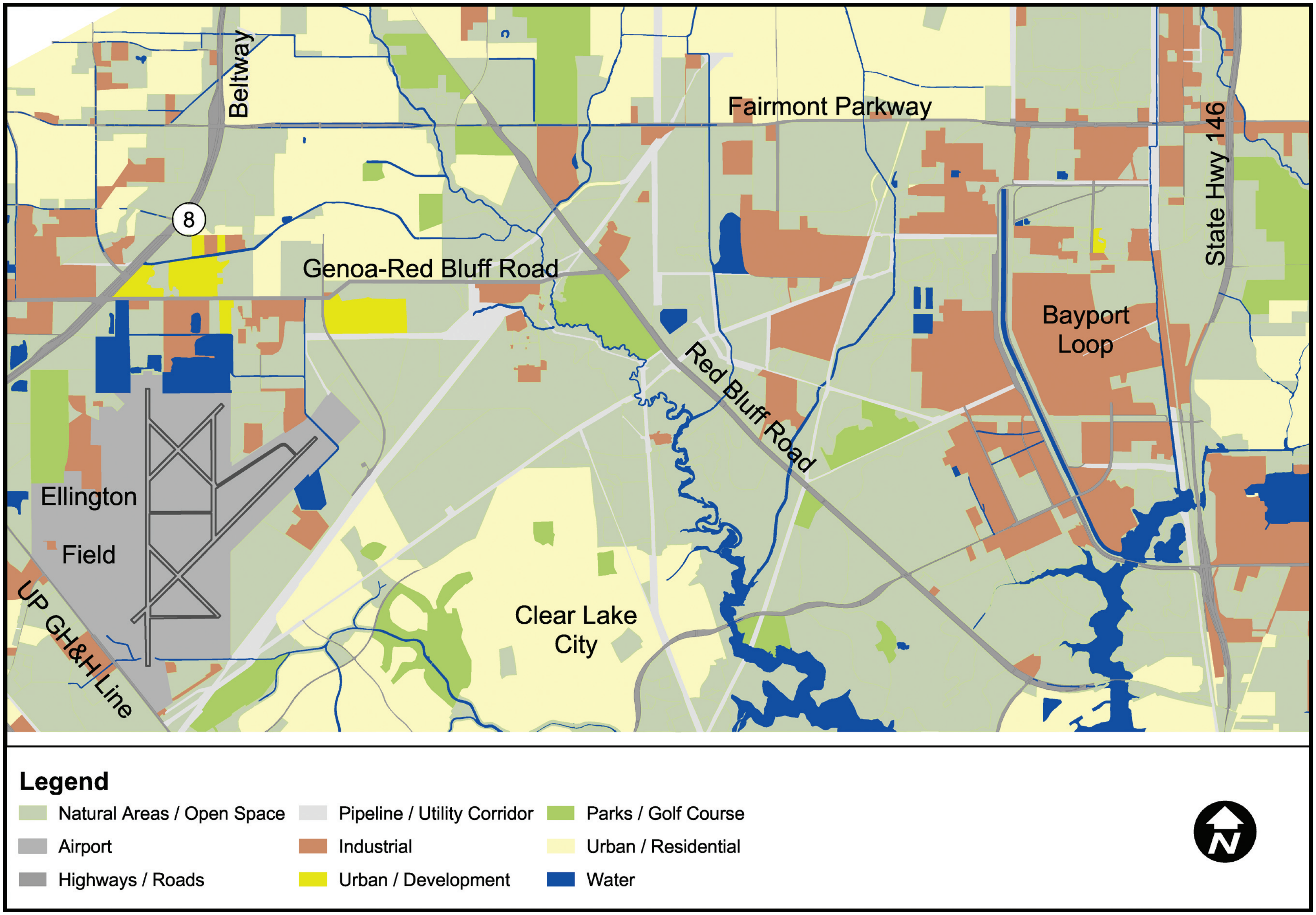
The Bayport Industrial Complex consists of approximately 8,800 acres of petro-chemical and specialty chemical facilities. Approximately 65 specialty chemical plants operate in this area. The Bayport Loop contains 24 specialty chemical plants. The City of Shore Acres is located on Galveston Bay, east of the Bayport Loop. Residential and commercial areas of the City of La Porte are also located northwest, northeast, and east of the Bayport Loop. La Porte Municipal Airport is north of the Bayport Loop. The residential area of Clear Lake City is located southwest of the Bayport Loop. The City of Seabrook is located south of the ATOFINA plant on Port Road. The Armand Bayou Nature Center is located southwest of the Bayport Loop and consists of a 2,500-acre wildlife preserve, with approximately 5 miles of walking trails and more than 370 species of wildlife. The preserve includes three major habitat types: hardwood forest, estuarine bayou with wetlands, and coastal tall grass prairie.

3.10.2.1 Proposed Action and Alternatives

Build Alternatives. The Build Alternatives involve approximately 12 to 14 miles of Build Segments as well as the use of existing lines. The land use in the project area around the Build Segments includes a number of existing developments and undeveloped land.

The Build Segment for the Proposed Action would depart from the GH&H's Graham Siding at the most southerly portion of Ellington Field. Most of Ellington Field's 2,590 acres are owned by the City of Houston. Ellington Field was established in 1917 as a military air base. It was

Figure 3.10-1
Land Use



expanded to its current size shortly before World War II. NASA began training astronauts at Ellington Air Force Base in 1962. GSA deeded (i.e., transferred the ownership) the former Ellington Air Force Base to the City of Houston in 1984 and the City renamed it Ellington Field. General aviation and commercial operations generate approximately 50 percent of the total operations at Ellington Field, Texas Air National Guard generates approximately 30 percent, and NASA generates approximately 18 percent. In addition, NASA owns 37 acres in six separate tracts and uses Ellington Field as the center of aviation-related operations for its manned space program.

After departing Graham Siding, the Build Segment would enter the airport property south of runway 35L, crossing through 3.5 acres of the Runway Protection Zone (RPZ) for runway 35L. The RPZ is an airport design standard whose function is to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape and centered about the extended runway centerline. RPZs underlie the approach paths to runways which are protected by 14 CFR Part 77, Objects Affecting Navigable Airspace. Figure 3.10-2 illustrates the runways, the RPZs, and the property lines for Ellington Field. The portion of the RPZ that the Build Segment crosses was acquired by the City of Houston with a grant from the FAA.

The Build Segment for the Proposed Action in this area is surrounded by grasslands and a wastewater treatment plant associated with Ellington Field, as well as a drainage canal to the east and a pipeline corridor to the south. It would pass within approximately 1,000 feet of Sylvan Rodriquez Park to the southeast and approximately 2,500 feet from the residences on the other side of the park.

The Build Segment would proceed to the northeast, leaving the property purchased by the City for the RPZ, and passing through 3.76 acres of land in the corner of the original Ellington Field property that DoD deeded to the City as surplus land. The Proposed Action would leave the original Ellington Field property and enter a 240-acre area that the City of Houston purchased on the southeast side of the airport to prevent the encroachment of residential development. The site is currently vacant. The Houston Airport System's Draft Site Suitability Analysis for the Ellington Field Master Plan Update recommends office and light industrial uses for the land closest to the residential area and heavier industrial development closer to the airport. It also indicates that the area closest to the airport could have airfield access if desired and, therefore aviation and/or aviation industrial uses would be appropriate. However, the Draft Suitability Analysis recommends other areas for aviation use based on the forecast for aviation growth (Leigh Fisher Associates, 2002).

The Build Segment would cross the undeveloped property as it runs parallel to the regional Ellington Field property line. It would pass a Boeing office building, the Boeing Product Development Center, and several NASA facilities. The NASA facilities include NASA's Sonny Carter Training Facility, which houses the Neutral Buoyancy Laboratory (NBL), the Software Development and Integration Laboratory, and the Light Manufacturing Facility, is located adjacent to Ellington Field, on Space Center Boulevard. The Training Facility is located in a former McDonnell Douglas warehouse building that was purchased by NASA in 1996. The NBL provides a controlled neutral buoyancy environment to simulate the zero-gravity or weightless condition that is experienced by spacecraft and crew during space flight. The Software

Figure 3.10-2
Ellington Field Runways and Runway Protection Zones

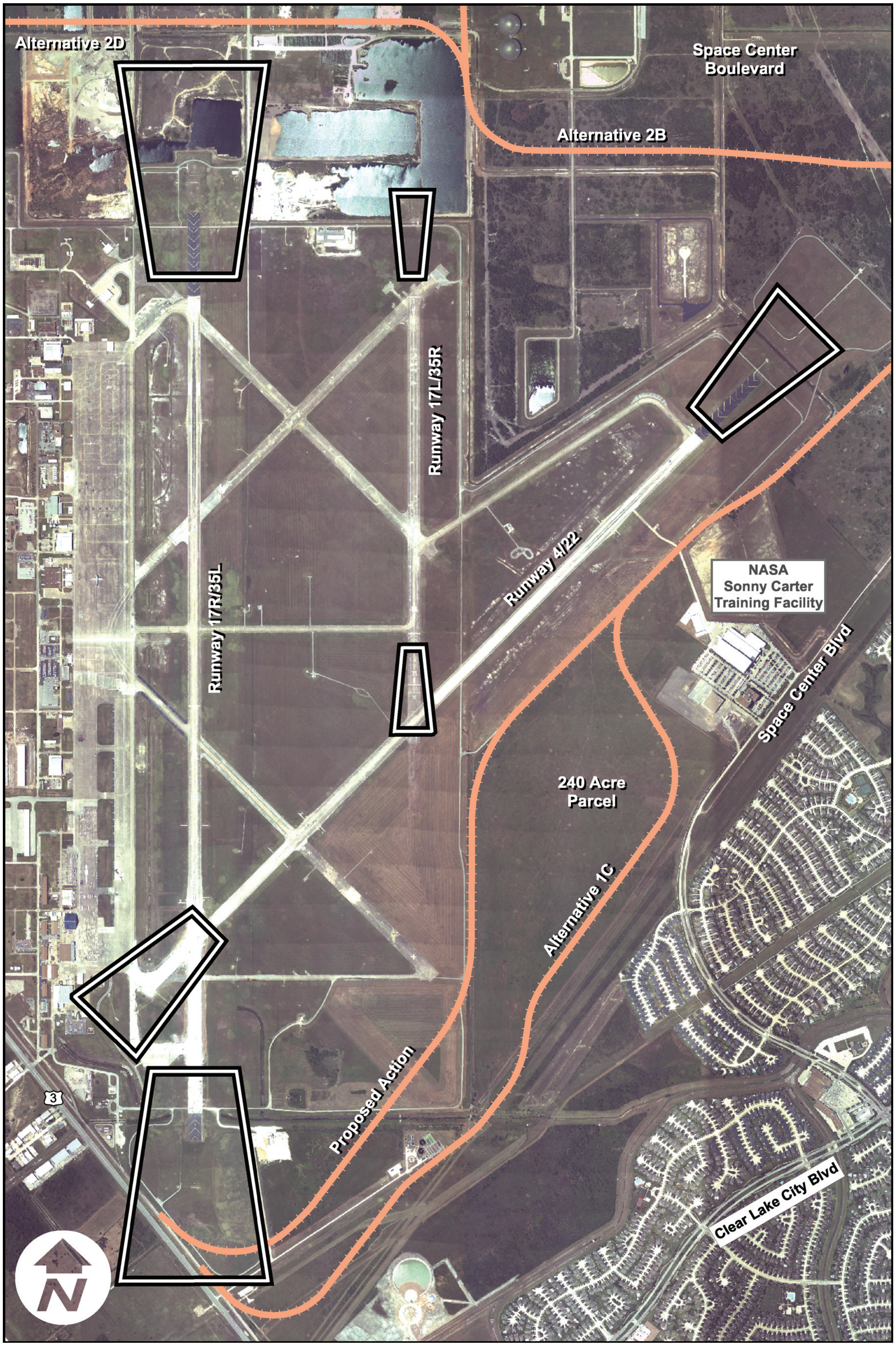
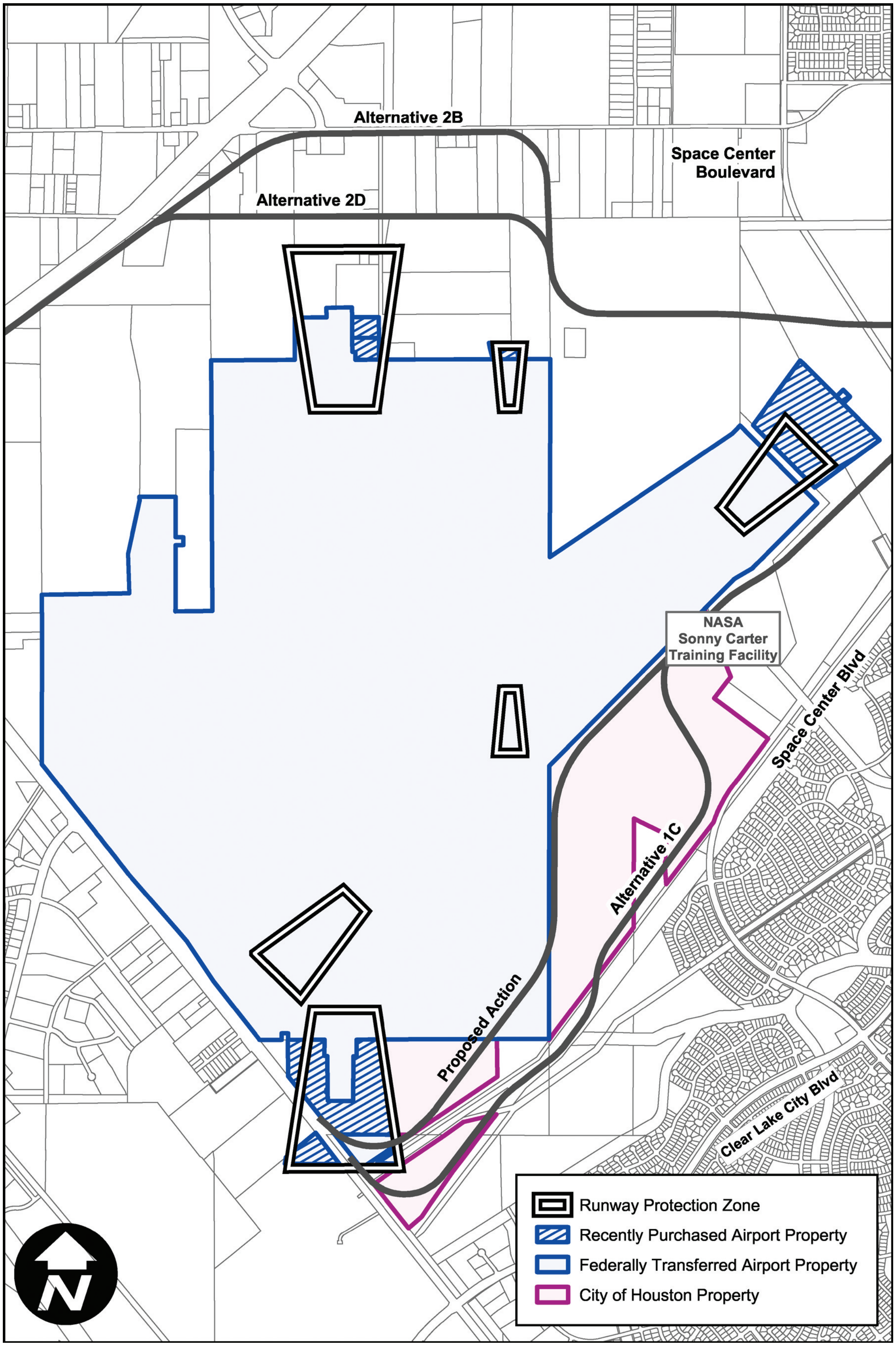


Figure 3.10-3
Ellington Field Property Lines and Runway Protection Zones



Development and Integration Laboratory develops, constructs, and tests computer equipment that will be used on the International Space Station project. The Light Manufacturing Facility fabricates mock-ups of the Space Shuttle and International Space Station for use in the NBL. The Light Manufacturing Facility houses a sheet metal shop, paint booth, wood shop, weld shop, machine shop, electrical wiring layout area, a plasma lab, and a clean room. Adjacent to the Sonny Carter Training Facility is a Boeing office building and the Boeing Product Development Center. The office building, known as Tower II, also houses a Space Shuttle monitoring facility. The Product Development Center develops and manufactures products for the International Space Station.

Alternative 1C would depart the GH&H line just south of the Proposed Action. It would run south of the runway 35L RPZ and parallel to the Proposed Action past and outside of the southeast corner of the Ellington Field fence line. Alternative 1C would run parallel to and just inside the southern boundary of the 240-acre parcel before turning northwest across the parcel to join the Proposed Action Build Segment. At its closest point, Alternative 1C would run adjacent to Sylvan Rodriquez Park and would come within approximately 550 feet of residences in Clear Lake City.

Alternatives 2B and 2D leave the GH&H near Beltway 8 and pass to the north of Ellington Field. The route then parallels Beltway 8 and Alternative 2B parallels Genoa-Red Bluff Road. The land use in the vicinity of Alternatives 2B and 2D consists of sparse residential and commercial. Alternative 2D passes between two landfill cells to the south of Genoa-Red Bluff Road.

Alternatives 2B and 2D pass south of the existing City of Houston's Southeast Water Treatment Plant, through land owned by the City of Houston. The Water Treatment Plant is located on a 400 acre site that extends south to the boundary of Ellington Field. The City of Houston has indicated an intent to expand it from the current 80 million gallons per day (MGD) capacity to 240 MGD by 2005. The City anticipates that the Water Treatment Plant could be expanded to 360 MGD by 2015 and 480 MGD by 2025.

To the east of the Deer Park School District property, all of the Build Alternatives would follow the same alignment. The route passes through an area with former oil wells and active gas fields and travels approximately one thousand feet to the south of Baywood Country Club. It then crosses the riparian corridor along the Armand Bayou Coastal Preserve and travels through forest/woodland and grassland areas, as well as small areas of agricultural land, for approximately ½ to 1 mile, before entering the industrial area of the Bayport Loop.

The proposed route then passes through the core of the Bayport Industrial District, which contains limited grassland areas between the industrial facilities and existing rail facilities. For most of this stretch, the route travels along existing transmission line and pipeline corridors. The proposed route crosses Taylor Bayou and travels through industrial facilities north of the City of Seabrook and south of the Shore Acres residential community.

No-Build Alternative. This Alternative does not involve construction of new rail lines and therefore would not affect land use.

3.10.2.2 No-Action Alternative

This Alternative does not involve construction of new rail lines and therefore would not affect land use.

3.10.2.3 Coastal Zone Management

The CZMA of 1972 was enacted to preserve, protect, develop, and restore coastal resources. The Texas GLO is the lead agency for the Texas Coastal Management Program. The Proposed Action and Alternatives are located entirely within the Galveston area of the Texas Coastal Zone. The Coastal Management Program emphasizes economic development that is compatible with the coastal zone resources, which ensures that loss of life and property from improper development (i.e., in flood-prone, wetland, geologic hazard, or land subsidence areas) are minimized and that development occurs near existing developed areas if possible.

3.10.2.4 Prime Farmland

The NRCS has compiled a national listing of soils that are considered to represent prime or unique farmland. Agricultural land classifications are very limited in the project area, due to the extensive industrial and residential development. SEA contacted the Soils Section of the local Texas NRCS office to determine the prime farmland soils for Harris County, Texas, and a formal request was submitted to evaluate the soils, as required by the Farmland Protection Act [7 CFR 658.4]. Along the Proposed Action and Alternatives, there are several soil types that are considered prime farmland within the approximately 155 acres of land that would be acquired for the project. SEA identified approximately 86.3 acres of prime farmland and 68.7 acres of statewide important farmland in the right-of-way for the Proposed Action and Alternative 1C. SEA identified approximately 80 acres of prime farmland in the right-of-way for Alternative 2B and 80 acres for Alternative 2D.

3.11 SOCIOECONOMICS

3.11.1 Background

The NEPA regulations (40 CFR 1508.14) require consideration of the socioeconomic effects of a Proposed Action and Alternatives where “economic or social and natural or physical environmental effects are interrelated.” In addition, the courts have ruled that socioeconomic issues are closely linked to quality of life and should be studied under NEPA. SEA analyzed the effects of the Proposed Action and Alternatives on socioeconomic issues and quality of life issues. These include demographics and employment, public services, recreation, and aesthetics.

3.11.2 Existing Conditions

3.11.2.1 Demographics and Employment

The project area is mostly located in Harris County, Texas. The CMC Dayton Yard is located in Liberty County. Harris County is the third largest county in the U.S. by population and is home to the fourth largest city, Houston. According to the 2000 Census, Harris County has a population of 3,400,578. Table 3.11-1 shows the ethnic composition of Harris County, based on responses to the 2000 Census. Population density in Harris County has been recorded at 1,966 people per square mile. Harris County contains approximately 16 percent of the population of Texas. According to the 2000 Census, Liberty County has a population of 70,154. Seventy-nine percent of Liberty County's population is white.

Table 3.11-1
Ethnic Composition of Harris County, Texas

Reported Race & Ethnicity	Population	Percentage of Population
Race		
White	1,997,123	58.7%
Black or African American	628,619	18.5%
Persons Reporting Some Other Race	482,283	14.2%
Asian	174,626	5.1%
Persons Reporting Two or More Races	100,652	3.0%
American Indian and Alaska Native	15,180	0.4%
Native Hawaiian & Other Pacific Islander	2,095	0.1%
Ethnicity		
Not Hispanic or Latino	2,280,827	67.1%
Hispanic or Latino	1,119,751	32.9%

Source: U.S. Census Bureau, Census 2000, Summary File 1 Tape (SF1), Table P4 available at www.census.gov.

Between 1990 and 2000, Harris County's population grew by 20 percent and Liberty County's population grew by 33 percent. The population of Harris County and the surrounding counties in Southeast Houston are predicted to continue their high growth rates, mainly due to immigration from other states in the U.S. and from other nations.

In April 2002, 1,730,322 people were employed in Harris County. The April 2002 unemployment rate was 5.3 percent.[14] Median household income (in 1997) was $39,037.[15] Table 3.11-2 shows the percentages of employment by occupation for Harris County, based on the 1990 Census.

Retailers, oil companies, petro-chemical manufacturers, aerospace, and health-related industries dominate the Harris County area employers. The Gulf Coast Region has emerged as the "energy capital" of the U.S., and the oil and gas industries are an important component of the regional economy. The area is home to one of the largest concentrations of chemicals and refined petroleum products manufacturers in the world.

[14] Source: Texas Workforce Commission.

[15] U.S. Bureau of Census, Small Area Income and Poverty Estimates, 1997.

Table 3.11-2
Percentage of Employment by Occupation

Occupation	Harris County
Managerial	13.9%
Professional Specialty	14.8%
Technicians	4.4%
Sales	13.0%
Administrative Support	16.5%
Private Household Service	0.8%
Protective Service	1.7%
Other Service	10.2%
Farming, Fishing, Forestry	1.0%
Precision, Production, Craft, Repair	11.4%
Machine Operators, Assemblers	4.4%
Transportation, Material Moving	3.8%
Laborers	4.1%

Source: 1990 Census

3.11.2.2 Public Services

Harris County, as befits a large metropolitan area, is served by the full range of public services, including elementary, middle, and senior high schools, medical facilities, and emergency services. The incorporated areas of the County have their own police and fire departments and the unincorporated areas are served by the Harris County Fire and Emergency Services Department.

3.11.2.3 Recreation

Recreational opportunities are abundant in the project area. These include parks, museums, golf courses, sports facilities, and a nature center. Sylvan Rodriguez Park is located on Clear Lake City Boulevard, near the southeastern corner of Ellington Field. The park is approximately 111 acres in size and offers a range of recreational opportunities, including sports fields, a small lake, and a jogging trail. Armand Bayou Nature Center is located on Bay Area Boulevard and encompasses a 2,500-acre nature reserve that includes five miles of walking trails, wildlife exhibits, and an early 20^{th} Century farm site. Clear Lake and Armand Bayou provide opportunities for water sports. Several golf courses are located in the area, including those at Baywood Country Club and Clear Lake Golf Club.

3.11.2.4 Aesthetics

The project area consists of mostly flat land with a mixture of urban, commercial, industrial, and airport development, open space land that includes a landfill and a former gas field, and more natural areas around Armand Bayou and the Armand Bayou Nature Center. The urban areas range in density of development, from the densely populated areas in the vicinity of the East Belt Subdivision to the planned suburban community of Clear Lake City. The commercial areas, especially near Beltway 8 (Sam Houston Parkway), are characterized by a profusion of advertizing hoardings and signs, strip malls, and roads. The GH&H line, outside of Beltway 8, passes through a mixture of open space land with scattered trees and a golf course to the visual texture of Ellington Field, which is characterized by aircraft hangars and runways. The industrial areas are characterized by petro-chemical plants and their associated pipes, towers, and flares. The petro-chemical plants also operate night-time safety lighting systems on their towers to warn approaching aircraft. There are gas fields in the project area with flares that are most visible at night. Existing roadways, rail lines, and utility and pipeline corridors contribute to the visual character of the project area.

The natural areas around Armand Bayou represent the highest scenic value to be found in the project area. The view is characterized by trees, water in the form of streams and lakes, and small areas of grassland. Some parts of the Armand Bayou Nature Center enjoy natural views of trees and water. In other parts of the natural area, the towers of the petro-chemical plants are usually within view in the background.

3.12 ENERGY

3.12.1 Background

The CEQ regulations found at 40 CFR 1502.16 require examination of the energy requirements and the conservation potential of the Proposed Action and Alternatives.

3.12.2 Existing Conditions

There is an extensive network of gas, petroleum, chemical, and liquid and/or gaseous product pipelines within the Bayport Loop that transport materials used or produced by the facilities. A similar situation exists along the Strang Subdivision. High-tension transmission lines that supply electricity to the production facilities or transfer electricity elsewhere are also located within the Bayport Loop. Most of these lines are owned and maintained by Reliant Energy. A transmission line corridor parallels Port Road on its western and southern sides. The existing UP rail lines run alongside the transmission lines throughout the Bayport Loop. An existing transmission line corridor runs south from Strang Yard, paralleling the UP rail lines to Choate Road, where it continues south, paralleling State Highway 146, on its western side. At the Port Road crossing of Taylor Bayou, the rail lines are located approximately 100 feet from the transmission lines and towers.

To the west of the Loop, in the project area, there are approximately 14 petroleum and gas pipeline corridors. The Clear Lake oil and gas field is located immediately north of Clear Lake

City and includes several active wells. Transmission line corridors also pass through the area. One passes north to south, crossing Red Bluff Road near the Baywood Country Club and entering Clear Lake City just west of Armand Bayou.

Rail traffic in the Houston area includes many different products, some of which could be considered recyclable. SEA has not quantified the potential recyclable commodities transported over these lines.

The products transported out of the Bayport Loop by UP include small pellets of different types of plastics. These pellets form the feedstocks for manufacturing finished plastic products at other facilities. They could be considered recyclable commodities. According to the Board's waybill sample, UP transports an average of 76 carloads per day of non-hazardous materials out of the Bayport Loop. The majority of these carloads contain plastic pellets that could conceivably be recyclable. Hazardous materials carloads are not considered to be recyclable.

3.13 HAZARDOUS MATERIALS/WASTE SITES

3.13.1 Background

USEPA, state agencies, and local emergency planning committees have adopted rules on the identification of hazardous materials spill sites located where proposed construction activities and/or railroad operations would occur.

As a general guide, SEA considers a corridor evaluation focusing on the area located within 500 feet on either side of the right-of-way. Typically, construction activities and railroad operations are not likely to disturb hazardous materials spill sites and hazardous waste sites located more than 500 feet from the rail line. Therefore, SEA focused its efforts on identifying sites within 500 feet of the proposed Build Segments using the assumption that sites located more than 500 feet away from the rail line would be unlikely to be affected.

3.13.2 Existing Conditions

SEA identified the location of hazardous materials spill sites, hazardous waste sites, reported releases, and pollution incidents to assess the potential effects that may occur as a result of the Proposed Action and Alternatives. To identify visual or documented evidence of hazardous materials spills sites or hazardous waste sites along the Build Alternatives, SEA used reports from searches of environmental regulatory agency databases, permits, and site specific records, as appropriate; USGS topographic maps; and recent and historical aerial photographs. SEA also interviewed regulatory agency representatives and conducted a site reconnaissance. USEPA information systems based on the CERCLA of 1980 and the RCRA of 1976, as well as information systems based on other Federal, state, and local statutes and regulations, were key sources of information. Appendix K describes in detail the methods, findings, and conclusions reached by SEA regarding these potential impacts.

SEA identified numerous facilities along the Build Segment corridors that manage hazardous materials in underground storage tanks, aboveground storage tanks, or drums. Several of these facilities have had documented releases of hazardous materials to the environment. The information reviewed by SEA indicated that all but four of the recorded cases of hazardous materials releases and hazardous waste sites located within 500 feet of the Build Segments have been closed or deemed by the responsible regulatory agency not to merit further action. The following three open cases are located at 12211 Port Road: a January 1992 spill of approximately 5 gallons of water with oil and acetate into Bayport Channel; a May 1996 spill of an unknown quantity of hydraulic fluid into the Bayport Turning Basin; and a December 1999 spill of 3 gallons of acrylonitrile into the Bayport Turning Basin. These three releases were to water bodies where there is no planned construction activity. One open case located at 12901 Baypark Road is a November 2000 spill of an unknown amount of wastewater from a pipeline. Clean-up for the spill is underway, and the responsible party is performing the clean-up itself.

One delisted CERCLA National Priorities List (NPL) site identified as the Harris (Farley Street) site is located within 500 feet of Alternative 2D. All required response actions were completed at this site, including removal of the source of contamination. The site was deleted from the NPL in 1991.

The Hughes Landfill, a closed Type IV landfill, is located within 500 feet of Alternative 2D. Alternative 2D would run parallel to the north side of a Harris County Flood Control District (HCFCD) drainage channel. An investigation of the landfill prepared for the Applicants included soil borings along the north and south side of the HCFCD drainage channel embankment and along a portion of the landfill slopes immediately adjacent to the HCFCD drainage channel. Based on analytical results, the waste debris appears to be consistent with Type IV construction wastes based on the subsurface conditions encountered. Organic vapor analyzer (OVM) readings (from photoionization detection (PID) readings) were generally detected at all borings, though considered low (<100 ppm). Elevated levels of hydrogen sulfide (H_2S) (>100 ppm) were found around two borings in an isolated area near the north side of the easement, which may suggest debris that is not consistent with construction and demolition material. The TCEQ Texas Risk Reduction Program (TRRP) Tier 1 Commercial/Industrial Soil Protective Concentration Levels (PCL) were used as basis for comparison with the analytical results. Three samples, from the borings located near the isolated area where elevated H_2S levels were detected, had detectable benzo(a)pyrene above TRRP-PCLs. Analytical results for all other cases were below TRRP-PCLs for RCRA metals, TPH, VOC and SVOC.

3.14 CULTURAL RESOURCES

3.14.1 Background

Section 106 of the NHPA of 1966 requires that Federal agencies "take into account how each of its undertakings could affect historic properties." Undertakings include any form of construction, rehabilitation and repair, demolition licenses and permits, loans, grants, property transfers, and other types of Federal involvement. An historic property includes buildings, structures, objects, sites, districts, and archeological resources that may or may not have been listed on the National Register of Historic Places (NRHP) and may or may not have been discovered. Consultation with Indian tribes is required under Section 106 when an undertaking does affect historic properties.

According to NEPA "it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice."

3.14.2 Existing Conditions

SEA conducted an investigation into the potential impacts of the Proposed Action and Alternatives. Appendix L contains the Archeological Survey. SEA identified the area of potential effect for potential archeological sites and historic structures that construction activities could disturb and consulted with the Texas Historical Commission to determine the appropriate level of investigation.

SEA characterized the project area using a desk-based investigation utilizing numerous resources. These included county soil surveys, aerial photographs, studies of previous cultural resource surveys, historic maps, USGS topographical quadrant maps (including older issues which may show historic structures), and a search for previously recorded sites within the project area by the Texas Archeological Research Laboratory, University of Texas at Austin. SEA incorporated the results from various cultural resource studies performed for the region into its Archaeological Survey. This information allows archeologists, in many cases, to determine a likelihood of encountering cultural resources within a given project area. The investigation of the project area resulted in the removal of portions (or in one case all) of individual Build Segments from the requirement for a survey.

The project area is within the Southeast Texas Archeological Region, which has been recently summarized by Patterson (1995). Other recent prehistoric summaries equally pertinent to the prehistory of the Brazoria-Fort Bend County area include Ensor (1991), Fields (1983, 1986), and Moore and Moore (1991). These works provide detailed data on the prehistory of this region.

Previous investigations in southeastern Texas have demonstrated that prehistoric people occupied this area as early as 12,000 years ago. The prehistoric inhabitants were nomadic hunter-gatherers. Ensor (1990) has proposed the following prehistoric cultural sequence of periods for southeast Texas which are as follows: Paleo-Indian (10,000-8,000 BC), Early Archaic (8,000-5,000 BC), Middle Archaic (5,000-1,000 BC), Late Archaic (1,000 BC – AD 400), Early Ceramic (AD 400-AD 800), and Late Ceramic (AD 800-AD 1750).

Evidence for prehistoric occupation of southeast Texas is scarce in the Paleo-Indian period, and is rather ambiguous through the Middle Archaic period (Patterson 1983; Aten 1983:156-157). Most previously recorded sites date to the Late Archaic and Ceramic periods, because earlier dating sites have probably been lost to erosion, channel cutting, and particularly in the case of very early sites, to rising sea level. When early-dating artifacts have been found, such as Wheat's (1953) finds of projectile points dating from the Paleo-Indian through Middle Archaic periods at Addicks Reservoir in western Harris County, the materials occur in deposits with poor contextual integrity.

Sites dating from the Late Archaic through the Ceramic periods are much more commonly found in the project vicinity. During the late Archaic period, modern climatic conditions evolved, sea level rose and stabilized, and coastal woodlands expanded. Aten (1983) hypothesizes that an increase in population and the establishment of seasonal rounds, including regular movement from littoral to inland areas, occurred during the Late Archaic period. Particularly relevant to the prehistory of the project area are Hall's (1981) data from the Allens Creek project in nearby Austin County, Texas. Excavations of a large cemetery there suggest a Late Archaic trade system that linked southeastern Texas to central Texas and areas eastward into Arkansas. The excavation of other, smaller cemeteries in this section of the Brazos River drainage, including some in Fort Bend County, have yielded similar evidence.

Aten (1983) has proposed that ceramics were introduced in the aboriginal artifact assemblage on the Upper Texas Coast at AD 100. Ensor places the beginnings of the Early Ceramic period at AD 400, which may be more applicable for areas inland from the coastline. The Early Ceramic period is characterized by a continued growth in population levels. Ensor (1991) places the beginning of the Late Ceramic at AD 800, which coincides with the introduction of the bow and arrow. A plain sand-tempered pottery dominates throughout both parts of the Ceramic era. Story *et al.* (1990) has defined the Mossy Grove Cultural Tradition for Late Prehistoric cultures in southeastern Texas with sandy paste pottery being the principle diagnostic artifact type.

European settlement did not begin to seriously disrupt aboriginal habitation in the areas inland from the Upper Texas Coast until after AD 1700 (Patterson, 1995; 249). European diseases, probably introduced by explorers and early traders, began to have impacts as early as AD 1528. At least seven epidemics were recorded among the tribes of the project area between that date and AD 1890 (Ewers, 1974). The project area appears to have been on the boundary of the territories of several Native American groups in the 18^{th} and 19^{th} centuries. Groups that may have resided in Harris County include the Atakapan, Karankawa, and the Tonkawa. During the 18^{th} and 19^{th} centuries, epidemic diseases, the mission system, and the fur trade acted to severely reduce, and in some cases exterminate, the indigenous populations.

Currently, seven Indian tribes have Areas of Concern in the Houston area, according to information from TxDOT. These tribes are the Alabama Coushatta Tribe of Texas, the Alabama-Quassarte Tribal Town, the Apache Tribe of Oklahoma, the Caddo Tribe of Oklahoma, the Comanche Tribe of Oklahoma, the Kiowa Tribe of Oklahoma, and the Mescalero Apache Tribe.

3.15 NAVIGATION

3.15.1 Background

SEA examined the proposed construction of bridges over navigable waters as part of the Proposed Action and Alternatives. Navigable waters of the U.S. are defined under USACE regulations, found at 33 CFR Part 329, as "waters that are subject to the ebb and flow of the tide shoreward to the mean high water mark, and/or are presently used, or have been used in the past, or may be susceptible to transport interstate or foreign commerce." USCG authorizes and permits the construction of bridges across navigable waters, as defined above, in accordance with the General Bridge Act of 1946. Bridges legally can not be constructed without prior approval by USCG of the plans and location of the proposed bridge. As required by the Section 9 permitting process, the Applicants have submitted information concerning the proposed bridge construction to USCG, including information describing the specific bridge locations, and vertical and horizontal clearances. USCG, a cooperating agency in the preparation of this EIS, has determined that a bridge permit will be required for construction of a structure at the proposed crossing site of Taylor Bayou. USCG also determined that all other proposed natural waterway crossings, including Armand Bayou, do not require a bridge permit under the Section 9 permitting process. This Draft EIS includes descriptions of the existing conditions for all five natural waterways to provide details in support of USCG's bridge permitting decisions.

3.15.2 Existing Conditions

The Build Alternatives cross five natural waterways and several drainage channels. HCFCD ditches/drainage channels are not tidally influenced and are not considered navigable waters of the U.S. The natural, navigable waterways crossed by the Build Alternatives are described below from west to east. All Alternatives would cross the same waterbodies in the same locations, except for Alternative 1C, which crosses Horsepen Bayou.

3.15.2.1 Armand Bayou

Armand Bayou is a perennial stream that flows in a general southeasterly direction into Clear Lake. The proposed crossing is at mile 5.4 of the new rail line under the Proposed Action, at which point the stream is approximately 30 feet wide[16] with a riparian buffer extending east and west. The stream is tidally influenced and is considered a navigable waterbody at the point of the proposed crossing. There is no commercial navigation in the area of the proposed crossing, but some non-motorized recreational usage of this waterway occurs. A low privately-owned bridge downstream of the proposed crossing makes recreation access to this section of the bayou difficult. The bridge proposed for this crossing would not require a Section 9 Permit from the USCG.

3.15.2.2 Spring Gully

Spring Gully is a small perennial stream that flows south into Armand Bayou south of the proposed crossing described above. Spring Gully is 10 feet wide at the proposed crossing and is not tidally influenced at this point. There is no evidence of navigation on this waterway. This crossing would not require a Section 9 Permit from the USCG.

3.15.2.3 Big Island Slough

Big Island Slough is a channelized perennial stream that is a tributary to Armand Bayou. No recreational navigation use has been confirmed, but such use could exist. The channel is approximately 20-25 feet wide at the proposed crossing, with a narrow riparian buffer. This crossing would not require a Section 9 Permit from the USCG.

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[16] The width of a stream is measured at the channel's ordinary high water mark at the point of the bridge crossing.

3.15.2.4 Taylor Bayou

Taylor Bayou, located near the eastern end of the Proposed Action, is a tidally influenced waterbody. The Bayou is approximately 590 feet wide at the point of the proposed crossing, which is adjacent to the Port Road bridge and an existing railroad bridge. Taylor Bayou currently is crossed by SH 146 upstream of the proposed crossing. The existing bridges are low non-movable structures that limit the size of vessels in this area. Small, motorized, recreational traffic occurs in this region, including possible use by small craft launched from privately-owned docks located upstream of SH 146. This proposed crossing would require a Section 9 Permit from the USCG.

3.15.2.5 Horsepen Bayou

Horsepen Bayou is located at the far west end of the project area, near Ellington Field. Alternative 1C would cross Horsepen Bayou at a location that is 6 feet wide and not tidally influenced. The Bayou is channelized and maintained by HCFCD. There is no navigation at the proposed bridge site. The USCG determined that a Section 9 Permit would not be required.

3.16 ENVIRONMENTAL JUSTICE

3.16.1 Background

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs Federal agencies to “promote nondiscrimination in Federal programs substantially affecting human health and the environment, and provide minority and low income communities access to public information on, and an opportunity for public participation in, matters relating to human health or the environment.” EO 12898 also directs agencies to identify and consider disproportionately high and adverse human health or environmental effects of their actions on minority and low income communities, and provide opportunities for community input in the NEPA process, including input on potential effects and mitigation measures.

EO 12898 provides the following definitions of the terms “minority” and “low income” in the context of environmental justice analysis. Minority individuals are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, and Hispanic. A low income household is one where the household income is below the Department of Health and Human Services’ poverty guidelines. CEQ has oversight for the Federal government's compliance with EO 12898 and the NEPA process. CEQ has prepared guidance to assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and considered. The USDOT and USEPA have also drafted guidelines to provide agencies with guidance to integrate environmental justice requirements into the decision-making process.

The Board has not issued rules or guidance specifically addressing environmental justice. In previous work, SEA has relied on relevant orders and guidance from other Federal agencies.

Although the President's directive on environmental justice, in EO 12898, technically does not apply to independent agencies like the Board, SEA has evaluated the potential high and adverse impacts to determine if they could be borne disproportionately by minority or low income communities.

3.16.2 Existing Conditions

The USEPA Region VI Environmental Index Methodology (USEPA, 1996) creates an Environmental Justice Index for a given project Alternative based on the population density, the percentage of minority residents, and the percentage of residents below a selected income threshold. The purpose of the methodology is to help compare Alternatives and to identify projects that merit more extensive environmental justice evaluation. SEA followed a similar approach, assessing both percentages and densities of low income and minority residents in the vicinity of the project.

3.16.2.1 Population Characteristics for the Project Area

Table 3.16-1 below presents year 2000 population and minority percentages for Harris County and six cities that are crossed by or adjacent to the Proposed Action and Alternatives.

Table 3.16-1
Percent Minority for Jurisdictions in Project Area

Geographic Area	Population	% Minority
Harris County	3,400,578	57.9%
City of Houston	1,953,631	69.2%
Pasadena City	141,674	52.8%
La Porte	31,880	29.3%
Deer Park	28,520	19.2%
South Houston City	15,833	19.6%
Dayton	5,709	32.4%

Source: U.S. Census Bureau, Census 2000, Summary File 1 Tape (SF1), table P4 available at www.census.gov.

3.16.2.2 Proposed Action and Alternatives

Build Alternatives. For each of the Build Alternatives, a new rail line would be constructed through areas with little residential development. The subdivision of Clear Lake City, south and southeast of the proposed construction area, is a middle to upper income subdivision within the jurisdiction of Houston. Pasadena, which is north of the Build Alternatives, is a diverse community with a lower minority concentration than the county average. It includes a substantial number of middle and low income residents.

All of the Build Alternatives would use the existing GH&H line to Tower 85. The population along the GH&H line near Ellington Field is not characterized by either low income or minority status. Heading northwest, the GH&H line passes through more densely populated areas that can be characterized as low income and through some census block areas that are characterized as minority. The area from Tower 30 to Tower 85, on the GH&H line, and from Tower 85 to Tower 87, on the East Belt Subdivision, contains several low income areas and some census blocks with minority populations. The areas from Tower 87 to Dayton Junction and on to the CMC Dayton Yard are sparsely populated and are not characterized as low income or minority.

No-Build Alternative. The No-Build Alternative involves no new rail construction. It would use the existing Baytown, Lafayette, Terminal, and East Belt Subdivisions, Strang Subdivision, and Bayport Loop Industrial Lead to access the Bayport Loop. The segment from the CMC Dayton Yard to Tower 30 is the same as that used under the Build Alternatives and its existing environmental justice populations are discussed above. The population along the Strang Subdivision, near Harrisburg Junction and Manchester Yard, is predominantly low income and some of the census blocks can be characterized as minority. Further east, the Strang Subdivision passes through less densely populated areas that are not characterized as low income, but do contain some census blocks with minority populations. Pasadena City, which is south of the Strang Subdivision, is a diverse community with lower minority concentration than the county average. It includes a substantial number of middle and low income residents. North of Strang Yard is a sparsely populated low income area.

The Bayport Loop Industrial Lead runs through sparsely populated areas that are not characterized as low income or minority.

No-Action Alternative. The No-Action Alternative involves the existing UP operations. UP currently operates its Bayport Loop traffic over the Bayport Loop Industrial Lead to the Strang Yard. UP then operates along a variety of rail lines to access Settegast, Spring, Galveston, or Englewood Yards. The existing environmental justice conditions along the Bayport Loop Industrial Lead and the Strang Subdivision are described above under the No-Build Alternative.