Water Quality Planning for the Houston-Galveston Region

Final Report, FY 2014

Funding for this project was provided by the Environmental Protection Agency through a Clean Water Act 604(b) grant to the Houston-Galveston Area Council, administered by the Texas Commission on Environmental Quality.

Houston-Galveston Area Council

TCEQ

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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Prepared by the Houston-Galveston Area Council, in coordination with the Texas Commission on Environmental Quality. This project was funded under a Clean Water Act Section 604(b) grant; TCEQ contract number 582-14-40163.

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Acronyms

BMP	Best Management Practice
CCP	Coastal Communities Program
CWSRF	Clean Water State Revolving Fund
DMR	Discharge Monitoring Report
EPA	United States Environmental Protection Agency
FOG	Fats, Oils, and Grease
GIS	Geographic Information System(s)
H-GAC	Houston-Galveston Area Council
HHW	Household Hazardous Waste
MUD	Municipal Utility District
NPS	Nonpoint Source
OLD	Outfall Location Dataset
OSSF	On-Site Sewage Facility
PID	Permit Information Database
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
SABD	Service Area Boundary Dataset
SAS	Statistical Analysis Software
SEP	Supplemental Environmental Project(s)
SRF	State Revolving Fund
SSO	Sanitary Sewer Overflow
TCEQ	Texas Commission on Environmental Quality
TEHA	Texas Environmental Health Association
TMDL	Total Maximum Daily Load
TSSWCB	Texas State Soil and Water Conservation Board

TWDB	Texas Water Development Board
TxDOT	Texas Department of Transportation
WCID	Water Conservation and Improvement District
WQMP	Water Quality Management Plan
WPP	Watershed Protection Plan
WWTF	Wastewater Treatment Facility

Executive Summary

This report summarizes Contract 582-14-40163 (Project), a 604b project administered by the Texas Commission on Environmental Quality (TCEQ). The Project entailed a series of five (5) data collection, special study, and coordination activity objectives[1] completed by the Houston-Galveston Area Council (H-GAC) in conjunction with the TCEQ. The purpose of these activities is to provide data and analysis regarding wastewater infrastructure, watershed planning, and sources of nonpoint source (NPS) pollution that impact water quality in the 13-county Houston Galveston area Region (Region) of the Upper Gulf Coast of Texas. This document[2] is a summary of the results of these efforts, and a discussion of future needs.

Objective 2 – Quality Assurance – This objective involved the maintenance and renewal of three existing Quality Assurance Project Plans (QAPPs): the Regional Water Quality Data Acquisition and Compilation QAPP (Data QAPP) for the collection and assessment of the various data sources described under Objective 3; the Regional Geospatial Data QAPP (Geospatial QAPP) for the collection and analysis of geospatial data as described in Objectives 4 (Subtask 4.1 - Lake Creek Characterization) and 6 (Subtasks 6.1 and 6.2 related to OSSF database maintenance); and the San Bernard Watershed Protection Plan Modeling QAPP (San Bernard QAPP) for watershed modeling under Objective 4 (Task 4.2 and 4.3). The following tasks were completed:

- A **QAPP meeting** was held (as part of a general post-award meeting) on 11/12/2013 between H-GAC and TCEQ staff, along with continuing conversations throughout the Project term, to discuss the development and terms of the QAPP (Task 2.1)
- Annual Reviews of the **Data and Geospatial QAPPs** were completed and submitted by H-GAC, and approved by TCEQ and EPA. The **San Bernard QAPP** (See Objective 8) was submitted and approved in conjunction with work added under Amendment 1 (See Objective 4).

Objective 3 - Water Quality Management Plan Review, Update and Coordination – Objective 3 of this Project involved the continued development and maintenance of a series of integrated wastewater treatment facility (WWTF) datasets, the review of State Revolving Fund (SRF) applications for compliance with regional data and aims, coordination of regional watershed management efforts, and an evaluation of bacteria data reported in WWTFs' discharge monitoring reports (DMRs). The following tasks were completed:

[1] These five water quality objectives are Objectives 2-6 of the Project. Objective 1 – Administration, and Objective 7 – Final Report are not discussed separately, but are referenced in relation to other Objectives.
[2] Due to size and length considerations, some documents or deliverables are provided on the enclosed DVD, as noted in the Report.

- Datasets containing spatial information related to **WWTF service area boundaries** and **permitted outfalls** were updated and amended to reflect changes and better reconcile with other related datasets (Task 3.1).
- The **WWTF permit information database** was updated with new permit information, reviewed for outdated or erroneous data, and then compared against the service area boundaries and outfall location datasets. Effluent data from Discharge Monitoring Reports was acquired and incorporated for use in a wide array of watershed, wastewater infrastructure, and other related projects[3] (Task 3.2).
- H-GAC reviewed **one** application to the **State Revolving Fund** (SRF), and provided formal comment to the TCEQ (Task 3.3).
- H-GAC provided general **watershed/water quality management coordination** through the staffing and facilitation of the Natural Resources Advisory Committee, coordination of data and efforts with ongoing Total Maximum Daily Load (TMDL) and Watershed Protection Plan (WPP) projects, sending liaisons to a variety of local water quality and watershed organizations including the Galveston Bay Estuary Program's Water and Sediment Quality subcommittee, and coordinating efforts between other H-GAC environmental efforts and this Project (Task 3.4).

Objective 4 - Support Watershed Planning– Objective 4 involved support of watershed planning in the Lake Houston and San Bernard River watersheds, through characterization of the Lake Creek Watershed, stakeholder facilitation in the San Bernard River Watershed, and watershed modeling for the San Bernard River Watershed Protection Plan (WPP). The following tasks were completed:

- A **watershed characterization** was completed for the Lake Creek watershed. The characterization study included source identification, source load modeling, land cover change analysis, and water quality data analysis. (Task 4.1).
- Continued **stakeholder coordination** for the San Bernard WPP projects was facilitated by H-GAC. One partnership meeting, one Stream Team training, one A&M AgriLife Riparian Workshop, one staff presentation to a community group, and several distributed contacts (individual calls to key partners) were conducted (Task 4.2).
- Additional **watershed modeling** was completed for the San Bernard using a revised run of the Soil and Water Assessment Tool (SWAT) model developed under a previous TCEQ contract. The resulting data will be added to the WPP (Task 4.3).

Objective 5 – Coastal Nonpoint Source Program Development – For the fifth objective, H-GAC continued to maintain communication with its program participants, and disseminated grant and funding opportunities as appropriate. The update was part of the second phase in an ongoing program to prioritize support for local needs that impact NPS issues in these communities. In addition, H-GAC provided support and services to help the program

[3] These data collection and analysis activities took place under the auspices of the H-GAC Regional Water Quality Data Acquisition and Compilation QAPP.

communities to meet needs related to a nonpoint source impact. A program website[4] was developed to host model materials, funding resources, and other pertinent information. Lastly, H-GAC engaged local stakeholders in reviewing potential funding opportunities and involvement with the RESTORE Act funding process. The following tasks were completed:

- H-GAC facilitated continued **program development** for the Coastal Communities project through materials disseminated by email and on its website. (Tasks 5.1).
- H-GAC **provided support services** to the program participants and other small coastal communities including assisting with TWDB funding application data; identifying potential funding sources; coordinating with a corresponding coastal stormwater BMP study through the University of Texas; coordinating with a Houston Wilderness-led project to generate a regional conservation plan and attract funding from RESTORE and other sources; and disseminating grant opportunity and programmatic resources information to all participants (Task 5.2).
- In addition, H-GAC maintained **a program websit**to host program resources, funding opportunities, and related information relevant to our program participants (Task 5.1).

Objective 6 - OSSF Database Update – In fulfillment of Objective 6, H-GAC updated and expanded an existing GIS database of regional on-site sewage facility (OSSF) locations and a spatial projection of likely locations for unpermitted systems[5]. The following tasks were completed:

- The **OSSF location database** was updated with new data received during the contract period (Tasks 6.1).
- A series of **real estate inspector trainings** were held to train point-of-sale personnel in locating unpermitted OSSFs, to generate additional locations for the database (Task 6.1).
- The **unpermitted OSSF methodology** was reviewed and updated by H-GAC staff. (Task 6.2)

[4] www.coastalcommunitiestx.com
[5] These data collection and analysis activities took place under the auspices of the H-GAC Regional Geospatial Data QAPP.

Introduction

This document is the culminating report for the fiscal year 2014 efforts conducted under 604b-funded Contract 582-14-40163 (Project) between the H-GAC and the TCEQ. The Project involved acquiring, compiling and evaluating water and wastewater data, and a series of special studies and coordination activities. The purpose of the Project is to support current and future planning decisions concerning water quality efforts, wastewater infrastructure development, watershed management, and related issues on both a regional and state level.

The 13-county Houston-Galveston Area Region (Region) has a variety of water quality concerns and developmental challenges. The majority of our local water bodies are impaired under state water quality standards, and our developmental patterns have resulted in a relatively patchwork and diffuse network of wastewater infrastructure. With population expected to expand dramatically in the coming decades, the ability to make informed decisions regarding water quality and wastewater infrastructure development will be a key tool in planning for the Region's future. The background of this Project is discussed in the **Project Significance and Background** section. The efforts summarized in this document serve to advance these purposes through a series of specific studies and the maintenance of regional datasets for local use and in support of the state's Water Quality Management Plan.

This report will focus on the progress achieved in the five primary objectives[6] set forth in the Project:

- Quality Assurance
- Water Quality Management Plan Data Update and Coordination
- Support Watershed Planning
- Coastal NPS Program Development
- OSSF Database Update

Each of these primary tasks serves to maintain, expand or implement the H-GAC's store of water quality and wastewater infrastructure data, or provide related services to the Region. Each objective is explained in greater depth later in the **Project Studies and Coordination Activities** section.

The Project required a series of interim deliverables related to these tasks. A description of the methodologies employed to generate outcomes is provided in the **Methods** section. Some of the deliverables are generated as large electronic datasets, unsuitable for full inclusion in a printed version of this final report[7]. However, representative pieces of each deliverable are included, and all Project outcomes are discussed in the **Results and Observations** section. The

[6] Objective 1 (Administration) and Objective 7 (Final Report) are not specifically reported on in this document, as they relate only to the maintenance of the contract and the development of this document.
[7] Copies of these electronic data are contained within the media that accompanies this report, and have been provided under separate cover.

synthesis of the information gathered and tasks implemented under this Project is discussed in the **Discussion** and **Summary** sections. Additional information and standalone reports completed for some deliverables are provided in the **Appendices.**

Project Significance and Background

Background

The Region has experienced robust economic expansion over the last several decades. That expansion resulted in a proportional increase in population growth and resulting land development. While this has been a boon to local prosperity, increased population and development also carry with them the challenges for our utility infrastructure and the potential for increased impact on our local waterways. With 3.5 to 4 million more residents expected by 2040, these challenges will only be exacerbated by future population growth.

The majority of the stream segments in the Houston area are listed on the State of Texas's list of impaired water bodies (303d list). An overwhelming majority of the region's segments are unable to meet one or more state water quality standards. The most common source of impairment is elevated bacteria levels in excess of the contact recreation standard. Other development related issues like low dissolved oxygen, PCBs, and dioxins are also present in some water bodies. The bacteria in our lakes, creeks, streams and bayous comes from a variety of sources, including human waste, domestic animal waste, pet waste, and wildlife. These wastes may enter the water through point sources, i.e. discrete "end of pipe" discharges, or diffusely through nonpoint sources, carried in precipitation flowing over the land. While some bacteria are naturally occurring, development brings with it additional bacterial sources and a greater potential impact to water bodies unless careful planning is employed.

The wastewater infrastructure that serves the Region's increasing population has expanded and developed much like the Region itself. The ability to fund infrastructure through political subdivisions like Municipal Utility Districts (MUDs) and other special districts allowed for a wastewater treatment network that is relatively widespread and diffuse rather than limited by the bounds of a traditional, centralized model. The resulting patchwork of regional wastewater infrastructure development offers both future challenges and opportunities for local decision-makers. These challenges are best served by the accumulation, maintenance and application of regional wastewater and effluent quality data to inform regional decisions. As management measures designed to deal with the current and potential water and wastewater infrastructure issues are put into place, the need for coordinated, regional sources of information becomes plain.

Under previous 604b projects, H-GAC has sought to address aspects of the information and data needs related to the water quality issues the Region faces. These projects have typically been a mix of ongoing efforts and short term special studies. Some of the project efforts have been continuous (wastewater data collection and maintenance, etc.) while others have been standalone research efforts relating to specific data needs or questions (GIS analyses for infrastructure consolidation, Phase II stormwater permit implementation, etc.). This balance allows the long term accumulation of data while retaining flexibility to address specific issues. The ongoing efforts in the FY14 Project focused on updating and improving existing regional

wastewater infrastructure databases and spatial datasets of OSSF locations, providing nonpoint source management support to small coastal communities, and supporting local watershed protection planning. Short term/special study efforts include development of watershed characterization for the Lake Creek Watershed and modeling data for the San Bernard River, two regional priority watersheds.

Significance

From a regional perspective, the water quality and wastewater infrastructure decisions facing our local areas are more effectively considered on a watershed basis, as contaminants do not adhere to political boundaries along waterways. This is especially important for watersheds that serve as significant drinking water sources, like Lake Houston. In order to provide useful information and viable recommendations, a large store of relevant and accessible data is necessary.

The data collection and analysis tasks completed under this Project have significant value for a variety of efforts in the Region, benefitting local watershed protection planning, wastewater infrastructure planning, and program development.

The significance of the efforts undertaken in this Project is demonstrated by the variety of capacities in which the outcomes are used:

- **Internal data collection and regional data sharing** – The wastewater permit data, service area boundaries, Lake Houston monitoring data, and OSSF location data collected/created under this Project serve to augment existing datasets, inform project decisions on related efforts, and expand internal abilities of both the H-GAC and TCEQ to incorporate and produce future data and analyses.
- **Regional project coordination** – Maintaining and expanding regional data resources allow the H-GAC and TCEQ to better understand and facilitate regional efforts between parties involved in wastewater infrastructure decisions, and general water quality/watershed protection efforts (WPP and TMDL efforts, etc.) Participation in regional groups and efforts helps ensure decisions benefit from project resources and expand the reach of the project's aims through partner efforts.
- **Source water protection** – A large portion of the Region's population is served by treated surface water that originates in our local rivers and lakes, of which Lake Houston is a primary source for the greater Houston area. The Lake Creek[8] characterization and coordination activities of this Project fostered greater understanding of the issues facing this prominent drinking water source.
- **Project review** – Data and analyses allow H-GAC Project staff to assist state and federal granting agencies in review of regional grant applications. These reviews ensure that potential projects concur with regional priorities and regional data projections.

[8] Lake Creek is a tributary to the West Fork San Jacinto River, the primary source of water for Lake Houston.

- **Education and outreach** – Data gathered under this project has been used as a focal point or basis for several educational efforts, including the OSSF location database, and various facilitated meetings like the ongoing Natural Resources Advisory Committee. The development of real estate trainings help expand the data collection and OSSF identification efforts.
- **Coastal NPS program development**– The continuation of the Coastal Communities Program focuses on supporting efforts by the participating communities and other small coastal communities to access funding and support to reduce point source and NPS issues.

Project Objectives

This section details the background, process and outcomes for the seven Objectives that represent the component efforts of this year's Project *(Objectives 1 and 9 of the Project are administrative tasks and Final Report requirements, and therefore are not reported on this document).*

Objective 2: Quality Assurance

This objective includes tasks related to maintenance and update of three existing Quality Assurance Project Plans (QAPPs): the Regional Water Quality Data Acquisition and Compilation QAPP (Data QAPP) for acquisition, compilation and assessment of TPDES permit data and related information as part of Objective 3; the Regional Geospatial Data QAPP (Geospatial QAPP) for the collection and analysis of geospatial data as described in Objectives 4 and 6; and the San Bernard River Watershed Modeling QAPP, for watershed modeling.

The purpose of this objective is to ensure all data are collected and analyzed in a manner appropriate for the data objectives of the Project.

Task 2.1 – QAPP Meeting

H-GAC and TCEQ met to formally discuss the QAPP needs for the project as part of a project kickoff conversation on 11/15/2013 after the initiation of the contract. The outcome of the meeting was a confirmation of the elements covered by each QAPP. Informal discussions regarding the maintenance and update of the QAPPs occurred continuously throughout the project term, including the development of the new San Bernard Modeling QAPP and the annual certification for the Data and Geospatial QAPPs.

Task 2.2 – QAPP

The existing QAPPs were maintained during this time period, with updates and revisions made as part of Task 2.3. The new San Bernard Modeling QAPP was developed during this project term.

Task 2.3 – QAPP Updates/Amendments

H-GAC amended the Data QAPP and the Geospatial QAPPs for content and for annual certification. The revised versions were submitted and approved by TCEQ and EPA.

Objective 3: Water Quality Management Plan Review, Update and Coordination

This objective includes tasks related to wastewater infrastructure data collection, dataset update and management, coordination of watershed planning efforts, and SRF project proposal reviews.

H-GAC maintains a series of datasets related to TPDES-permitted wastewater infrastructure facilities in the region. They are the **Service Area Boundaries Dataset (SABD)**, the **Outfall Locations Database (OLD)**, and the **Permit Information Database (PID)**. A primary task under this Project is to update and continue to integrate these data sources.

Task 3.1 - Service Area Boundaries

The SABD is the spatial representation of the wastewater dischargers' service area boundaries. Typically, this boundary data include municipalities, public districts (MUDs, WCIDs, etc) and private utilities.

During previous annual Projects, the SABD was modified to integrate it with the Permit Information Database (PID) and the Outfall Location Dataset (OLD) directly in a shared GIS, to allow data updates to be shared across platforms directly, rather than through duplicated effort.

H-GAC GIS staff accumulated and integrated service area boundaries during this project term on an ongoing basis. The current version of the SABD is included in digital format on the media accompanying this report.

Task 3.2 – Wastewater Database Maintenance

In addition to the SABD, H-GAC maintains two other sets of data, the Outfall Location Database, a GIS layer, and the Permit Information Database, a Microsoft Access database.

> Outfall Location Database (OLD) – The OLD is a companion dataset to the SABD, and maintains the outfall location of each permitted wastewater outfall. TCEQ updates are the initial source of this dataset, as precise outfall location coordinates are not provided in permit documents (only general descriptions of the outfall path). However, when H-GAC receives data from individual permit holders or other sources that contradicts TCEQ data, staff members review the conflicting data against the existing records.
>
> During this project period, staff conducted an in-depth integration review after incorporating the most recent version of TCEQ data (dated March, 2014). As part of the review process, project staff compared the existing dataset with the most current TCEQ dataset and the TCEQ Central Registry permit entries to identify and resolve any discrepancies. Subsequent to this review, the outfall dataset was compared to the PID to ensure that each outfall record in the PID had a corresponding outfall location. Based on the review, H-GAC generated a list of discrepancies for TCEQ's review. The primary

source of discrepancies was a mismatch between an outfall status and a permit status in the Central registry.

A list of the discrepancies is provided in digital format in the media that accompanies this Report.

Permit Information Database (PID) – The PID is the collecting point for wastewater discharge permit data from regulated wastewater dischargers across the region. The H-GAC receives copies of WWTF permit information from the TCEQ, and incorporates it into a centralized, queriable Access database. The data H-GAC receives includes new permits, permit renewals, permit modifications, notices of permit applications/renewal applications, preliminary decisions on permit applications/renewal applications, and permit information updates[9]. From these documents, all relevant information is extracted into pre-determined fields. These fields include name of discharger, name of facility, addresses, EPA and TCEQ permit numbers, capacity and permitted flow requirements, contaminant limits, outfall path, and other identifying data and regulatory restrictions.

Two updates, one major and one minor, occurred during this Project term, bring the PID current with data received through at least 6/1/2014. The H-GAC Project Manager conducted a quality control audit for the data entry on at least 10% of the data. No appreciable errors were found. The current database includes records for 1506 permits, representing well over 2000 individual outfalls. A screenshot of the database format is attached as Figure 1.

[9] It should be noted that H-GAC does not receive notices of permit expiration, abandonment, or administrative enforcement orders.

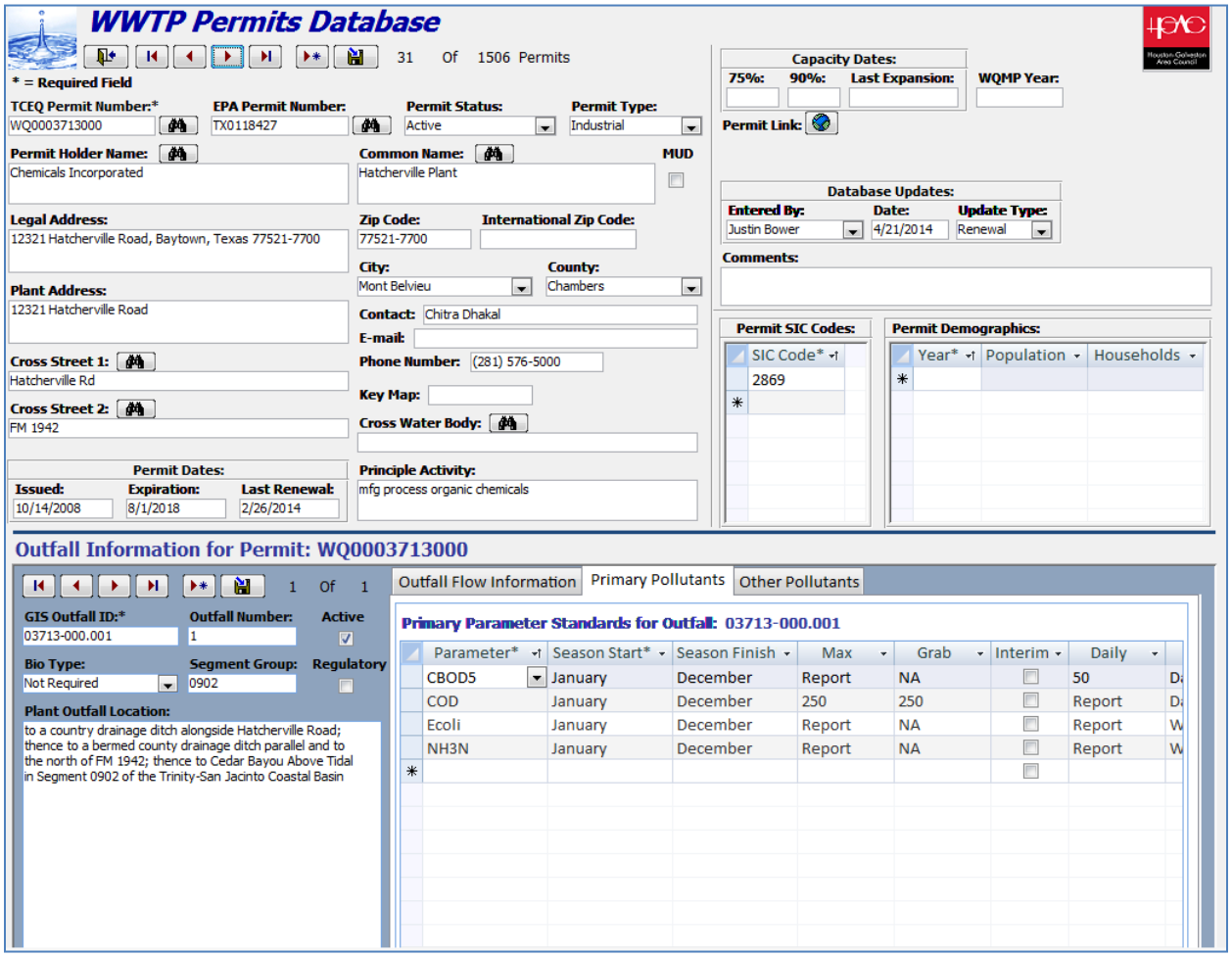

Figure 1 - The Permit Information Database (PID)

The data was checked for consistency across all outfalls of a single permit, and for consistency across all permits. It should be noted that while the PID and the SABD are integrated for those WWTFs that have boundaries, a 1:1 is not possible as boundaries do not exist for the majority of the industrial permits (which may serve a single parcel, and do not have traditional boundaries, but do have outfall locations). Over 500 documents were added or amended during this year's updates.

Task 3.3 - State Revolving Fund

In conjunction with H-GAC's role as a regional planning group and the council of governments for the Houston-Galveston area of the Upper Gulf Coast, staff regularly provides comment on

fundingproposals of varying types. These reviews help to assure that regional goals were represented in project funding decisions at variety of governmental levels.

H-GAC reviews the grant applications and associated engineering documentation (PER, Environmental Review, population projections) for concurrence with regional planning goals. Specifically, staff looked for:

- Population projections that matched TWDB, H-GAC or other relevant forecasts
- Consideration of alternatives that may impact water quality considerations
- Concurrence with regional priorities and goals (water quality impacts, etc.)

As part of this Project, H-GAC staff used data gathered under this and previous projects to provide comment on **one (1)** State Revolving Fund (SRF) project for the TCEQ. The outcome of the review is shown in Table 1 below.

Table 1 – Projects Reviewed in FY 2014

Granting Agency	Project ID#	Requesting Entity	Project Summary	Findings	Notes
TWDB CWSRF	73676	City of Houston	Rehabilitation of multiple wastewater systems/infrastructure.	Support	Sent letter of support. Annual multi-area project.

Task 3.4 - Coordination

As an extension of H-GAC's role as a coordinator of regional planning efforts in a variety of fields, project staff members develop and maintain relationships with other local and state governments, community groups, and other organizations involved in efforts related to the aims of this Project.

Staff members facilitate the H-GAC's Natural Resources Advisory Committee, which provides policy recommendations for the H-GAC's Board of Directors, and serves as a regional roundtable for coordinating environmental efforts. The NRAC provides an efficient communication network and point of contact for H-GAC staff with other local and regional water quality decision makers, and four (4) meetings were held during the original Project term. Those (November 2014; February 2015) held in the extended timeframe were conducted under the FY2015 604b project. The topics discussed at these meetings included Coastal conservation funding under the RESTORE Act and emerging contaminants in water (November 2013); Valuation of ecosystem services (February 2014); Environmental considerations in transportation planning (May 2014); and Houston area Superfund sites (August 2014). Project staff members also routinely attend meetings of, or otherwise support, a variety of other organizations involved in water quality efforts. This project term, staff helped coordinate activities with a wide variety of organizations. An example of these groups that staff worked with this year includes:

- Coordination with the Clean Rivers Program on the development of the Basin Highlights Report and other CRP efforts.
- Coordination with TCEQ on developing a project to address watershed planning in the Lake Houston watershed.
- Promotion of OSSF data collection efforts relating to Objective 6, and other water quality efforts through presence and speaking engagements with a variety of conferences including the Texas Environmental Health Association (TEHA), Texas Watershed Stewards trainings, the Texas Watershed Coordinators Roundtable, and other watershed coordinator meetings at the local and regional level.
- The Galveston Bay Estuary Program – Water and Sediment Committee membership and leadership (Justin Bower is vice-chair of the Committee).
- A variety of interactions with state and local policy and regulatory efforts (including coordination with ongoing TMDL, Watershed Protection Plan, and other efforts). Some projects of specific note are:
    - Bacteria Implementation Group (BIG) and Upper Oyster Creek TMDL Implementation Plans
    - Cedar Bayou, San Bernard River, and Bastrop Bayou Watershed Protection Plans
    - The Gulf Coast Regional Conservation Plan group for Houston

In addition to facilitating regional communication, coordination, and cooperation on water quality efforts through staff presence and participation, H-GAC also uses the data generated under this project to support various internal and external project needs.

Objective 4 - Support Watershed Planning

Objective 4 provides targeted support for ongoing source water and watershed planning in priority watersheds of the region. The efforts under this objective include a watershed characterization for the Lake Creek Watershed (Tasks 4.1); continued stakeholder group maintenance for the San Bernard River Watershed (Task 4.2); and watershed modeling for the San Bernard River WPP (Task 4.3).

Tasks 4.1 – Lake Creek Characterization

Lake Houston serves as source water for a large population, and therefore elicits special attention for water quality protection efforts. H-GAC previously maintained two continuous water quality monitoring sites in the Lake Houston Watershed, both located on the West Fork of the San Jacinto River. Data from these sites, CRP monitoring data, and local stakeholder concerns about diminishing quality make the San Jacinto River portion of the Lake Houston Watershed a primary concern for the region. Lake Creek is a relatively undeveloped tributary watershed to the Lake Houston system. To support stakeholder actions in the watershed, and develop a framework for further watershed protection, a preliminary watershed characterization study was completed for Lake Creek.

Lake Creek (Segment 1015) is a largely undeveloped tributary of the West Fork of the San Jacinto River, and part of the greater Lake Houston watershed. Of the many tributaries to the West Fork, only Lake Creek remains unimpaired[10]. The watershed is still relatively undeveloped, with most activity focused in its southwesterly extent. Its land cover, wildlife, and climate are similar to other undeveloped areas in the northern portion of the Houston-Galveston region.

In recent years, local stakeholders have expressed growing concern for the potential impacts of rapid development in the Lake Creek watershed. Located on the horizon of the greater Houston metropolitan area, the area around Lake Creek is expected to experience appreciable growth in the coming decades.

To provide a baseline characterization of the watershed, H-GAC conducted four assessment efforts: 1) evaluation of 7 years of water quality data; 2) comparison of past, current and projected land use/land cover; 3) a review of existing sources and evaluation of potential new sources; and 4) preliminary source modeling using the Spatially Explicit Load Enrichment Calculation Tool (SELECT).

Water quality trends in the Creek show a decline in overall quality among some constituents of concern such as fecal bacteria and low dissolved oxygen[11]. Other constituents (Nitrogen and phosphorus compounds) showed more mixed results. Hydrologic impacts of increased impervious cover have also been noted by area stakeholders, including increased volume and velocity of flows and apparent sediment loads.

An evaluation of past (2001), current, and projected (2040) land cover indicated that development and impervious cover are increasing in the watershed. Based on growth projections and modeling results for the area, it is likely that existing water quality issues will be exacerbated by future growth. The primary areas of growth in developed land uses are subwatersheds 7 and 8, in the southeastern/downstream portion of the watershed.

A review of potential sources of contamination in the watershed indicated that those found in previous studies were continuous and additional growth had happened in the interim. The primary potential sources of contaminants of concern (bacteria, nutrients, sediment) identified were additional residential and commercial developments, especially in subwatersheds 7 and 8.

Modeling using the Spatially Explicit Load Enrichment Calculation Tool (SELECT) indicated that bacteria sources in the watershed were varied, but still reflected an area on the cusp of developmental transition. In current conditions, cattle are the predominant (54%) source of

[10] Based on the 2012 Texas Integrated Report. The Draft 2014 Report was not available at the time.
[11] Based on a review of existing water quality data trends for Clean Rivers Program stations 11367, 17937, and 18191.

potential load, with dogs (19%), sheep and goats (10%), and on-site sewage facilities[12] (OSSFs, 10%) also representing appreciable potential sources. By 2040, the relative contribution of sources is projected to shift, with dogs being the predominant source (55%). OSSFs double in relative contribution (20%), and cattle are relative smaller part of the overall load (10%). In current and future conditions, wastewater treatment facilities, deer and horses are minimal sources, while feral hogs range between 1-5%. The shift is primarily attributed to the further development of the watershed. While relative percentages shift, the more important facet of the modeling is the change in actual loading. Between current conditions and 2040, the watershed is projected to experience a 167% increase in bacteria without intervention.

Based on the information summarized and generated as part of this characterization effort, Lake Creek faces appreciable challenges to maintaining compliance with SWQs in the coming decades. In consideration of the potential stakeholder resources available in the watershed, and the character of bacteria sources, further efforts in the watershed should be based on four primary recommendations:

- Gather additional water quality data to enhance understanding of dissolved oxygen cycles.
- Conduct additional modeling, including refined source load models, identification of flow impacts, and incorporation of stakeholder input to existing data.
- Develop a community-led Watershed Protection Plan based on sound science and local buy-in to serve as a roadmap for voluntary efforts to improve and maintain water quality.
- Continue and expand implementations of water quality solutions, including education, riparian corridor protection, and reducing source loads.

The full characterization study is included with the digital media accompanying this report.

[12] OSSF is a generic term for the class of wastewater treatment facilities characterized by individual treatment apparatus on or directly adjacent to a piece of property. These have traditionally been septic systems, but now include aerobic and drip system technologies.

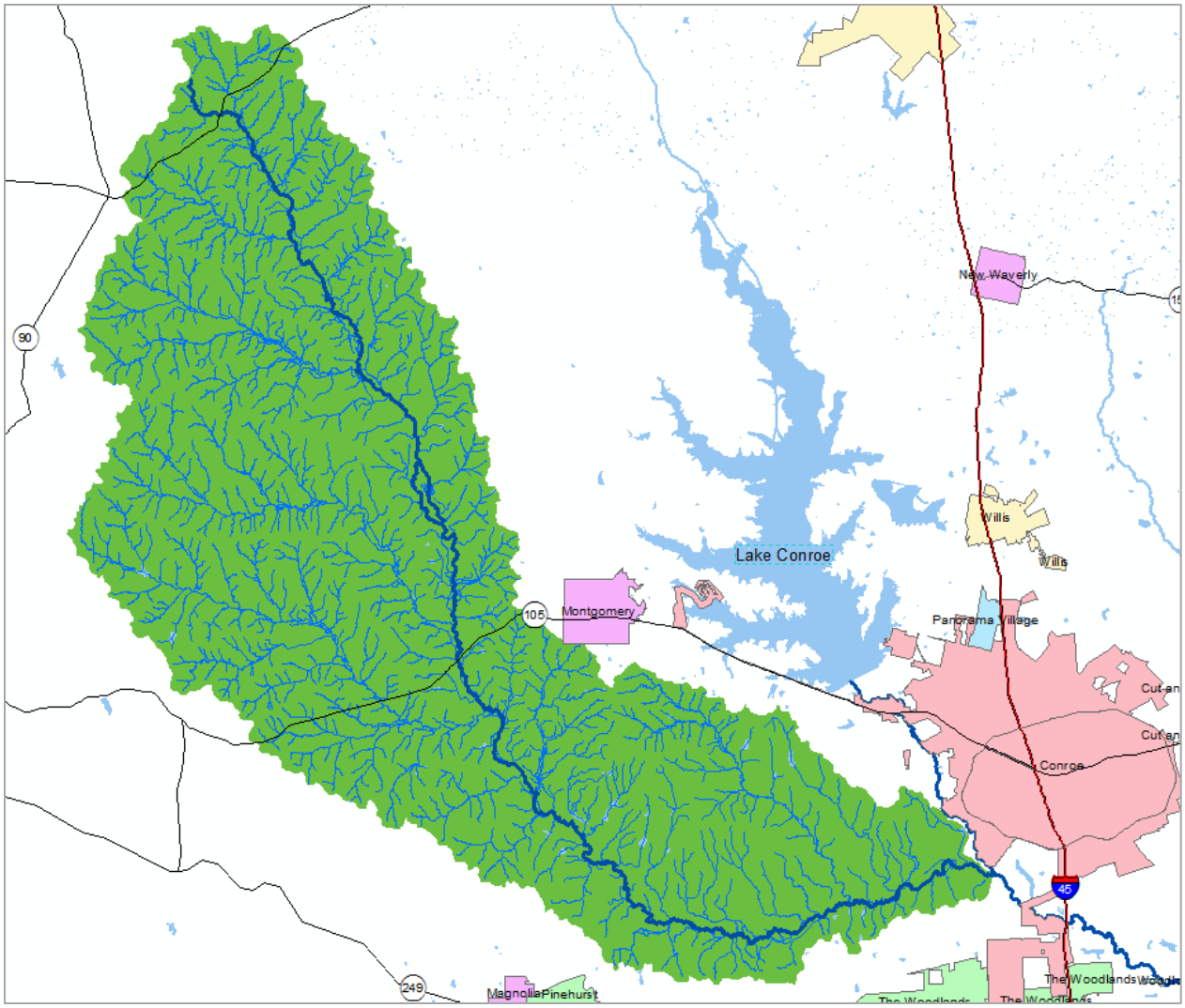

Figure 2 - The Lake Creek Watershed

4.2 – San Bernard River WPP Coordination

H-GAC has established a Watershed Protection Plan effort in the San Bernard River Watershed through previous 604b and 319h grants from the TCEQ. During this project, staff worked with TCEQ to revise the Watershed Protection Plan (in conjunction with Task 4.3). To maintain an active and engaged stakeholder base, H-GAC held a required stakeholder meeting, and also engaged in several additional speaking engagements and stakeholder events in the watershed. These events are summarized in Table 2.

Table 2 – San Bernard River Stakeholder Events

Date	Event	Participation
1/30/2014	**WPP Stakeholder Meeting**	**H-GAC held a meeting to discuss project status. 15 stakeholders attended.**
2/22/2014	Friends of the River San Bernard Annual Meeting	H-GAC presented on the watershed, the WPP, and project progress.
3/18/2014	Riparian Workshop (Texas A&M AgriLife)	H-GAC presented on the watershed at this AgriLife event aimed at protecting riparian areas through landowner education. Held in the San Bernard watershed.
8//2014	Austin County Horticulture Meeting	H-GAC gave a presentation on the project.
6/14/2014	Friends of the River Monitoring Workshop	H-GAC attended and updated participants on project status
10/28-10/29/2014	Annual Meeting, Association of Texas State Soil and Water Conservation Districts	H-GAC attended to promote efforts in the San Bernard and other watershed areas. Held in Region, but not in watershed.

Additionally, H-GAC coordinated with several stakeholders through the year on various projects including participation in regional efforts to encourage RESTORE act investment in the Upper Texas Gulf Coast, specific stakeholders engaged in reopening the mouth of the San Bernard River, and coordination of OSSF education efforts with A&M AgriLife and Brazoria County.

4.3 – San Bernard River WPP Modeling

Subsequent to the original contract, per Amendment 2, TCEQ requested that H-GAC complete additional modeling for the San Bernard River WPP. H-GAC completed SWAT and Tidal Prism modeling runs to produce load and reduction estimation numbers based on TCEQ requests.

The results of the modeling runs are designed to supplement existing information in the San Bernard WPP.

Objective 5 – Coastal NPS Development

While many communities in the Region are covered by MS4 storm water permits, there are a large number of small communities with known NPS issues who have received less attention and have less access to, or less knowledge of, existing resources that could mitigate challenges they face and lessen the impact of NPS sources in their communities. Of specific interest to the Region are those small communities in our coastal counties that may impact our coastal bays and estuaries.

Under the FY12 604b project, H-GAC initiated a Coastal Communities Program to evaluate the needs of these communities, the nexus of those needs with NPS contributions, and potential services that would serve elements of the communities' needs while alleviating NPS pollution. During this Project term, H-GAC maintained the program, disseminating resources to coastal communities, and taking part in broader regional discussions and projects concerning coastal funding priorities.

Task 5.1 – Program Development

The primary focus of this year's Program effort was to make program resources and services available to the participating communities. The following services or products were delivered to the participants:

- A **program website** (www.coastalcommunitiestx.com) was maintained for disseminating information to participants. The website hosts model programmatic resources, previous year's assessments, information on funding resources, information on events of interest (RESTORE Act, etc.), and project updates. Branding elements for the program were developed as part of this effort. Figure 3 is a screenshot of the website landing page.
- **Grant opportunities** were disseminated to the program participants as they were developed. Examples of grant announcements disseminated include the RESTORE Act information, TWDB SRF solicitations, and other coastal environmental opportunities.

Task 5.2 – Coordination and Resource Support

While no individual communities took advantage of H-GAC services during this project year, H-GAC continued to maintain relationships and investigate potential opportunities. Additionally, project staff coordinated with large regional efforts which promised to have direct benefit for the participant communities and coastal zone.

- **RESTORE Act Representation –** As part of a large effort to ensure representation of the needs of coastal communities in the region, H-GAC took part in several meetings, seminars, and trainings surrounding the development of RESTORE Act funding priorities for the state of Texas. These meetings included H-GAC hosted NRAC discussions of RESTORE Act priorities, trainings hosted by a local coalition of environmental organizations, and individual discussions and briefings with regional stakeholders. The intent of this representation is to ensure that the needs and NPS sources identified under this coastal program are part of the priority for funding/project selection. H-GAC served as part of a steering committee for the Houston-area Regional Conservation Plan

project (facilitated by Houston Wilderness) which seeks to define conservation and remediation priorities for the coastal areas in the region, in advance of RESTORE and other coastal funding sources coming fully online.

- **BMP Resource Guide Development –** H-GAC continued to coordinate with a team from the University of Texas to support their development of a BMP handbook for small coastal communities. H-GAC staff will continue to help develop and disseminate their product as appropriate.

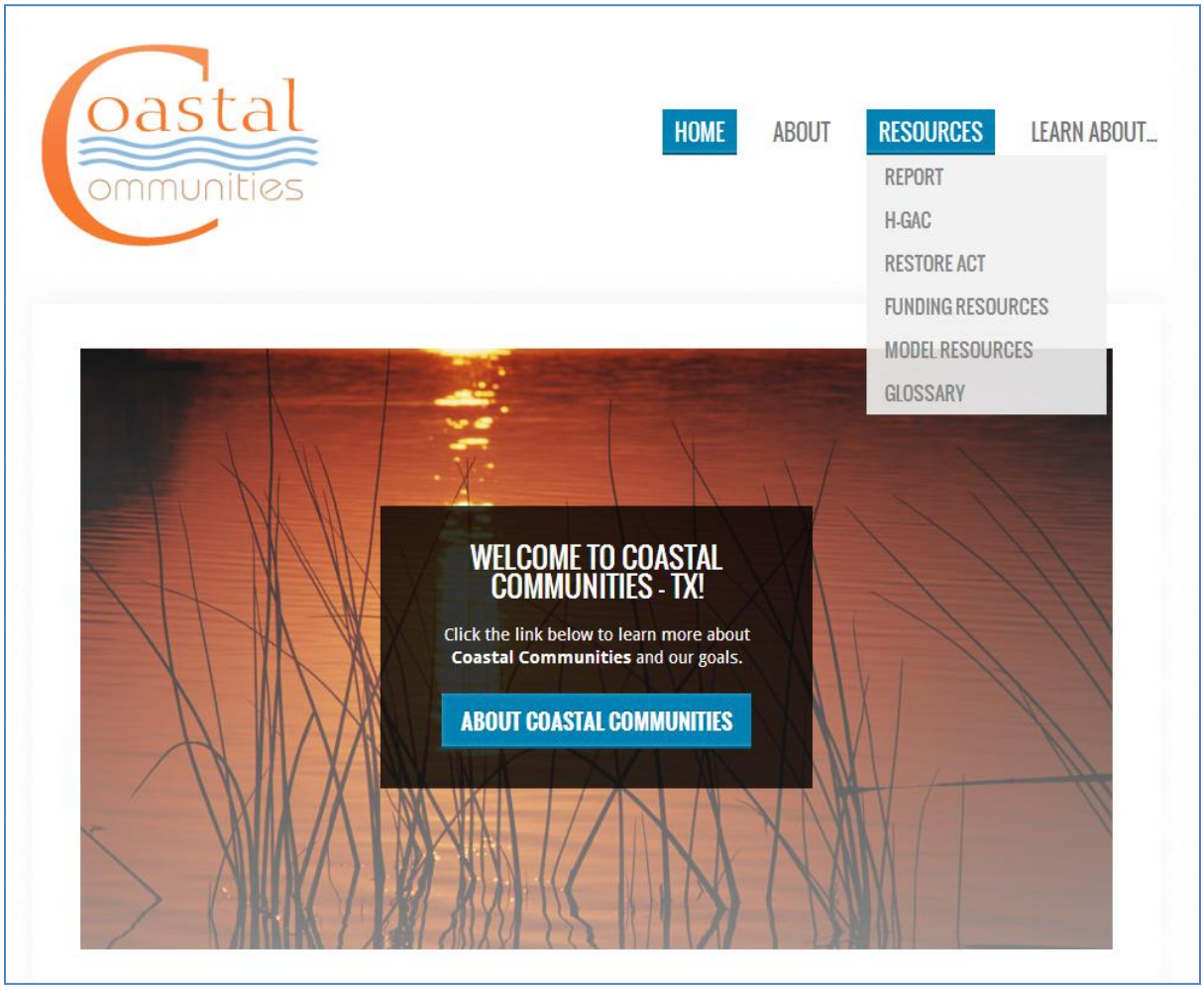

Figure 3 – Coastal Communities Program Website

Objective 6 – OSSF Database Update

On-Site Sewage Facilities (OSSFs), or septic systems, are a widespread wastewater treatment technology in the Region, especially in the developing counties on the Region's borders. OSSFs are relied upon for the treatment and disposal of wastewater in areas not conducive to sanitary service, but can be appreciable sources of contamination. The Houston-Galveston Area Council estimates that there are over 300,000 OSSFs within the region. This constitutes, roughly, 13% of all OSSFs within the state of Texas. Annually thousands of additional OSSFs are designed, sited, and installed within the Region, especially in the rapidly developing unincorporated areas of northern Harris and Montgomery Counties, as well as the rural counties that reside along the Region's periphery. While new systems are subject to permit requirements, systems older than 1989 may be grandfathered and specific locations may be unknown.

Authority over managing OSSF permitting is designated to Authorized Agents (counties, municipalities and other responsible entities), who have traditionally kept this data in a variety of formats. To ensure a regional, uniform set of data for use by authorized agents and water quality planning efforts, H-GAC developed a comprehensive inventory of permitted system locations and likely unpermitted system locations under previous grant contracts[13].

During the 2014 Project, new data from the Authorized Agents and old data not previously converted were added to the OSSF permit database. Additionally, H-GAC staff updated the unpermitted OSSF location methodology to include commercial and industrial OSSFs. While not required under the contract, H-GAC also held a series of OSSF inspection seminars for Real estate personnel, to assist in capturing locations at point of sale.

Task 6.1 – Maintain OSSF Database

The intent of the existing OSSF database is to provide a comprehensive, spatially-explicit inventory for all permitted OSSF locations throughout the region. No such inventory existed prior to the initiation of H-GAC's initial database development. The initial work had collected existing location data for permitted OSSFs and developed a program under which participating Authorized Agents would submit new system data on a regular basis, including spatial locations using GPS units provided by H-GAC[14].

In total, H-GAC added 3,789 records to the OSSF Permits Database in FY14. Prior to the recent update, the database consisted of 84,921 records of permitted OSSFs. With the update, the database now contains 88,710 records. This update is a net 4.5% increase to the database total. The updated OSSF database is included in the digital media attached to this report.

[13] The effort was initiated in an ARRA grant (Federal ID #96690301), and continued in previous years' 604b projects.

[14] Further information about the development of the database, the methodologies employed, and previous efforts can be found in the FY12 604b Final Report, FY13 604b Final Report, and the Geospatial QAPP.

Our partners have been very responsive with data submittals, partly in thanks to increased efforts (monthly emails, increased contact) to remind them to submit data. Records submitted by Brazoria County, Chambers County, Fort Bend County, Galveston County, Liberty County, Montgomery County, Waller County, and Wharton County contained latitude and longitude coordinates of the location of the system's septic or trash tank, allowing very precise siting. Permit Records received by the remaining Authorized Agents were geo-referenced, or identified on a map, by the permit address.

Project staff worked directly with several Authorized Agents to improve their data quality and submissions. H-GAC held a GPS training and audit with Waller County staff, and provided database management support and advice for Fort Bend, Chambers and Montgomery Counties.

Task 6.2 – Update Unpermitted OSSFs

The OSSF inventory data developed by H-GAC under Task 5.1 dealt with permitted OSSFs. For most Agents, systems began to be permitted subsequent to 1989. OSSFs installed prior to this date were not required to have a permit and in most cases are not actively tracked unless violation data exists for that site. While many of these systems are well maintained, aging systems in general pose a greater threat of failure and contamination of surface water sources. These systems also potentially represent an appreciable portion of the systems in service. H-GAC devised and tested a methodology to use existing data to identify by process of deduction, likely locations for unpermitted systems. During this Project year, the identification methodology was re-run to update the analysis. The updated Unpermitted OSSF map is included in the digital media attached to this report.

As part of the effort to identify unpermitted OSSFs, H-GAC held a series of training events for real estate inspectors. The content of the event covered OSSF location and inspection. The intent is to train real estate inspectors to recognize and assess OSSFs during inspections, which may lead to catching failing systems at point of sale, before catastrophic failures. Additionally, knowledge of a system location and existence can improve the homeowner's maintenance potential. Trainings were held in the City of Angleton (in conjunction with H-GAC's 319h Bastrop Bayou project) and in the City of Conroe. Both were well attended by real estate and local government personnel. H-GAC's training program is accredited, and credit-hours are available for participants toward licensure.

Methods

The following is a brief summary of the methods employed by Project staff, and their strategy and approach to each of the primary Objectives. The methods used, objective goals, and results for each are described in more detail in their respective sections in the Project Objectives section.

Objective 2: Quality Assurance

The general strategy employed by H-GAC was to first confirm that the new Project year tasks were covered under the existing QAPPs, and the implement the existing QAPPS. Annual Certifications were completed as required. The new San Bernard Modeling QAPP was developed based on existing QAPPs for similar work, using TCEQ's template and guidance.

H-GAC utilized its existing QA/QC methods developed with TCEQ and other agencies over the course of many years of related projects, in application to the FY14 Project.

Objective 3: Water Quality Management Plan (WQMP) Review, Update and Coordination

The permit database updates were routine, and adhered to existing QAPPs and QC methods.

For the SRF coordination aspects of the Objective, Project staff maintained a manifest in which to log SRF and other project reviews, and in which transition time was monitored internally.

Objective 4: Support Watershed Planning

To plan and execute the work on the Lake Creek Characterization, staff reviewed existing watershed characterization studies, watershed protection plans, and TMDLs/Implementation plans for similar waterways. Additionally, the assumptions and approach used for the SELECT modeling was based on a simplified version[15] of H-GAC's standard approach, itself based on literature values and other standardized assumptions to ensure compatibility with other SELECT analyses. H-GAC used existing datasets and information.

To foster the San Bernard WPP group, H-GAC maintained an active presence in the watershed beyond the minimum requirements of the contract. In addition to a watershed meeting, H-GAC also maintained communication with stakeholder groups, and attended or presented at several watershed area events.

The SWAT and Tidal PRISM model evaluations were intended to provide additional data for the WPP. The methods involved in generating the data are described in greater detail in the QAPP.

Objective 5: Coastal NPS Program Development

[15] Because no stakeholder group exists yet for this watershed, the feedback elements of a typical SELECT process were not undertaken. One of the recommendations of the characterization was for a review and adjustment of modeling efforts to take stakeholder suggestions into account when and if further work is completed in this watershed.

The methods employed in the maintenance of the Coastal Communities Program focused on providing information and services to support the needs of the participant (and other) small coastal communities).

To meet this goal, H-GAC focused on identifying feasible needs and matching services to meet them. Because none of the participants took advantage of direct planning support (despite initial discussions on a few potential projects or grants) H-GAC focused on participation in regional projects that would benefit the participants directly or indirectly. At the same time, information (grant opportunities, etc.) was disseminated to the participants.

H-GAC's methods in developing grant opportunities were to screen all grant possibilities, and disseminate those with relevant applicability. The approach with the participants was designed to be as community specific as possible, although the communities did not engage H-GAC in any specific projects beyond conceptualization. The website continued to be the approach that would allow a central depository for information and a quick reference for all resources.

Recognizing the benefit of shared resources and potential redundancy, H-GAC worked proactively with the UT study group to support their efforts and avoid redundancy. At the same time, the advent of potential funding under the RESTORE Act and related sources was determined to be of importance to the needs of the participant communities. H-GAC identified a need to represent these and other localities in an ongoing regional prioritization process, and was selected to serve on the steering committee developing a regional plan for funding priorities.

Objective 6: OSSF Database Update

The methods employed in the update of the OSSF database and unpermitted OSSF analysis are described in further detail in the Geospatial QAPP. Generally, H-GAC maintained regular contact with submitting AAs, to ensure regular data submissions. H-GAC's methods for the unpermitted analysis were the same as previous project years, in which unpermitted locations were deduced through a comparison of known parcels, known OSSFs, and known sanitary sewer systems.

Methods Summary

In general, the methodical approach of the Project team for all tasks was to assess available data/resources, make a preliminary plan toward the task objective, periodically review the progress and plan, and make adjustments as necessary.

For those objectives dealing with public interaction, staff utilized existing communication networks and meetings to maximize the number of people reached, and incorporated feedback into revised versions of deliverables.

As much of the data and analysis developed under this Project will likely serve other water quality and watershed efforts, H-GAC coordinated with internal and external project managers to assure that the format and approach to these efforts would provide meaningful products.

To the greatest degree possible, project staff attempted to streamline and make uniform the methods and processes involved in the various Tasks to increase efficiency in future project years.

Results and Observations

This year's project was successful in building on progress made in last fiscal year's project, and providing a solid base for a number of regional efforts. The following observations will inform the approach to future iterations of this Project.

Objective 2, QAPP - The extent of QAPP coverage under the FY14 contract, and a more proactive approach by TCEQ and H-GAC staff to planning for annual certifications and other QAAPP changes were generally successful.

Objective 3, WWTF Data – A significant number of permit documents were incorporated this year. Streamlining the data review QA process this year assisted H-GAC project staff in ensuring easily accessible records of QA compliance. Changes to TCEQ online hosting of permit documents may require future consideration of the need for additional PID updates.

Objective 4, Watershed Planning Support - The conclusion of the Lake Creek characterization project will support future efforts in this watershed, which is the recent focus of a great deal of stakeholder interest and activity. As the number of watershed/water quality efforts in the region continues to grow, the coordination aspect of this Objective will continue to remain relevant.

Objective 5, Coastal NPS Program Development - The shift from planning to assistance in the Coastal Communities Program FY14 project was intended to allow staff to focus specifically on serving participants based on the established needs and priorities. However, few of the participants opted to take advantage of services for specific projects, partially because their primary needs were for large infrastructure financing or engineering work beyond the scope of this project. H-GAC's pivot to involve itself in larger regional efforts that will benefit these communities has been a productive use of time. Cooperation between the UT coastal communities BMP handbook project, the Houston area Regional Conservation Plan and this Project will continue to be beneficial to all parties.

Objective 6, OSSF Database Update – The OSSF data continues to be one of the most useful elements produced under this Project. It has already been used for a variety of watershed protection efforts. With the population expansion of the coming decades, and aging infrastructure, additional information about unpermitted system locations will be vital to utility planning. Future work should consider ways in which to account for OSSF abandonment in expanding sanitary sewer areas, which cannot be easily captured currently.

In general, H-GAC project staff members are confident in the results of this year's Project. H-GAC feels that the deliverables meet the needs of the current Project, and will provide a solid foundation for future work.

Results and observations specific to each task and objective of this Project are described in detail in their corresponding subsection of the **Project Objectives** section of this document.

Future needs identified during this year's Project are established in the **Discussion** section of this document.

Discussion

This section will detail the areas of need identified for inclusion in future projects, including any recommended solutions.

Additional WWTF Data Needs

Deeper integration of DMR data and SSO data continues to be a need for the WWTF data collection efforts. Fully digital submission of this data by end users may accelerate this process. Additionally, a better methodology to identify and remove outdated/abandoned permits should be developed. No permit notice is sent out when a permit expires or is abandoned.

OSSF Inventory

With the new permit data submission process streamlined, the focus of subsequent efforts will need to be on expanding and improving the process by which unpermitted systems are located. Outer counties currently have limited parcel or single unit data, making specific site locations unworkable. Additional means to limit assessments in these areas to single parcels will need to be developed, rather than reliance on census blocks (which are very large in these areas). The development of an OSSF remediation Supplemental Environmental Project (SEP) by H-GAC offers the opportunity for coordination between data gathering activities under this project, and implementation activities in specific watersheds.

Coastal Communities

With the successful completion of the second phase of the program, and growing integration with other efforts (the UT study, RESTORE Act opportunities), the next step will be to continue to market services to the participants while also focusing on the larger regional opportunities. Continuation of this effort may be dependent on the ability to garner service opportunities with participant communities. Absent greater participation, the effort may be better focused on the regional aspects.

Summary

This year's Project was successful in updating WWTF infrastructure data for the Region, for the benefit of both local and state purposes.

H-GAC continues to provide its unique regional perspective to the review of SRF projects, and continued refinement of databases and GIS resources allowed us to be more efficient this year.

H-GAC continues to develop and foster relationships with interested parties in the Region's watersheds, and coordinate regional water quality activities. We have been leaders in previous TMDL and WPP efforts, and the coordination activities of this Project mesh well with our overall approach of outreach, targeted studies and implementation activities. By having multiple water quality projects within the same organization, we are able to achieve a good vertical integration between base data sources, internal analysis, planning efforts (WPPs, TMDLs, etc), and external coordination.

The Coastal Communities Program has continued to be a source of information for participant communities, but has not attracted as many specific community projects as anticipated. The greater potential for this effort has been the opportunity for representation and integration with RESTORE Act and similar coastal funding. H-GAC will continue to grow this effort with an eye toward potential future expansion to a stand-alone effort if appropriate.

The OSSF inventory development continued during this fiscal year, and improvements to communications with partners helped streamline and regulate the submittal process. This deliverable remains one of our most popular efforts among internal and external clients. .

This report, the accumulated datasets, the GIS analyses, and other deliverables of this Project are attached in electronic format on accompanying media. Where allowable and appropriate, data from this Project will be used to support other related efforts and/or made available (upon TCEQ approval) on H-GAC's website at http://www.h-gac.com/community/water/quality. This Final Report document, when approved, will be made available at this location.

Appendices

Appendix A – Summary of Materials included on Media

The following materials are included on the media attached with this Report:

1) Service Area Boundaries Dataset and map (GIS format) – Task 3.1
2) Outfall discrepancies list – Task 3.2
3) Permit Information Database (Microsoft Access database format) – Task 3.2
4) Lake Creek Characterization study – Task 4.1
5) Permitted OSSFs (GIS format) – Task 6.1
6) Potential Non-Permitted Systems Location Map(image file) – Task 6.2
7) Final Report, digital version (Objective 7)