

TRES PALACIOS BAY TMDL SOURCE ASSESSMENT REPORT

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Texas General Land Office**

**Project Title:
Tres Palacios Bay Dissolved Oxygen TMDL Project**

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Tres Palacios Bay TMDL Source Assessment

Introduction

A GIS database was created to identify the potential causes of low dissolved oxygen values in Tres Palacios Bay. Several different types of physical and anthropogenic data were gathered for the database.

Base layer information including urban areas, roadways, county boundaries, and shoreline features were provided by the Texas General Land Office (GLO) and the Texas Department of Transportation (TxDOT). The GLO provides this information to the public through their website (<http://www.glo.state.tx.us/maps.html>). Water feature information, such as streams and watershed information, was used to determine which water features directly affected Tres Palacios Bay. Water feature information was provided by the TxDOT and is available to the public through the GLO's website. Watershed information was provided by Texas Water Development Board and is available to the public through their website (<http://www.twdb.state.tx.us/mapping/gisdata.asp>). Elevation and soil drainage information was used to help determine the runoff potential to Tres Palacios Bay. Both of these datasets were provided by the National Oceanic and Atmospheric Administration's Coastal Assessment and Data Synthesis System (CA&DS), which is available to the public through their website (http://spo.nos.noaa.gov/projects/cads/digital_data.html). Land use information was used to determine possible non-point sources of the Colorado-Lavaca watershed that contributes to Tres Palacios Bay. This dataset was also provided by CA&DS and is available through their website. Cropland acreage and agricultural estimates were used to determine possible non-point sources of nutrients. This dataset was provided by the US Department of Agriculture's 2002 census.

Anthropogenic data was used to look at point source of pollution. Information on permitted dischargers was provided by the Texas Commission on Environmental Quality (TCEQ). Information on storm water outfalls in the city of Palacios was created by the University of Texas Marine Science Institute based on a city map provided by the Matagorda County Health Department.

Non-point source

Tres Palacios Bay is within the Colorado-Lavaca watershed and is identified by hydrologic unit code (HUC) 12100401 (Figure 1). The primary water source to Tres Palacios Bay is the Tres Palacios River, which originates with intermittent streams in the city of El Campo at the northern most region of the Colorado-Lavaca watershed.

The Colorado-Lavaca watershed is a coastal flood plain and ranges from sea level to 34 meters (Figure 2). The Tres Palacios River becomes a major stream by TxDOT standards at an elevation of 8 meters. This primary segment of the Tres Palacios River has a soil drainage of moderately well and moderately poor rank (Figure 3). Land use adjacent to the primary segment of the Tres Palacios River will have a greater non-point source run-off potential because it is a large water source to Tres Palacios Bay, at a moderate elevation, and has areas of moderately

poor soil drainage. The majority of land directly adjacent to the primary segment of the Tres Palacios River is mixed forest land, evergreen forest land, and herbaceous rangeland (Figure 4). This land is surrounded by cropland and pasture. The upland counties of Wharton and Matagorda in the Colorado-Lavaca watershed have a higher amount of cropland in comparison to the low land counties (Figure 5). Land use and activities in these upland counties also have a greater influence on Tres Palacios Bay and the TMDL monitoring stations due to their proximity to the Tres Palacios River. Cattle is the primary livestock in all counties within the watershed (Table 1), but these counties have a small to moderate amount of cattle compared to other Texas counties (Figure 5). Cotton and sorghum are the primary crops in Wharton and Matagorda County (Figure 6). The most likely source of nutrients to Tres Palacios Bay are from cattle operations, cotton, and sorghum crops in Wharton and Matagorda County.

Table 1. Cropland (acre), crop (acre), and livestock (individual) estimates for the counties within the Colorado-Lavaca watershed. Information is provided by the US Department of Agriculture 2002 census.

Crop	Matagorda	Calhoun	Jackson	Wharton
Total cropland	255195	94647	251592	428683
Corn	7708	13001	60860	48423
Sorghum	37710	8363	33261	70238
Soybeans	8811	5921	10925	19226
Cotton	27156	15721	29391	72431
Hay	12823	3345	10131	27959
Rice	24124	2245	14193	52678
Orchards	2102	0	490	2717
Vegetables	0	2	9	221
Cattle	83787	23892	52317	75633
Hogs	30	10	57	149
Sheep	304	96	259	197
Poultry	473	175	440	726

Point Source

There are currently four permitted dischargers in the Tres Palacios Bay segment (Table 2, Figure 7). Wastewater treatment plants in El Campo are unlikely to be a source of nutrients because the city is relatively small with a population of 11,098 in 2002 (<http://www.ci.el-campo.tx.us/>) and is about 30 miles north of Palacios. The permitted dischargers that immediately surround Tres Palacios Bay are more likely to be a higher contributor of point source pollution.

Harold Wilbur Bowers (04005) is adjacent to Tres Palacios Bay at the end of Cockburn Road. This facility treats and disposes of wastes from the Bowers Shrimp Farm, an aquaculture shrimp and fish production facility (SIC 0273). The discharge goes to Matagorda County Drainage District #3 Ditch, thence to an unnamed natural tidal channel, thence to Little Redfish Lake, thence to Tres Palacios Bay. This facility is approximately 1.8 miles from the TMDL station

14682 and 3.3 miles from station 13381.

Seaside Aquaculture (03660) (formerly Saroc Oil Co., DBA Redfish Unlimited) is located on the eastern side of FM3280 where FM3280 terminates at Matagorda Bay. This facility treats and disposes wastes from a mariculture facility (SIC 0273, 0921). Outfalls 001-008 discharge directly to Matagorda Bay and outfall 009 discharges to Tres Palacios Bay. This facility is approximately 4 miles from station 13381.

Matagorda County Water Control and Improvement District No. 5 (10217) is located immediately west of the intersection of Pecan Street and 6th Street. This facility treats and discharges wastes from the Blessing Wastewater Treatment Facility (SIC 4952). Discharge drains to an unnamed drainage ditch, thence to Cashes Creek, thence Tres Palacios Bay. This permit expires October 1, 2009. This facility is approximately 7.7 miles (as the crow flies) from the intersection of Cashes Creek and Palacios Bay.

The City of Palacios Wastewater Treatment (10593) facility is located approximately 1,800 feet west of the intersection of 12th Street and Mosier Drive. It treats and disposes of wastes from the Palacios Wastewater Treatment Plant (SIC 4952). Discharge drains into a ditch, thence to Prices Slough, thence to Tres Palacios Bay. This permit expires December 1, 2005. TCEQ station 14689 is located in Tres Palacios Bay at the end of Prices Slough. This wastewater treatment facility is likely that largest source of nutrient concentrations because of its close proximity to the TMDL monitoring stations.

Both the Seaside Aquaculture and Harold Wilbur Bowers facilities have higher daily flow rates than do the Matagorda County and City of Palacios wastewater treatment facilities. The nutrient levels of these facilities are unknown, but it is likely that the mariculture and aquaculture facilities have lower nutrient concentration due to the large amount of seawater that is often included in the outfall.

Table 2. Permitted dischargers to Matagorda and Tres Palacios Bay. Flow rate is displayed as millions of gallons per day (MGD).

Permit No.	Outfall No.	Permittee Name	Flow Discharge Per Permit (MGD)	Type of Discharge
04005	11	Harold Bowers	32	Industrial - minor
03660	9	Seaside Aquaculture	54	Industrial – minor
10217	1	Matagorda Co. WCID No. 5	0.075	Municipal – minor
10593	1	City of Palacios	0.8	Municipal – minor

An additional nonpoint source of nutrient loading in Palacios Harbor is storm water runoff. The shoreline of the City of Palacios has a soil drainage ranking of poor, which indicates that the residential areas adjacent to the TMDL monitoring stations have a greater run-off potential than adjacent upland areas. Stormwater outfalls surround the City of Palacios and are a potential

source of nutrient loading from residential areas (Figure 7).

Another source of nutrient loading may be the disposal of shrimp carcasses from the bay shrimp vessels within the harbor. The processing of bay shrimping and gulf shrimping are very different. Gulf shrimp are deheaded and frozen off shore, therefore, gulf shrimping is not a likely source of nutrient loading. The amount bay shrimping vessels have significantly decreased in 2006 due to price of diesel gas and increased abundance of imported shrimp. In fact, Texas Parks and Wildlife Department (TPWD) conducts qualitative biweekly interviews and have discovered that there currently are very few people bay shrimping and fish houses are closing. The TPWD also conducts a coastline survey on the opening day of bay shrimp season. There were only 51 bay shrimp boats in 2006, whereas in the past, the number of boats have ranged from 300-900. Analysis of nutrients during this time of decreased shrimping will further discern the nutrient loading sources.

Summary

The most likely non-point source of nutrients to Tres Palacios Bay from land are from cattle operations, cotton, and sorghum crops in the areas of Wharton and Matagorda County that are adjacent to the Tres Palacios River. Run-off from residential areas may also be a non-point source of nutrient loading. The most likely non-point source of nutrients to Tres Palacios Bay from water may be the disposal of shrimp carcasses from the bay shrimp vessels within the harbor. The City of Palacios Wastewater Treatment facility is likely that largest permitted source of nutrient concentrations because of its close proximity to the TMDL monitoring stations.

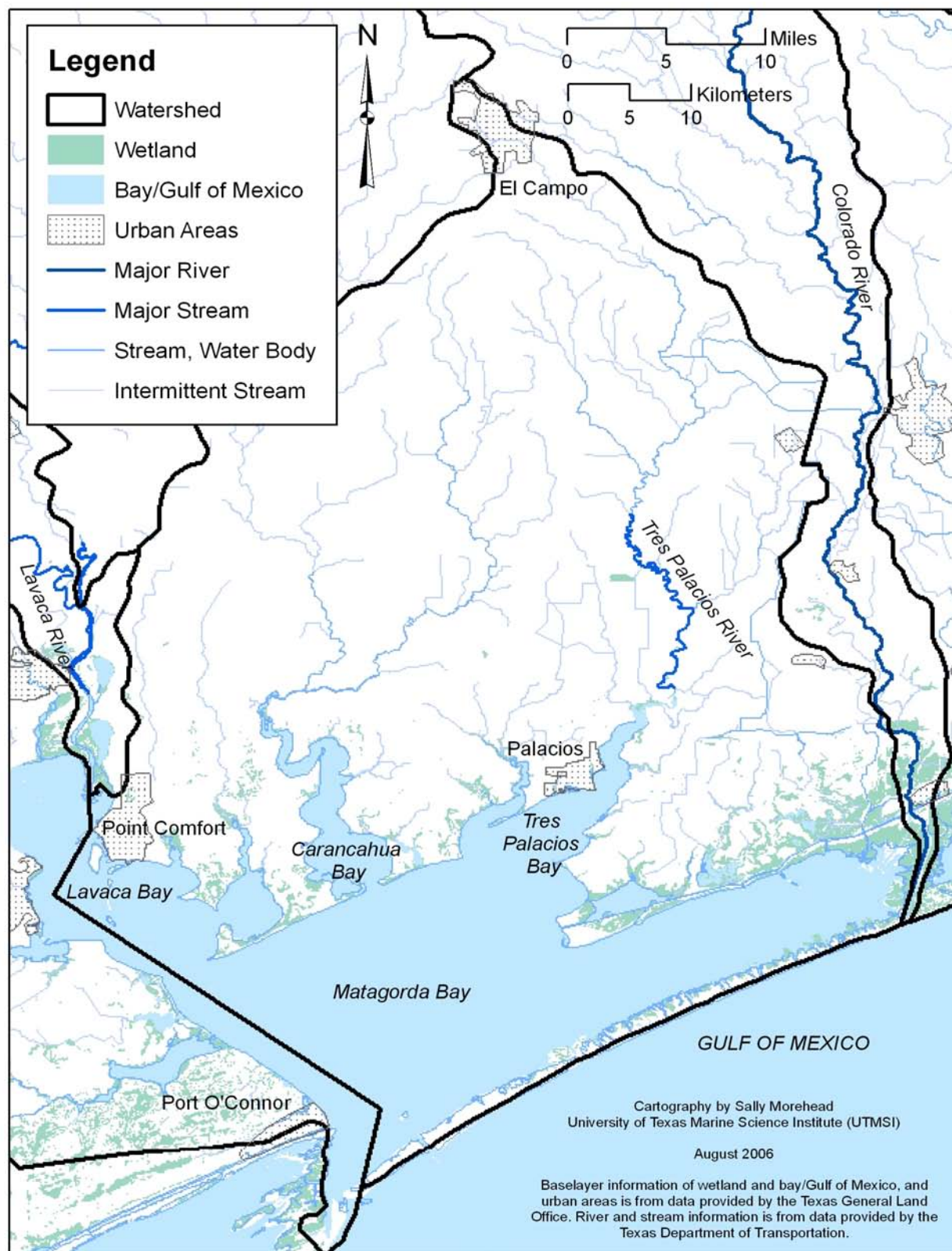


Figure 1. Water features within the Colorado-Lavaca watershed.

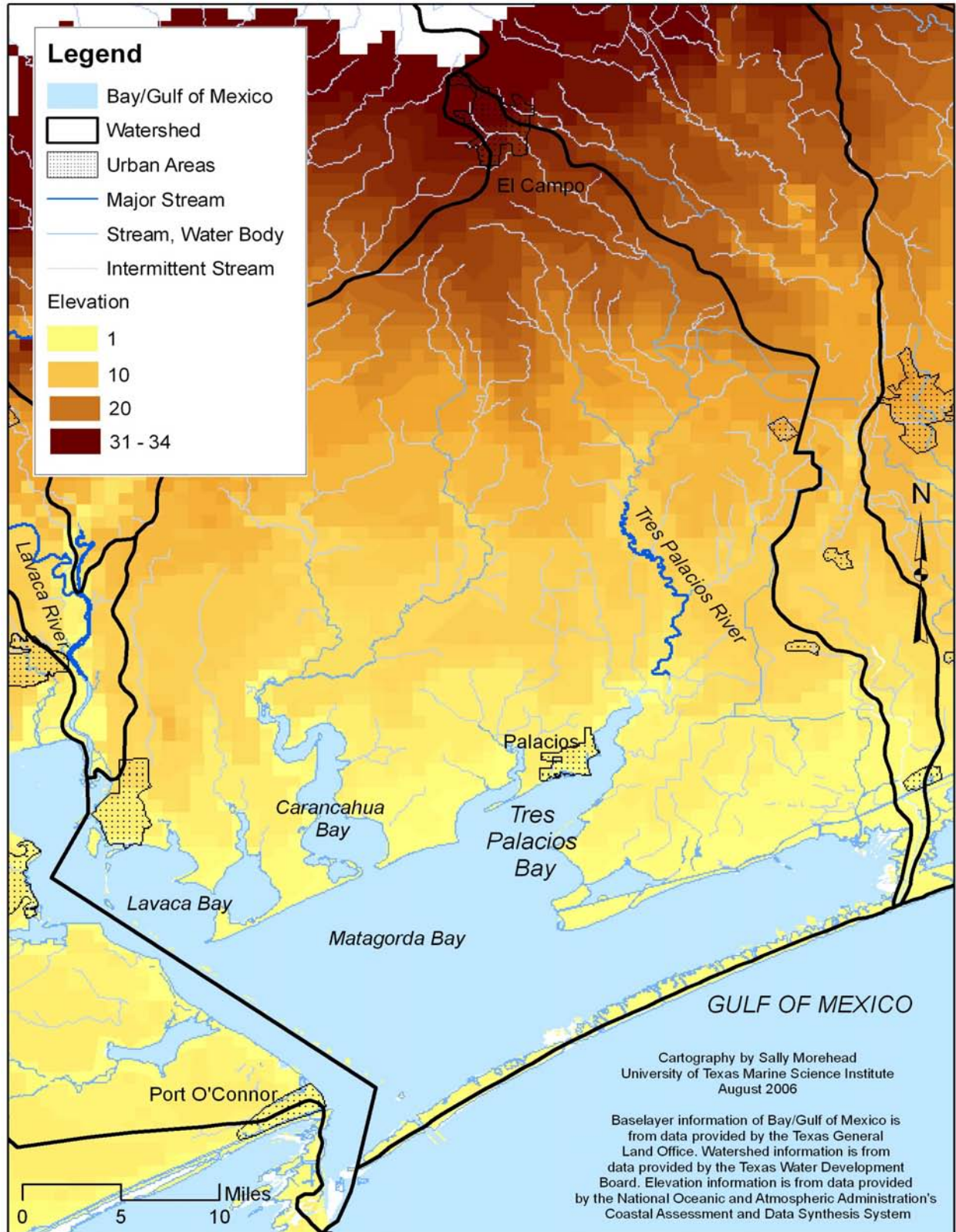


Figure 2. Elevation in meters within the Colorado-Lavaca watershed.

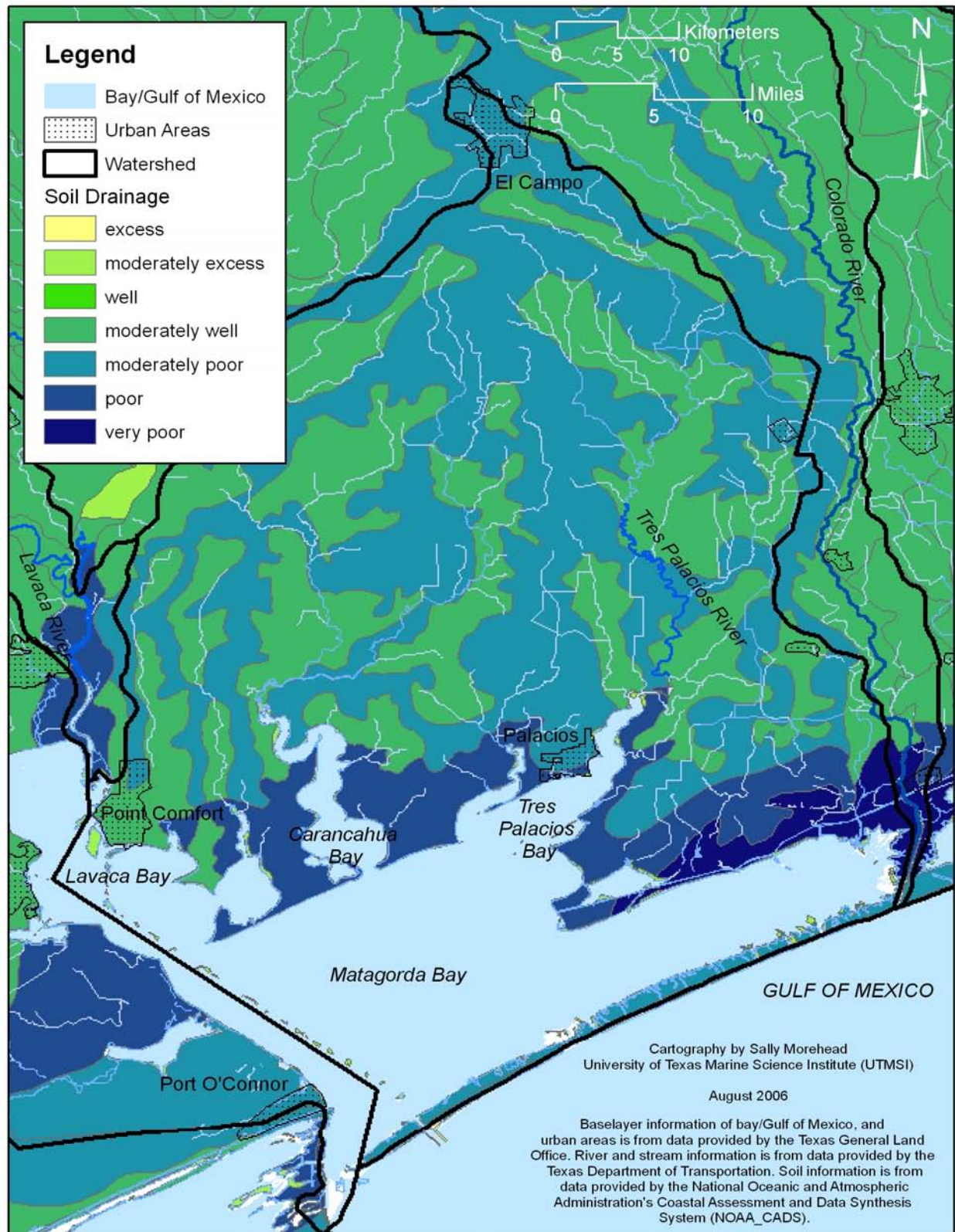


Figure 3. Soil drainage patterns within the Colorado-Lavaca watershed.



Figure 4a. Legend for land use patterns within the Colorado-Lavaca watershed.

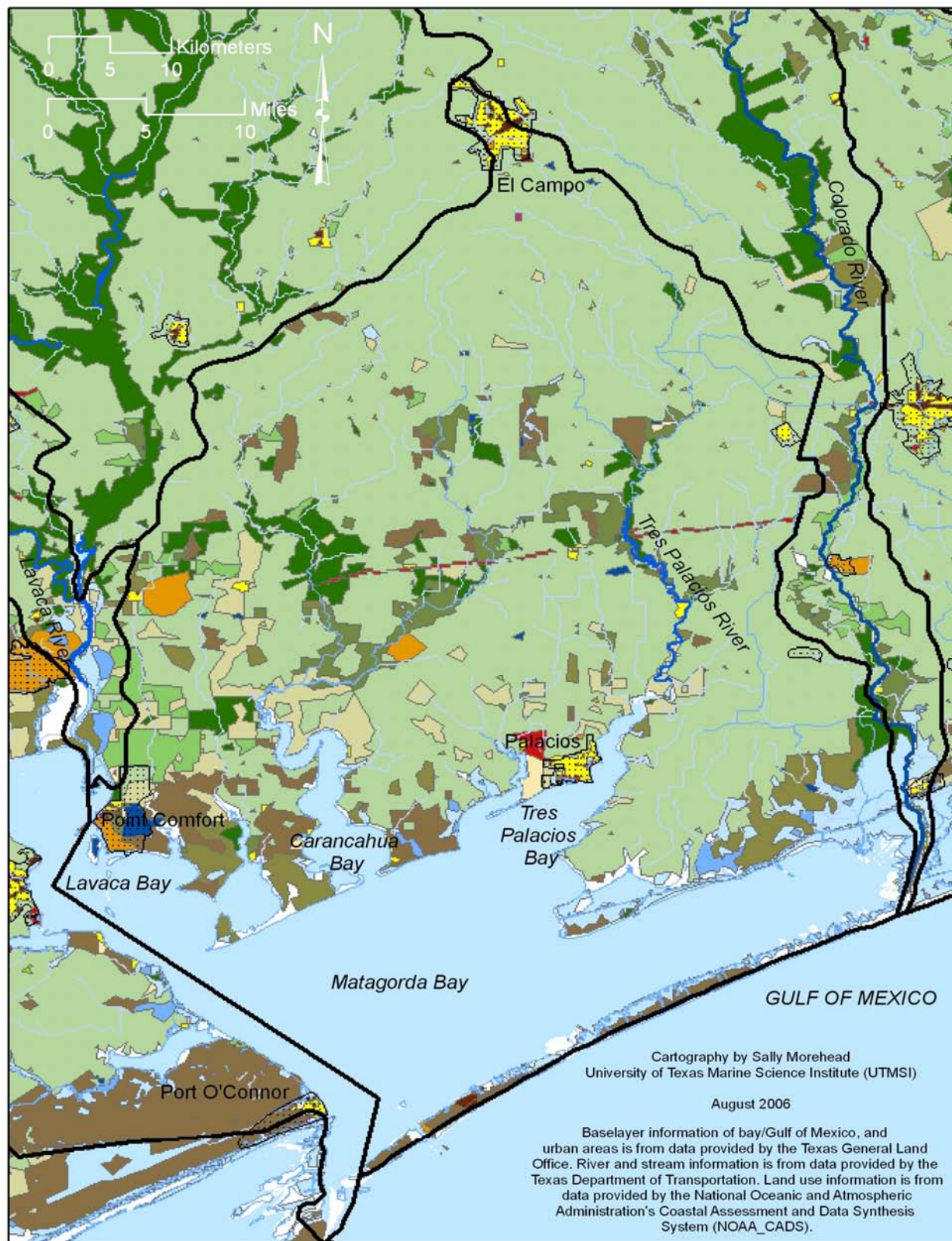


Figure 4b. Land use patterns within the Colorado-Lavaca watershed.

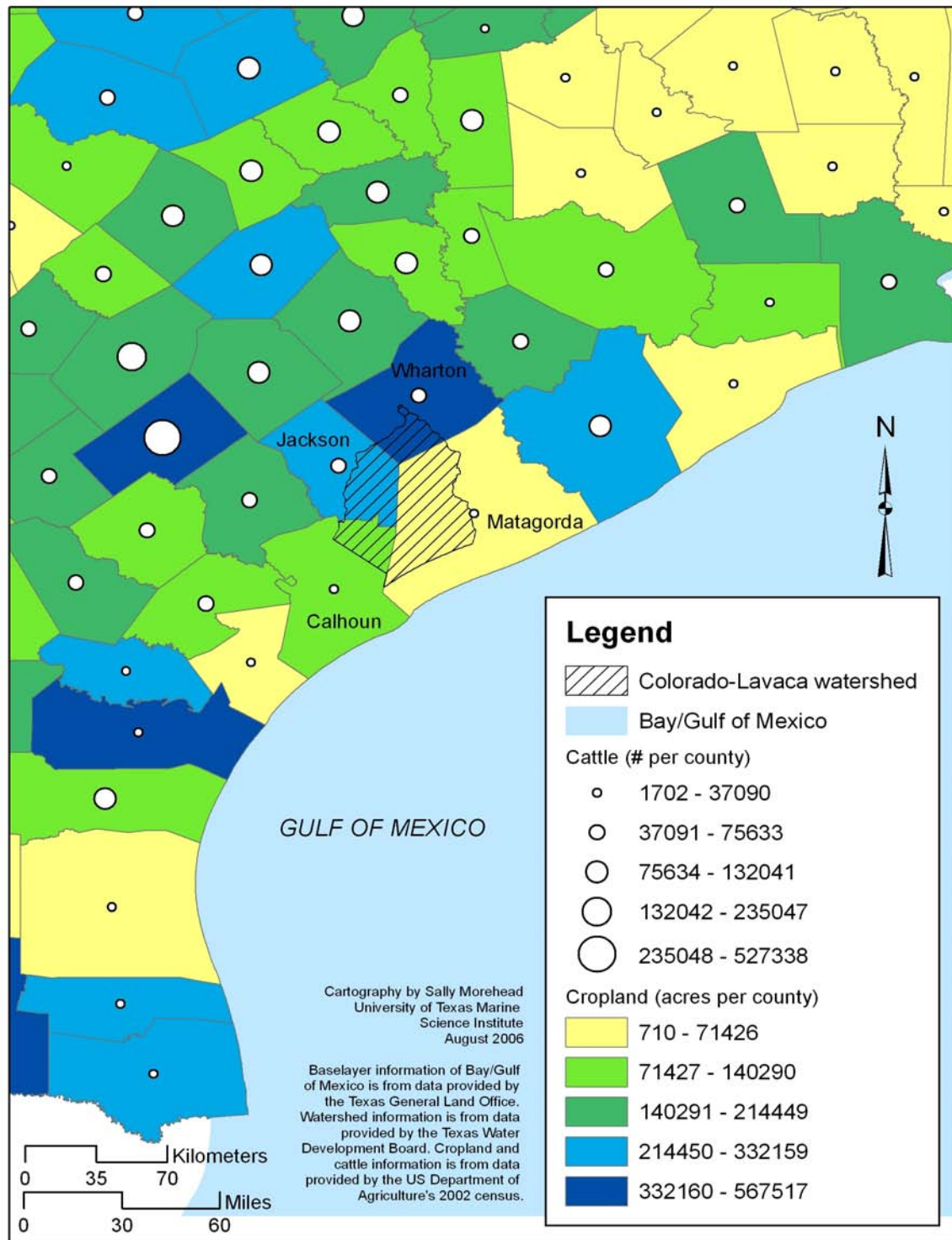


Figure 5. Cropland acreage amounts per county and number of cattle per county. Counties within the Colorado-Lavaca watershed are labeled by name.

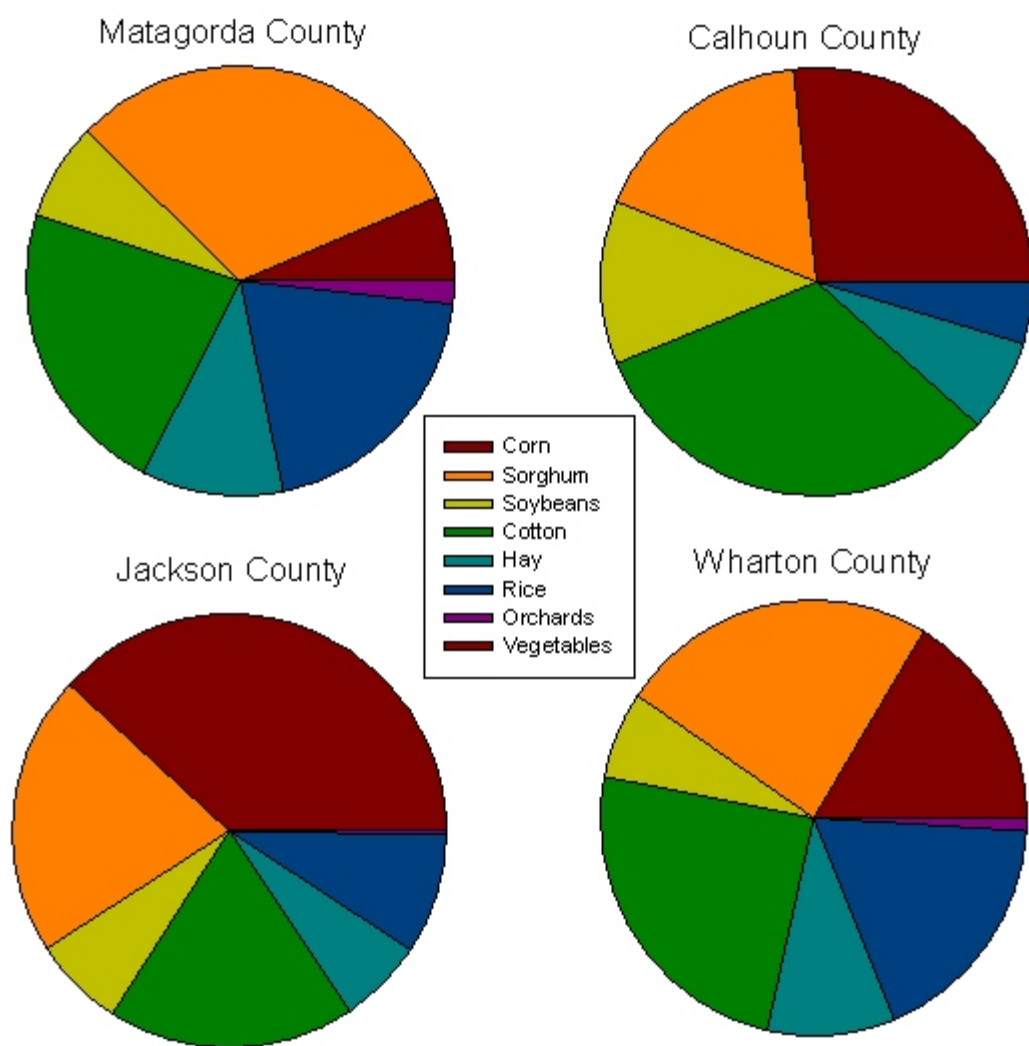


Figure 6. Crop acreage amounts for counties in the Colorado-Lavaca watershed.

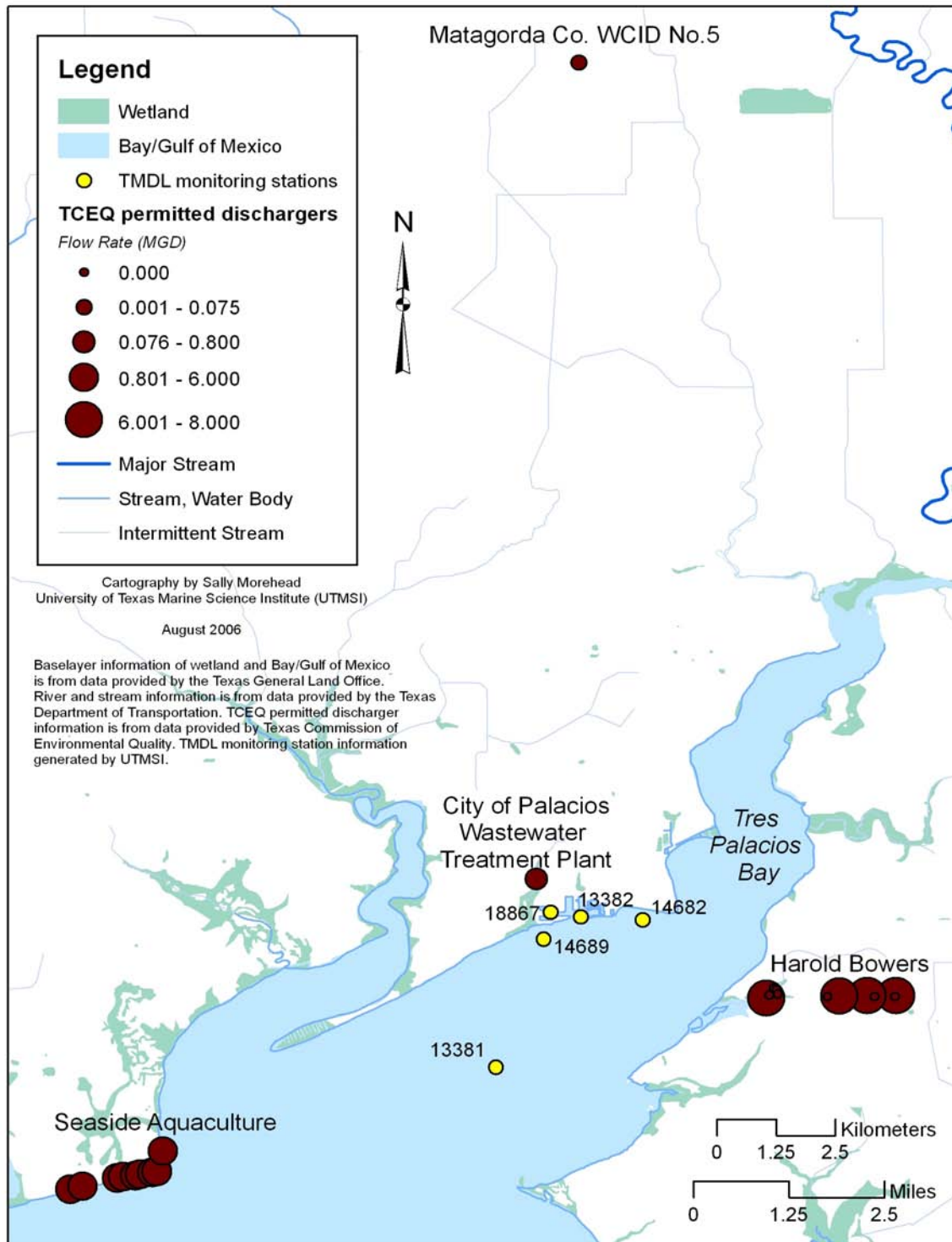


Figure 7. TCEQ permitted dischargers and TMDL project monitoring stations in the Tres Palacios Bay area.

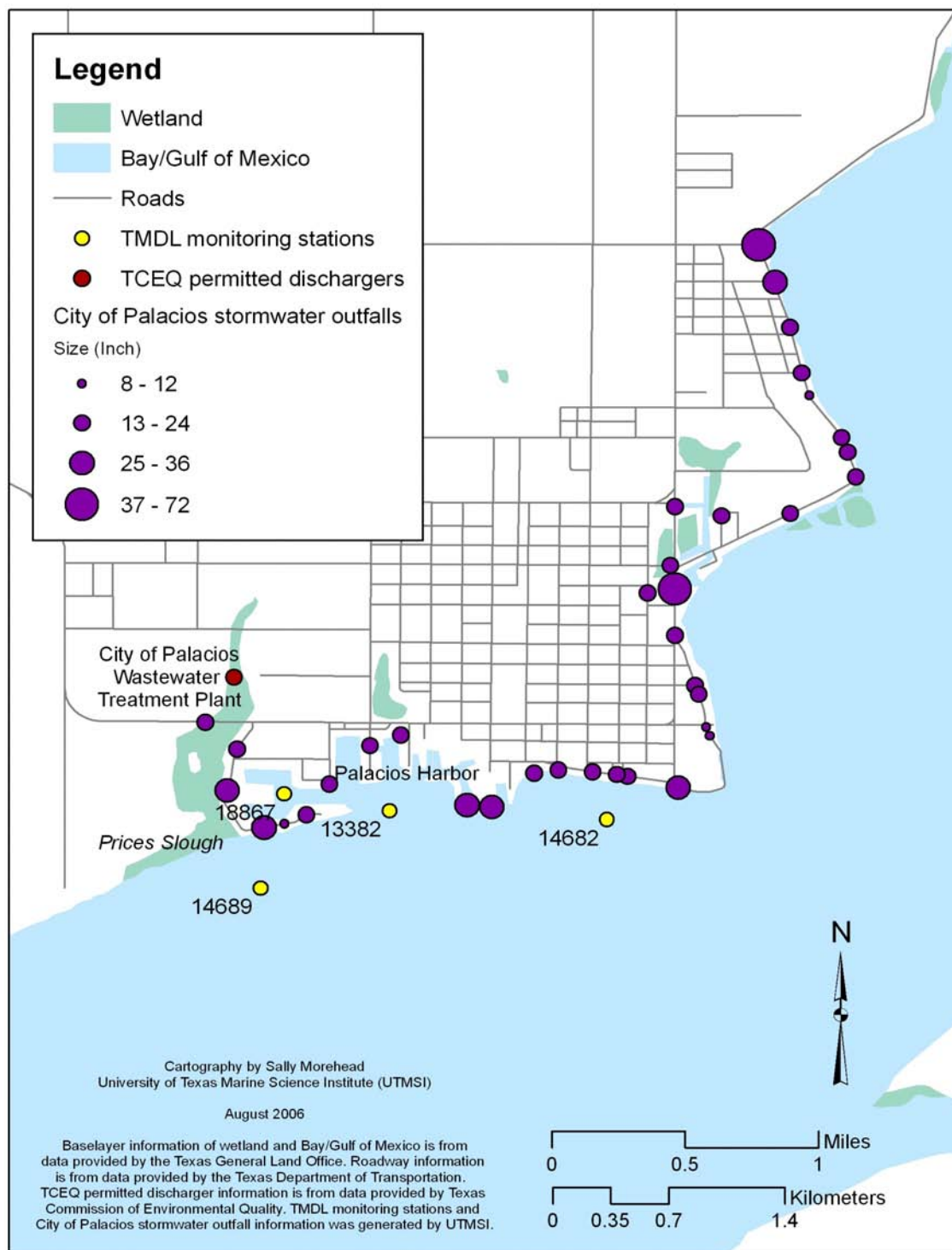


Figure 8. City of Palacios stormwater outfalls and TMDL project monitoring stations in the Tres Palacios Harbor area.

Database Information

Roads

Source: Texas Department of Transportation
File name: txdotrds2

The transportation information in the TxDOT urban map files were digitized from USGS 7.5 minute quadrangles. Updates are made using TxDOT highway construction plans, aerial photographs, official city maps and field inventory data. These files contain many of the features found on 7.5 minute quads, except for contour lines, fence lines, jeep trails, electrical transmission lines, oil and gas pipelines and control data monuments.

Baselayer & Wetlands

Source: Texas General Land Office
File Name: hydroglop

Hydrographic features of the coastal counties of Texas, including streams, bayous, canals, ditches, lakes, reservoirs, marshes, tidal flats, bays, estuaries and the nearshore Gulf of Mexico. The arcs and polygons were extracted from a number of sources by Texas General Land Office (GLO) personnel, including U.S. Geological Survey and U.S. Fish and Wildlife Service National Wetlands Inventory digital line graphs (DLGs) and U.S. Geological Survey hardcopy maps digitized by the GLO, Jefferson County Appraisal District and other entities.

Urban Areas

Source: Texas General Land Office
File Name: urbanareas

Urbanized areas in Texas for display/cartography at intermediate or smaller scales (e.g. smaller than 1:24,000).

Water Features

Source: Texas Department of Transportation
File Name: hydrotxdota

Polygonal water bodies (e.g. lakes, bays, Gulf of Mexico) in the state of Texas. Lines digitized by Texas Dept. of Transportation (TxDOT) and extracted from county map series files by Texas General Land Office (GLO) personnel. Lines were closed, polygon structure created, and polygon attributes added by GLO personnel.

Watersheds

Source: Texas Water Development Board
File Name: tx_hucdd

This dataset represents the boundaries for the river basins of Texas. It was developed by the U.S. Geological Survey.

Elevation

Source: National Oceanic and Atmospheric Administration's Coastal Assessment and Data Synthesis System

File Name: gom_eda_elevation

The Elevation Digital Geography was developed using geographic information system (GIS) technology. It was developed from a US Geological Survey (USGS) three arc second (nominally 90 meter) Digital Elevation Model (DEM) of the United States. For the Coastal, Upstream and Interior Watershed shapefiles, the 90-meter USGS DEM file was resampled to one-kilometer resolution using a center-cell technique and deprojected to geographic coordinates. The center-cell technique of resampling to a coarser resolution retains only the center value of the original matrix and does not represent an average or mean. The shoreline, international boundaries, and many attributes in the geography come from NOAA's Coastal Assessment Framework.

Soil Drainage

Source: National Oceanic and Atmospheric Administration's Coastal Assessment and Data Synthesis System

File Name: gom_eda_soils

The Soils Digital Geography was developed using geographic information system (GIS) technology. It was developed from eighteen US Geological Survey (USGS) coverages of the United States, see <http://water.usgs.gov/GIS/metadata/usgswrd/ussoils.html>.

Land Use

Source: National Oceanic and Atmospheric Administration's Coastal Assessment and Data Synthesis System

File Name: gom_eda_land_use

The Land Use / Land Cover (urban enhanced 1990) Digital Geography was developed using U.S. Geological Survey (USGS) LANDSAT images and aerial photography information from the middle 1970s to the early 1980s. The data were 'updated' using U.S. Census Bureau information and an Advanced Very High Resolution Radiometer (AVHRR) Land Cover Characterization Database to enhance the characterization of urban areas and better reflect more recent (1990) conditions. The shoreline and international boundaries in the geography come from NOAA's Coastal Assessment Framework.

County

Source: Texas General Land Office

File Name: counties

Boundaries and names of the 254 Texas counties. Digital boundaries provided by the Texas Commission on Environmental Quality (TCEQ).

Cropland and Cattle Inventory

Source: UTMSI

File Name: counties_USDAcensus

Cropland estimates and cattle inventory were added to the Texas General Land Office's county shapefile. Cropland estimates and cattle inventory were provided by the 2002 US Department of Agriculture census (http://www.nass.usda.gov/Census_of_Agriculture/index.asp).

TCEQ permitted dischargers

Source: Texas Commission on Environmental Quality

File Name: outfalls_TMDL

Data was cut from TCEQ file "outfall.shp" and updated and imported as an event file with a dbf extension.

City of Palacios Stormwater Outfalls

Source: University of Texas Marine Science Institute

File Name: stormwater_outfalls

Data was digitized based on a map provided by Ed Schulze of the Matagorda County Health Department. Data was imported as an event file with a dbf extension.

TMDL monitoring stations

Source: University of Texas Marine Science Institute

File Name: TMDL_stations

Data was cut from TCEQ file "tracsstations_dec2003.shp" and imported as an event file with a dbf extension. An additional monitoring station (18867) was added in 2006 and included in this file.