FINAL PROJECT REPORT: HIGHLAND BAYOU WATERSHED PROTECTION PLAN

DECEMBER 14, 2016

GALVESTON BAY ESTUARY PROGRAM
A PROGRAM OF THE TCEQ
TEXAS COASTAL WATERSHED PROGRAM

Photo by Valeria Rodriguez, TCWP Intern

Final Project Report: Highland Bayou Watershed Protection Plan

DECEMBER 14, 2016

Texas Commission on Environmental Quality

Intergovernmental Cooperative Reimbursement Contract
With Federal, State and Local Governments and Agencies

Highland Bayou Watershed Protection Plan (WPP), Phase II
Contract Number 582-14-41415: CE-00655005

Final Report Sections

PROJECT TEAM 2
PROJECT BACKGROUND AND OVERVIEW 2
ADMINISTRATIVE TIMELINE 3
APPROACH 5
Update Elements A-E 5
Develop schedule for implementation 6
Develop milestones and criteria for load reductions 6
Develop a monitoring plan 6
Volunteer water quality monitoring program 6
Develop draft WPP 6
STAKEHOLDER PARTICIPATION 7
NPS LOAD ESTIMATES AND LOAD REDUCTIONS 9

PROJECT TEAM

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Project Sponsor Point of Contact: Lisa Marshall, Galveston Bay Estuary Program, Monitoring & Research and Water & Sediment Quality Coordinator

PROJECT BACKGROUND AND OVERVIEW

This contract supported project work by Texas A&M University's Texas Coastal Watershed Program on a watershed protection plan for Highland and Marchand Bayous, here referred to collectively as Highland Bayou. Funding for this effort was secured through GBEP's Water and Sediment Quality Committee's project funding process in 2013. A map of the study area (below) shows these and surrounding watersheds in the coastal basin; the WPP watersheds are marked yellow and orange on the map. Highland bayou is listed by the Texas Commission on Environmental Quality's 303(d) for high levels of bacteria and low levels of oxygen in the water. The bacteria impairment is classified as Category 5a and the dissolved oxygen impairment is classified as Category 5c. All segments are classified as tidally influenced. The structure of the plan is based on the US EPA's 9 element watershed protection plan, consisting of major components needed for a successful watershed protection plan. Local governments in the watershed are La Marque, Hitchcock, Bayou Vista, Texas City, and unincorporated Galveston County.

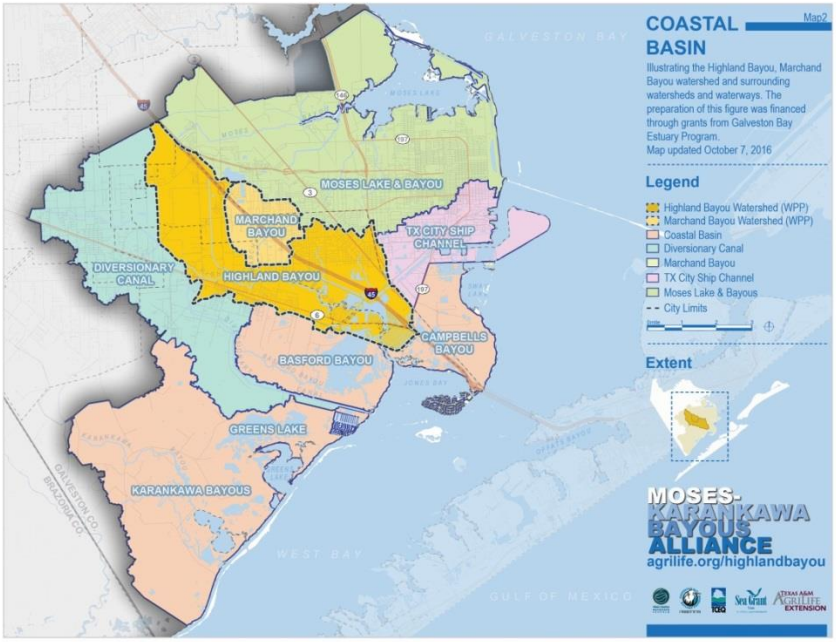


FIGURE 1: HIGHLAND/MARCHAND BAYOUS AND SURROUNDING WATERSHEDS

The Highland and Marchand Bayous Watershed Protection Plan (WPP) is a vision and set of project ides for voluntary action by community stakeholders for improving water quality. The impaired water quality poses risks to public health and diminishes its value as a recreational, aesthetic, and ecological resource for these communities. The project team described to stakeholders the WPP document as a community resource, compiling in one place the wide range of factors impacting water quality here, estimated pollution loads and reductions, specific stakeholder concerns, and pathways for action.

The Highland Bayou WPP Working Group began in 2012 under the previous contract as an ad hoc group to develop recommendations for water quality improvement. The group was reactivated for this contract in fall 2015. The group consisted of participants from state, county and municipal agencies, together with private citizens and not-for-profit organizations. Nearly 60 individuals were contacted for this process to hear and understand their experiences and concerns. This resulted in collecting over 100 project ideas, which were further organized into 38 Action Areas, all discussed in the WPP. From these, 10 Priority Action Areas were developed into detailed strategies, costs, required resources, timelines, and milestones.

Next Steps

The project team was unable to determine that proposed load reductions would achieve regulatory limits due to the lack of flow data necessary to calibrate observed values with estimated loading values. Remedies for this have been and are currently being considered by the project team, GBEP, HGAC and TSSWCB. The installation of flow gauges or, alternatively, the use of flow data from nearby bayous to approximate conditions in the watershed have emerged as potential pathways for remedying this data gap. Regardless of whatever remedy utilized for calibrating load values, it is likely that stakeholder's priority BMPs would not significantly change in light of that, although adjustments to milestones and resources might be warranted. With this understanding, the project team proceeded with stakeholder engagement and load reductions for priority BMPs. As with any WPP, continued engagement with the work group and newly identified stakeholders is critical. As stakeholders implement aspects of this plan, it will be important that it be updated to reflect new realities and a better understanding of NPS pollution in the watershed.

ADMINISTRATIVE TIMELINE

Contract Information & Dates

Contract No.:	582-14-41415
TCEQ Obligation:	$100,000
Grantee:	Texas A&M University AgriLife Extension Service
Grantee Account:	07-446010-00000
Contract Start Date:	January 24, 2014
Original Contract End Date:	August 31, 2015
Budget Revision:	March 01, 2016

Budget Revision:	May 27, 2016
Amended Contract End Date:	May 31, 2016
Revised Final Deliverables:	September 20, 2016
Revised Final Deliverables:	December 14, 2016

QAPP Dates

QAPP Approval:	September 09 2014
QAPP Audit Meeting:	May 28, 2015
QAPP Audit Response:	July 17, 2015
QAPP Amended Audit Response:	September 01, 2015
QAPP Approval:	September 20, 2015
QAPP Audit:	March 25, 2016

Personnel Eligibility List Revision Dates

Updated PEL:	October 2015
Updated PEL:	January 2016
Updated PEL:	April 01, 2016

Contractor Evaluation Dates

FY 2015 email confirmation:	November 19, 2014
FY 2016 email confirmation:	November 12, 2015
Final evaluation email confirmation:	October 26, 2016

Quarterly Progress Reports and Submittal Dates

QPR 1, Feb April 2014:	August 06, 2014
QPR 2, May-July 2014:	September 04, 2014
QPR 3, Sept – Nov 2014:	December 18, 2014
QPR 4, Dec-Feb 2015:	April 03, 2015
QPR 5, March-May 2015:	June 26, 2016
QPR 6, June – Aug 2015:	September 14, 2015
QPR 7, Sept – Nov 2015:	December 14, 2015
QPR 8, Dec-Feb 2016:	March 10, 2016
QPR 9, Mar-May 2016:	June 20, 2016
QPR 10, June- Aug 2016:	July 30, 2016 & September 22, 2016
FINAL QPR 11, Sep-Dec, 2016	December 14, 2016

Monthly Meetings with Project Sponsor

June 23, 2015
July 22, 2015
August 20, 2015
September 30, 2015
October 30, 2015
November 30, 2015

January 21, 2016
February 26, 2016
March 25, 2016
April 28, 2016
May 19, 2016
June 13, 2016
July 12, 2016
August 11, 2016
September 14, 2016

FINAL Project DELIVERABLES: WPP and Project Report
Email to GBEP's L. Marshall, December 14, 2016

APPROACH

Project approach is organized by tasks in the scope of work.

Update Elements A-E

Elements A-E were updated contingent on additional input gathered from stakeholders about conditions and project ideas. Element A was structured using the framework of four NPS quadrants- urbanization, waste water infrastructure, drainage/hydrology, and wildlife/natural areas. Load values were calculated for the watershed using the Simple Method and the CHARM data framework. Summary tables and maps of loading values are included in A. Full loading tables are included in the appendices. For more info on modeling, see separate section below.

Element B addresses loads reductions to be achieved by implementing several of the 10 Priority Action Areas. Using a 10-year implementation horizon and conservative implementation rates, the watershed could see a 42% reduction in bacteria, a 10% reduction in nitrogen, and a 12% reduction in phosphorous. Load reductions were calculated for waste water collection system repairs, pet waste pick-up programs, green stormwater infrastructure, and stormwater wetlands. Calculations, tables and maps are included in Element B. Not every priority Action Area would have a direct impact on NPS loading, but were considered priorities by stakeholders for public education and awareness purposes.

Element C contains a description of all 38 action areas. For the 10 Priority Action Areas, detailed tables were prepared with goals, objectives, phases, likely responsible parties, and likelihood of success.

Element D identifies major technical resources and support, organized by the 10 Priority Action Area goal and phase. Funding is organized by level of government and identifies the priority projects that funding would go to. The resource is intended to provide the watershed group with a method for narrowing options from a comprehensive list of funding source. An appendix was included that provides a more detailed look at the funding sources by agency.

Element E identifies the Stakeholder strategy used to develop the plan, the outreach methods used, and provides additional detail about a subset of the 38 Action Areas that concern public education and awareness. Additional details on the stakeholder process are included in the Stakeholder Section below.

Develop schedule for implementation

Element G includes a description of the implementation schedule for the 10 Priority Action Areas. The schedule was based on prior projects in this and other watersheds, stakeholder input and the project team's professional input.

Develop milestones and criteria for load reductions

Elements F & H covers milestones and criteria for measuring progress. As with the previous task, these elements were developed using prior projects in this and other watersheds, stakeholder input and the project team's professional input. Criteria were based on regulatory limits, screening limits, aesthetic standards, and general goals.

Develop a monitoring plan

Element I consist of the monitoring plan. The monitoring plan was developed using existing and available monitoring programs in the region, such as TCEQ's SWQM program, Texas Stream Team, and the Galveston County Health District. In addition to these existing programs, two additional programs are proposed- a USGS stream gauge program and bacterial source tracking to determine leading sources of bacteria in the watershed. The monitoring plan is based on meeting regulatory limits and conducted at reaches of the bayou that coincide with assessment unit boundaries.

Volunteer water quality monitoring program

TCWP joined Texas Stream Team in 2012 to support water quality monitoring within Highland and Marchand bayous as part of the Highland Bayou Watershed Protection efforts. Since then, a small but dedicated group of volunteers have participated. All sites in the Highland Bayou watershed are tidally influenced, and the *Water Quality Monitoring Form – Tidal* is used during data collection. Results of this program are included in *The Highland Bayou Volunteer Water Quality Monitoring Report*, with a final revised report submitted to GBEP on June 16, 2016.

Develop draft WPP

Extensive drafting began after gathering substantial input from stakeholders about priority projects. Once this information was known, load reduction estimates could then be estimated and thus unlocking progress on several subsequent elements of the WPP, such as timelines and necessary resources. A very preliminary draft version was submitted to GBEP in August 2015. Beginning in spring 2016 and into the summer, the bulk of the WPP had been drafted along with illustrations and map figures. A completed, internal final draft was prepared on September 20, 2016. A public comment draft was released to the stakeholder group on October 26. Public comments were received by November 04. The final map revisions were concluded by November 29, and after an in-house technical review, a final draft version was ready by December 07. The completed draft WPP was forwarded to GBEP by email on December 14, 2016. Four hardcopies were also

submitted to GBEP. The Final Draft WPP contains the 9 Elements, bibliography, and six appendices: Maps, Land Use-Land Cover Change Tables, NPS Pollutant Loading Tables, Stormwater BMP Factsheets & Sources, Funding Sources, and GIS Metadata.

STAKEHOLDER PARTICIPATION

Challenges. The WPP project team anticipated several challenges that became the basis for designing the planning process.

1. Quickly informing a diverse stakeholder group about the background and context for planning;
2. Seeking candid input from participants about their perspectives, vision, and experiences in the watershed; and
3. Promoting whole group discussion to build common purpose, identify priority projects, and foster familiarity among participants.

Role of the Planning Team. As lead facilitators, the planning team's role was to keep the process and meetings on track, reach out to newly identified stakeholders, inform participants about the process and their role in it, and to gather and organize the group's ideas and priorities.

Role of Stakeholders. Stakeholders were asked to share with the group their role or their agency's role in the watershed, to become familiar with the purpose of the WPP, to contribute to the group's understanding of issues in the basin, and to provide their ideas and their vision for priorities in the WPP.

Stakeholder Inspired Plan. Stakeholders were regularly reminded by the project team that the WPP is not the project team's plan; rather, it is the stakeholders' plan. As facilitators, the project team's goal is to bring out the ideas and issues that the group believes are relevant to the WPP. Input was sought through whole group meetings and one on one meetings.

Reaching Out. the project team sought individuals from the local governments and agencies. The question was posed to our initial contacts, "who else should be part of the planning process?" Who else has a stake in the conditions of the bayou? Who else has resources to improve those conditions? Who do you believe should be aware of this planning effort? Through this incremental approach, the project team brought together over 56 individuals representing more than three dozen entities.

One-on-One Meetings. A "One-on-one meeting" is an approach taken by the project team to work with stakeholders through an in-person, one-hour meeting at their place of work. The goal was to solicit feedback that was otherwise difficult to do in a group setting and where participants were more likely to be guarded with their comments. The informal, free-form conversation gave the project team a detailed perspective about that stakeholders' role and activities. Similarly, stakeholders expressed appreciation to the project team for taking time to work with them individually. 56 individuals were contacted and 40 one-on-one meetings were held. The one-on-one meetings were held during the same phase as the whole group meetings.

Whole Group Meetings. The stakeholder advisory meetings were designed as 'whole group meetings,' a process where all stakeholders are involved in a single, large meeting. This gave stakeholders the opportunity to directly learn about others' work in the watershed. The use of subcommittees to reduce meeting size was purposely avoided, but may be useful during the implementation phase. For this initial WPP effort, it was a

priority for the project team that participants become familiar with a broad range of leaders, organizations, and issues involved in the watershed. Hearing about what others were doing would lead to conversations about how to coordinate and prioritize seemingly unrelated activities. The project team believed that from this mix of individual perspectives, a shared sense of purpose and understanding of roles would emerge. Meetings usually required 2.5 hours to conduct.

Workgroup Meetings (attendee count), Date- Primary Agenda & Guest Speaker (Affiliation)
Meeting 1 (19), December 08, 2015- WPP Kickoff
Meeting 2 (16), January 19, 2016- WPP Approach & Funding, Brian Koch (TSSWCB)
Meeting 3 (22), February 24, 2016- NPS Quadrants, Charriss York (Dickinson Bayou Coordinator, TX A&M)
Meeting 4 (15), March 10, 2016- One on One follow up & Funding Sources, no guest
Meeting 5 (21), May 18, 2016- Mapping Exercise Wastewater & Wildlife, no guest
Meeting 6 (18), June 14, 2016- Mapping Exercise Urbanization, no guest
Meeting 7 (16), June 28, 2016- Mapping Exercise Flow & Hydrology, no guest
Meeting 8 (17), July 14, 2016- Voting Exercise & BMP Prioritization, no guest
Meeting 9 (28), August 23, 2016- USACE Supported Projects & Funding, Mario Beddingfield (USACE)
Meeting 10 (14), December 14, 2015- Final WPP Project Presentation

Project Binders. All participants were given a three ring binder with tabs for organizing meeting agendas, minutes, presentations and other relevant documents, such as maps and factsheets. Participants were asked to bring the binder with them to each meeting, where the project team would then hand out documents for that meeting. Stakeholders that joined the meetings mid-calendar were given binders complete up that meeting. The binder included approximately 200 pages of material by the final meeting.

Mapping Exercises. Mapping exercises were held across three whole group meetings. Participants were asked to sort through all the stakeholder identified projects and concerns in the watershed and to place them on a map if they were specific any particular location or to place them in a separate box if the issue was watershed-wide. Participants were also asked to cull from the list project ideas that were not deemed feasible or unlikely to happen. Decisions were based on a consensus opinion of the table. The results of the mapping were used to develop the 38 Action Areas that are now a part of the WPP.

FIGURE 2: ONE OF FOUR MAPPING EXERCISES

Prioritizing BMPs (Action Areas). Once the 38 Action Areas were identified, the project team asked stakeholders to prioritize the projects through a voting exercise. Stakeholders were asked to consider both the project's likelihood of being implemented and the project's likelihood of being effective. The top ten projects became the basis for the 10 Priority Action Areas, for which detailed information was prepared for costs, timelines, milestones, and resources.

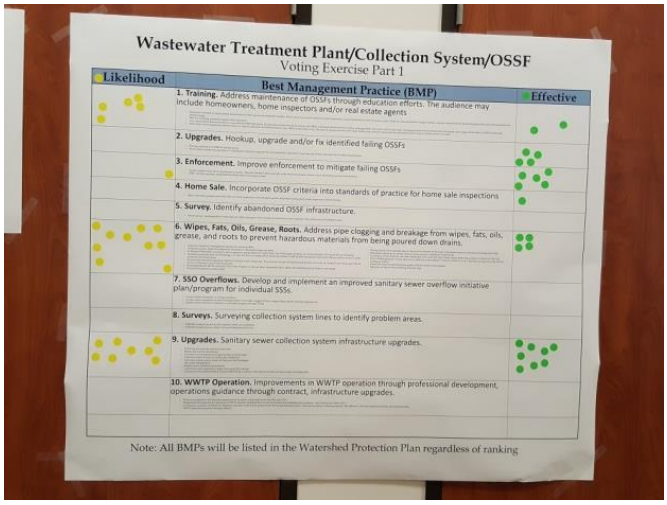


FIGURE 3: VOTING RESULTS FOR ONE NPS QUADRANT

Ongoing Engagement. The stakeholder process is currently engaged through email and the website. The website contains resources, event calendars, and an archive of meeting notes and WPP documentation. The stakeholders appear committed to taking steps to seek funding for project implementation.

NPS LOAD ESTIMATES AND LOAD REDUCTIONS

To estimate pollutant loads for selected indicators (nitrogen, phosphorus, biochemical oxygen demand, sediment, and Enterococci bacteria), the Simple Method (Schueler, 1987) was determined to be the most appropriate model for the Highland Bayou Watershed. The Simple Method is just that –a very simple model based on just a few parameters. The Simple Method model is specifically designed for use in urbanized areas. The capacity of this method to easily estimate pollutant load for multiple land uses is one of its strengths. Schueler notes that the Simple Method "is designed to provide a quick, easy, and versatile means for estimating pollutant loads. Therefore, the method sacrifices precision for the sake of simplicity and generality. Despite its limitations, the Simple Method is considered precise enough to make reasonable and reliable nonpoint pollution management decision at the site-planning level."

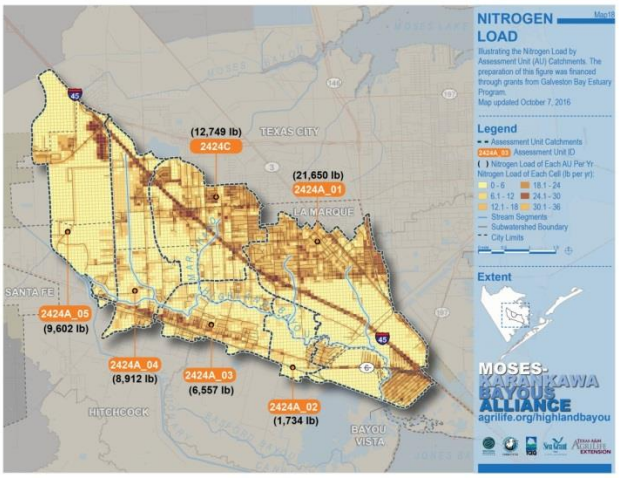
Loads were estimated in a GIS environment using the CHARM data framework, developed by TCWP in 2011. The data framework allowed the project team to develop a granular loading estimate using a 2.5-acre unit of analysis throughout the watershed. Localized land uses were synthesized using information from parcel and remotely sensed data sources. Details of the calculations, assumed values, and data framework are included in the WPP. Output values were tabulated by sub-watershed catchments (defined by assessment unit segments) and by NPS pollutant type. Assumed values, i.e., rainfall or pet ownership rates could be adjusted

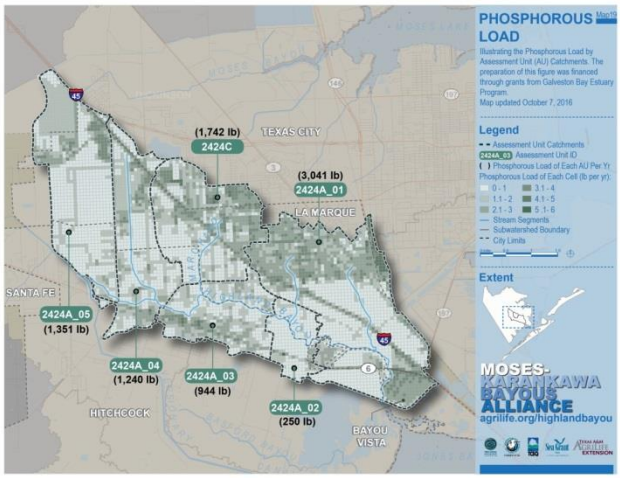
'on the fly' due to the functionality of third-party GIS software, CommunityViz. Outputs were summarized in tables and mapping products.

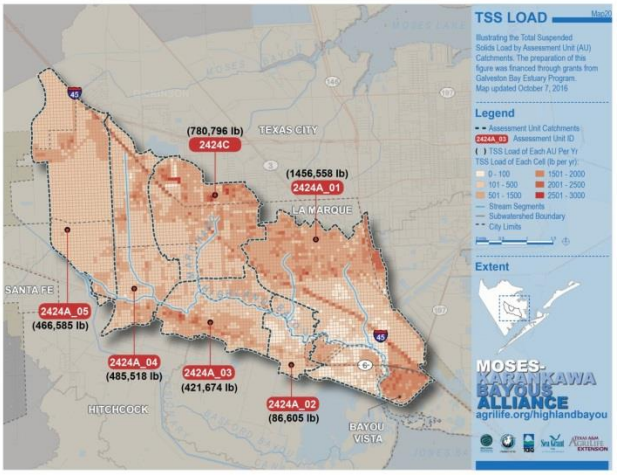
FIGURE 4: SUMMARY OF POLLUTANT LOADS BY ASSESSMENT UNIT, AS SHOWN IN TABLE A-8 OF THE HIGHLAND BAYOU WPP

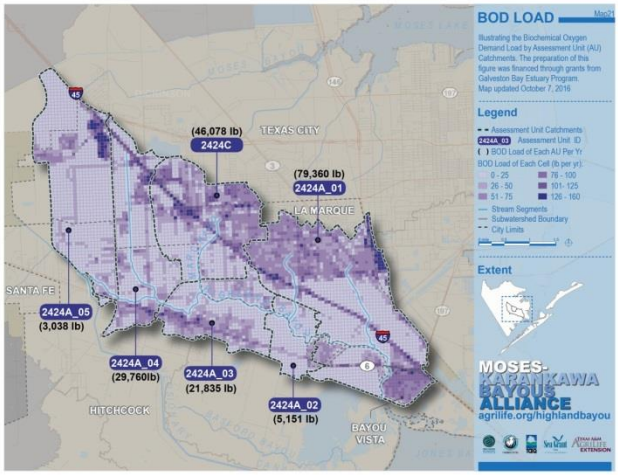
Pollutant of Concern	Total	2424A_01	2424A_02	2424A_03	2424A_04	2424A_05	2424C_01
N (lb)	**61,204**	21,650	1,734	6,557	8,912	9,602	12,749
P (lb)	**8,568**	3,041	250	944	1,240	1,351	1,742
BOD (lb)	**3,697,738**	1,456,559	86,605	421,674	485,518	466,585	780,797
TSS (lb)	**212,567**	79,361	5,152	21,835	29,760	30,381	46,078
Enterro (B. CFUs)	**422,535**	175,635	5,396	44,646	54,349	41,936	100,573

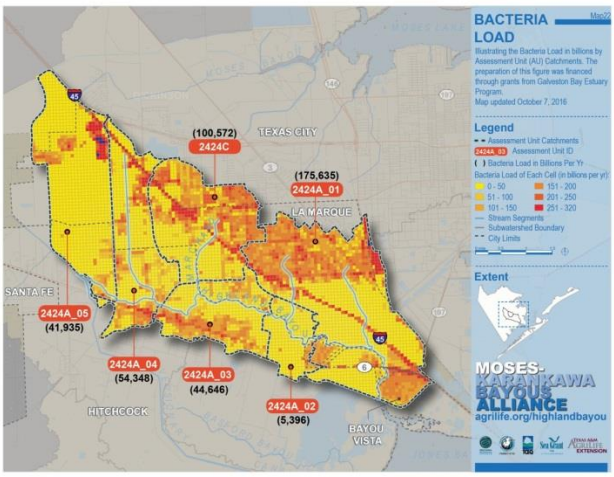
The following maps illustrate estimated loading rates by CHARM cell and Assessment Unit Catchment areas using the Simple Method. Full images are included in the WPP and in WPP Appendix 1: Maps.











Schueler, Thomas R. 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs*. Washington, D.C. Metropolitan Washington Council of Governments.