Figure 12-12. Fire Intensity Scale Map – Council of Cities

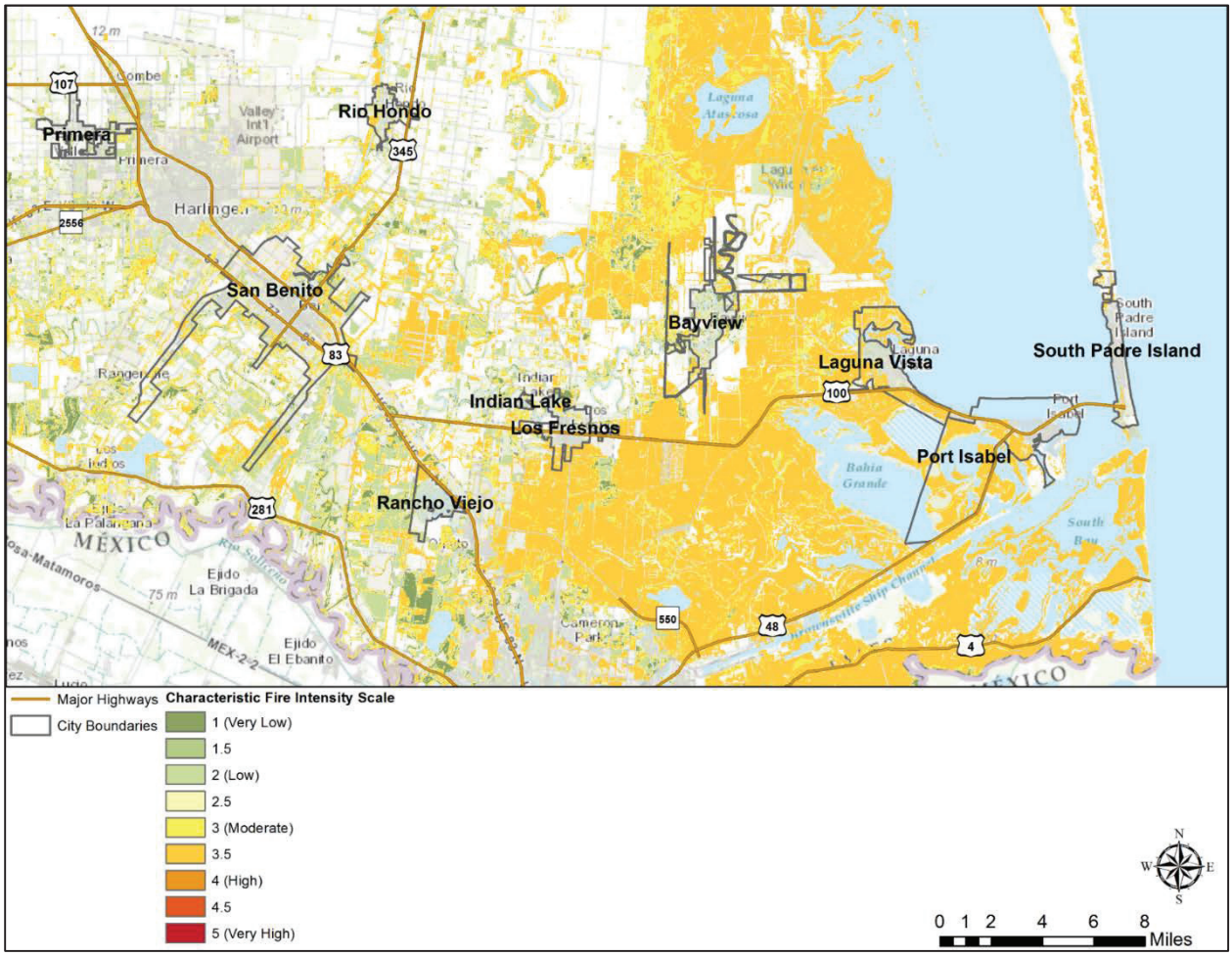


Figure 12-13. Fire Intensity Scale Map – Bayview

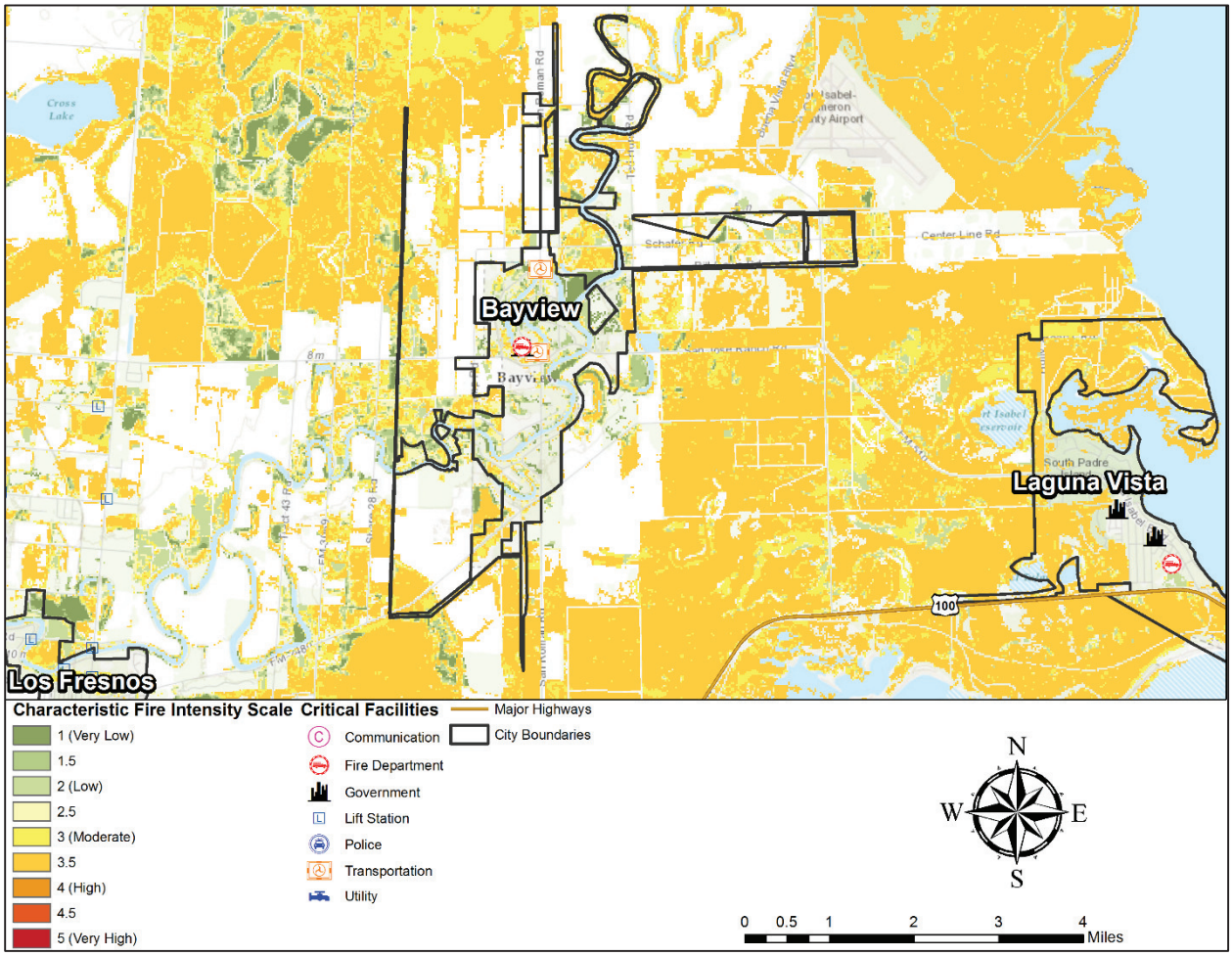


Figure 12-14. Fire Intensity Scale Map – Indian Lake

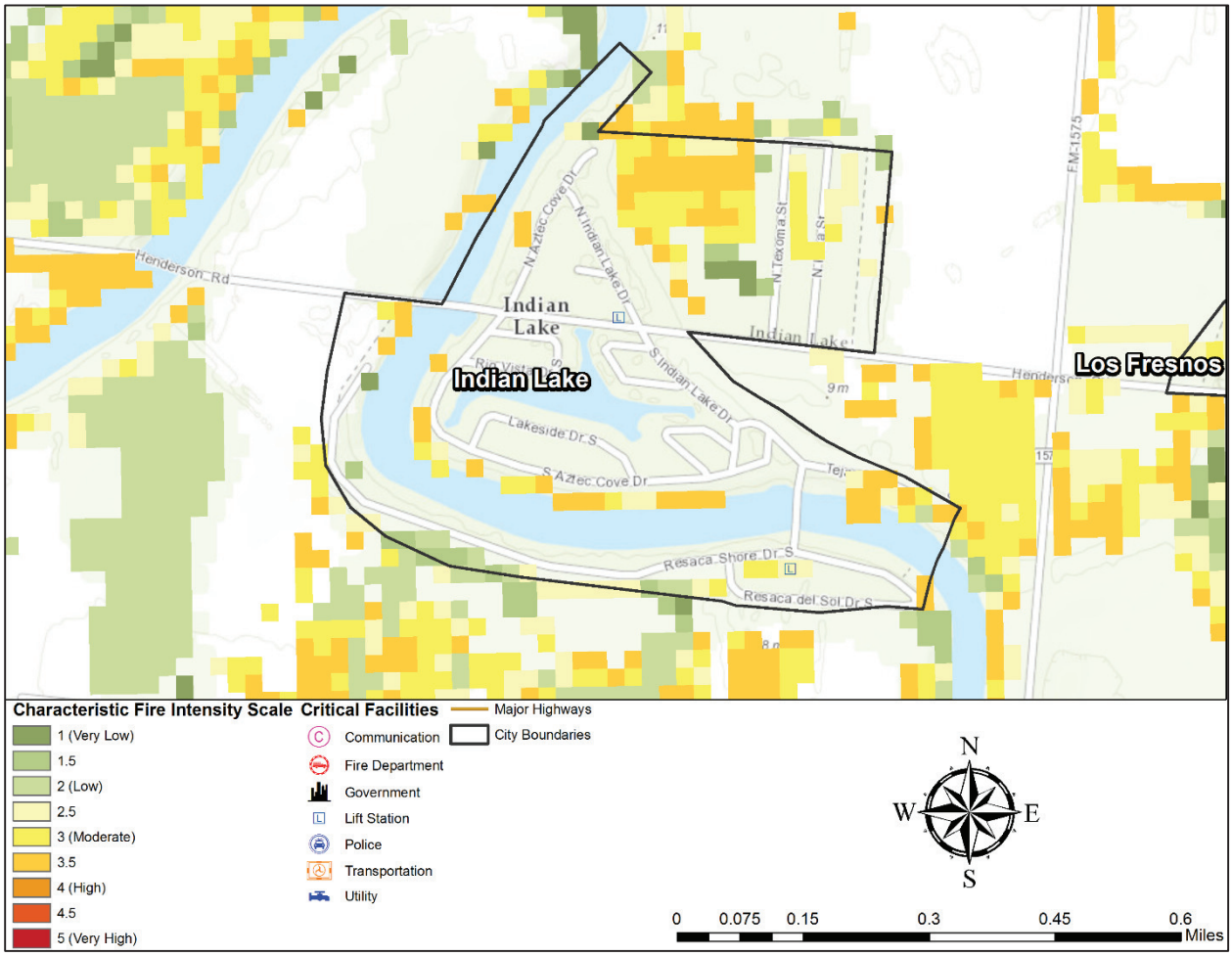


Figure 12-15. Fire Intensity Scale Map – Laguna Vista

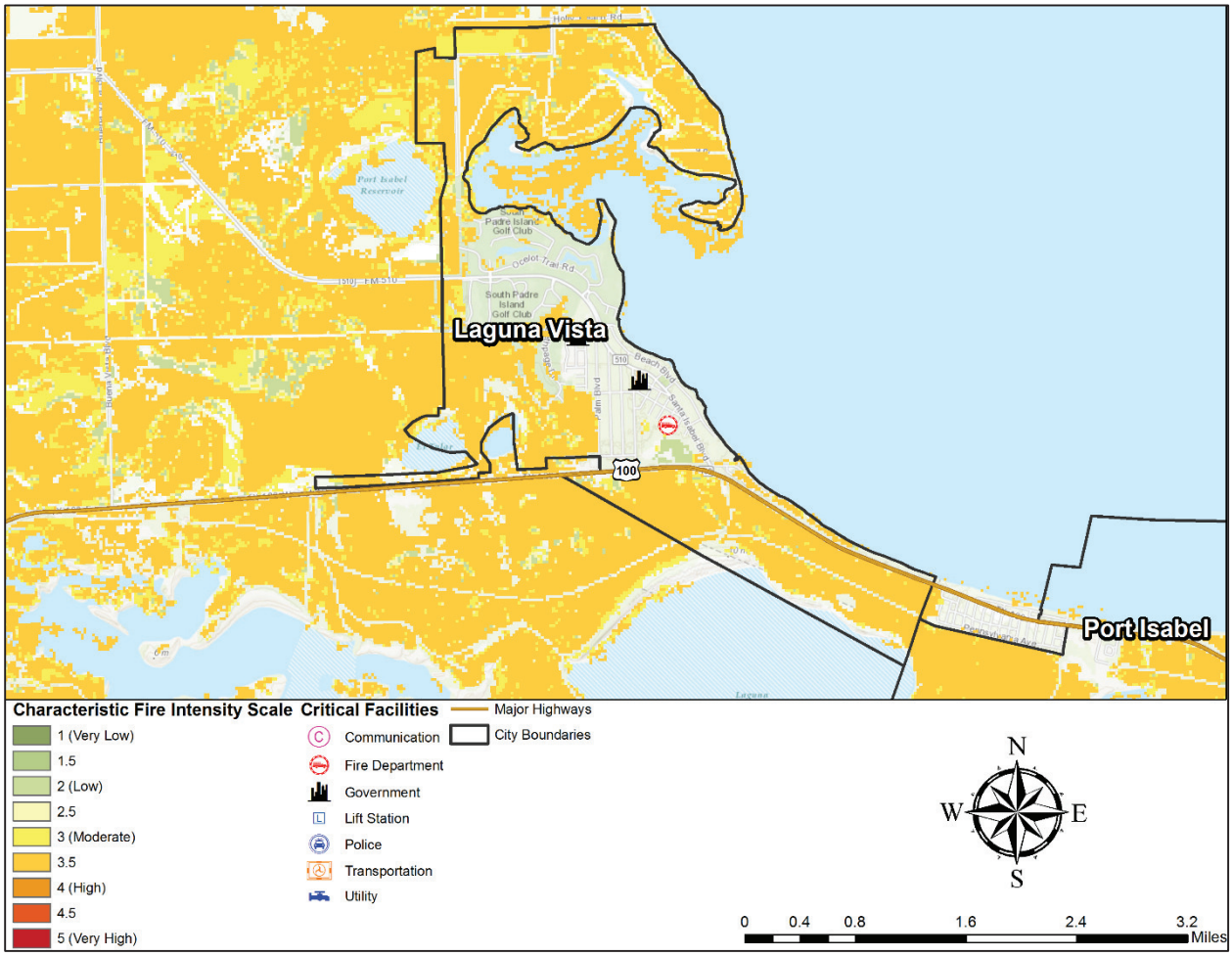


Figure 12-16. Fire Intensity Scale Map – Los Fresnos

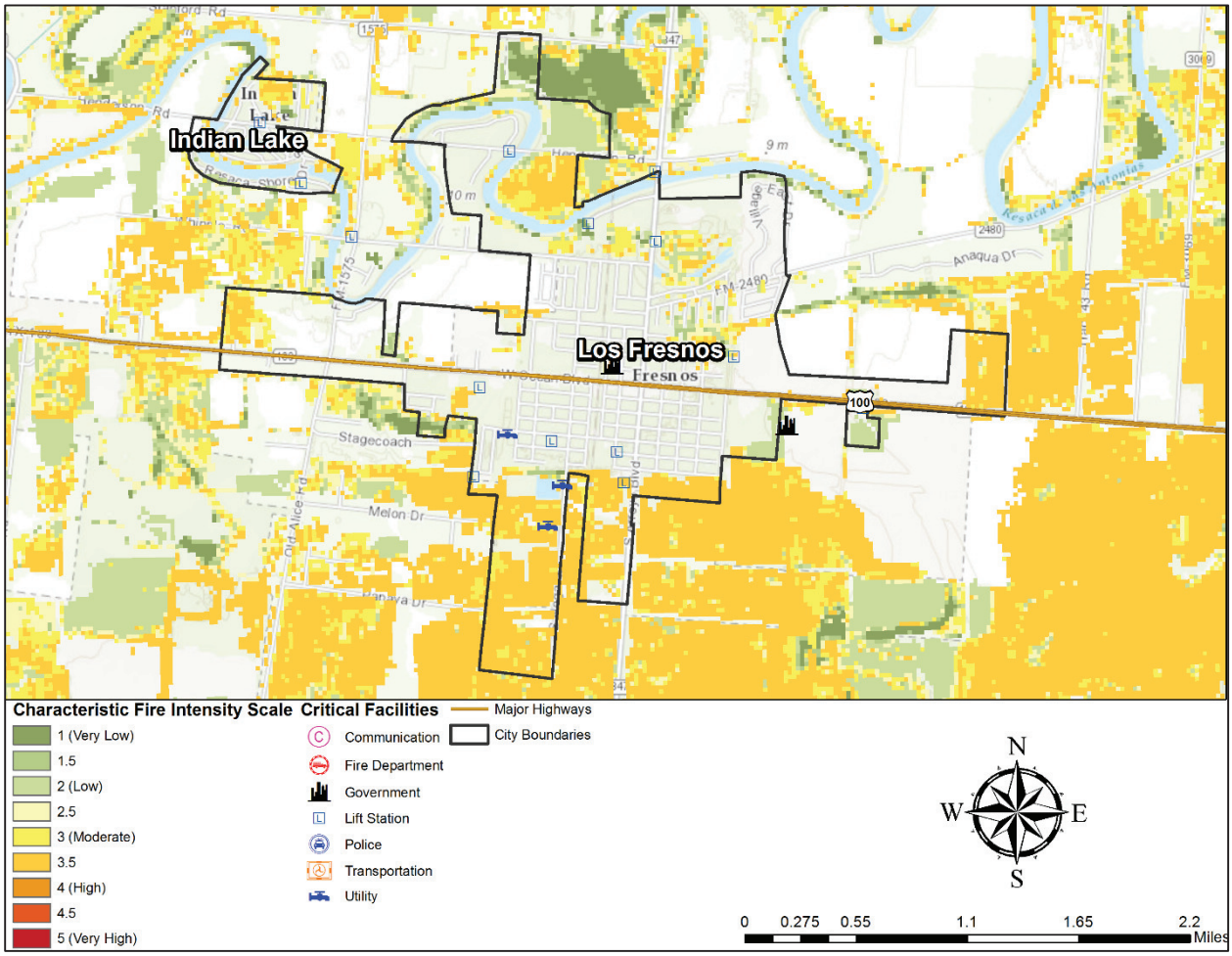


Figure 12-17. Fire Intensity Scale Map – Port Isabel

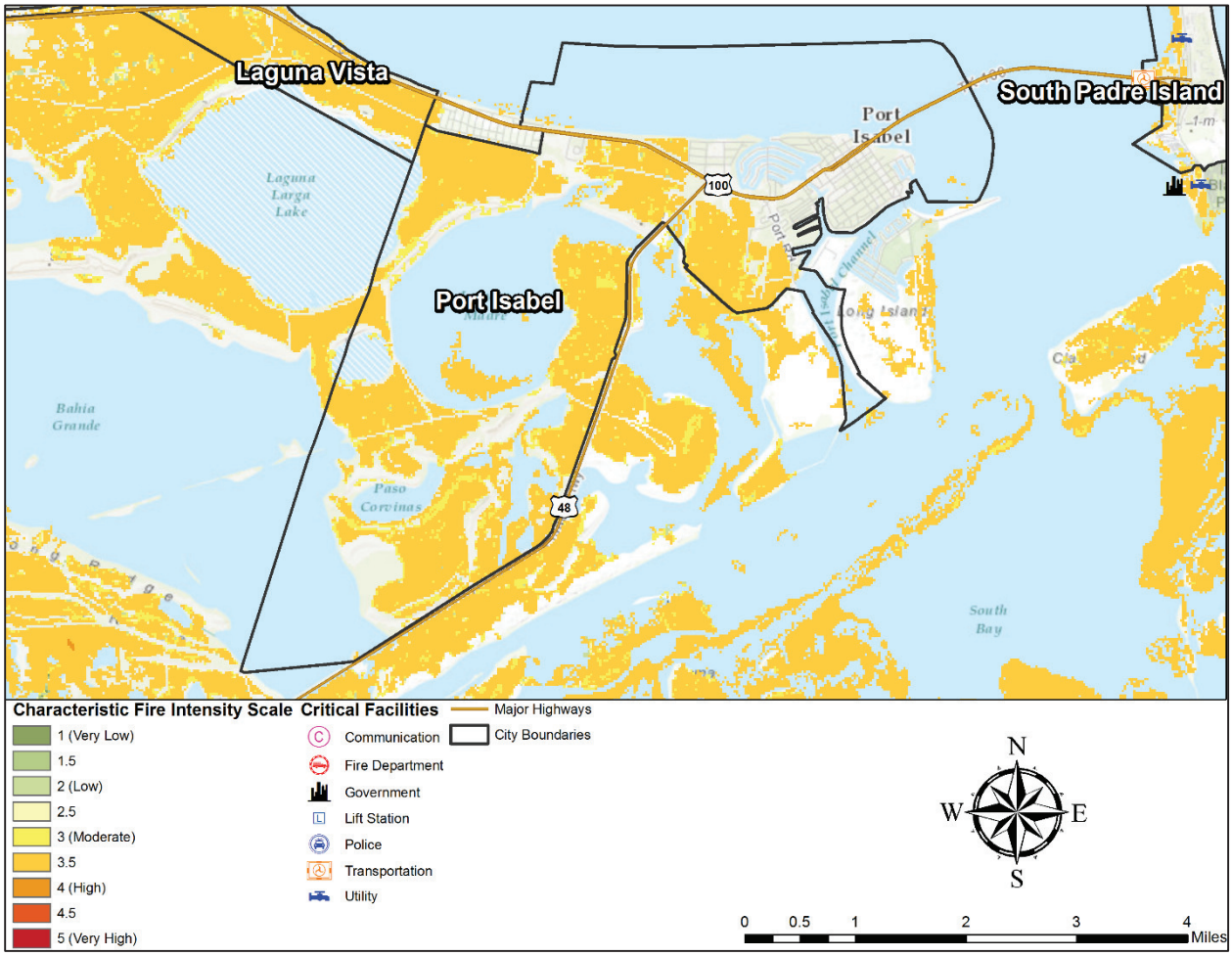


Figure 12-18. Fire Intensity Scale Map – Primera

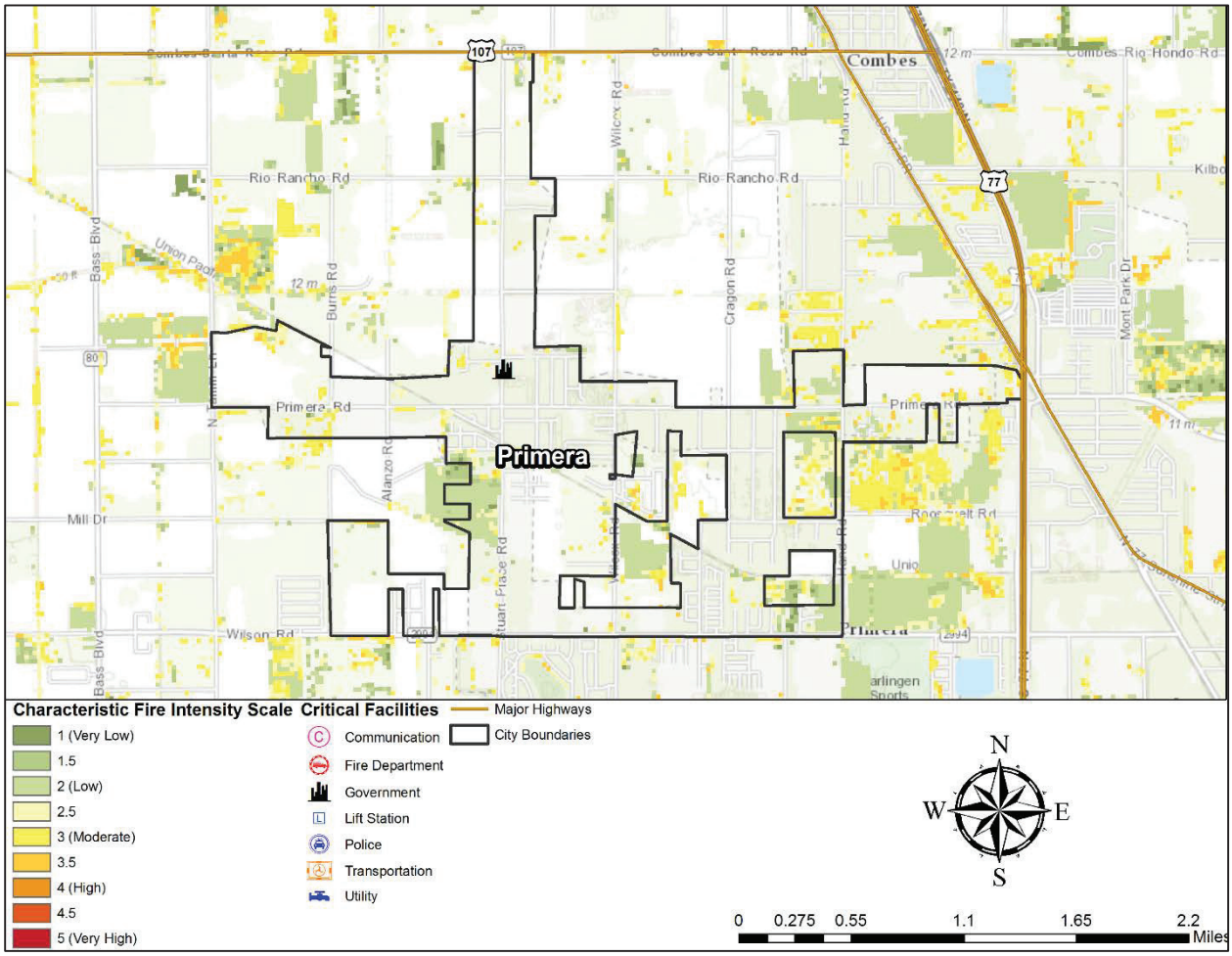


Figure 12-19. Fire Intensity Scale Map – Rancho Viejo

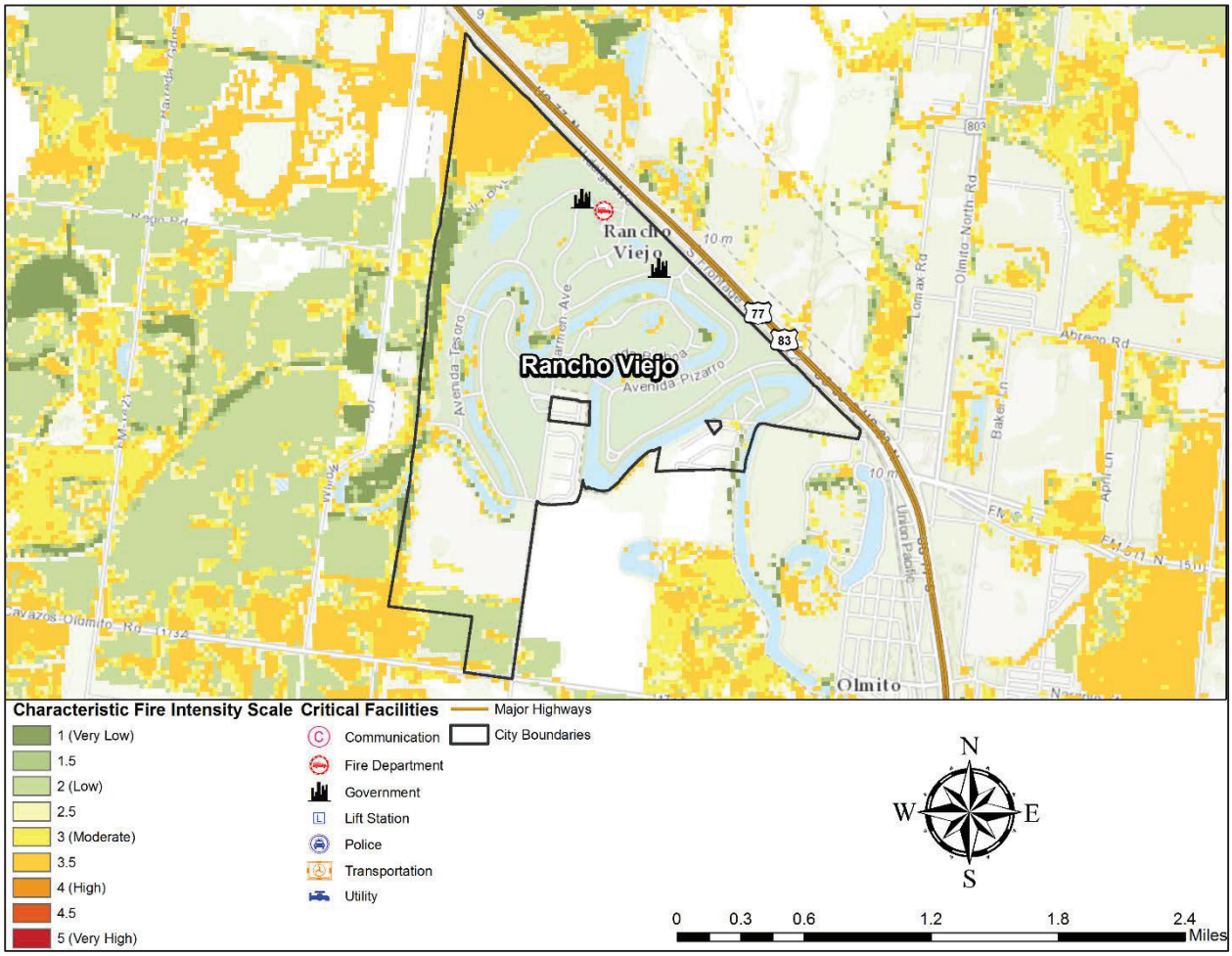


Figure 12-20. Fire Intensity Scale Map – Rio Hondo

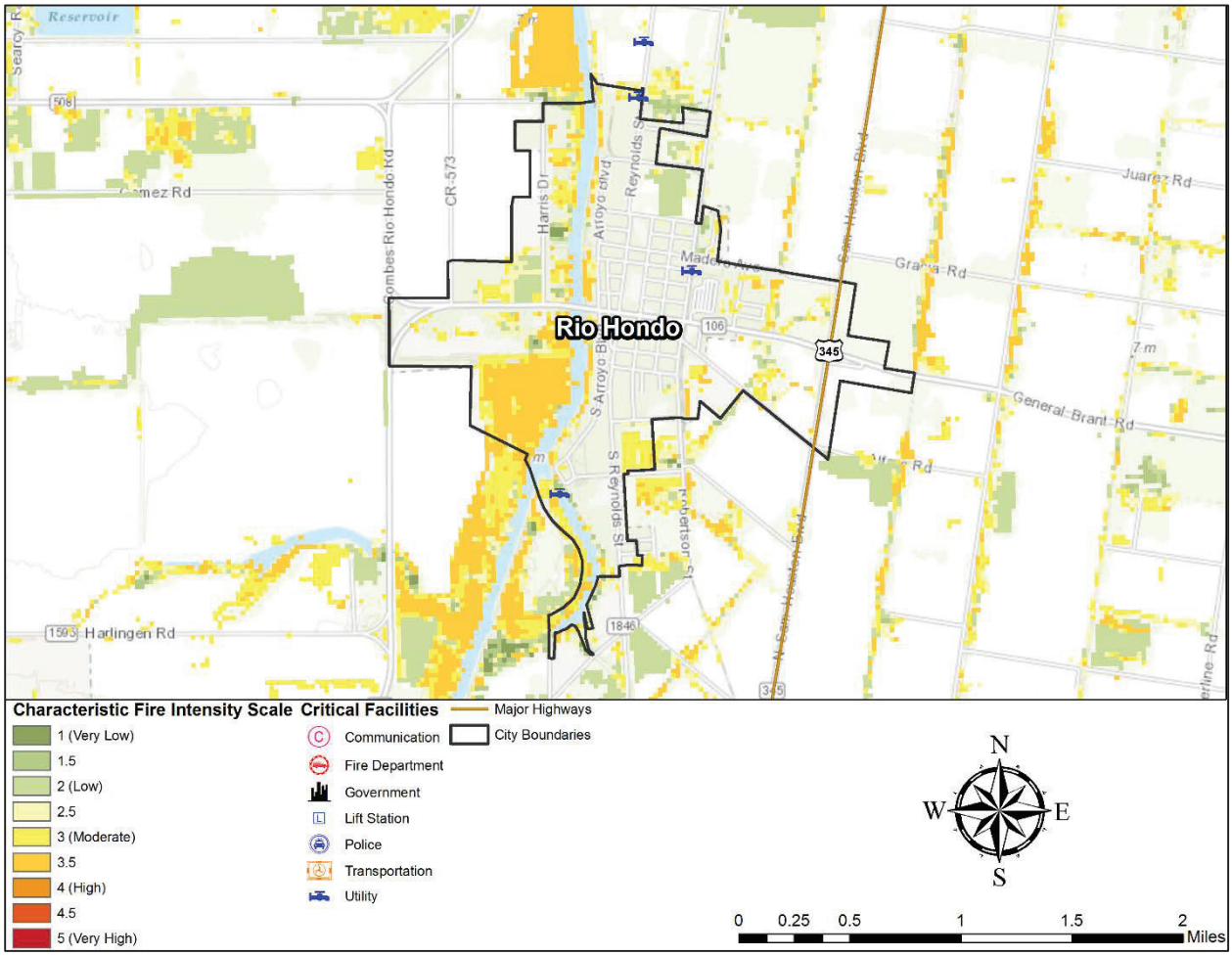


Figure 12-21. Fire Intensity Scale Map – San Benito

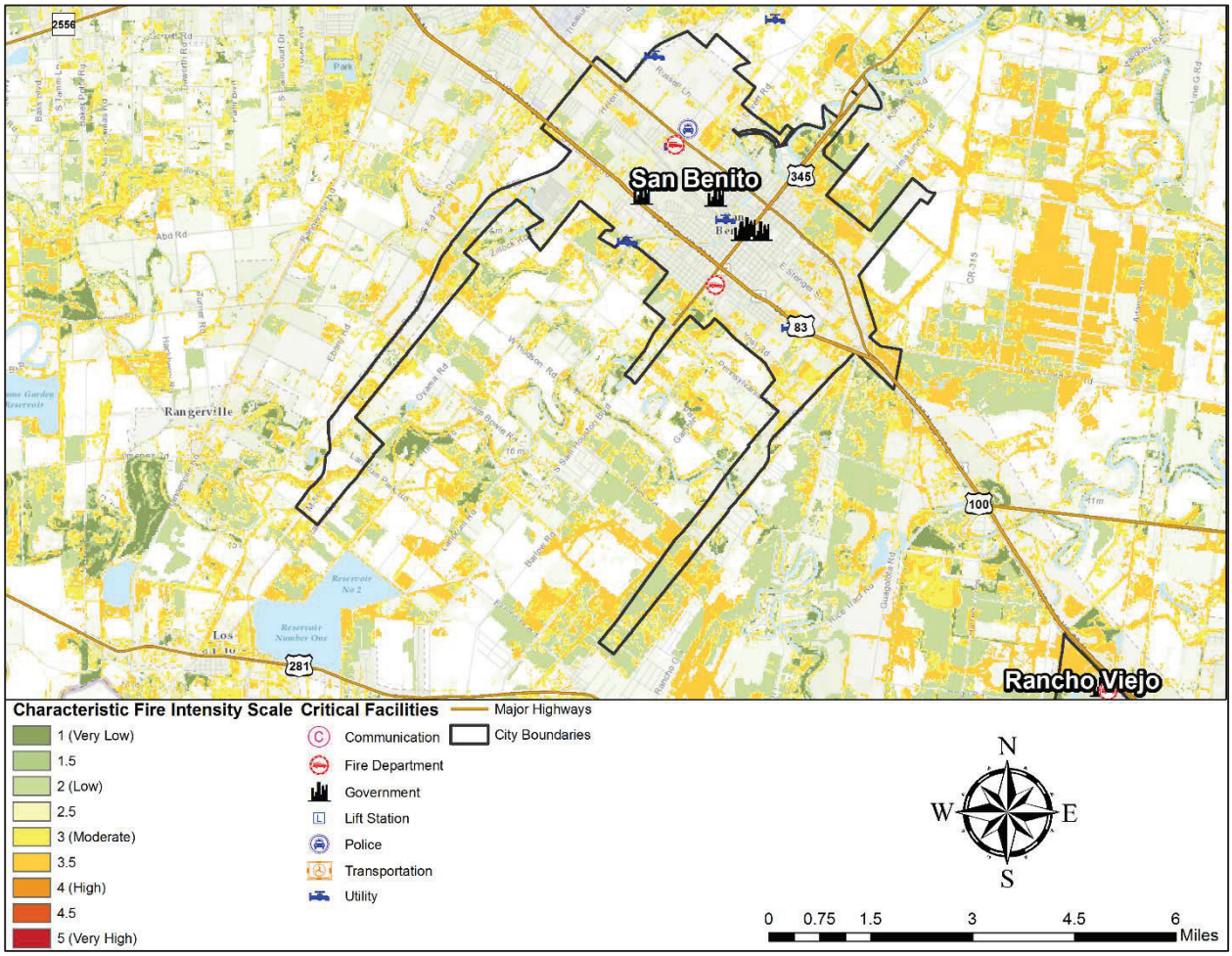
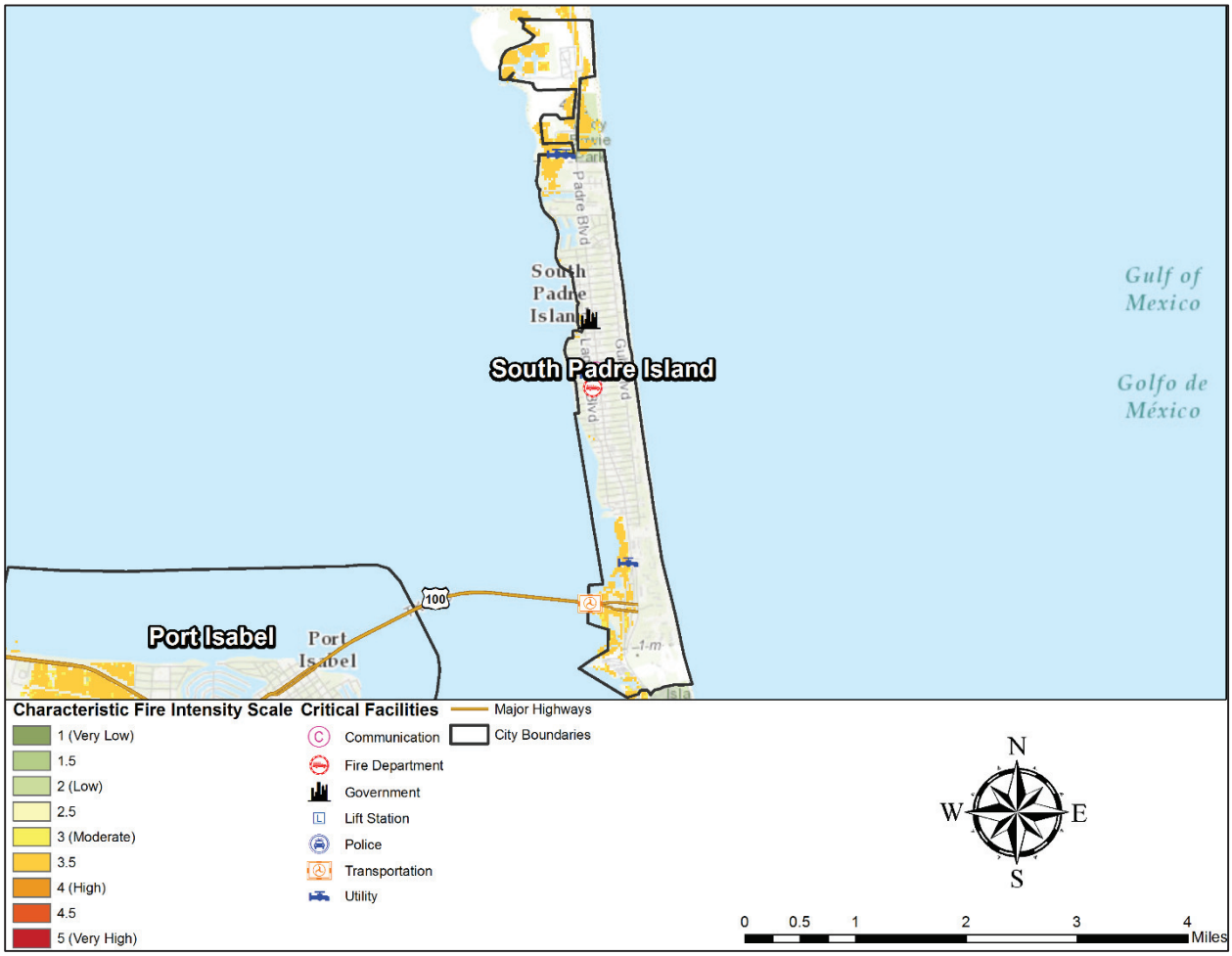


Figure 12-22. Fire Intensity Scale Map – South Padre Island



Historical Occurrences

The Texas Forest Service reported 133 wildfire events between 1996 and 2015. Damages for the reported events was not available. The National Climatic Data Center (NCDC) did not have any reported events through the same period. The Texas Forest Service (TFS) started collecting wildfire data in 1985 and volunteer fire departments started reporting events in 2005. Due to a lack of recorded data for wildfire events prior to 2005, frequency calculations are based on a ten-year period, using only data from recorded years. Figure 12-23 illustrates the approximate locations of wildfires according to the Texas Forest Service. Table 12-1 and 12-2 identify the number of wildfires by jurisdiction, and total acreage burned.

Figure 12-23. Location and Historic Wildfire Events – Council of Cities

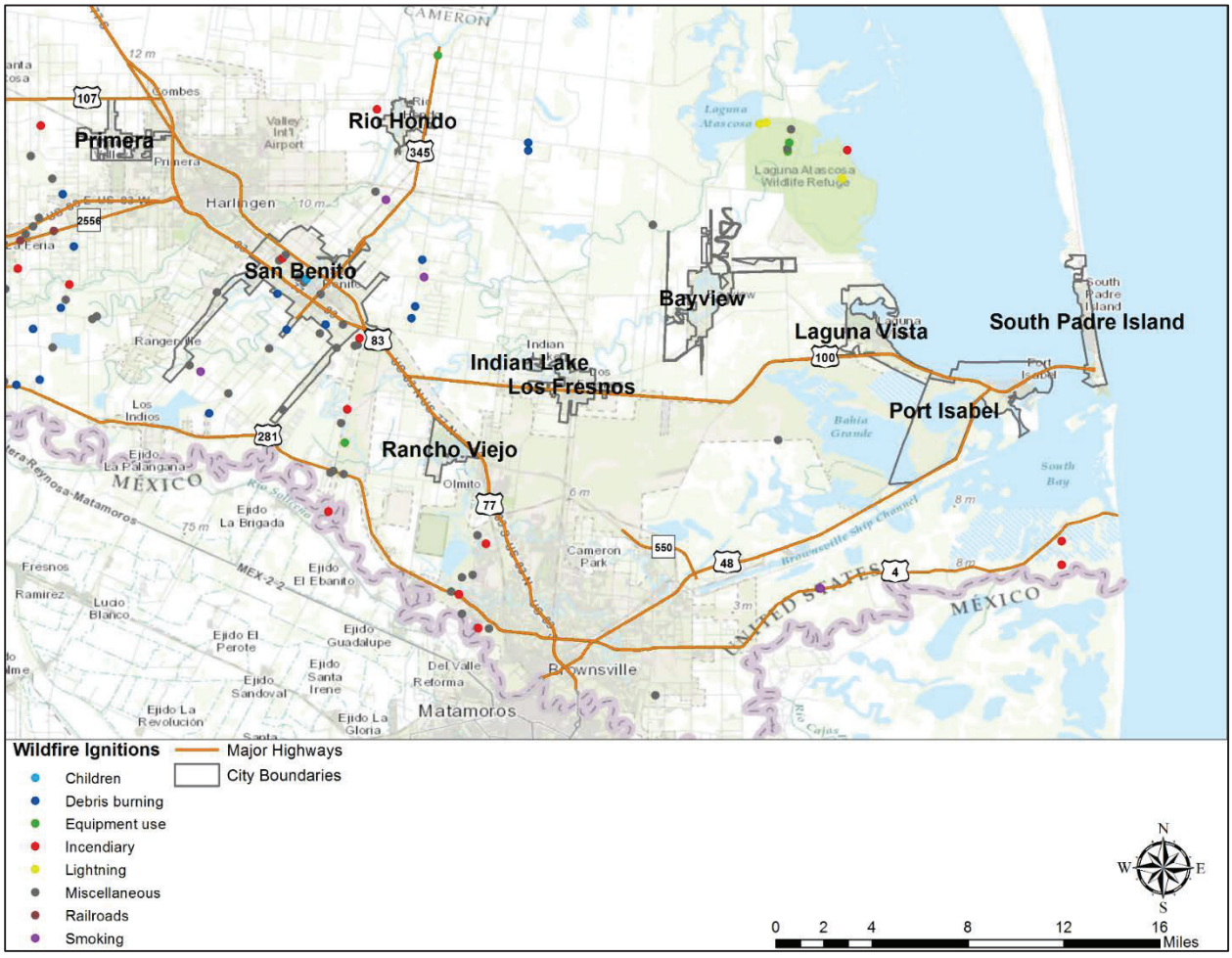


Table 12-1. Historical Wildfire Events Summary

JURISDICTION	NUMBER OF EVENTS	ACRES BURNED
Bayview	0	0
Indian Lake	0	0
Laguna Vista	0	0
Los Fresnos	0	0
Port Isabel	0	0
Primera	0	0
Rancho Viejo	0	0
Rio Hondo	0	0
San Benito	9	6.24
South Padre Island	0	0
County	133	2,130.39

Table 12-2. Acreage of Suppressed Wildfire by Year

JURISDICTION	2005	2006	2007	2008	2009
Bayview	0	0	0	0	0
Indian Lake	0	0	0	0	0
Laguna Vista	0	0	0	0	0
Los Fresnos	0	0	0	0	0
Port Isabel	0	0	0	0	0
Primera	0	0	0	0	0
Rancho Viejo	0	0	0	0	0
Rio Hondo	0	0	0	0	0
San Benito	0.25	5.99	0	0	0
South Padre Island	0	0	0	0	0
County	712.15	1,184.44	5.8	193.1	34.9

Probability of Future Events

Wildfires can occur at any time of the year. As the jurisdictions within the county move into wildland, the potential area of occurrence of wildfire increases. With 133 events in a 20 year period, an event within the Council of Cities planning area, including all participating jurisdictions, is highly likely, meaning an event is probable within the next year.

Vulnerability and Impact

Periods of drought, dry conditions, high temperatures, and low humidity are factors that contribute to the occurrence of a wildfire event. Areas along railroads and people whose homes are in woodland settings have an increased risk of being affected by wildfire.

The heavily populated, urban areas within the Council of Cities are not likely to experience large, sweeping fires. Areas outside of city limits and in the unincorporated areas of Cameron County are vulnerable. Unoccupied buildings and open spaces that have not been maintained have the greatest vulnerability to wildfire. The overall level of concern for wildfires is located mostly along the perimeter of the study area where wildland and urban areas interface.

The sparsely populated participating jurisdictions and rural areas of Bayview and Indian Lake are capable of experiencing large sweeping fires, especially where areas of vegetation are not maintained. Areas along major highways in Primera, Rancho Viejo, and San Benito have an increased vulnerability where empty lots and unoccupied areas are located.

The following critical facilities would be vulnerable to wildfire events in each participating jurisdiction, respectively. (Facilities listed in red font are located in the WUI and are more susceptible to wildfire)

Table 12-3. Critical Facilities by Jurisdiction

Jurisdiction	Critical Facilities
Bayview	Town Hall, Fire Station, 2 Bridges (north and south side)
Indian Lake	Town Hall, Police Station, Community Center, 2 Water Utility Facilities, Main Water Meter, Henderson Road Bridge, Resaca Shores Bridge
Laguna Vista	City Hall/Police Station, Fire Station, Library
Los Fresnos	City Hall, Water Plant, Sewer Plant, Raw Water Meter Station, 20 Lift Stations (18 Lift Stations located in WUI)
Port Isabel	14 Lift Stations, AEP Electrical Substations, Texas Gas Service, EOC, City Hall, Police Department, Fire Department, Port Isabel EMS, Port Isabel Health Clinic, Port Isabel Medical Clinic, H.E.B., Walmart, Harbor-Pampano Park, 3 Main Harbor Entrances
Primera	City Hall

Jurisdiction	Critical Facilities
Rancho Viejo	Town Hall, Fire Station, Valley Municipal Utilities Department
Rio Hondo	Rio Hondo Bridge, Water Plant, Reservoir Dam, Sewer Plant, Fertilizer Plant, Police Station
San Benito	2 Water Plants (1 Water Plant located in WUI), 2 Water Towers, Waste Water Treatment Plant, Waste Water Wetlands, City Hall, Municipal Building, Public Works, School administration, School Campuses, AT&T Hub Location, Police Station, 2 Fire Stations, Cameron County Annex, 2 Power substations
South Padre Island	City Hall, Water Tower (north), AT&T Hub, Fire Station, Water Tower (south), Power substation (north), Power Substation (south), US Coast Guard Station, Queen Isabella Causeway

Within Cameron County, a total of 133 fire events were reported from 1996 to 2015. All of these events were suspected wildfires. Historic loss and annualized estimates due to wildfires are presented in Table 12-3 below. The frequency is approximately 7 events every year.

Table 12-4. Historic Loss Estimates due to Wildfire[2]

JURISDICTION	NUMBER OF EVENTS	ACRES BURNED	ANNUAL ACRE LOSSES
Bayview	0	0	0
Indian Lake	0	0	0
Laguna Vista	0	0	0
Los Fresnos	0	0	0
Port Isabel	0	0	0
Primera	0	0	0
Rancho Viejo	0	0	0
Rio Hondo	0	0	0
San Benito	9	6.24	0.62
South Padre Island	0	0	0
County	133	2,130.39	213.0

Figures 12-24 through 12-33 show the threat of wildfire to the each participating jurisdiction.

[2] *Events divided by 10 years of data.*

Figure 12-24. Wildfire Threat – Bayview

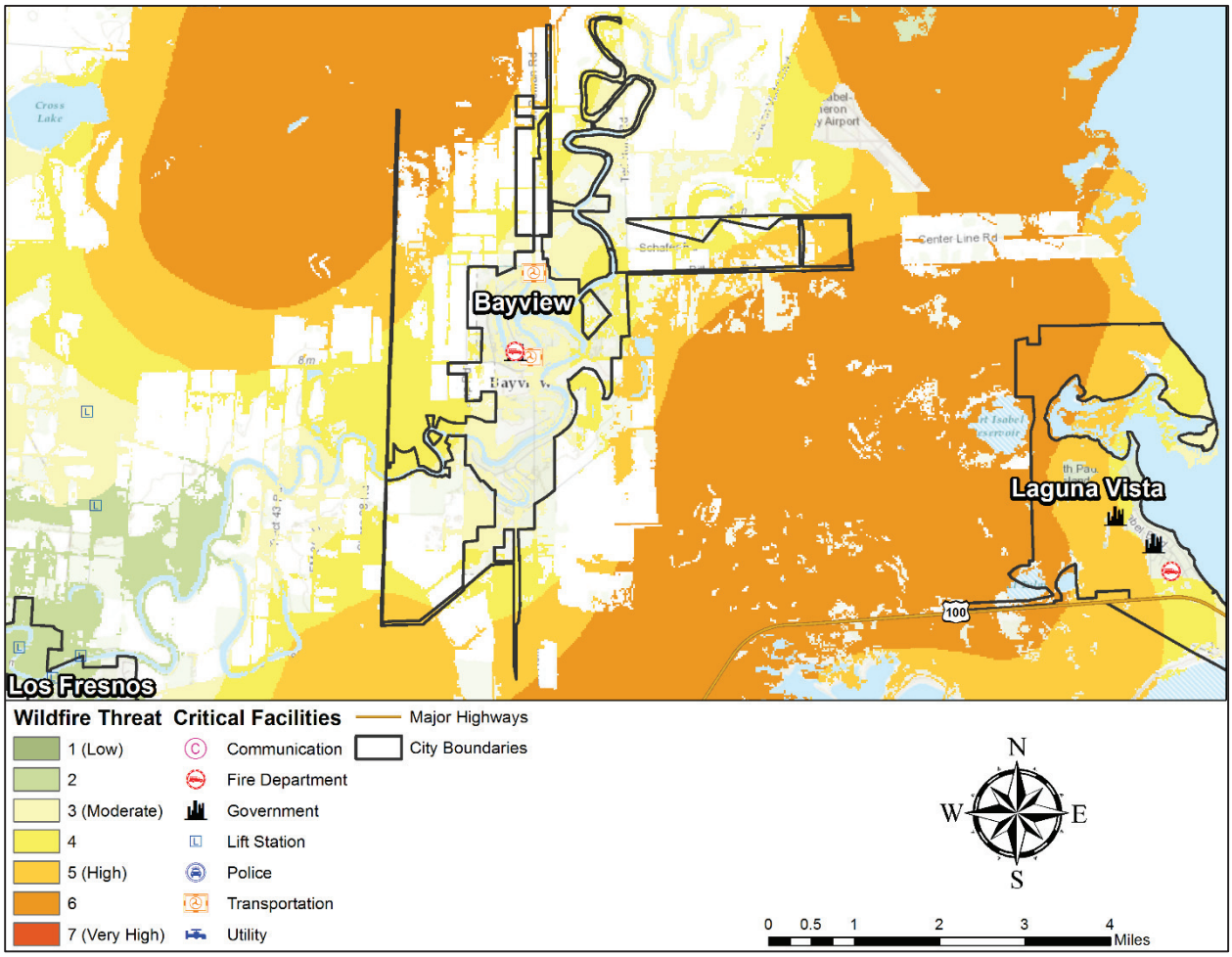


Figure 12-25. Wildfire Threat – Indian Lake

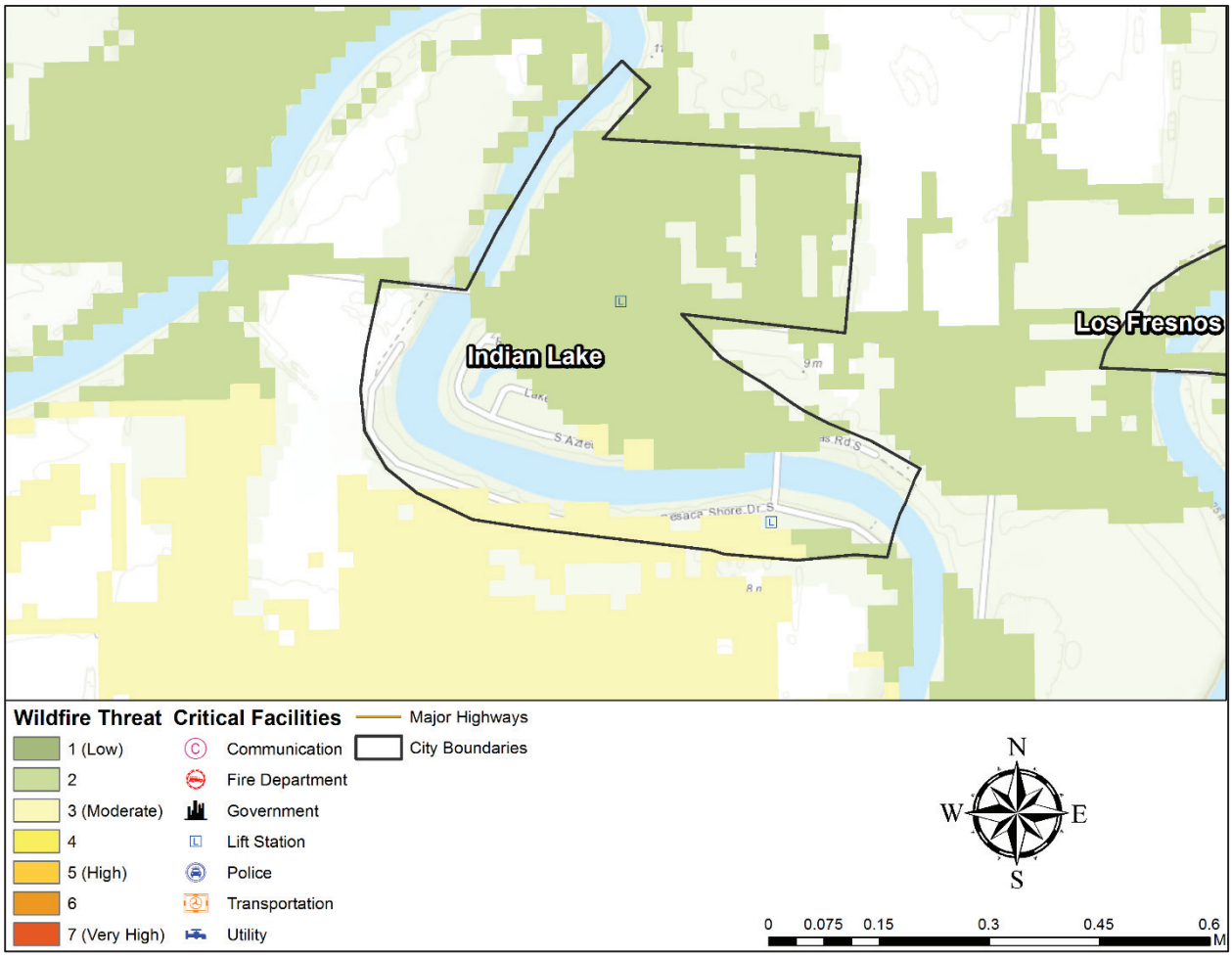


Figure 12-26. Wildfire Threat – Laguna Vista

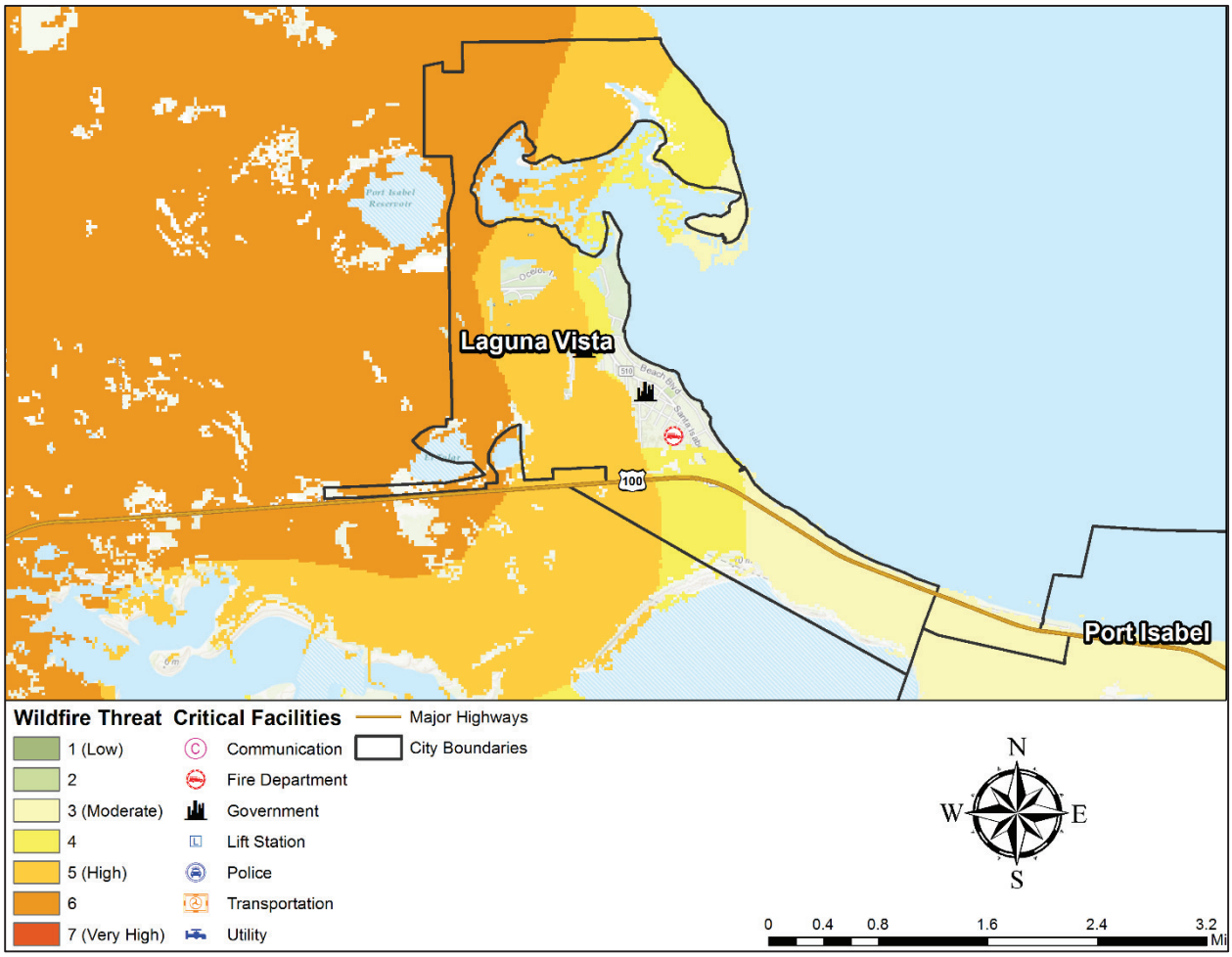


Figure 12-27. Wildfire Threat – Los Fresnos

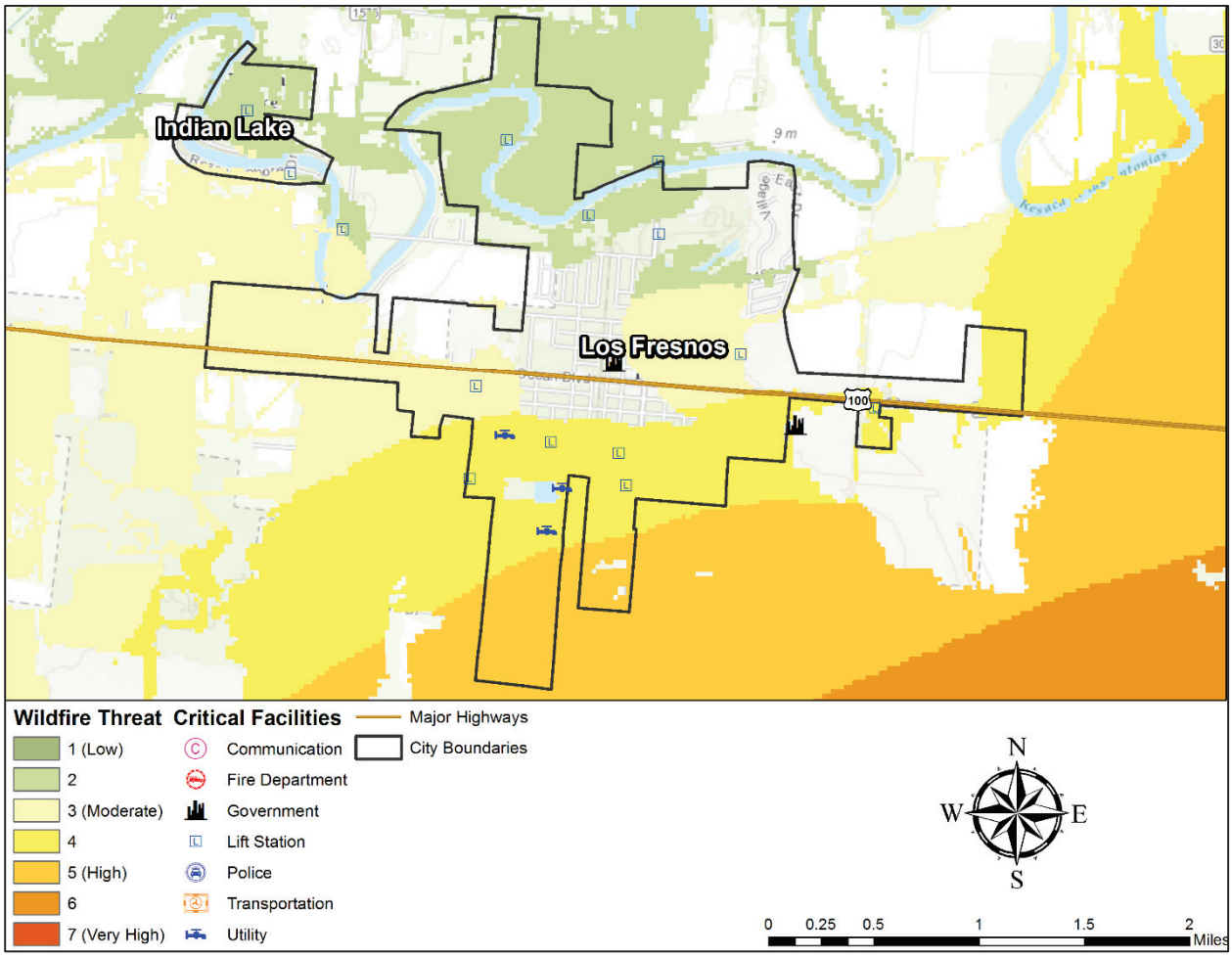


Figure 12-28. Wildfire Threat – Port Isabel

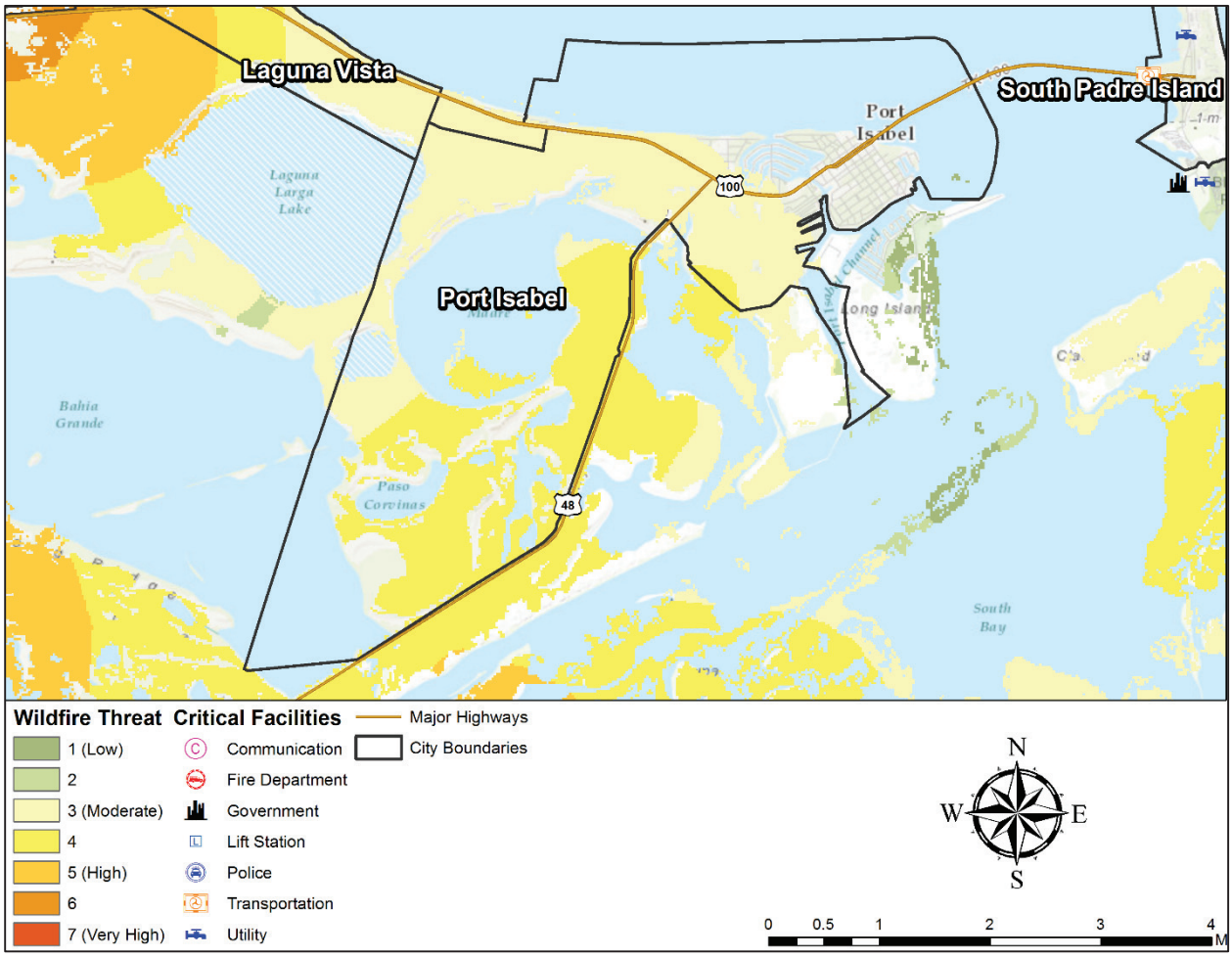


Figure 12-29. Wildfire Threat – Primera

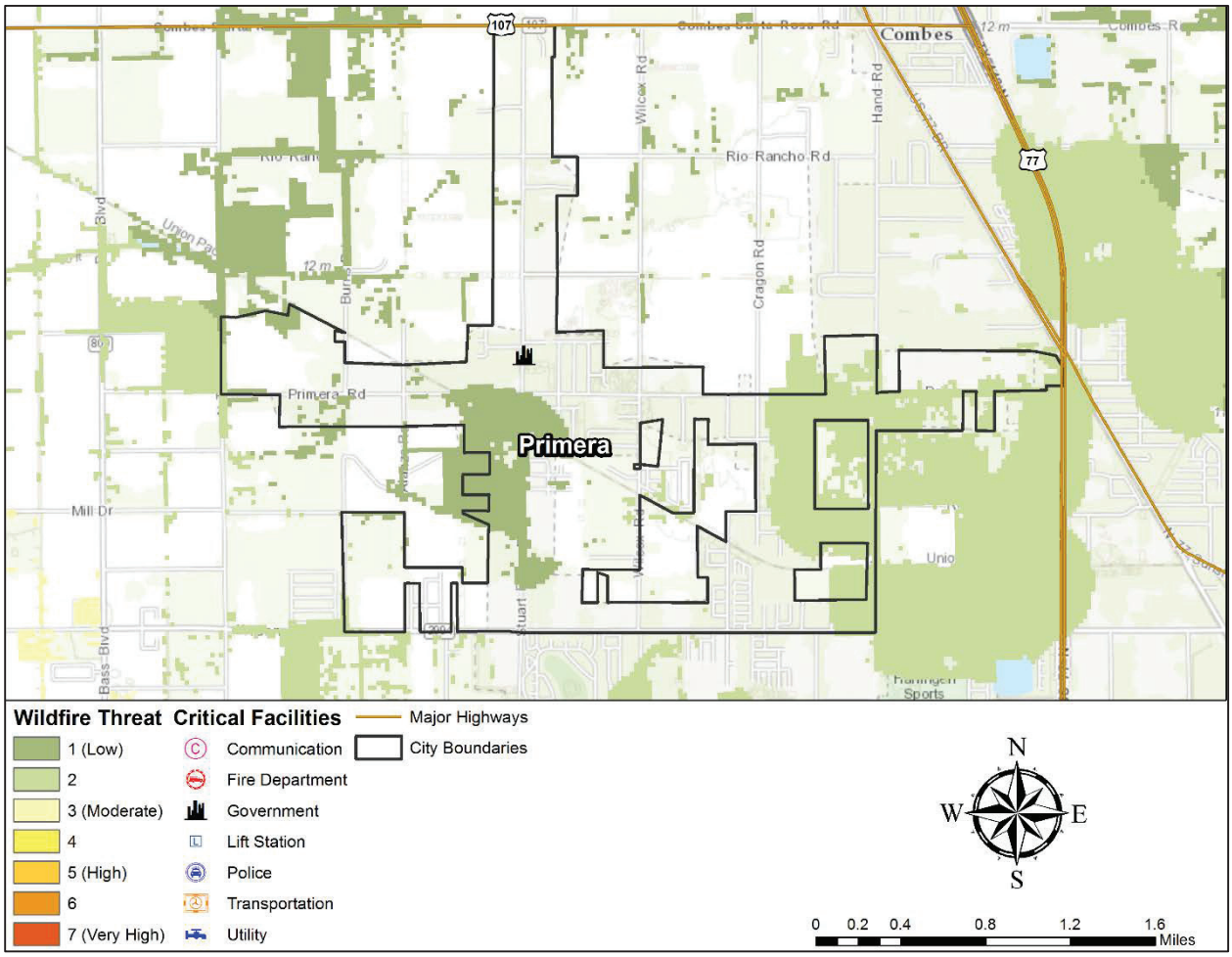


Figure 12-30. Wildfire Threat – Rancho Viejo

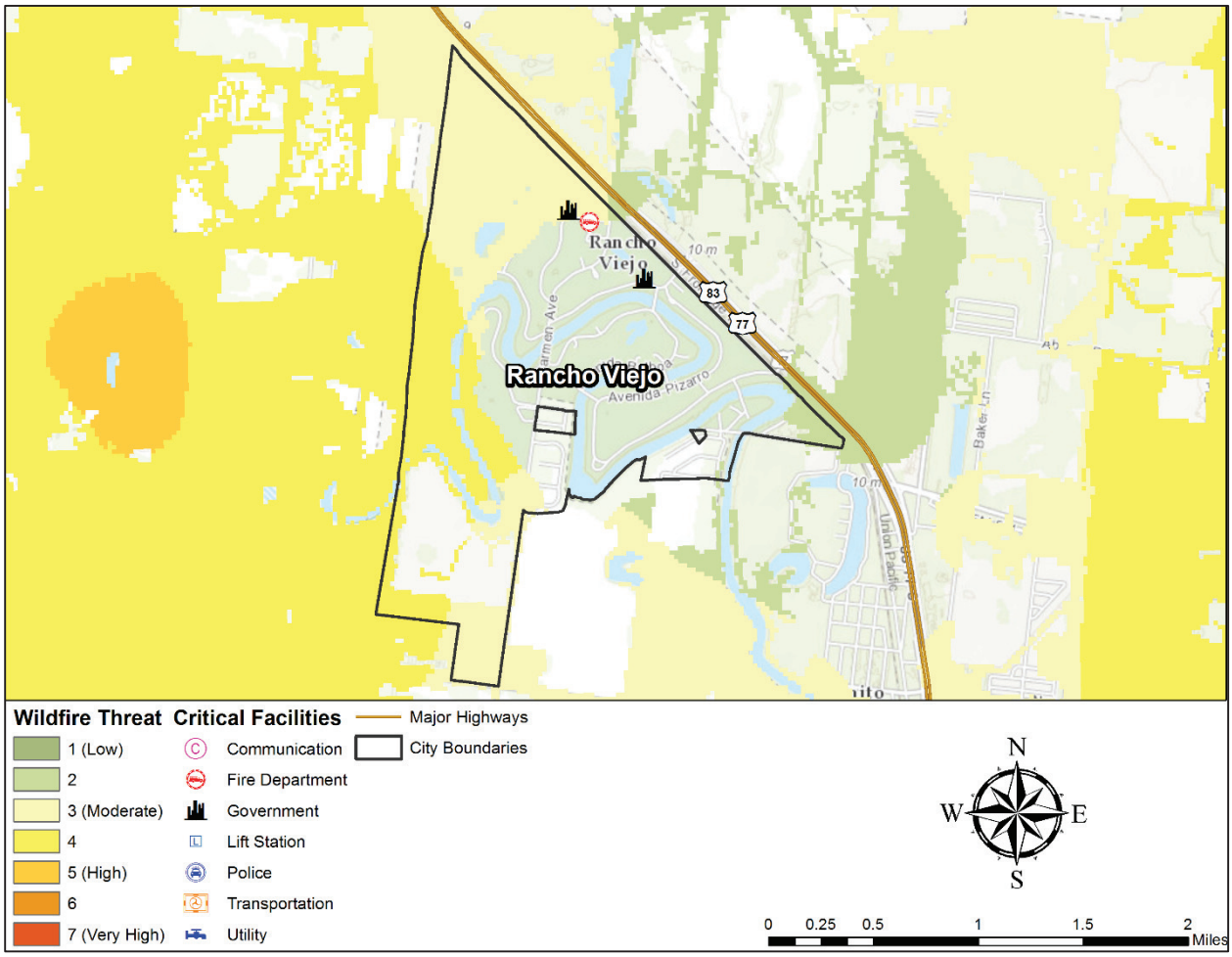


Figure 12-31. Wildfire Threat – Rio Hondo

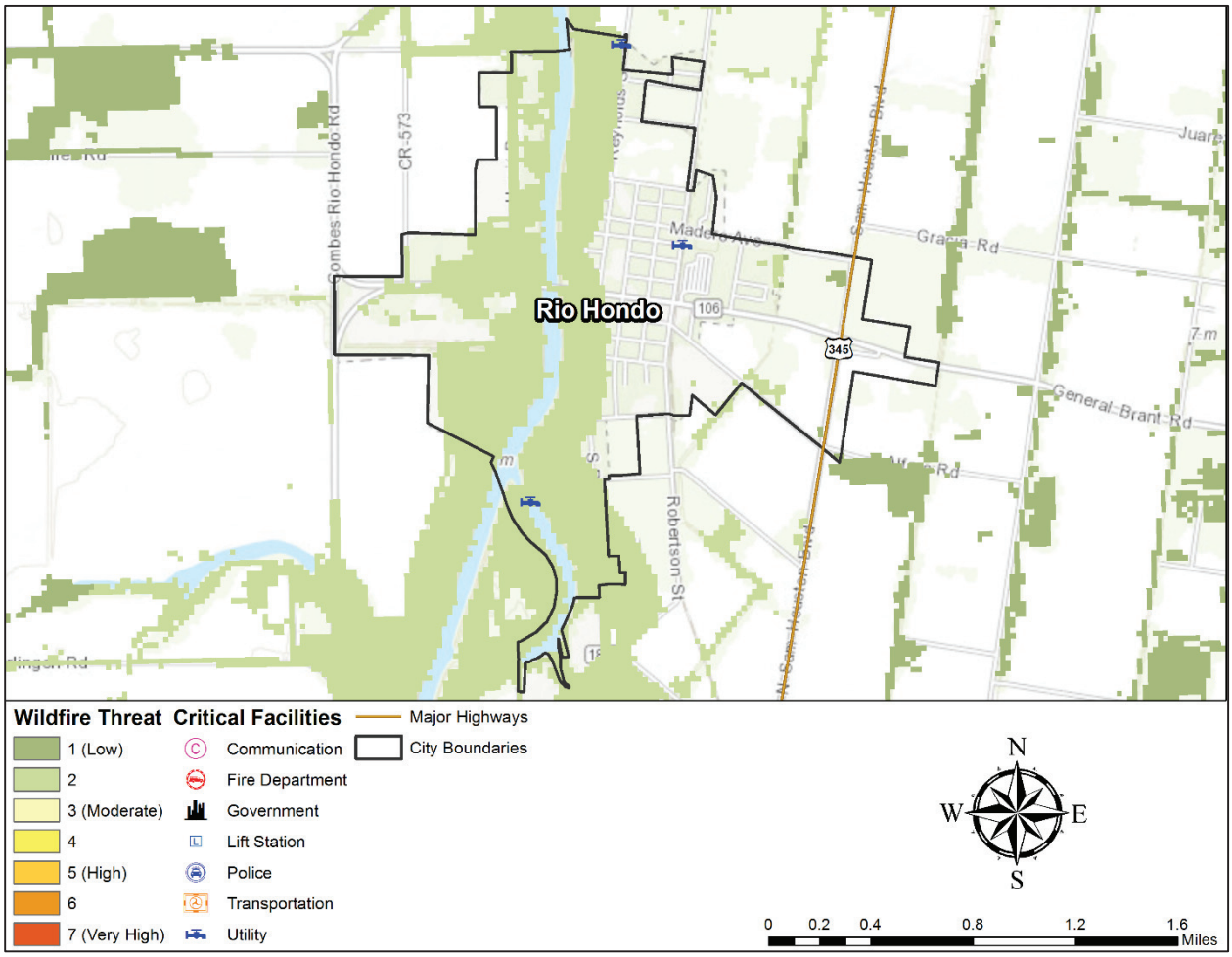


Figure 12-32. Wildfire Threat – San Benito

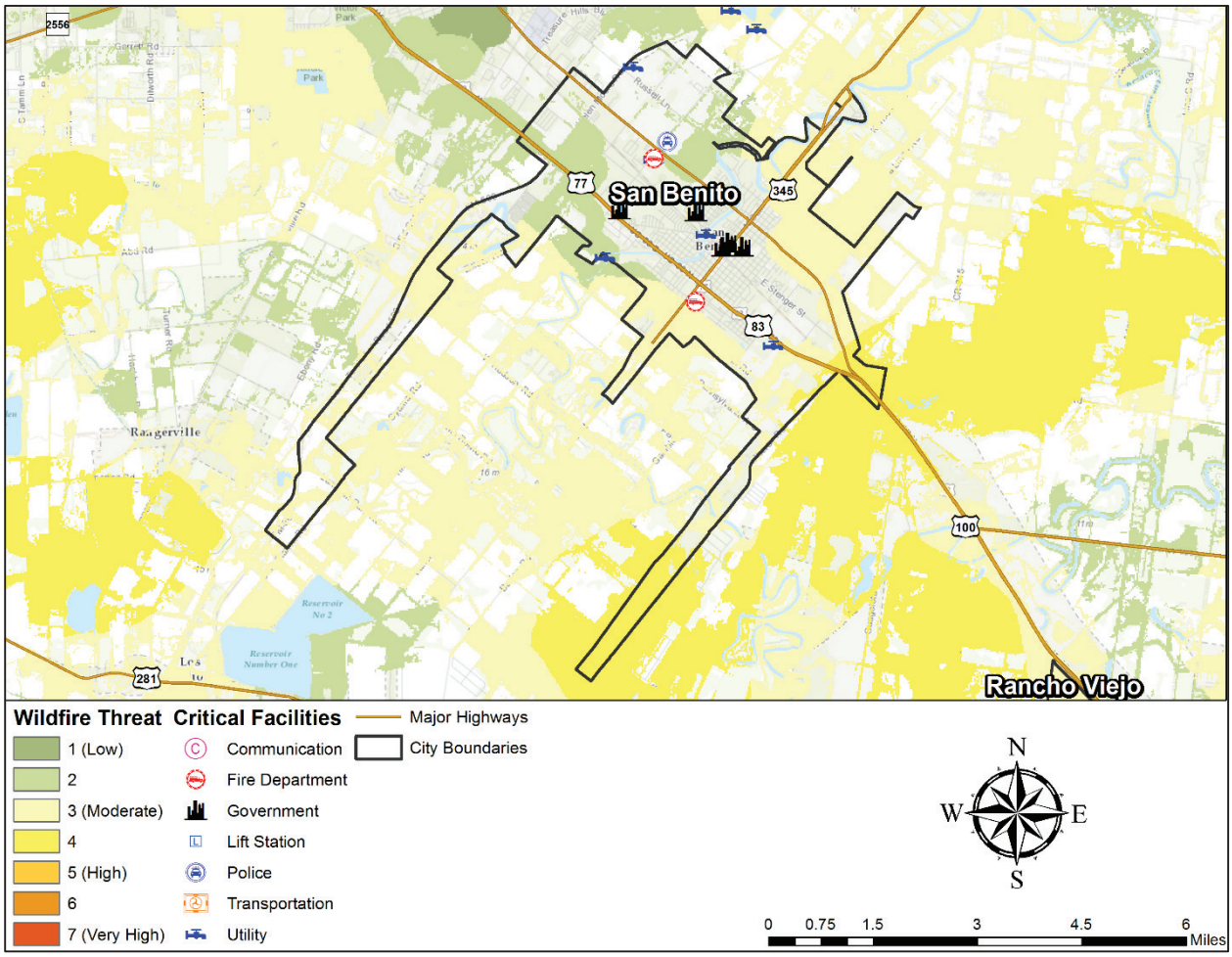
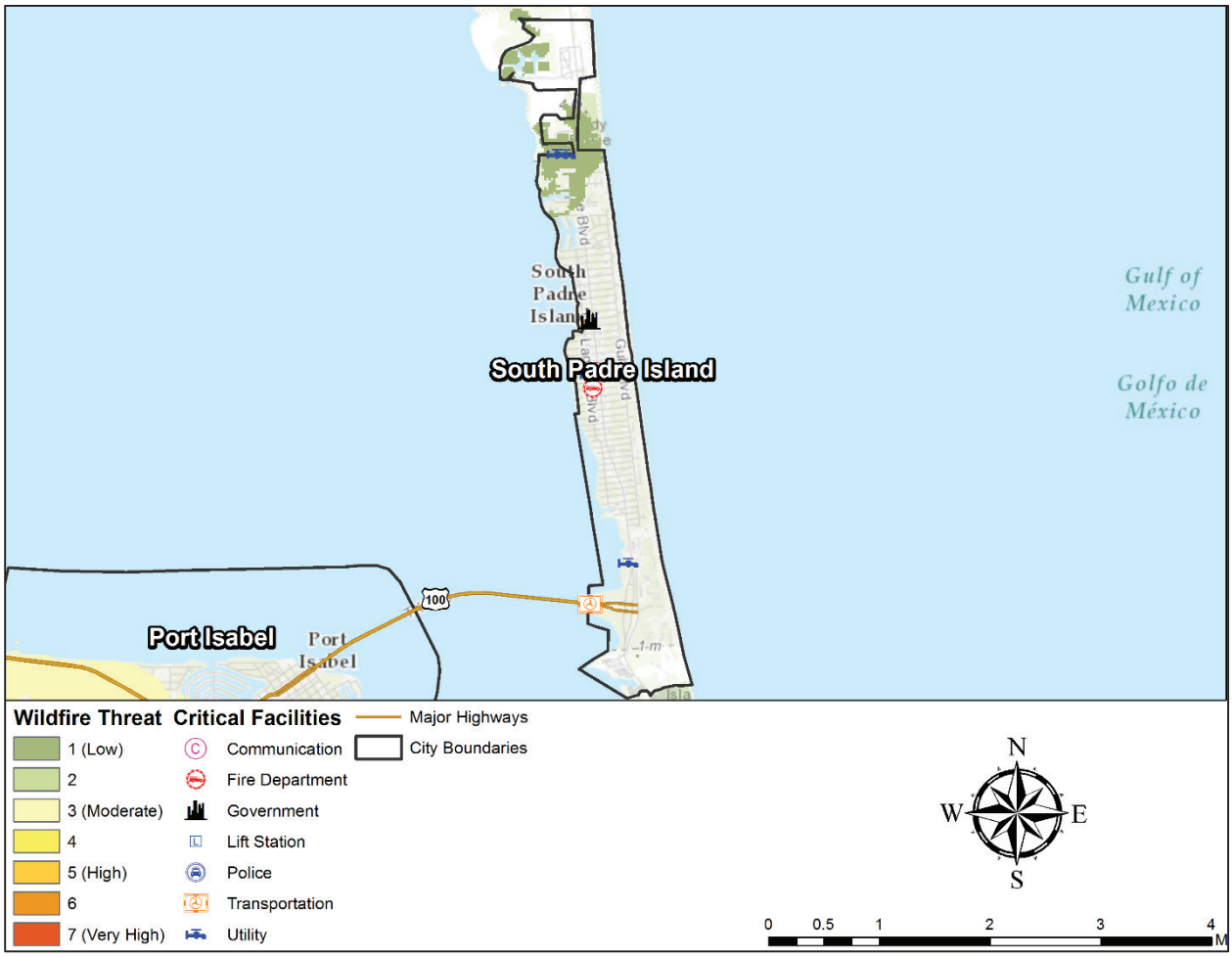


Figure 12-33. Wildfire Threat – South Padre Island



Diminished air quality is an environmental impact that can result from a wildfire event and pose a potential health risk. The smoke plumes from wildfires can contain potentially inhalable carcinogenic matter. Fine particles of invisible soot and ash that are too microscopic for the respiratory system to filter can cause immediate and possibly long term health effects. The elderly or those individuals with compromised respiratory systems may be more vulnerable to the effects of diminished air quality after a wildfire event.

Climatic conditions such as severe freezes and drought can significantly increase the intensity of wildfires since these conditions kill vegetation, creating a prime fuel source for wildfires. The intensity and rate at which wildfires spread are directly related to wind speed, temperature, and relative humidity.

The severity of impact from major wildfire events can be substantial. Such events can cause multiple deaths, shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. Severity of impact is gauged by acreage burned, homes and structures lost, and the number of resulting injuries and fatalities. For the Council of Cities planning area,

the impact from a wildfire event can be considered “Limited," meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10% of property is destroyed or with major damage.

Assessment of Impacts

A Wildfire event poses a potentially significant risk to public health and safety, particularly if the wildfire is initially unnoticed and spreads quickly. The impacts associated with a wildfire are not limited to the direct damages. Potential impacts for the planning area include:

- Persons in the area at the time of the fire are at risk for injury or death from burns and/or smoke inhalation.
- First responders are at greater risk of physical injury since they are in close proximity to the hazard while extinguishing flames, protecting property or evacuating residents in the area.
- First responders can experience heart disease, respiratory problems, and other long term related illnesses from prolonged exposure to smoke, chemicals, and heat.
- Emergency services may be disrupted during a wildfire if facilities are impacted, roadways are inaccessible or personnel are unable to report for duty.
- Critical city and/or county departments may not be able to function and provide necessary services depending on the location of the fire, and the structures or personnel impacted.
- Non-critical businesses may be directly damaged, suffer loss of utility services, or be otherwise inaccessible, delaying normal operations and slowing the recovery process.
- Displaced residents may not be able to immediately return to work, further slowing economic recovery.
- Roadways in or near the WUI could be damaged or closed due to smoke and limited visibility.
- Older homes are generally exempt from modern building code requirements, which may require fire suppression equipment in the structure.
- Some high density neighborhoods feature small lots with structures close together, increasing the potential for fire to spread rapidly.
- Air pollution from smoke may exacerbate respiratory problems of vulnerable residents.
- Charred ground after a wildfire cannot easily absorb rainwater, increasing the risk of flooding and potential mudflows.
- Wildfires can cause erosion, degrading stream water quality.
- Wildlife may be displaced or destroyed.
- Historical or cultural resources may be damaged or destroyed.
- Tourism can be significantly disrupted, further delaying economic recovery for the area.
- Vegetated dunes can be stripped, significantly damaging the function of the dunes to protect inland areas from the destructive forces of wind and waves.
- Economic disruption negatively impacts the programs and services provided by the community due to short and long term loss in revenue.
- Fire suppression costs can be substantial, exhausting the financial resources of the community.

- Residential structures lost in a wildfire may not be rebuilt for years, reducing the tax base for the community
- Recreation and tourism can be unappealing for years following a large wildfire, devastating directly related businesses.
- Direct impacts to municipal water supply may occur through contamination of ash and debris during the fire, destruction of aboveground delivery lines, and soil erosion or debris deposits into waterways after the fire.

The economic and financial impacts of a wildfire event on local government will depend on the scale of the event, what is damaged, costs of repair or replacement, lost business days in impacted areas, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by government, businesses and citizens will contribute to the overall economic and financial conditions in the aftermath of a wildfire event.

Section 13: Expansive Soils

Hazard Description

Expansive soils are soils and soft rocks with a relatively high percentage of clay minerals that are subject to changes in volume as they swell and shrink with changing moisture conditions. Drought conditions can cause soils to contract in response to a loss of soil moisture.

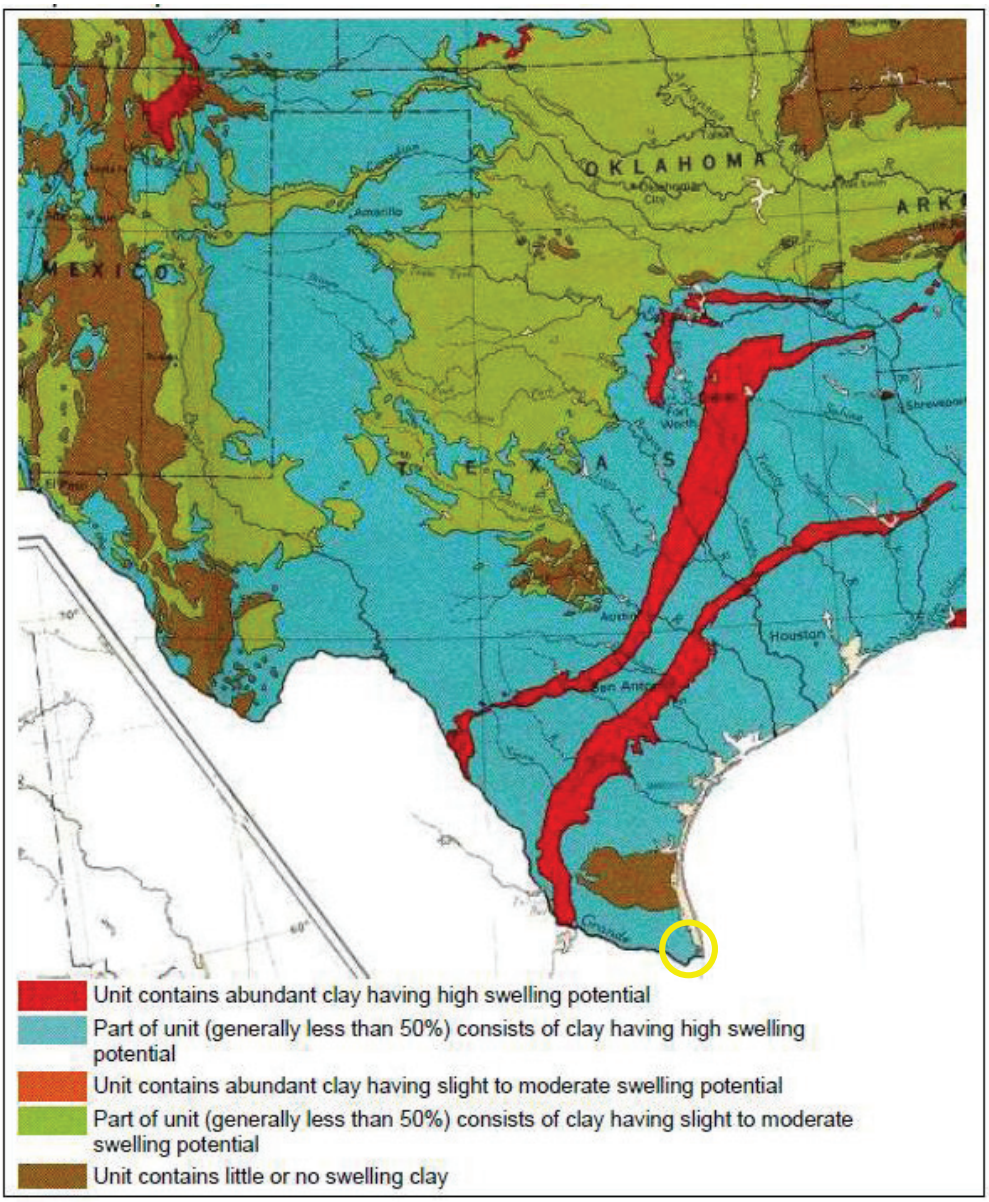
Expansive soils contain minerals such as smectite clays that are capable of absorbing water. When these clays absorb water they increase in volume and expand. The change in soil volume and resulting expansion can exert enough force on a building or other structure to cause damage.

Expansive soils will also lose volume and shrink when they dry. A reduction in soil volume can affect the support to buildings or other structures and result in damaging soil subsidence. Fissures in the soil can also develop and facilitate the deep penetration of water when moist conditions or runoff occurs. This produces a cycle of shrinkage and swelling that places repetitive stress on structures.

Location

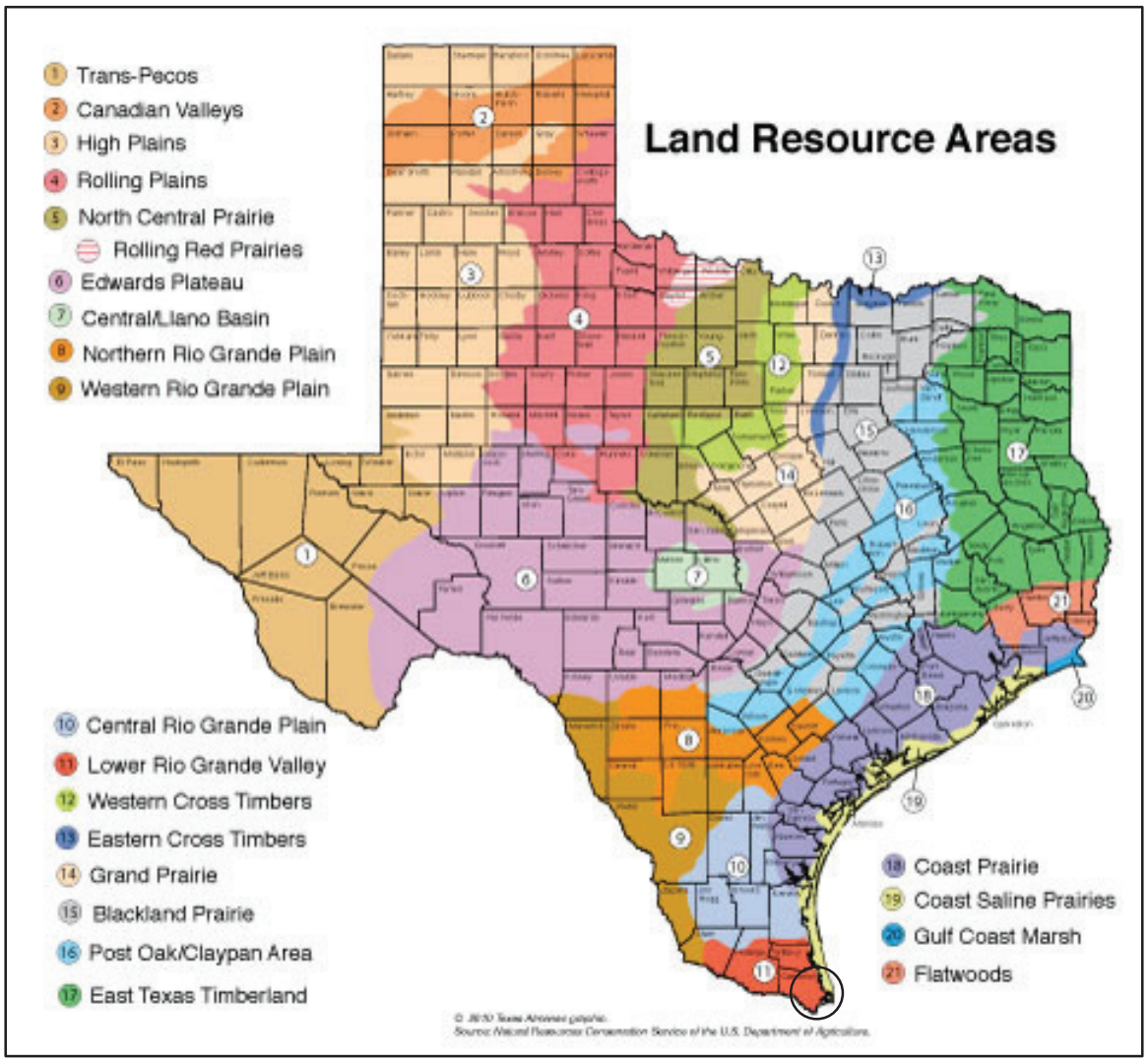
The Council of Cities planning area may be affected by expansive soils predominant throughout the state. Figure 13-1 depicts expansive soils across the State of Texas and the Council of Cities planning area is identified within the yellow circle. These areas receive the significant moisture and are also vulnerable to droughts, which can cause the soils to expand and contract. Figure 13-2 depicts the types of land resources in the State of Texas due to their soil types.

Figure 13-1. Texas Geological Survey[1]



[1] *Source: United States Geological Survey, http://www.usgs.gov*

Figure 13-2. Texas Geological Survey

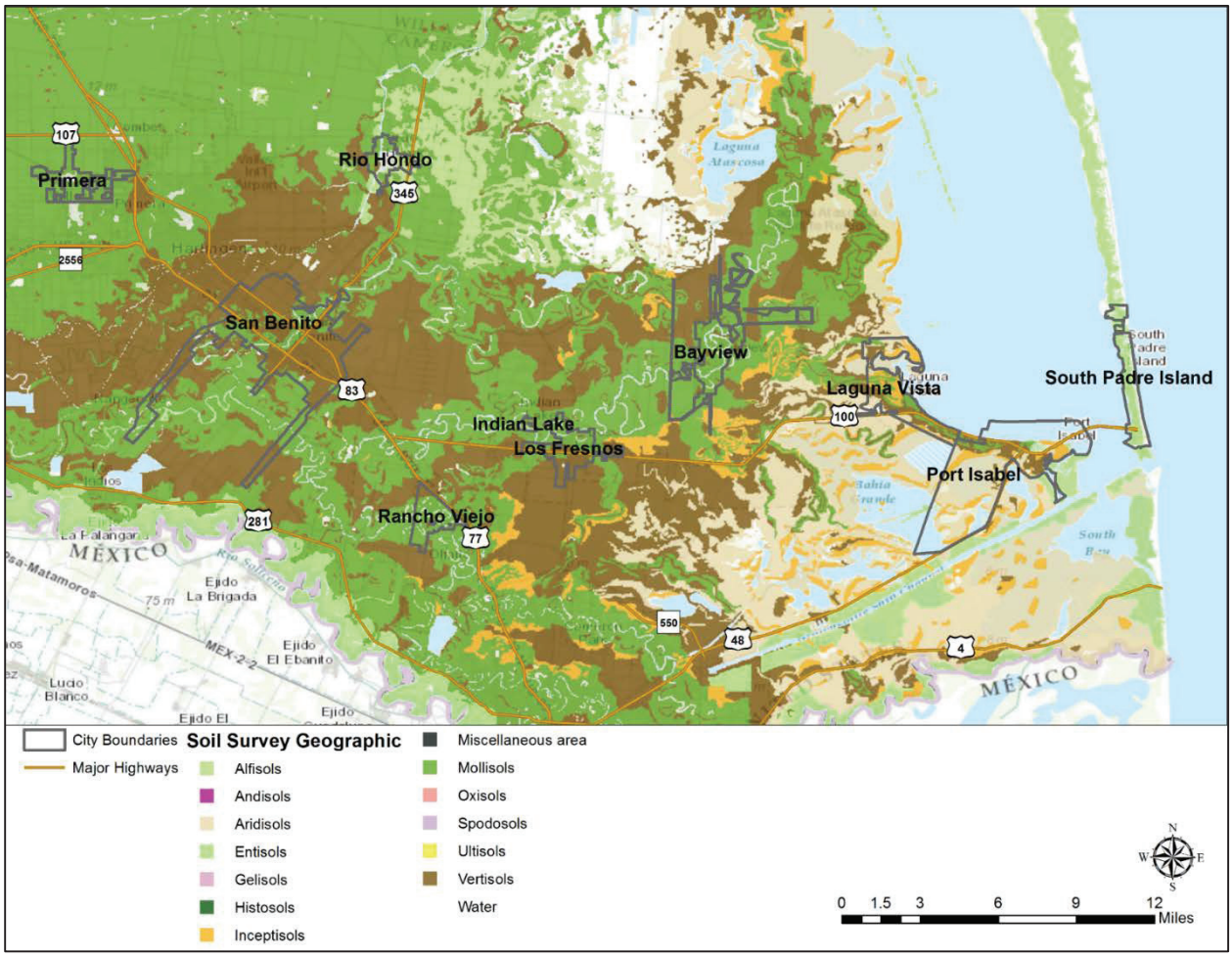


The Council of Cities planning area is located within the Lower Rio Grande Valley as identified within the black circle in Figure 13-2. The entire planning area is located in an area affected by moderate expansive soils.

Lower Rio Grande Valley: The valley is located in the southernmost tip of South Texas. It makes up about 2,500 square miles and lies along the northern bank of the Rio Grande, which separates Mexico from the United States. The Rio Grande Valley of South Texas is not a valley, but a delta or floodplain containing many oxbow lakes or resacas formed from pinched-off meanders in earlier courses of the Rio Grande.

The soils in this region are dominantly Alfisols, Aridisols, Inceptisols, Mollisols, and Vertisols. Ustolls and Usterts are especially prominent in the southeastern part. Figure 13-3 indicates the soil types found throughout the Council of Cities planning area. The soils in this region dominantly have a hyperthermic soil temperature regime, an ustic soil moisture regime, and mixed mineralogy.

Figure 13-3. Council of Cities Soil Survey



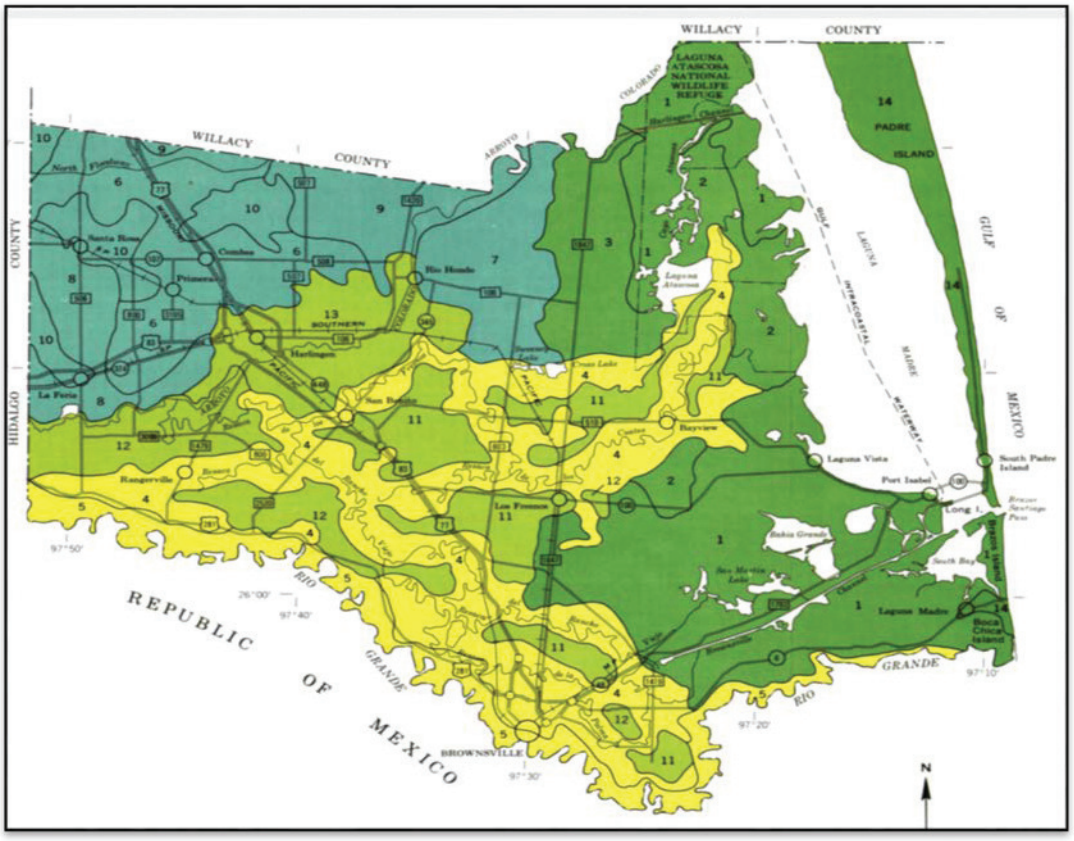
The native vegetation consists mainly of shrubs interspersed with grasses and scattered trees. Grazing is the dominant land use in most of the region, but wheat, grain sorghum, and other small grain crops are grown in areas where the soils, topography, and moisture supply are favorable. Irrigated cotton is an important crop in the southeastern part of the region. Citrus fruits and winter vegetables are grown in the lower Rio Grande Valley.

Extent

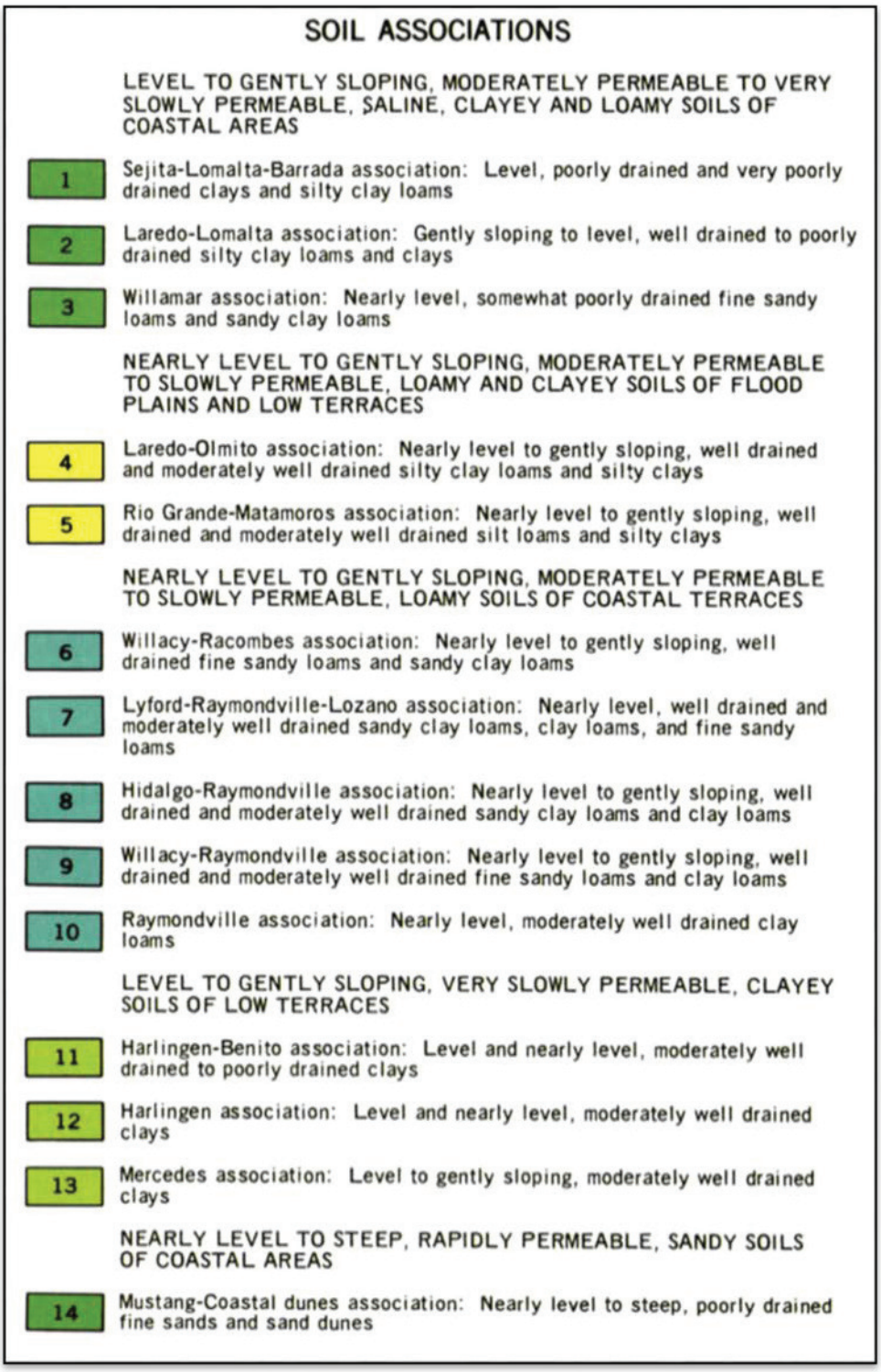
The extent to which soil expansion is present in an area can be determined using the predominant soil composition and associated permeability. The Soil Survey, Figure 13-4, was developed by the USDA Soils

Conservation Service and contains information that can be applied in determining the suitability of soils in the planning area when selecting sites for roads, structures, and infrastructure.[2]

Figure 13-4. USDA Cameron County Soil Survey



[2] *Source: United States Department of Agriculture Soil Conservation Service*



The yellow areas shown in Figure 13-4 indicate locations with clayey soils which are poorly drained clays that have a high shrink-swell potential. These clayey soils feature a higher plasticity index values and can crack and shrink when dry and swell when wet. Higher plasticity index soils exhibit greater sensitivity to

drought conditions. The shrinking and swelling causes significant problems with foundations, roadways, sidewalks and other structures and infrastructure. Table 13-1 includes the plasticity index value ranges and soil properties.

Table 13-1. Value and Plasticity Index of Soils

PLASTICITY INDEX (PI)	SOIL PROPERTIES	SWELLING POTENTIAL
0-18	Sand	Low
18-22	Silt	Medium
22-35	Silt Clay	High
>35	Clay	Very High

The USDA Cameron County Soil Survey provides a soil association class and plasticity index range for soil types in each class for each jurisdiction (Table 13-2).

Table 13-2. USDA Council of Cities Plasticity Index Range

JURISDICTION	SOIL ASSOCIATION CLASS	PLASTICITY INDEX	POTENTIAL EXPANSION/EXTENT LEVEL
Bayview	5	4-16; 30-40	Low, Medium, High
Indian Lake	4	11-20	Low, Medium
Laguna Vista	1	11-18; 12-18; 30-45	Low, Medium, High
Los Fresnos	11	45-60	Very High
Port Isabel	1	11-18; 12-18; 30-45	Low, Medium, High
Primera	6	5-10; 12-24	Low, Medium
Rancho Viejo	4	11-20	Low, Medium
Rio Hondo	7&13	4-10; 11-20; 22-35; 35-50	Low, Medium, High
San Benito	4	11-20	Low, Medium
South Padre Island	14	0	Low

High plasticity soils are prone to shrink and swell as soil moisture changes, which can degrade pavement, causing longitudinal cracking and edge drop-off. This effect can damage foundations of buildings and homes. The Council of Cities planning area is subject to a range of plasticity Index levels including low, medium and high, as indicated by the soils in Figure 13-4 and Table 13-1 above.

Historical Occurrences

Expansive soils is a condition that is native to Texas soil characteristics, and cannot be documented as a time-specific event, except when it leads to structural and infrastructure damage. Extreme conditions can damage roads, structures, and infrastructure, including projects still under construction. One known lawsuit was filed by the developers of Ocean Towers Condominiums on South Padre Island. The suit was filed against several engineering firms involved with the project after cracks were discovered where the parking garage was attached to the main tower.

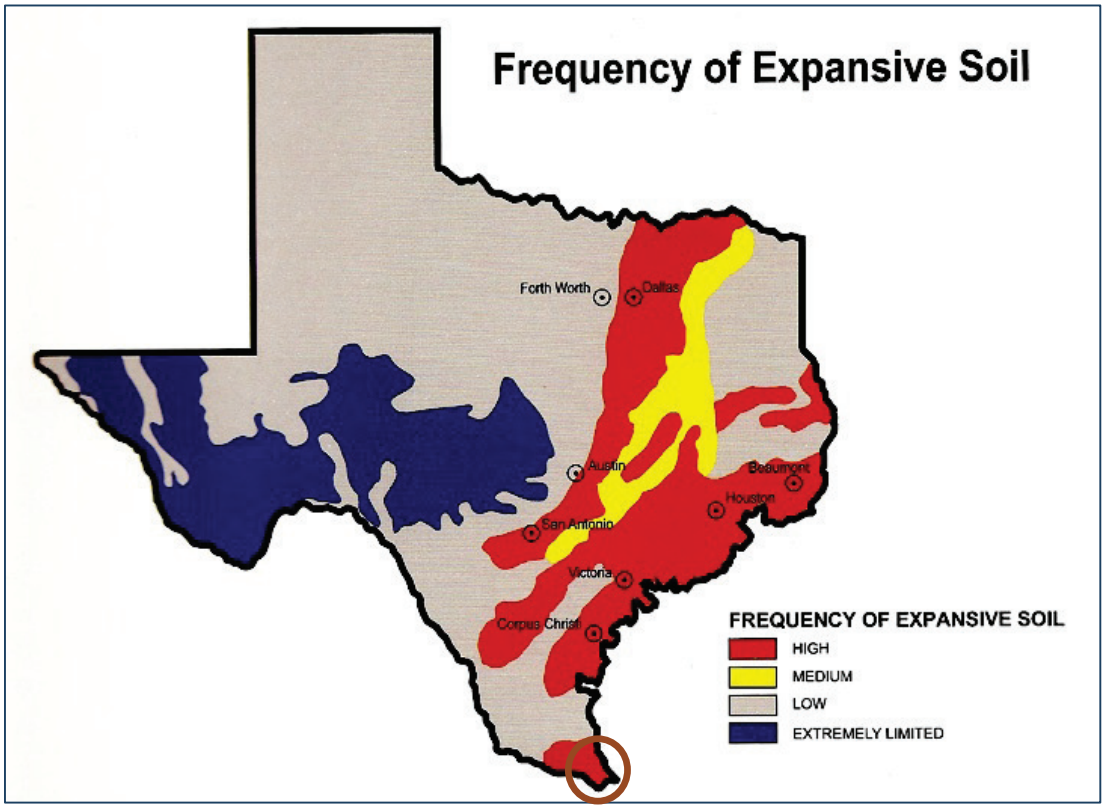
Damages from expansive soils are typically associated with droughts, previous occurrences for expansive soils can be correlated with previous occurrences for drought.

Probability of Future Events

Since no other records of specific incidences of loss associated with expansive soils were found, and no specific occurrences of expansive soils were identified within the planning area, the probability of future events cannot be determined at this time. Through meetings and collaborative discussions, experienced Team members with local knowledge and expertise determined the probability of future events of loss due to expansive soils within the planning area, is highly possible, especially when periods of drought increase throughout the planning area.

Figure 13-5 displays the frequency of expansive soil occurrences for the entire state. The Council of Cities planning area is shown in the green circle and is subject to a “High” frequency of expansive soils. Section 9 of the plan provides in-depth analysis of drought in the planning area. Damages from expansive soils are typically associated with droughts. Historical drought records supports a highly likely probability of future events. Assuming a correlation between drought and expansive soils, the planning area can anticipate a similar frequency for expansive soil events.

Figure 13-5. Frequency of Expansive Soil



Vulnerability and Impact

The effects of expansive soils are most prevalent when periods of moderate to high precipitation are followed by drought and then again by periods of rainfall. Other cases of damage result from increases in moisture volume from such sources as broken or leaking water and sewer lines. Dry clays are capable of absorbing water and will increase in volume in an amount proportional to the amount of water absorbed. Soils capable of changes in volume present a hazard to structures built over them and to the pipelines buried in them. Houses and one-story commercial buildings are more apt to be damaged by the expansion of swelling clays than are multi-story buildings, which are usually heavy enough to counter swelling pressures. However, if constructed on wet clay, multi-story buildings may also be damaged by clay shrinkage when moisture levels are substantially reduced.

Cracked foundations and floors, jammed windows and doors, and ruptured pipelines are typical types of damage resulting from swelling soils. Damage to the upper floors of larger buildings can occur when motion in the structure is significant. While all infrastructure within in the Council of Cities planning area,

slab on grade structures are more likely to suffer damages from expansive soils. In addition, older structures built to less stringent building codes may also be more susceptible to damages than new construction.

While the number of slab on grade structures are not available, the US Census data indicates approximately 10,175 of the residential structures in the planning area were built before 1980 (Table 13-2), which may be more suseptible to damages.

Table 13-2. Structures at Greater Risk by Jurisdiction

JURISDICTION	SFR STRUCTURES BUILT BEFORE 1980
Bayview	86
Indian Lake	178
Laguna Vista	338
Los Fresnos	592
Port Isabel	821
Primera	352
Rancho Viejo	512
Rio Hondo	481
San Benito	5002
South Padre Island	1813
COUNCIL TOTAL	10,175

The following critical facilities would be vulnerable to expansive soils in the planning area by jurisdiction.

Table 13-3. Critical Facilities by Jurisdiction

Jurisdiction	Critical Facilities
Bayview	Town Hall, Fire Station, 2 Bridges (north and south side)
Indian Lake	Town Hall, Police Station, Community Center, 2 Water Utility Facilities, Main Water Meter, Henderson Road Bridge, Resaca Shores Bridge
Laguna Vista	City Hall/Police Station, Fire Station, Library
Los Fresnos	City Hall, Water Plant, Sewer Plant, Raw Water Meter Station, 20 Lift Stations

Jurisdiction	Critical Facilities
Port Isabel	14 Lift Stations, AEP Electrical Substations, Texas Gas Service, EOC, City Hall, Police Department, Fire Department, Port Isabel EMS, Port Isabel Health Clinic, Port Isabel Medical Clinic, H.E.B., Walmart, Harbor-Pampano Park, 3 Main Harbor Entrances
Primera	City Hall
Rancho Viejo	Town Hall, Fire Station, Valley Municipal Utilities Department
Rio Hondo	Rio Hondo Bridge, Water Plant, Reservoir Dam, Sewer Plant, Fertilizer Plant, Police Station
San Benito	2 Water Plants, 2 Water Towers, Waste Water Treatment Plant, Waste Water Wetlands, City Hall, Municipal Building, Public Works, School administration, School Campuses, AT&T Hub Location, Police Station, 2 Fire Stations, Cameron County Annex, 2 Power substations
South Padre Island	City Hall, Water Tower, AT&T Hub, Fire Station, 2 Water Towers, 2 Power substation, US Coast Guard Station, Queen Isabella Causeway

The impact of expansive soils ranges from cosmetic cracks in walls to substantial foundation and structural damage that can result in a need for building demolition. Infrastructure such as pipelines can be damaged, causing increased maintenance and repairs, replacement, or damage to the point of failure. Sewer and water lines are also affected by shrink and swell soils. The movement of the soils can snap water and sewer lines, producing a minimum of temporary discomfort, and a maximum of a serious health and welfare risk.

Homeowners and public agencies that assume they cannot afford preventative measures such as more costly foundations and floor systems, often incur the largest percentage of damage and costly repairs from expanding soil. No figures are available for the total damage to homes in the planning area from expansive clays. However, several examples are known where the cost of repairs has exceeded the value of homes. Additionally, streets and highways in the planning area have required frequent and very expensive reconstruction or maintenance due to damage from expansive clay.

For the Council of Cities planning area, the most extensive damage from expansive soils can occur to bridges, highways, streets, and parking lots. The greatest damage occurs when structures are constructed when clays are dry (such as during a drought) and then subsequent soaking rains swell the clay.

Section 14: Dam Failure

Hazard Description

Dams are water storage, control or diversion structures that impound water upstream in reservoirs. Dam failure can take several forms, including a collapse of or breach in the structure. While most dams have storage volumes small enough that failures have few or no repercussions, dams storing large amounts can cause significant flooding downstream. Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which cause most failures;
- Inadequate spillway capacity, resulting in excess overtopping of the embankment;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, or maintain gates, valves, and other operational components;
- Improper design or use of improper construction materials;
- Failure of upstream dams in the same drainage basin;
- Landslides into reservoirs, which cause surges that result in overtopping;
- High winds, which can cause significant wave action and result in substantial erosion;
- Destructive acts of terrorism; and,
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, leading to structural failure.

Benefits provided by dams include water supplies for drinking, irrigation and industrial uses; flood control; hydroelectric power; recreation; and navigation. At the same time, dams also represent a risk to public safety. Dams require ongoing maintenance, monitoring, safety inspections, and sometimes even rehabilitation to continue safe service.

In the event of a dam failure, the energy of the water stored behind the dam is capable of causing rapid and unexpected flooding downstream, resulting in loss of life and substantial property damage. A

devastating effect on water supply and power generation could be expected as well. The terrorist attacks of September 11, 2001 generated increased focus on protecting the country's infrastructure, including ensuring the safety of dams.

One major issue with the safety of dams is their age. The average age of America's 84,000 dams is 52 years. More than 2,000 dams near population centers are in need of repair, according to statistics released in 2009 by the Association of State Dam Safety Officials[1]. In addition to the continual aging of dams there have not been significant increases in the number of safety inspectors resulting in haphazard maintenance and inspection.

The Association of State Dam Safety Officials estimate that $16 billion will be needed to repair all high-hazard dams, but the total for all state dam-safety budgets is less than $60 million[2]. The current maintenance budget does not match the scale of America's long-term modifications of its watersheds. Worse still, more people are moving into risky areas. As the American population grows, dams that once could have failed without major repercussions are now upstream of cities and development.

Location

The State of Texas has 7,413 dams, all regulated by the Texas Commission on Environmental Quality (TCEQ). Of these, 854 are considered "high-hazard," 779 are considered "significant-hazard," and 5,780 are considered "low-hazard." According to the American Society of Civil Engineers "Report Card," the

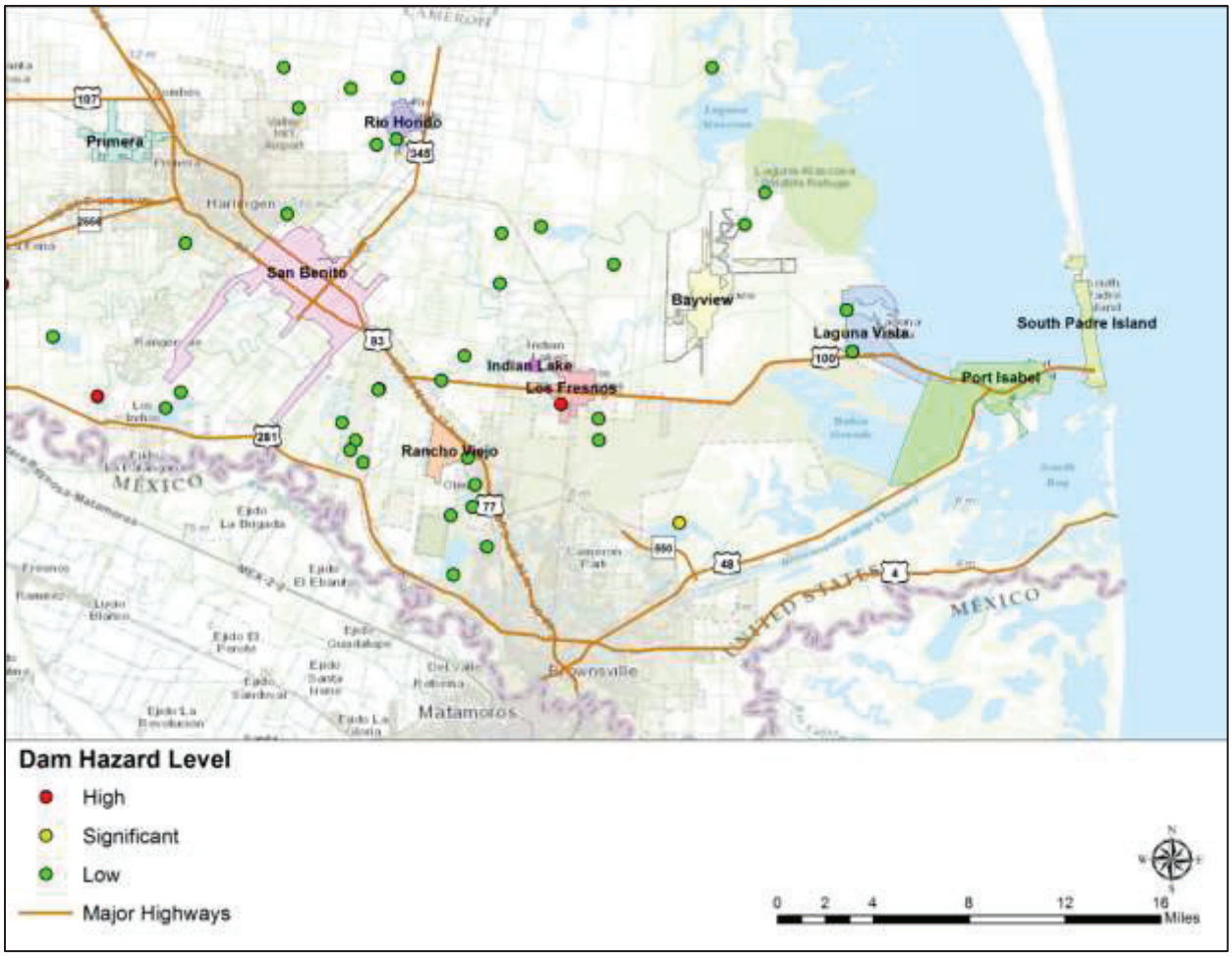
[1] *Association of State Dam Safety Officials, Journal of Dam Safety*

[2] *www.damsafety.org*

Section 14: Dam Failure

Association of State Dam Safety Officials reports that there are 403 unsafe dams in Texas.[3] For dams in Cameron County classifications location, volume, elevation, condition, and classification information was factored into the risk ranking in Figure 14-1, which illustrates general locations for each dam in the area. Currently, there are 48 dams located in Cameron County and 5 within the Council of Cities planning area. Four of the dams in the planning area are low hazard dams and have no history of failure. In the event of a breach there is expected to be no loss of life or impact to critical facilities, therefore, these four dams will not be profiled. The Raw Water Reservoir No 2 Levee, located in the City of Los Fresnos, is classified by the NID as a high hazard dam and is the only dam that poses a risk.

Figure 14-1. Dam Locations in Council of Cities Planning Area



[3] *Source: http://www.asce.org/reportcard/pdf/tx.pdf*

Table 14-1. Council of Cities County Dam Survey

JURISDICTION	DAM NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CONDITION[4]	IMPACT
Rio Hondo	Montgomery Dam	21	505	Not Rated	No Impact
Rancho Viejo	Rancho Viejo Dam A	7	295	Not Rated	No Impact
Los Fresnos	Raw Water Reservoir No 2 Levee	10	87	Not Rated	Limited
Laguna Vista	Cameron County FWSD Dam 1	7	1,900	Not Rated	No Impact
Laguna Vista	Cameron County FSWD NO 1 RES NO 3 Levee	10	283	Not Rated	No Impact

Extent

The extent or magnitude of a dam failure event is described in terms of the classification of damages that could result from a dam's failure; not the probability of failure. The Classifications for extent effective in 2009 are found in Table 14-2 below. For dams with a maximum storage capacity of less than 10,000 acre-feet, the area within one mile of the dam is considered to be at risk to potential dam failure hazards.

Table 14-2. Extent Classifications

HAZARD POTENTIAL CLASSIFICATION	LOSS OF HUMAN LIFE	DAM STORAGE CAPACITY
Low	None Expected	Less than 10,000 acre-feet
Significant	Probable (1 to 6)	Between 10,000 and 100,000 acre-feet
High	Loss of Life Expected (7 or More)	100,000 acre-feet or more

The Raw Water Reservoir No 2 Levee Dam, owned by the City of Los Fresnos, is on an off-channel river in Los Fresnos and is used for flood control purposes. Construction was completed in 1996 and is of earthen construction with a foundation of soil. Although the dam is considered a high hazard dam, its extent classification is low because of the limited storage capacity. It has a normal surface area of 8.2 acres. If there was a breach, only the City of Los Fresnos would be impacted and it is estimated the average breach width would be 51.6 ft. with a maximum breach flow of 1,488 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth of up to 5 feet. With developments downstream of the dam, all populations located downstream of the dam is considered to be at risk to potential safety if a dam failure occurred, especially areas downstream at a lower elevation.

[4] *Condition provided if available.*

Historical Occurrences

There are approximately 84,000 dams in the United States today.[5] Catastrophic dam failures have occurred frequently throughout the past century. Between 1918 and 1958, 33 major U.S. dam failures caused 1,680 deaths. From 1959 to 1965, nine major dams failed worldwide. Some of the largest disasters in the U.S. have resulted from dam failures. More than 90 dam incidents, including 23 dam failures, were reported in the past ten years to the National Performance of Dams Program, which collects and archives information on dam performance from state and federal regulatory agencies and dam owners.

The State of Texas has not experienced loss of life or extensive economic damage due to a dam failure since the first half of the twentieth century. However, there may be many incidents that are not reported and, therefore, the actual number of incidents is likely to be greater.

There has not been a recorded dam failure event for any of the participating jurisdictions in the Council of Cities planning area.

Probability of Future Events

No historical events of dam failure have been recorded in the Council of Cities planning area, though the risk of dam failure is monitored closely. Due to the lack of historical occurrences, the probability of a future event is unlikely, meaning an event is possible in the next ten years.

Vulnerability and Impact

The City of Los Fresnos would be affected by flooding should the Raw Water Reservoir No 2 Levee fail. A dam failure could cause power outages and disrupt utilities systems and populations in the planning area would be vulnerable. Several residential developments are located in the immediate area along with an apartment complex and a few commercial sites including the Los Fresnos Water Treatment Plant, several restaurants, a bar, a Pallet Depot and Flea Market that could be at risk. However, the minimal capacity of the reservoir indicates limited damage potential. There may be significant environmental effects that result in flooding that disperses debris and hazardous materials downstream, damaging local ecosystems. Annualized loss-estimates for dam failure are not available; neither is there a breakdown of potential dollar losses for critical facilities, infrastructure and lifelines, or hazardous-materials facilities. If a dam failure were to occur, the severity of impact would be limited.

The impact of a dam breach on the City of Los Fresnos can be considered limited severity of impact meaning injuries and/or illnesses are treatable with first aid with facilities being shut down for 24 hours or less, and less than 10 percent of property destroyed or damaged. For these reasons, creating

[5] *Federal Emergency Management Agency, Dam Safety Program, available at:* http://www.fema.gov/hazards/damsafety/

mitigations actions to remove or protect people and structures from the path of destruction is necessary in order to minimize impact from dam failure.

Assessment of Impacts

Any individual dam has a very specific area that will be impacted by a catastrophic failure. Dams identified as high or significant hazard can directly threaten the lives of individuals living or working in the inundation zone below the dam. The impact from any catastrophic failure would be similar to that of a flash flood. Potential impacts for the planning area include:

- There could be injuries from impacts with debris carried by the flood.
- Swift-water rescue of individuals trapped by the water puts the immediate responders at risk for their own lives.
- Individuals involved in the cleanup may be at risk from the debris left behind.
- Continuity of operations for any jurisdiction outside the direct impact area could be very limited.
- Homes and businesses could be damaged or destroyed.
- Wildlife and wildlife habitat caught in the flow could be impacted.
- Topsoil will erode, slowing the return of natural vegetation.
- Debris and hazardous material deposited downstream may cause further pollution of areas far greater than the inundation zone.

The economic and financial impacts of dam failure on the area will depend entirely on the location of the dam, scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any dam failure event.

Section 15: Coastal Erosion

Hazard Description

Coastal erosion is the wearing away of land and loss of beach, shoreline, or dune material because of natural coastal processes or manmade influences. Erosion is the process by which large storms, flooding, strong wave action, sea level rise, and human activities wear away beaches and bluffs along coastlines. All beaches are affected by storms and other natural events that cause erosion; however, the extent and severity of the problem differs in different parts of the country. The two major erosion mechanisms are wind and water. Wind that blows across sparsely vegetated or disturbed lands can cause erosion by picking up soil, carrying it through the air, and displacing it in another place. Water erosion occurs over land, and in streams and channels. Major storms can cause coastal erosion from the combination of high winds and heavy surf and storm surge. Human interactions, such as construction and development in coastal and riparian regions, can also exacerbate erosion.

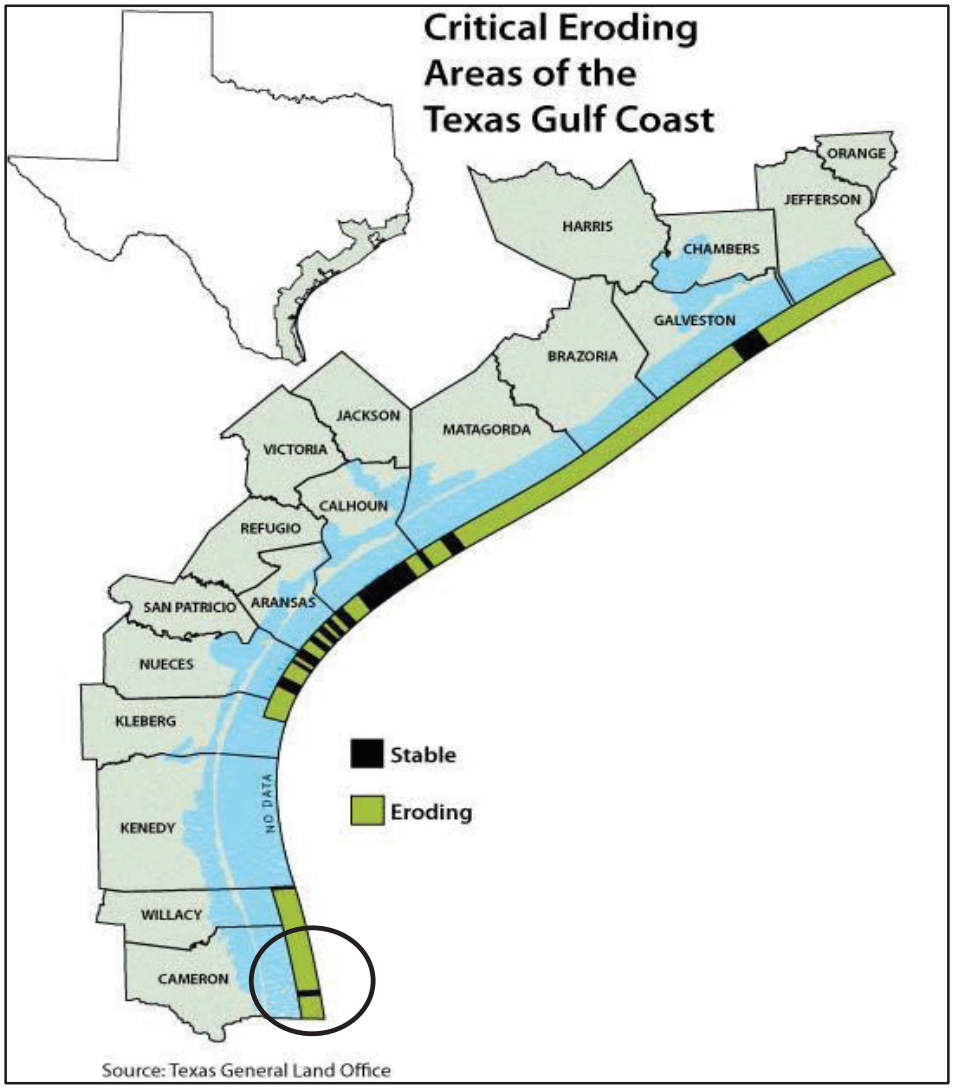
While coastal erosion affects all regions of the United States, erosion rates and potential impacts are highly localized. Average coastline recession rates of 25 feet per year are not uncommon on some barrier islands in the Southeast. Texas has one of the longest coastlines in America coupled with some of the highest rates of coastal erosion in the nation. Sixty-four percent of the Texas coast is eroding at an average of 6 feet per year, with an overall average rate of 4.1 feet per year for the 367 miles of Texas coast, according to the Texas General Land Office. However, some locations are losing more than 30 feet per year. Coastal erosion can have long-term economic and social consequences.

Location

While the Council of Cities planning area is considered a coastal community, only one of the participation jurisdictions is located directly on the coast and is subject to coastal erosion. South Padre Island is

vulnerable to threats directly related to coastal erosion resulting from extreme hazards such as hurricane and tropical storm events. The most common time for such extreme storm events to impact the planning area is from June to November, the official Atlantic U.S. hurricane season. The water front communities of Port Isabel and Laguna Vista are located on the mainland and are protected by the barrier island system along the gulf. As such, these communities are not subject to coastal erosion.

Figure 15-1. Location of Jurisdictions at Risk for Coastal Erosion

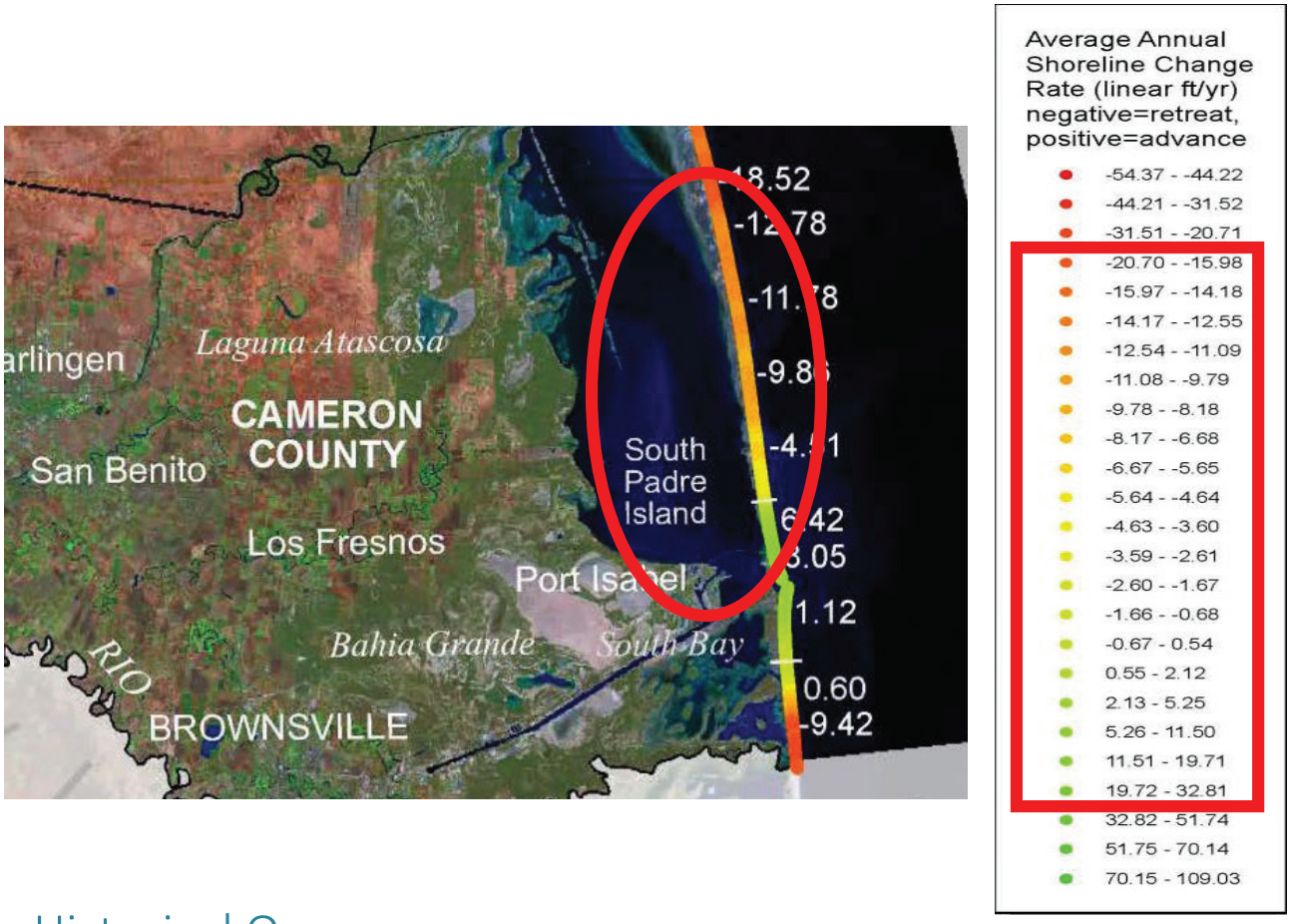


Extent

South Padre Island is vulnerable to the effects of coastal erosion from the Gulf of Mexico. The island has no stable (vegetated) dunes in the area located as close to the mean low water (MLW) line. Through experience it has proven that barrier island development imposes risks on private property owners, investors, and to taxpayers statewide. The average rate of retreat or extent of coastal erosion is estimated

between 3 and 12 feet per year for South Padre Island according to the study for the Erosion Protection Dune System (EPDS)[1].

Figure 15-2. Critical Eroding Areas, South Padre Island



Historical Occurrences

Previous occurrences for coastal erosion are not reported by the NCEI. In addition, local governments do not typically have the capabilities to monitor or report statistical data for coastal erosion for a specific event. Coastal erosion is typically measured as an average annual shoreline change rate in linear feet. While the Council of Cities Planning area does not record historical coastal erosion rates per event, the 2013 Texas Hazard Mitigation Plan depicts coastal erosion occurrences for the Cameron County Planning Area, including South Padre Island (Table 15-2).

[1] *Cameron County Erosion Analysis, Study of Future Shoreline Change and Public Cost Implications of Beachfront Development*, Texas General Land Office, 2013

Table 15-2. Historical Coastal Erosion Rates, Cameron County[2]

JURISDICTION	GULF SHORELINE	BAY SHORELINE	CRITICAL EROSION	EROSION RATES
Cameron County	166,320 ft	1,145,760 ft	147,840 ft	-2 to -25 ft/yr

Probability of Future Events

Due to data limitations, the planning team relied on available studies and research as well as the Texas State Hazard Mitigation Plan to determine coastal erosion probability. According to Texas General Land Office (GLO) the average coastal erosion rate for South Padre Island is between 3 and 12 feet per year with an average of approximately 6 feet per year. This rate supports a highly likely probability of future events, with an event probable in the next year.

Vulnerability and Impact

The barrier island known as South Padre Island is continuously subject to coastal erosion, as all barrier islands are. While usually a slow-evolving hazard, coastal erosion presents a serious threat to the City of South Padre Island. As a densely-populated barrier island, any loss of land equates to an increase in the City's vulnerability to hurricanes, coastal storms and above-average tidal events. When the land lost is beach that provides valuable protections from these coastal storm events, that loss results in greater vulnerability.

The rate of the coastal erosion for the island is typically offset by continuous and aggressive community planning to protect the island assets including critical structures and infrastructure. However, the very nature of a barrier island makes it prone to erosion as detailed in the sections above. While it is critical to employ mitigation techniques to protect the assets of the community, it is equally critical to regulate future development to reduce the risk of future losses. While erosion is a continuous threat, aggressive planning and regulations have ensured limited damages to the island structures and infrastructures resulting from erosion. Extreme building codes have been adopted along with restrictions on development to preserve open space and protect the barrier system while enhancing economic development and growth.

The vast majority of beachfront properties within the City are developed, including bulkheads along the historical building line. The City, including its public infrastructure and private property, is vulnerable to the effects of beach erosion. Protection of the built environment landward of the beach from damage caused by coastal storms is dependent upon the maintenance of a healthy, continuous dune system. The

[2] State of Texas Mitigation Plan Update 2013 Page 126 as reported by the Texas General Land Office

South Padre Island Erosion Response Plan provides and annual cost estimate of $400,000 for beach nourishment to protect structures and infrastructure from the effects of coastal erosion.

The potential severity of impact from coastal erosion for the Council of Cities planning area is classified as limited, meaning minor quality of life is lost and shutdown of critical facilities; services are loss less than 24 hours; and less than 10 percent of property would be destroyed or have major damage.

Assessment of Impacts

Coastal erosion events have the potential to pose a significant risk to structures, infrastructure and the local economy. Impacts to the planning area can include:

- Structures and infrastructure can be damaged or destroyed. Extreme erosion, typically resulting from a significant storm event, may result in uninhabitable parcels where structures cannot be rebuilt.
- Coastal communities may suffer substantial damage, requiring immediate shelter and long term displacement assistance.
- Damaged bridges in and out of Bayview and South Padre Island (Causeway) could prevent or delay emergency response, strand or prevent entry of tourists, commuters, supply delivery, or goods and services for extended periods.
- Coastal erosion may dramatically prohibit rebuilding and recovery efforts.
- Beaches may be less desirable, reducing tourism and negatively impacting the economy.
- Economic disruption negatively impacts the programs and services provided by the community due to short and long term loss in revenue.
- Some businesses not directly damaged by the coastal erosion may be negatively impacted while access roads or beach front properties are repaired.

The economic and financial impacts of coastal erosion on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses and citizens will also contribute to the overall reduction of coastal erosion impacts.

Section 16: Hazardous Materials

Hazard Description

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. A hazardous material (HAZMAT) incident involves a substance outside normal safe containment in sufficient concentration to pose a threat to life, property, or the environment.

Chemicals are found everywhere. They purify drinking water, increase crop production, and simplify household chores. But chemicals also can be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use, or disposal. You and your community are at risk if a chemical is used unsafely or released in harmful amounts into the environment where you live, work, or play.

In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops.

The Toxics Release Inventory (TRI) is a publicly available database from the federal Environmental Protection Agency (EPA) which contains information on toxic chemical releases and other waste management activities that are reported annually by certain covered industry groups federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990. Each year, facilities that meet certain activity thresholds must report their releases and other waste management activities for listed toxic chemicals to the EPA and their state or tribal entity. A facility must report if it meets the following three criteria:

- The facility falls within one of the following industrial categories: manufacturing; metal mining; coal mining; electric generating facilities that combust coal and/or oil; chemical wholesale distributors; petroleum terminals and bulk storage facilities; Resource Conservation and Recovery Act (RCRA) Subtitle C Treatment, Storage and Disposal (TSD) facilities; and solvent recovery services.
- Have ten or more full-time employee equivalents.