Clean Water Act 319(h) Nonpoint Source Pollution Control Program

Surface Water Quality Monitoring to Support Implementation of the San Bernard River Watershed Protection Plan

TSSWCB Project 11-10
Revision No. 0

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Prepared by:
Houston-Galveston Area Council
3555 Timmons Lane, Suite 120
Houston, TX 77027

Effective Period: Upon EPA Approval through October 2013
(With annual revisions required)

Questions concerning this quality assurance project plan should be directed to:

Aubin Phillips
P.O. Box 22777
Houston, TX 77227-2777
(832)681-2524

Aubin.Phillips@H-GAC.com

A1 APPROVAL PAGE

Quality Assurance Project Plan (QAPP) for the *Surface Water Quality Monitoring to Support Implementation of the San Bernard River Watershed Protection Plan*

United States Environmental Protection Agency (EPA), Region VI

Name: Curry Jones
Title: USEPA Chief; State/Tribal Programs Section
Signature: _____ Date: 3/5/2013

Name: Henry Brewer
Title: USEPA Texas Nonpoint Source Project Officer
Signature: _____ Date: MARCH 5, 2013

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Ashley Alexander
Title: TSSWCB Project Manager (PM)
Signature: _____ Date: 2/25/13

Name: Pamela Casebolt
Title: TSSWCB Quality Assurance Officer (QAO)
Signature: _____ Date: 2/25/13

Houston-Galveston Area Council (H-GAC)

Name: Aubin Phillips
Title: H-GAC Senior Environmental Planner/Project Lead
Signature: _____ Date: 2-21-13

Name: Jean Wright
Title: H-GAC QAO
Signature: _____ Date: 2/21/13

Environmental Institute of Houston, University of Houston Clear Lake (EIH)

Name: Dr. George Guillen
Title: EIH PM

Signature: _____ Date: 2-19-13

Name: Jenny Oakley
Title: EIH Field QAO

Signature: _____ Date: 2-19-13

Eastex Environmental Laboratory, Inc. (Eastex)

Name: Pam Hickman
Title: Eastex Lab Director
Signature: Pam R. Hickman Date: 2-19-13

Name: Daniel Bowen
Title: Eastex QAO
Signature: Daniel Bowen Date: 2/19/13

A2 TABLE OF CONTENTS

Appendices

A3 DISTRIBUTION LIST

Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

U.S. Environmental Protection Agency Region 6
1445 Ross Avenue, Suite # 1200; Dallas, TX 75202-2733

Name: Henry Brewer
Title: Texas NPS Project Officer, Water Quality Division

Texas State Soil and Water Conservation Board
P.O. Box 658; Temple, Texas 76503

Name: Ashley Alexander
Title: TSSWCB PM

Name: Pamela Casebolt
Title: TSSWCB QAO

Houston-Galveston Area Council
P.O. Box 22777; Houston, TX 77227-2777

Name: Aubin Phillips
Title: H-GAC Project Lead

Name: Jean Wright
Title: H-GAC QAO

Eastex Environmental Laboratory, Inc.
P.O. Box 1089; Coldspring, TX 77331

Name: Pam Hickman
Title: Eastex Lab Director

Environmental Institute of Houston, University of Houston Clear Lake
2700 Bay Area Blvd., MC 540, North Office Annex; Houston, Texas 77058-1098

Name: Dr. George Guillen
Title: EIH PM

List of Acronyms

ACS	American Chemical Society
AWRL	Ambient Water Reporting Limit
BMP	Best Management Practice
CAR	Corrective Action Report
CFS	Cubic Feet Per Second
COC	Chain of Custody
CRP	Clean Rivers Program
CWA	Clean Water Act
DO	Dissolved Oxygen
DOQ	Data Quality Objective
DM	Data Manager
EIH	Environmental Institute of Houston
EPA	United States Environmental Protection Agency
FS	Field Supervisor
GIS	Geographic Information System
H-GAC	Houston-Galveston Area Council
LCS	Laboratory Control Sample (formerly Laboratory Control Standard)
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantitation (formerly Reporting Limit)
NPS	Nonpoint Source
PM	Project Manager
QA	Quality Assurance
QC	Quality Control
QAM	Quality Assurance Manual
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
RPD	Relative Percent Difference
SM	Standard Methods for Examination of Water and Wastewater, 20th edition
SOP	Standard Operating Procedure
SWQMIS	Surface Water Quality Monitoring Information System
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TSSWCB	Texas State Soil and Water Conservation Board
TSWQS	Texas Surface Water Quality Standards
VOA	Volatile Organic Analyte
WPP	Watershed Protection Plan
WWTF	Wastewater Treatment Facility

A4 PROJECT/TASK ORGANIZATION

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities:

EPA

Henry Brewer, EPA Project Officer

Responsible for managing the project for EPA. Reviews project progress and reviews and approves QAPP and QAPP amendments.

TSSWCB

Ashley Alexander, TSSWCB PM

Maintains a thorough knowledge of work activities, commitments, deliverables, and time frames associated with the project. Develops lines of communication and working relationships between H-GAC and TSSWCB. Tracks deliverables to ensure that tasks are completed as specified in the contract. Responsible for ensuring that project deliverables are submitted on time and are of acceptable quality and quantity to achieve project objectives. Responsible for verifying that the QAPP is followed by H-GAC, EIH, and Eastex. Notifies the TSSWCB QAO of particular circumstances that may adversely affect the quality of data derived from the collection and analysis of samples as documented in quarterly progress reports from the H-GAC Project Lead. Enforces corrective action.

Pamela Casebolt, TSSWCB QAO

Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants. Responsible for verifying that the QAPP is followed by project participants. Assists the TSSWCB PM on QA-related issues. Determines that the project meets the requirements for planning, QA/QC, and reporting under the CWA Section 319 program. Coordinates reviews and approvals of QAPPs and amendments or revisions. Monitors implementation of corrective actions. Coordinates and conducts audits of field and laboratory systems and procedures.

H-GAC

Aubin Phillips, H-GAC Project Lead

Responsible for ensuring tasks and other requirements in the contract are executed on time and are of acceptable quality. Monitors and assesses the quality of work. Coordinates attendance at conference calls, training, meetings, and related project activities with the TSSWCB. Responsible for verifying the QAPP is followed and the project is producing data of known and acceptable quality. Ensures adequate training of data collection personnel and supervision of all monitoring and data collection activities. Complies with corrective action requirements.

Jean Wright, H-GAC QAO, Field Supervisor (FS)

Responsible for coordinating development and implementation of the QA program. Responsible for writing and maintaining the QAPP. Responsible for maintaining records of QAPP distribution, including appendices and amendments. Responsible for maintaining written records of sub-tier commitment to requirements specified in this QAPP. Responsible for identifying, receiving, and maintaining project quality assurance records. Responsible for coordinating with the TSSWCB QAO to resolve QA-related issues. Notifies EIH PM and TSSWCB PM of particular circumstances which may adversely affect the quality of data. Responsible for validation and verification of all data collected according with procedures listed in this document and acquired data procedures after each task is performed. Coordinates the development and review of technical QA material as well as data related to water quality monitoring system design and analytical techniques. Conducts laboratory inspections; develops, facilitates, and conducts monitoring systems audits. Responsible for supervision of all aspects of the sampling and measurement of surface waters and other parameters in the field. Responsible for the acquisition of water samples and field data measurements in a timely manner that meet the quality objectives specified in Section A7 (Table A7.1) as well as the requirements of Sections B1 through B8. Responsible for field scheduling, staffing, and ensuring that staff are appropriately trained as specified in Sections A6 through A8.

William Hoffman, H-GAC Data Manager

Responsible for acquisition, verification, and transfer of data to the TSSWCB. Oversees data management for the study. Performs data quality assurances prior to transfer of data to TSSWCB. Responsible for transferring data to the TSSWCB in the acceptable format. Ensures data are submitted according to workplan specifications. Provides the point of contact for the TSSWCB PM to resolve issues related to the data.

EIH

Dr. George Guillen, EIH PM, FS and QAO

Responsible for meeting the requirements of the contract between H-GAC and EIH by implementing project requirements, the QAPP, and QAPP amendments and appendices. Ensures project oversight is consistent with QAPP requirements and communicates project status to H-GAC Project Lead. Notifies H-GAC Project Lead and/or the H-GAC QAO of circumstances that may adversely affect quality of data derived from collection and analysis of samples. Helps coordinates basin planning activities and works with basin partners. Responsible for ensuring that proper methods and protocols are followed during sample collection and that field data are properly reviewed, verified and submitted to H-GAC in a timely manner.

Jenny Oakley, EIH Data Manager & Field QAO

Responsible for entering data in spreadsheets, reviewing and verifying data with field operations and with contract laboratory personnel. Performs required QA/QC checks on data and ensures results are acceptable for submission to H-GAC. Trains all field monitoring personnel and is responsible for ensuring that proper methods and protocols are followed during sample collection.

EASTEX

Pam Hickman, Eastex Laboratory Director

Responsible for producing quality analytical data for all samples. Maintains verification of procedures establishing the level of quality. Responsible for sending data and COC forms to EIH for delivery to H-GAC.

Daniel Bowen, Eastex Laboratory QAO

Checks training, competency, and re-training of technicians. Performs verification and validation procedures to confirm quality data is issued to clients. Performs other QA/QC duties and checks associated with lab activities. Resolves out-of-control issues. Conducts internal lab audits.

Figure A4.1a-Organization Chart

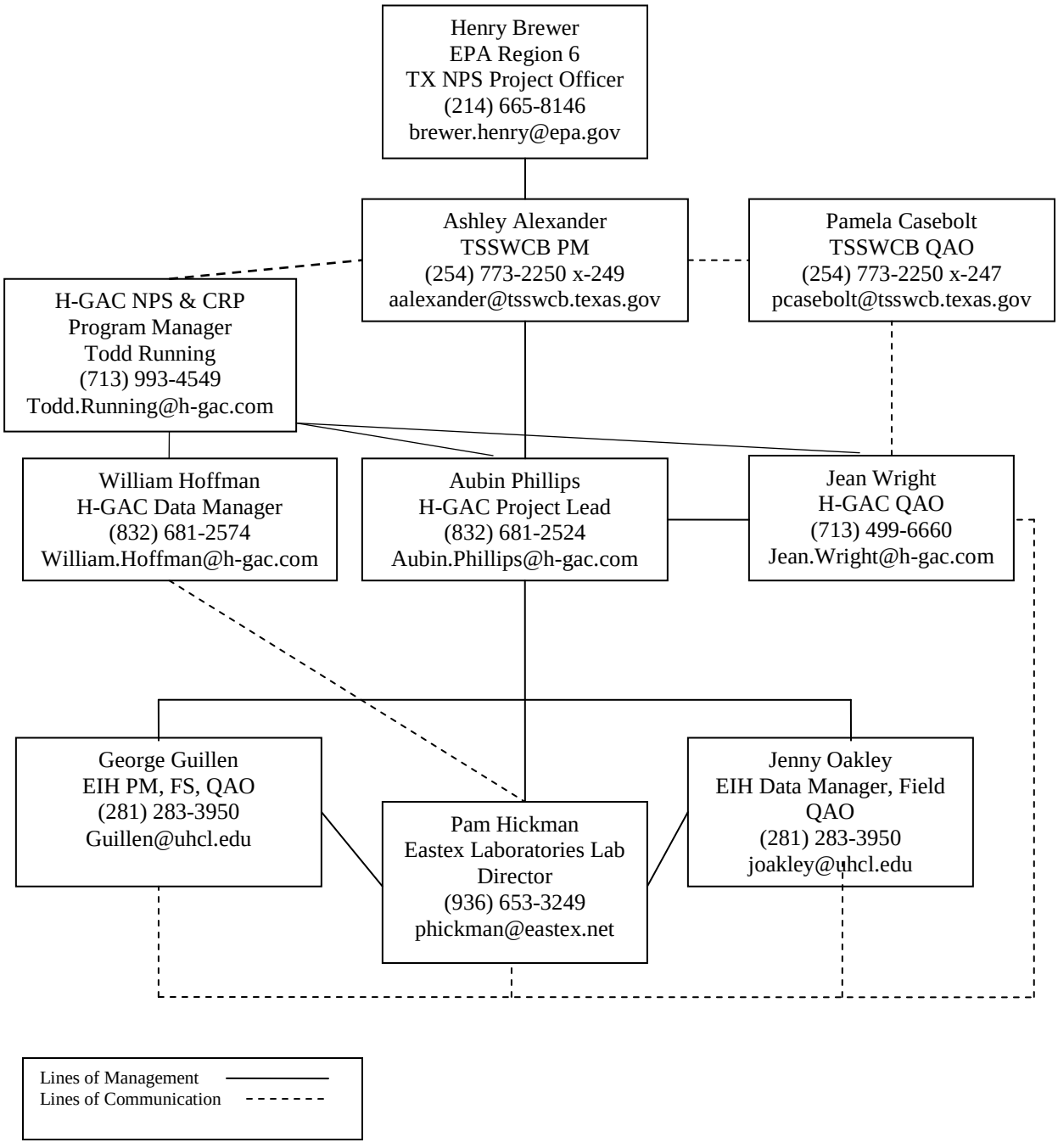
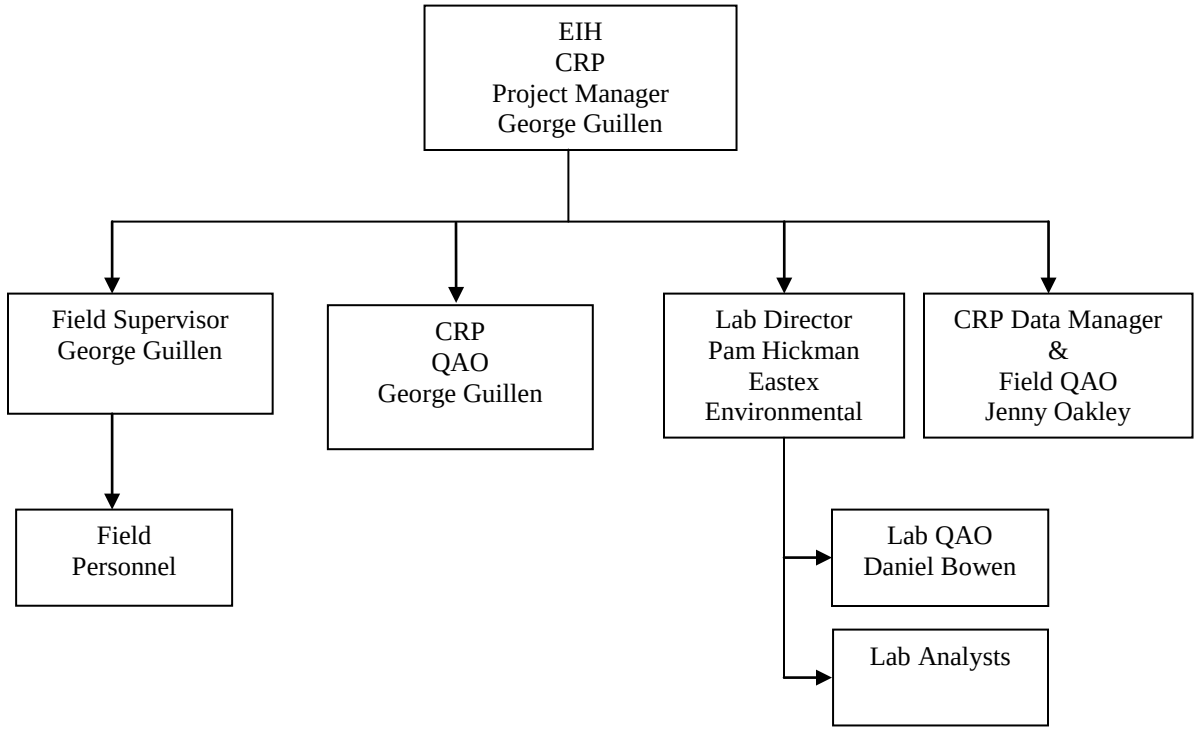


Figure A4.1ab. EIH Organizational Chart.



A5 PROBLEM DEFINITION/BACKGROUND

The purpose of this monitoring project is to establish baseline data for specific implementation sites representing key strategies for three different land use types. This is in coordination with the development of a Watershed Protection Plan for the San Bernard River Watershed which will satisfy the EPA's nine element guide. The monitoring results will not be included in the Watershed Protection Plan (WPP), but will verify the modeling results used to estimate load reductions in the WPP.

The San Bernard River watershed drains approximately 900 square miles. The river flows southeast to form the boundary between Austin and Colorado counties, then flows between Wharton and Fort Bend Counties and through Brazoria County before flowing into the Gulf of Mexico. The San Bernard River comprises two stream segments as defined by TCEQ. Stream segment 1302 is the San Bernard River Above Tidal which flows from the city of New Ulm in Austin County to a point 2.0 mi upstream of State Highway 35 in Brazoria County. Stream segment 1301 is San Bernard River Tidal which flows from 2.0 mi upstream of State Highway 35 in Brazoria County to the confluence with the Intracoastal Waterway in Brazoria County. Portions of the river are listed as impaired for bacteria on the 2010 Texas 303(d) List and there are concerns about dissolved oxygen levels and nutrients.

In the upper portions of the watershed, the river has had minimal flow for most of the year. Over the past 20 years, however there has been a more significant flow. A number of factors have contributed to the lack of flow, including recent drought, creation of retention ponds, more groundwater pumpage, and increased vegetation and tree cover along and within the river banks.

Currently, the H-GAC has monitoring data from five stations in the watershed. Two of the monitoring stations have data from as early as 1969, two have data starting in 2007 and one has data since 2001. The two newest monitoring stations are being monitored by the H-GAC Clean Rivers Program and the older monitoring stations are monitored by TCEQ.

The purpose of this QAPP is to clearly delineate H-GAC's QA policy, management structure, and procedures which will be used to implement the QA requirements necessary to verify and validate the monitoring effort through this project. The QAPP is reviewed by the TSSWCB and EPA to help ensure that data generated for the purposes described above are scientifically valid and legally defensible. This process will ensure that data developed under this QAPP and submitted to TSSWCB and EPA have been collected and managed in a way that guarantees its reliability and therefore can be used as deemed appropriate by the TSSWCB and EPA.

A6 PROJECT/TASK DESCRIPTION

This project will gather further monitoring data for the San Bernard River. This will help stakeholders determine the improvements of water quality as a benefit of implementing BMPs laid out in the WPP.

There are currently 8 monitoring stations in the San Bernard Watershed. Five are located along the main stem of the San Bernard River and 3 are located on tributaries. Three of the stations are monitored by TCEQ and the other five are monitored by the H-GAC Clean Rivers Program. All eight sites are currently monitored only once per quarter year.

Through this project, H-GAC, in conjunction with EIH, will conduct routine ambient monitoring at the 8 current monitoring stations twice per quarter and an additional 4 sites once per month over 21 months, collecting field, conventional, flow, and bacteria parameter groups. This will result in routine monitoring being conducted monthly at 12 sites.

H-GAC, in conjunction with EIH, will conduct routine ambient monitoring at 15 sites quarterly through 7 seasons, collecting field, conventional, flow, and bacteria parameter groups. Spatial and seasonal variation will be captured in these snapshots of watershed water quality.

H-GAC, in conjunction with EIH, will conduct biased flow monitoring at 15 sites once per season under wet weather conditions over 7 seasons, collecting field, conventional, flow, and bacteria parameter groups. Spatial, seasonal and meteorological variation will be captured in these snapshots of watershed water quality.

H-GAC, in conjunction with EIH, will conduct quarterly effluent monitoring at 3 WWTFs collecting field, conventional, flow, bacteria, and effluent parameter groups.

Collected data will be assessed for trends and variability, effectiveness of implementing BMPs, and interim short-term progress in achieving water quality goals in the WPP.

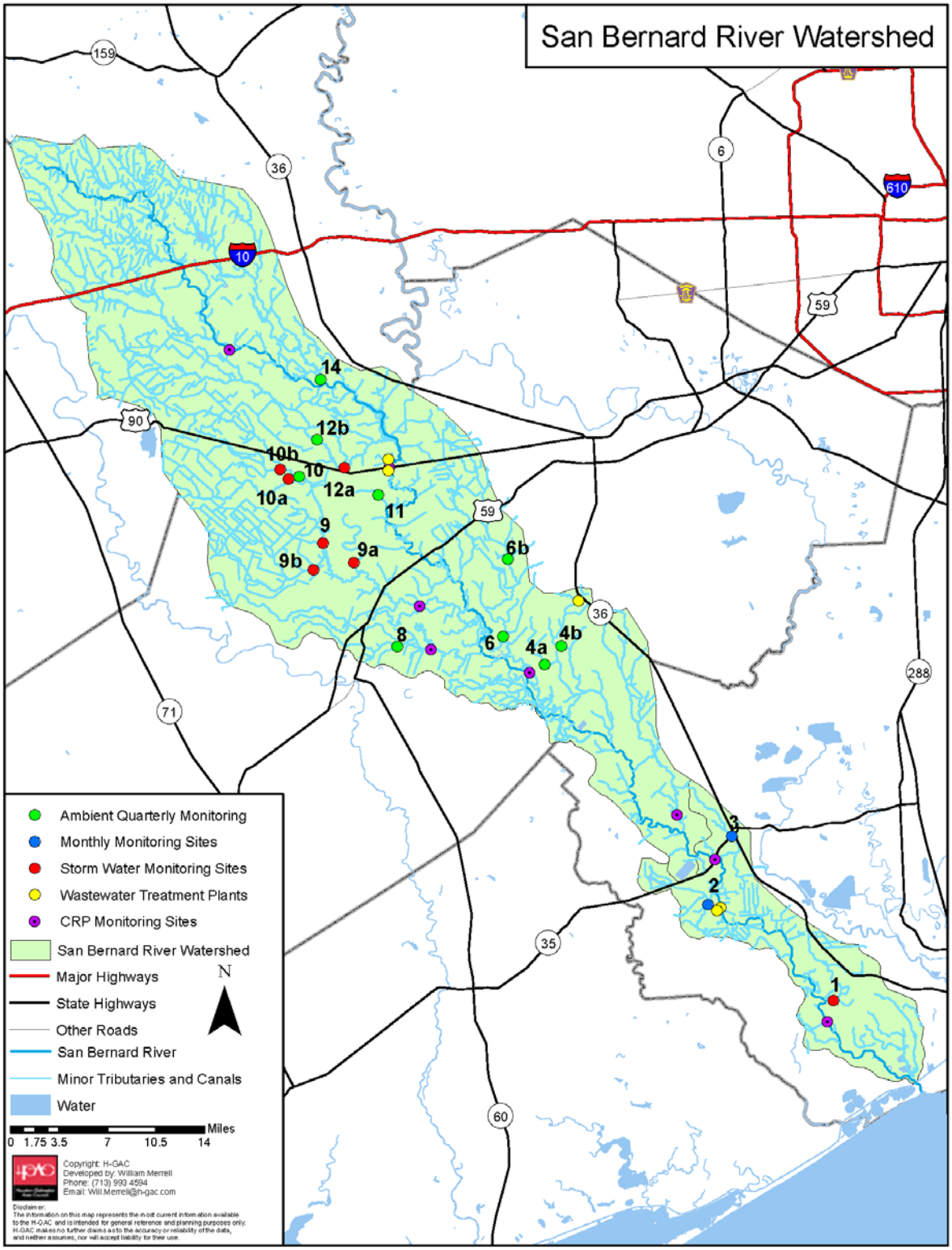


Figure A6.1 Location of Monitoring Sites.

Routine Ambient Monitoring
H-GAC, in conjunction with EIH, will conduct routine ambient monitoring at 4 sites once per month and at 8 sites twice per quarter year, collecting field, conventional, flow, and bacteria parameters groups.

Currently, routine ambient monitoring is conducted quarterly at 5 stations by H-GAC (16370, 20721, 20722, 20723, and 20460) and at 3 stations by TCEQ (12146, 16373, and 12147) through the Clean Rivers Program; H-GAC will work with TCEQ to avoid duplicative routing ambient monitoring at these stations. Sampling through this subtask will complement existing routine ambient monitoring regimes such that routine water quality monitoring is conducted monthly at 12 sites (adding two additional sampling events on top of the current quarterly sampling event under the Clean Rivers Program) in the San Bernard River watershed. H-GAC, in conjunction with EIH, will conduct routine ambient monitoring at 15 additional sites quarterly, collecting field, conventional, flow and bacteria parameter groups. Sampling period extends over 21 months. H-GAC will contract with Eastex Laboratory who will conduct sample analysis.

Field parameters to be collected are pH, temperature, conductivity, and dissolved oxygen. Conventional parameters to be sampled are total suspended solids, turbidity, sulfate, chloride, nitrate+nitrite nitrogen, ammonia nitrogen, total kjeldahl nitrogen, chlorophyll-a, total hardness, orthophosphorus and total phosphorus. Flow parameters are flow collected by Doppler, including severity. Bacteria parameters are *E. coli* enumerated using Standard Methods (21st Edition) 9223 B, “Enzyme Substrate Test” and Enterococcus (both for tidal and above tidal sites).

Stormflow Monitoring
H-GAC, in conjunction with EIH, will conduct biased-flow monitoring at 15 sites once per season under wet weather conditions, collecting field, conventional, flow, and bacteria parameter groups. These sites shall be the same as the sites for routine ambient monitoring described in Subtask 3.2 in addition to several sites from Subtask 3.3. If a storm event was captured under routine monitoring in subtasks 3.2, a separate biased flow sample will not be collected under this subtask. Field, conventional, flow, and bacteria parameters to be collected are described in the preceding paragraph. The sampling period extends through 7 seasons. The number of samples planned for collection through this subtask is 189. Spatial, seasonal and meteorological variation will be captured in these snapshots of watershed water quality.

Effluent Data Review and Monitoring
H-GAC compiled the last 5 years of self-reported effluent discharge data from TPDES permittees in the watershed. H-GAC assessed the value of this data with respect to the pollutants of interest in this project. The self-reported data from TPDES permittees were not sufficient to characterize the point source contribution to pollutant loading to the waterbody, so H-GAC has engaged EIH, to conduct effluent monitoring at three selected WWTFs once per month collecting field, flow, bacteria, and effluent parameter groups (same as subtask 3.1). Effluent parameters are BOD, CBOD and COD. The sampling period extends over 12 months. The number of samples planned for collection through this subtask is 36.

Coordination between TPDES permittees and the TCEQ Regional Office will be done as necessary. Neither H-GAC nor TSSWCB shall submit WWTF data to TCEQ for use in permit compliance and enforcement; rather, WWTF data will only be used to estimate pollutant loadings from wastewater discharges and to assist TPDES permittees in improving management and operations.

Table A6.1. Schedule of Milestones

Task #	Description	Start Date	End Date
2	**Quality Assurance**		
2.1	Develop monitoring and modeling QAPPs	November 1 2011	January 31, 2013
2.2	Implement QAPPs	February 1, 2013	October 31, 2013
3	**Surface Water Quality Monitoring**		
3.1	Conduct monthly routine ambient monitoring	February 1, 2013	October 31, 2013
3.2	Conduct quarterly routine ambient monitoring	February 1, 2013	October 31, 2013
3.3	Stormflow monitoring	February 1, 2013	October 31, 2013
3.4	Compile and evaluate effluent data	February 1, 2013	October 31, 2013
3.5	Transfer data to TSSWCB for SWQMIS	March 1, 2013	October 31, 2013

A7 QUALITY OBJECTIVES AND CRITERIA

The goal of this project is to generate data of known and acceptable quality for surface water quality monitoring (routine ambient and biased flow) of mainstem, tributary, and WWTF stations for field, conventional, flow, bacteria and effluent parameters. The purpose of evaluating effluent is to characterize the point source contribution of WWTFs in the watershed. This project is being done to support the implementation of the San Bernard River WPP by collecting water quality data for use in evaluating the overall effectiveness of BMP implementation, and to assessing water quality improvement and progress in achieving water quality restoration. This project will also be used to communicate water quality conditions to the public in order to support adaptive management of the San Bernard River WPP and to expand public knowledge on San Bernard River water quality

As part of coordination between TSSWCB and H-GAC, H-GAC will provide routine ambient water quality data to TSSWCB on a quarterly basis for inclusion in TCEQ's SWQMIS. Routine water quality monitoring is needed for conducting water quality assessments in accordance with TCEQ's *Guidance for Assessing and Reporting Surface Water Quality in Texas*.

The measurement performance specifications to support the project objectives are specified in Table A7.1b. The representative data collected during this project will be submitted to SWQMIS via the TSSWCB.

Quantitative and qualitative information regarding measurement of direct data are provided below in Tables A7.1a-A7.1e

Table A7.1a – Routine Ambient Monitoring Measurement Performance Specifications

PARAMETER	UNITS	MATRIX	METHOD	PARAMETER CODE	AWRL	Limit of Quantitation (LOQ)	LOQ CHECK STANDARD %Rec	PRECISION (RPD of LCS/LCSD)	BIAS %Rec. of LCS	LAB
Field Parameters										
pH	pH/ units	water	EPA 150.1 and TCEQ SOP, V1	00400	NA*	NA	NA	NA	NA	Field
DO	mg/L	water	SM 4500-O G and TCEQ SOP, V1	00300	NA*	NA	NA	NA	NA	Field
Specific Conductance	µS/cm	water	EPA 120.1 and TCEQ SOP, V1	00094	NA*	NA	NA	NA	NA	Field
Salinity	ppt, marine only	water	SM 2520 and TCEQ SOP, V1	00480	NA*	NA	NA	NA	NA	Field
Temperature	°C	water	SM 2550 B and TCEQ SOP V1	00010	NA*	NA	NA	NA	NA	Field
Total water depth	meters	water	TCEQ SOP V2	82903	NA*	NA	NA	NA	NA	Field
Secchi Depth	meters	water	TCEQ SOP V1	00078	NA*	NA	NA	NA	NA	Field
Turbidity, Observed (if no secchi)	1-low 2-medium 3-high	water	TCEQ	88842	NA*	NA	NA	NA	NA	Field
Water Clarity (if no secchi)	1-excellent 2-good 3-fair 4-poor	water	TCEQ	20424	NA*	NA	NA	NA	NA	Field
Days since last significant rainfall	days	NA	TCEQ SOP V1	72053	NA*	NA	NA	NA	NA	Field
Present Weather	1-clear 2-partly cloudy 3-cloudy 4-rain 5-other	NA	NA	89966	NA*	NA	NA	NA	NA	Field
Flow, Instantaneous**	cfs	water	TCEQ SOP V1	00061	NA*	NA	NA	NA	NA	Field
Flow measurement method**	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	water	TCEQ SOP V1	89835	NA*	NA	NA	NA	NA	Field
Flow severity	1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry	water	TCEQ SOP V1	01351	NA*	NA	NA	NA	NA	Field
Water Color	1-brownish 2-reddish 3-greenish 4-blackish 5-clear 6-other	water	TCEQ	89969	NA*	NA	NA	NA	NA	Field
Water Odor	1-sewage 2-chemical 3-rotten egg 4-musky 5-fishy 6-none 7-other	water	TCEQ	89971	NA*	NA	NA	NA	NA	Field
Wind Intensity	1-calm 2-slight 3-moderate 4-strong	NA	NA	89965	NA*	NA	NA	NA	NA	Field

Water Surface	1-calm 2-ripples 3-waves 4-whitecap	water	TCEQ	89968	NA*	NA	NA	NA	NA	Field

PARAMETER	UNITS	MATRIX	METHOD	PARAMETER CODE	AWRL	Limit of Quantitation (LOQ)	LOQ CHECK STANDARD %Rec	PRECISION (RPD of LCS/LCSD)	BIAS %Rec. of LCS	LAB
Conventional and Bacteriological Parameters										
TSS	mg/L	water	SM 2540 D	00530	4	1	NA	NA	NA	Eastex
Sulfate	mg/L	water	ASTM D516	00945	5	5	70-130	20	80-120	Eastex
Chloride	mg/L	water	SM 4500 Cl^- C	00940	5	5	70-130	20	80-120	Eastex
Chlorophyll-a, spectrophotometric method	µg/L	water	EPA 446.0	32211	3	3	NA	20	80-120	Eastex
E. coli, IDEXX Colilert	MPN/ 100 mL	water	Colilert-18****	31699	1	1	NA	0.5***	NA	Eastex
enterococcus, IDEXX Enterolert	MPN/ 100 mL	water	Enterolert	31701	1	1	NA	0.5***	NA	Eastex
Ammonia-N, total	mg/L	water	SM 4500 NH3-D or G	00610	0.1	0.1	70-130	20	80-120	Eastex
Nitrate/nitrite-N, total	mg/L	water	SM 4500-NO_3 F	00630	.05	.02	70-130	20	80-120	Eastex
Total Kjeldahl Nitrogen	mg/L	water	SM 4500-Norg C and SM 4500-NH3 C	00625	0.2	0.2	70-130	20	80-120	Eastex
O-phosphate-P, field filter <15 min.	mg/L	water	SM 4500-P E or F	00671	.04	.04	70-130	20	80-120	Eastex
Total phosphorus-P	mg/L	water	SM 4500-P E	00665	.06	.06	70-130	20	80-120	Eastex
Hardness, total	mg/L	water	SM 2340C	00900	5	5	NA	20	80-120	Eastex
Turbidity, Lab Nephelometric	NTU	water	SM2130B	82079	0.5	0.5	NA	NA	NA	Eastex

*Reporting to be consistent with SWQM guidance and based on measurement capability.

**This information will be acquired from USGS gage stations where located at or in close proximity to sampling sites or through direct measurement by EIH staff.

*** Based on a range statistic as described in Standard Methods, 20th Edition, Section 9020-B, "Quality Assurance/Quality Control - Intralaboratory Quality Control Guidelines." This criterion applies to bacteriological duplicates with concentrations >10 MPN/100mL or >10 organisms/100mL.

**** *E.coli* samples should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 24 hours.

References for Table A7.1a:

United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition, 1998.

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data, 2007 (RG-416)

American Society for Testing and Materials (ASTM) Annual Book of Standards, Vol. 11.02: Method ASTM D516 – 90 (Reapproved in 1995); Method ASTM D 6503 – 99 (Reapproved in 2005)

Table A7.1b – Stormflow Monitoring Measurement Performance Specifications

PARAMETER	UNITS	MATRIX	METHOD	PARAMETER CODE	AWRL	Limit of Quantitation (LOQ)	LOQ CHECK STANDARD %Rec	PRECISION (RPD of LCS/LCSD)	BIAS %Rec. of LCS	LAB
Field Parameters										
pH	pH/ units	water	EPA 150.1 and TCEQ SOP, V1	00400	NA*	NA	NA	NA	NA	Field
DO	mg/L	water	SM 4500-O G and TCEQ SOP, V1	00300	NA*	NA	NA	NA	NA	Field
Specific Conductance	µS/cm	water	EPA 120.1 and TCEQ SOP, V1	00094	NA*	NA	NA	NA	NA	Field
Salinity	ppt, marine only	water	SM 2520 and TCEQ SOP, V1	00480	NA*	NA	NA	NA	NA	Field
Temperature	°C	water	SM 2550 B and TCEQ SOP V1	00010	NA*	NA	NA	NA	NA	Field
Total water depth	meters	water	TCEQ SOP V2	82903	NA*	NA	NA	NA	NA	Field
Secchi Depth	meters	water	TCEQ SOP V1	00078	NA*	NA	NA	NA	NA	Field
Turbidity, Observed (if no secchi)	1-low 2-medium 3-high	water	TCEQ	88842	NA*	NA	NA	NA	NA	Field
Water Clarity (if no secchi)	1-excellent 2-good 3-fair 4-poor	water	TCEQ	20424	NA*	NA	NA	NA	NA	Field
Days since last significant rainfall	days	NA	TCEQ SOP V1	72053	NA*	NA	NA	NA	NA	Field
Present Weather	1-clear 2-partly cloudy 3-cloudy 4-rain 5-other	NA	NA	89966	NA*	NA	NA	NA	NA	Field
Flow, Instantaneous**	cfs	water	TCEQ SOP V1	00061	NA*	NA	NA	NA	NA	Field
Flow measurement method**	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	water	TCEQ SOP V1	89835	NA*	NA	NA	NA	NA	Field
Flow severity	1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry	water	TCEQ SOP V1	01351	NA*	NA	NA	NA	NA	Field
Water Color	1-brownish 2-reddish 3-greenish 4-blackish 5-clear 6-other	water	TCEQ	89969	NA*	NA	NA	NA	NA	Field
Water Odor	1-sewage 2-chemical 3-rotten egg 4-musky 5-fishy 6-none 7-other	water	TCEQ	89971	NA*	NA	NA	NA	NA	Field

Wind Intensity	1-calm 2-slight 3-moderate 4-strong	NA	NA	89965	NA*	NA	NA	NA	NA	Field
Water Surface	1-calm 2-ripples 3-waves 4-whitecap	water	TCEQ	89968	NA*	NA	NA	NA	NA	Field

PARAMETER	UNITS	MATRIX	METHOD	PARAMETER CODE	AWRL	Limit of Quantitation (LOQ)	LOQ CHECK STANDARD %Rec	PRECISION (RPD of LCS/LCSD)	BIAS %Rec. of LCS	LAB
Conventional and Bacteriological Parameters										
TSS	mg/L	water	SM 2540 D	00530	4	1	NA	NA	NA	Eastex
Sulfate	mg/L	water	ASTM D516	00945	5	5	70-130	20	80-120	Eastex
Chloride	mg/L	water	SM 4500 Cl^- C	00940	5	5	70-130	20	80-120	Eastex
Chlorophyll-a, spectrophotometric method	µg/L	water	EPA 446.0	32211	3	3	NA	20	80-120	Eastex
E. coli, IDEXX Colilert	MPN/ 100 mL	water	Colilert-18****	31699	1	1	NA	0.5***	NA	Eastex
Enterococcus, IDEXX Enterolert	MPN/ 100 mL	water	Enterolert	31701	1	1	NA	0.5***	NA	Eastex
Ammonia-N, total	mg/L	water	SM 4500 NH3-D or G	00610	0.1	0.1	70-130	20	80-120	Eastex
Nitrate/nitrite-N, total	mg/L	water	SM 4500-NO_3 F	00630	.05	.02	70-130	20	80-120	Eastex
Total Kjeldahl Nitrogen	mg/L	water	SM 4500-Norg C and SM 4500-NH3 C	00625	0.2	0.2	70-130	20	80-120	Eastex
O-phosphate-P, field filter <15 min.	mg/L	water	SM 4500-P E or F	00671	.04	.04	70-130	20	80-120	Eastex
Total phosphorus-P	mg/L	water	SM 4500-P E	00665	.06	.06	70-130	20	80-120	Eastex
Hardness, total	mg/L	water	SM 2340C	00900	5	5	NA	20	80-120	Eastex
Turbidity, Lab Nephelometric	NTU	water	SM2130B	82079	0.5	0.5	NA	NA	NA	Eastex

*Reporting to be consistent with SWQM guidance and based on measurement capability.

**This information will be acquired from USGS gage stations where located at or in close proximity to sampling sites or through direct measurement by EIH staff.

*** Based on a range statistic as described in Standard Methods, 20th Edition, Section 9020-B, "Quality Assurance/Quality Control - Intralaboratory Quality Control Guidelines." This criterion applies to bacteriological duplicates with concentrations >10 MPN/100mL or >10 organisms/100mL.

**** *E.coli* samples should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 24 hours.

References for Table A7.1b:

United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition, 1998.

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data, 2007 (RG-416)

American Society for Testing and Materials (ASTM) Annual Book of Standards, Vol. 11.02: Method ASTM D516 – 90 (Reapproved in 1995); Method ASTM D 6503 – 99 (Reapproved in 2005)

Table A7.1c – WWTF Effluent Monitoring Measurement Performance Specifications

PARAMETER	UNITS	MATRIX	METHOD	PARAMETER CODE	AWRL	Limit of Quantitation (LOQ)	LOQ CHECK STANDARD %Rec	PRECISION (RPD of LCS/LCSD)	BIAS %Rec. of LCS	LAB
Field Parameters										
pH	pH/ units	water	EPA 150.1 and TCEQ SOP, V1	00400	NA*	NA	NA	NA	NA	Field
DO	mg/L	water	SM 4500-O G and TCEQ SOP, V1	00300	NA*	NA	NA	NA	NA	Field
Specific Conductance	µS/cm	water	EPA 120.1 and TCEQ SOP, V1	00094	NA*	NA	NA	NA	NA	Field
Salinity	ppt, marine only	water	SM 2520 and TCEQ SOP, V1	00480	NA*	NA	NA	NA	NA	Field
Temperature	°C	water	SM 2550 B and TCEQ SOP V1	00010	NA*	NA	NA	NA	NA	Field
Total water depth	meters	water	TCEQ SOP V2	82903	NA*	NA	NA	NA	NA	Field
Secchi Depth	meters	water	TCEQ SOP V1	00078	NA*	NA	NA	NA	NA	Field
Turbidity, Observed (if no secchi)	1-low 2-medium 3-high	water	TCEQ	88842	NA*	NA	NA	NA	NA	Field
Water Clarity (if no secchi)	1-excellent 2-good 3-fair 4-poor	water	TCEQ	20424	NA*	NA	NA	NA	NA	Field
Days since last significant rainfall	days	NA	TCEQ SOP V1	72053	NA*	NA	NA	NA	NA	Field
Present Weather	1-clear 2-partly cloudy 3-cloudy 4-rain 5-other	NA	NA	89966	NA*	NA	NA	NA	NA	Field
Flow, Instantaneous**	cfs	water	TCEQ SOP V1	00061	NA*	NA	NA	NA	NA	Field
Flow measurement method**	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	water	TCEQ SOP V1	89835	NA*	NA	NA	NA	NA	Field
Flow severity	1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry	water	TCEQ SOP V1	01351	NA*	NA	NA	NA	NA	Field
Water Color	1-brownish 2-reddish 3-greenish 4-blackish 5-clear 6-other	water	TCEQ	89969	NA*	NA	NA	NA	NA	Field
Water Odor	1-sewage 2-chemical 3-rotten egg 4-musky 5-fishy 6-none 7-other	water	TCEQ	89971	NA*	NA	NA	NA	NA	Field

Wind Intensity	1-calm 2-slight 3-moderate 4-strong	NA	NA	89965	NA*	NA	NA	NA	NA	Field
Water Surface	1-calm 2-ripples 3-waves 4-whitecap	water	TCEQ	89968	NA*	NA	NA	NA	NA	Field

PARAMETER	UNITS	MATRIX	METHOD	PARAMETER CODE	AWRL	Limit of Quantitation (LOQ)	LOQ CHECK STANDARD %Rec	PRECISION (RPD of LCS/LCSD)	BIAS %Rec. of LCS	LAB
Conventional and Bacteriological Parameters										
TSS	mg/L	water	SM 2540 D	00530	4	1	NA	NA	NA	Eastex
Sulfate	mg/L	water	ASTM D516	00945	5	5	70-130	20	80-120	Eastex
Chloride	mg/L	water	SM 4500 Cl^- C	00940	5	5	70-130	20	80-120	Eastex
BOD_5	mg/L	water	SM5210B	00310	2	2	70-130	20	80-120	Eastex
$CBOD_5$	mg/L	water	SM 5210B	00314	2	2	70-130	20	80-120	Eastex
COD	mg/L	water	EPA 410.4	00335	10	10	70-130	20	80-120	Eastex
E. coli, IDEXX Colilert	MPN/ 100 mL	water	Colilert-18****	31699	1	1	NA	0.5***	NA	Eastex
Enterococcus, IDEXX Enterolert	MPN/ 100 mL	water	Enterolert	31701	1	1	NA	0.5***	NA	Eastex
Ammonia-N, total	mg/L	water	SM 4500 NH3-D or G	00610	0.1	0.1	70-130	20	80-120	Eastex
Nitrate/nitrite-N, total	mg/L	water	SM 4500-NO_3 F	00630	.05	.02	70-130	20	80-120	Eastex
Total Kjeldahl Nitrogen	mg/L	water	SM 4500-Norg C and SM 4500-NH3 C	006275	0.2	0.2	70-130	20	80-120	Eastex
O-phosphate-P, field filter <15 min.	mg/L	water	SM 4500-P E	00671	.04	.04	70-130	20	80-120	Eastex
Total phosphorus-P	mg/L	water	SM 4500-P E	00665	.06	.06	70-130	20	80-120	Eastex
Hardness, total	mg/L	water	SM 2340C	00900	5	5	NA	20	80-120	Eastex
Turbidity, Lab Nephelometric	NTU	water	SM2130B	82079	0.5	0.5	NA	NA	NA	Eastex

*Reporting to be consistent with SWQM guidance and based on measurement capability.

**This information will be acquired from USGS gage stations where located at or in close proximity to sampling sites or through direct measurement by EIH staff.

*** Based on a range statistic as described in Standard Methods, 20th Edition, Section 9020-B, "Quality Assurance/Quality Control - Intralaboratory Quality Control Guidelines." This criterion applies to bacteriological duplicates with concentrations >10 MPN/100mL or >10 organisms/100mL.

**** *E.coli* samples should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 24 hours.

References for Table A7.1c:

United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition, 1998.

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2008 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data, 2007 (RG-416)

American Society for Testing and Materials (ASTM) Annual Book of Standards, Vol. 11.02: Method ASTM D516 – 90 (Reapproved in 1995); Method ASTM D 6503 – 99 (Reapproved in 2005)

Precision

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar condition, conform to themselves. It is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions, and is an indication of random error. Laboratory precision is assessed by comparing replicate analyses of laboratory control standards in the sample matrix (e.g., deioinized water) or sample/duplicate pairs in the case of bacterial analysis. Precision results are plotted on quality control charts that are based on historical data and used during evaluation of analytical performance. Performance specifications for laboratory control standard/laboratory control standard duplicate pairs are defined in Table A7.1. Field splits are used to assess the variability of sample handling, preservation, and storage, as well as the analytical process, and are prepared by splitting samples in the field. Control limits for field splits are defined in Section B5.

Bias

Bias is a statistical measurement of correctness and includes multiple components of systematic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is verified through the analysis of laboratory control standards prepared with verified and known amounts of analytes and by calculating percent recovery. Results are compared against measurement performance specifications and used during evaluation of analytical performance. Project control limits for laboratory control standards are specified in Table A7.1.

Representativeness

The data collected as routine grabs and storm samples will be considered representative of the target population or phenomenon to be studied. The representativeness of the data is dependent on 1) the sampling locations, 2) the flow regime during sample collection, 3) the number of years sampling is performed, and 4) the sampling procedures. Site selection and sampling of pertinent media (i.e., water) and use of only approved analytical methods will assure that the measurement data represent the population being studied at the site. Although data may be collected during varying regimes of weather and flow, data collection will be targeted toward both ambient conditions and storm events, representing water quality at high and low flow conditions. The goal for meeting total representation of the water body will be tempered by the funding available. To assure that the measurement data represents the conditions of the San Bernard Watershed, site selection was determined by field reconnaissance and review of aerial photos and GIS maps.

According to TCEQ's *Surface Water Quality Monitoring Procedures Manual, Volume 2 (RG-416, June 2007),* biological organisms are collected and identified in a manner that, in most cases, permits an assessment of community composition and integrity. Bioassessment data should be collected during summertime critical conditions. The belief that if the criteria are met during these conditions, it would be expected that the criteria would be met during other seasons as well.

Comparability

Confidence in the comparability of data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format as specified in Section B10 on Data Management.

Completeness

The completeness of the data is basically a relationship of how much of the data is available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project that 90% data completion is achieved.

Limit of Quantitation

Uniform limits of quantitation (LOQs) are not specified for the NPS program due to the variety of types of data collected. However, because surface water data are being collected for the purpose of comparison to the Texas Surface Water Quality Standards (TSWQS), the Ambient Water Reporting Limits (AWRLs) do apply and have been added to table A7.1.

The AWRL establishes the reporting specification at or below which data for a parameter must be reported to be compared with freshwater screening criteria. The AWRLs specified in Table A7.1 are the program-defined reporting specifications for each analyte and yield data acceptable for the TCEQ's water quality assessment. A full listing of AWRLs can be found at http://www.tceq.texas.gov/compliance/monitoring/crp/qa/index.html. The limit of quantitation is the minimum level, concentration, or quantity of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The following requirements must be met in order to report results to the CRP:

- The laboratory's LOQ for each analyte must be at or below the AWRL as a matter of routine practice

- The laboratory must demonstrate its ability to quantitate at its LOQ for each analyte by running an LOQ check standard for each analytical batch of CRP Samples analyzed.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria are provided in Section B5

A8 SPECIAL TRAINING/CERTIFICATION

All field personnel receive training in proper sampling and field analysis as necessary. Before actual sampling or field analysis occurs, they will demonstrate to the QAO (or designee) their ability to properly calibrate field equipment and perform field sampling and analysis procedures. Field personnel training is documented and retained in the personnel file and will be available during a monitoring systems audit.

Global Positioning System (GPS) equipment may be used as a component of the information required by the Station Location (SLOC) request process for creating the certified positional data that will ultimately be entered into the TCEQ's SWQMIS database. Any positional data obtained by the Nonpoint Source Program grantees using a GPS system will follow the TCEQ's OPP 8.11 and 8.12 policy regarding the collection and management of positional data.

Positional data entered into SWQMIS will be collected by a GPS certified individual with an agency approved GPS device to ensure that the agency receives reliable and accurate positional data. Certification can be obtained in any of three ways: completing a TCEQ training class, completing a suitable training class offered by an outside vendor, or by providing documentation of sufficient GPS expertise and experience. Contractors must agree to adhere to relevant TCEQ policies when entering GPS-collected data.

In lieu of entering certified GPS Coordinates, positional data may be acquired with a GPS and verified with photo interpolation using a certified source, such as Google Earth or Google Map. The verified coordinates and map interface can then be used to develop a new SLOC.

Contractors and subcontractors must ensure that laboratories analyzing samples under this QAPP meet the requirements contained in section 5.4.4 of the NELAC standards (concerning Review of Requests, Tenders and Contracts).

EIH personnel also received additional training when they attended TCEQ's Biological Monitoring Training Course conducted in Austin in June 2010. EIH's field QAO (or their designee) evaluates and documented each employee's demonstration of capabilities for their personnel files. These records are shared with H-GAC and made available during the routine monitoring systems audit.

Table A8.1 Designated Trainer for each Contractor and Subcontractor

Local Partner Agency	Designated Trainer
Environmental Institute of Houston	George Guillen
Houston-Galveston Area Council	Jean Wright

A9 DOCUMENTS AND RECORDS

Hard copies of all field data sheets, general maintenance (GM) records, chain of custody forms (COCs), laboratory data entry sheets, field data entry sheets, calibration logs, and corrective action reports (CARs) will be archived by H-GAC for at least five years after the close of the contract, and for the two years of the project, for a total minimum of seven years. In addition, H-GAC will archive electronic forms of all project data for at least five years. Examples of field data sheets are presented in Appendix A, a COC form in Appendix B, a CAR form in Appendix C, and a Data Management Plan in Appendix D.

Quarterly progress reports will be produced electronically for the TSSWCB and will note activities conducted in connection with audits of the water quality monitoring program, items or areas identified as potential problems, and any variations or supplements to the QAPP. CARs will be utilized when necessary (Appendix C). CARs will be maintained in an accessible location for reference at H-GAC. CARs that result in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in an update or amendment to the QAPP when appropriate.

Individuals listed in Section A3 will be notified of approval of the most current copy of the QAPP by the H-GAC Project Lead. The H-GAC Project Lead will make the most recent version of the QAPP available to all entities listed in Section A3 of this QAPP. Current copies of the QAPP will be kept on file for all individuals on the distribution list.

The final project report will be produced electronically and as a hard copy and all files used to produce the final report will be saved electronically by H-GAC for at least five years. The TSSWCB may elect to take possession of records at the conclusion of the specified retention period.

The documents and records that describe, specify, report, or certify activities are listed in Table A9.1.

Laboratory Documentation

The laboratory will document sample results clearly and accurately. Information about each sample will include the following to aid in interpretation and validation of data:

- A clear identification of samples analyzed for the project including station information
- Date and time of sample collection
- Identification of preservation and analysis methods used
- Sample results, units of measurement, and sample matrix
- Information on QC failures or deviations from requirements that may affect the quality of results or is necessary for verification and validation of data

Table A9.1 Project Documents and Records

Document/Record	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	TCEQ / H-GAC	2 year project + 5 years after end of contract	Electronic & Paper
QAPP, distribution documentation	H-GAC	2 year project + 5 years after end of contract	Paper
Field training records	H-GAC	2 year project + 5 years after end of contract	Paper
Field notebooks or data sheets (see Appendix B for examples of field data sheets)	H-GAC	2 year project + 5 years after end of contract	Paper
Field equipment calibration/maintenance logs	H-GAC	2 year project + 5 years after end of contract	Paper
Field instrument printouts	H-GAC	2 year project + 5 years after end of contract	Paper
Field SOPs	H-GAC	2 year project + 5 years after end of contract	Electronic & Paper
Chain of custody records (see Appendix C for example)	H-GAC	2 year project + 5 years after end of contract	Paper
Laboratory Quality Manuals	Eastex Lab	2 year project + 5 years after end of contract	Current version – electronic & paper; prior versions paper only
Laboratory training records	Eastex Lab	2 year project + 5 years after end of contract	Paper
Laboratory SOPs	Eastex Lab	2 year project + 5 years after end of contract	Current version – electronic & paper; prior versions paper only
Laboratory instrument printouts	Eastex Lab	2 year project + 5 years after end of contract	Paper
Laboratory data reports/results	Eastex Lab	2 year project + 5 years after end of contract	Paper

Laboratory equipment maintenance logs	Eastex Lab	2 year project + 5 years after end of contract	Paper
Laboratory calibration records	Eastex Lab	2 year project + 5 years after end of contract	Paper
Corrective Action Documentation (see D for example)	H-GAC	2 year project + 5 years after end of contract	Electronic & Paper

Revisions to the QAPP

Until the work described is completed, this QAPP shall be revised as necessary and reissued annually on the anniversary date, or revised and reissued within 120 days of significant changes, whichever is sooner. If the entire QAPP is current and valid, the document may be reissued by certifying that the plan is current and including a new copy of the signed approval page. The approved version of the QAPP shall remain in effect until revised versions have been approved only if the revised version is submitted for approval before the approved version expires. If the entire QAPP is current, valid, and accurately reflects the project goals and the organization's policy, the annual re-issuance may be done by a certification that the plan is current. This will be accomplished by submitting a cover letter stating the status of the QAPP and a copy of new, signed approval pages for the QAPP.

QAPP Amendments

Amendments to the QAPP should be approved prior to implementation in order to reflect changes in project organization, tasks, schedules, objectives and methods, to address deficiencies and non-conformance, improve operational efficiency and to accommodate unique or unanticipated circumstances. Requests for amendments are directed from the H-GAC Project Lead to the TSSWCB PM in writing. They are effective immediately upon approval by the TSSWCB PM and QAO, or their designees, and the EPA Project Officer.

Justifications, summaries, and details of the amendment will be documented and distributed to all persons on the QAPP distribution list under the direction of the H-GAC QAO. Amendments will be reviewed, approved, and incorporated into the next revision of the QAPP.

B1 SAMPLING PROCESS DESIGN

The sample design rationale for these four sampling efforts is intended to evaluate ambient water quality throughout the watershed, stormflow conditions, and WWTF effluent character.

Monitoring sites for each of these four sampling efforts are provided in Tables B1.1a and B1.1b (routine ambient monitoring), B1.1c (stormflow monitoring), and B1.1d (WWTF effluent monitoring).

Routine Quarterly Ambient Monitoring

H-GAC, in conjunction with EIH, will conduct quarterly routine ambient monitoring at 15 sites. Each monitoring event will include field, conventional, flow and bacteria parameter groups. The sampling period extends through 7 seasons. Spatial and seasonal variation will be captured in these snapshots of watershed water quality.

Field parameters are pH, temperature, conductivity, and dissolved oxygen. Conventional parameters are total suspended solids, turbidity, sulfate, chloride, nitrate+nitrite nitrogen, ammonia nitrogen, total kjeldahl nitrogen, chlorophyll-a, total hardness, orthophosphorus and total phosphorus. Flow parameters are flow collected by Doppler, including severity. IDEXX methods will be used to enumerate *E. coli* and Enterococcus bacteria parameters.

Table B.1a indicates the routine quarterly ambient monitoring site locations and sampling frequencies.

Table B1.1a Routine Quarterly Ambient Monitoring Sites and Frequencies

Site No.	Collecting Entity	Site ID	Site Description	Start Date[1]	End Date	Sample Matrix	Sampling Frequency[2]
1	EIH	1	Unnamed Tributary at 2611	2/1/13	10/31/13	Water	7
2	EIH	1a	Unnamed Tributary at CR306	2/1/13	10/31/13	Water	7
3	EIH	4a	Buffalo Creek at FM 442	2/1/13	10/31/13	Water	7
4	EIH	4b	Cedar Creek at FM 442	2/1/13	10/31/13	Water	7
5	EIH	6	Snake Creek at Moody Rd	2/1/13	10/31/13	Water	7
6	EIH	6b	Snake Creek at Modena School Rd	2/1/13	10/31/13	Water	7
7	EIH	8	Baughman Slough at CR 129	2/1/13	10/31/13	Water	7
8	EIH	9	West Bernard Creek at CR 211	2/1/13	10/31/13	Water	7
9	EIH	9a	Sandy Branch at CR 213	2/1/13	10/31/13	Water	7
10	EIH	10	West Bernard Creek at CR 252	2/1/13	10/31/13	Water	7
11	EIH	10b	Dewberry Branch at CR 252	2/1/13	10/31/13	Water	7
12	EIH	11a	Britt Branch at FM 2919	2/1/13	10/31/13	Water	7
13	EIH	12a	Middle Bernard Creek at CR 291	2/1/13	10/31/13	Water	7
14	EIH	12b	Middle Bernard Creek at 289	2/1/13	10/31/13	Water	7
15	EIH	14	East Bernard Creek at FM 1093	2/1/13	10/31/13	Water	7

[1] These dates are delayed from the start dates as indicated in the project workplan.

Routine Monthly Ambient Monitoring

H-GAC, in conjunction with EIH, will conduct monthly ambient monitoring at 12 sites once per month and at, collecting field, conventional, flow, and bacteria parameters groups. The sampling period extends over 21 months. The number of samples planned for collection through this subtask is 196.

Currently, routine ambient monitoring is conducted quarterly at 5 stations by H-GAC (16370, 20721, 20722, 20723, and 20460) and at 3 stations by TCEQ (12146, 16373, and 12147) through the Clean Rivers Program; H-GAC will work with TCEQ to avoid duplicative routing ambient monitoring at these stations. Sampling through this subtask will complement existing routine ambient monitoring regimes such that routine water quality monitoring is conducted monthly at 12 sites in the San Bernard River watershed.

Field parameters are pH, temperature, conductivity, and dissolved oxygen. Conventional parameters are total suspended solids, turbidity, sulfate, chloride, nitrate+nitrite nitrogen, ammonia nitrogen, total kjeldahl nitrogen, chlorophyll-a, total hardness, orthophosphorus and total phosphorus. Flow parameters are flow collected by Doppler, including severity. IDEXX methods will be used to enumerate *E. coli* and Enterococcus bacteria parameters.

Table B1.1b Routine Monthly Ambient Monitoring Sites and Frequencies

Site No.	Collecting Entity	Site ID	Site Description	Start Date[1]	End Date	Sample Matrix	Sampling Frequency[2]
1	HG	16370	San Bernard River immediately downstream of FM 3013 on the Colorado-Austin County Line approximately 15 KM SW of Sealy	2/1/13	10/31/13	Water	4
1	EIH	16370	San Bernard River immediately downstream of FM 3013 on the Colorado-Austin County Line approximately 15 KM SW of Sealy	2/1/13	10/31/13	Water	8
2	HG	20721	West Bernard Creek at Wharton CR 225 east of Hungerford	2/1/13	10/31/13	Water	4
2	EIH	20721	West Bernard Creek at Wharton CR 225 east of Hungerford	2/1/13	10/31/13	Water	8

3	HG	20722	Peach Creek at Wharton CR 117/Chudalla Road/ Archer Road 89 meters south of the intersection of Wharton CR 117/ Chudalla Road/ Archer Road and Wharton CR 212/ Wharton CR 119/ Donaldson Road East of Wharton	2/1/13	10/31/13	Water	4
3	EIH	20722	Peach Creek at Wharton CR 117/Chudalla Road/ Archer Road 89 meters south of the intersection of Wharton CR 117/ Chudalla Road/ Archer Road and Wharton CR 212/ Wharton CR 119/ Donaldson Road East of Wharton	2/1/13	10/31/13	Water	8
4	HG	20723	Mound Creek at Brazoria CR 450/ Jackson Settlement Road 1.22 KM upstream of FM 1301 west of West Columbia	2/1/13	10/31/13	Water	4
4	EIH	20723	Mound Creek at Brazoria CR 450/ Jackson Settlement Road 1.22 KM upstream of FM 1301 west of West Columbia	2/1/13	10/31/13	Water	8
5	HG	20460	San Bernard River Tidal at SH 35 southwest of West Columbia	2/1/13	10/31/13	Water	4
5	EIH	20460	San Bernard River Tidal at SH 35 southwest of West Columbia	2/1/13	10/31/13	Water	8
6	FO	12146	San Bernard River Tidal east bank immediatley upstream of FM 2611	2/1/13	10/31/13	Water	4
6	EIH	12146	San Bernard River Tidal east bank immediatley upstream of FM 2612	2/1/13	10/31/13	Water	8
7	FO	16373	San Bernard River immediatley downstream of US 90A in East Bernard	2/1/13	10/31/13	Water	4

7	EIH	16373	San Bernard River immediatley downstream of US 90A in East Bernard	2/1/13	10/31/13	Water	8
8	FO	12147	San Bernard River mid channel 60 M downstream of FM 442 bridge SW of Needville	2/1/13	10/31/13	Water	4
8	EIH	12147	San Bernard River mid channel 60 M downstream of FM 442 bridge SW of Needville	2/1/13	10/31/13	Water	8
9	EIH	2	Texas Gulf Canal at FM 1459	2/1/13	10/31/13	Water	12
10	EIH	3	Bells Creek at SH 35	2/1/13	10/31/13	Water	12
11	EIH	9b	Clarks Branch at CR 211	2/1/13	10/31/13	Water	12
12	EIH	10a	Gum Tree Branch at CR 252	2/1/13	10/31/13	Water	12

[1] These dates are delayed from the start dates as indicated in the project workplan.
[2] Routine samples are scheduled for collection 8 times a year for the existing CRP sites, and 12 times per year for the remaining sites, but fewer samples may be collected if flow is not present during scheduled routine monitoring. Sampling frequencies represent sampling under this sample design, and not the CRP QAPP.

Stormflow

H-GAC, in conjunction with EIH, will conduct biased-flow monitoring at 15 sites once per season under wet weather conditions, collecting field, conventional, flow and bacteria parameter groups. These sites shall be the same as the sites for routine ambient monitoring. If a storm event was captured under routine monitoring in subtasks 3.1-3.2, a separate biased flow sample will not be collected under this subtask. The sampling period extends through 7 seasons. The number of samples planned for collection through this subtask is 189. Spatial, seasonal and meteorological variation will be captured in these snapshots of watershed water quality.

Table B1.1c indicates the monitoring site locations and sampling frequencies for stormflow monitoring.

Table B1.1c Stormflow Monitoring Sites and Frequencies

Site No.	Collecting Entity	Site ID	Site Description	Start Date[1]	End Date	Sample Matrix	Sampling Frequency[2]
1	EIH	16370	San Bernard River immediately downstream of FM 3013 on the Colorado-Austin County Line approximately 15 KM SW of Sealy	2/1/13	10/31/13	Water	7
2	EIH	20721	West Bernard Creek at Wharton CR 225 East of Hungerford	2/1/13	10/31/13	Water	7
3	EIH	20722	Peach Creek at Wharton CR 117/Chudalla Road/ Archer Road 89 meters South of the intersection of Wharton CR 117/ Chudalla Road/ Archer Road and Wharton CR 212/ Wharton CR 119/ Donaldson Road East of Wharton	2/1/13	10/31/13	Water	7
4	EIH	20723	Mound Creek at Brazoria CR 450/ Jackson Settlement Road 1.22 KM upstream of FM 1301 west of West Columbia	2/1/13	10/31/13	Water	7
5	EIH	20460	San Bernard River Tidal at SH 35 southwest of West Columbia	2/1/13	10/31/13	Water	7
6	EIH	12146	San Bernard River Tidal east bank immediatley upstream of FM 2611	2/1/13	10/31/13	Water	7
7	EIH	16373	San Bernard River immediatley downstream of US 90A in East Bernard	2/1/13	10/31/13	Water	7
8	EIH	12147	San Bernard River mid channel 60 M downstream of FM 442 bridge SW of Needville	2/1/13	10/31/13	Water	7
9	EIH	1a	Unnamed trib off 2611	2/1/13	10/31/13	Water	7
10	EIH	9	West Bernard Creek at CR 211	2/1/13	10/31/13	Water	7
11	EIH	9a	Sandy Branch at CR 213	2/1/13	10/31/13	Water	7
12	EIH	9b	Clarks Branch at 211	2/1/13	10/31/13	Water	7
13	EIH	10a	Gum Tree Branch at CR 252	2/1/13	10/31/13	Water	7
14	EIH	10b	Dewberry Branch at CR 252	2/1/13	10/31/13	Water	7

15	EIH	12a	Middle Bernard Creek at CR 289	2/1/13	10/31/13	Water	7

[1] These dates are delayed from the start dates as indicated in the project workplan.
[2] Stormflow samples will be collected once per season.

WWTF Effluent Monitoring

H-GAC compiled the last 5 years of self-reported effluent discharge data from TPDES permittees in the watershed. H-GAC assessed the value of this data with respect to the pollutants of interest in this project. The self-reported data from TPDES permittees were not sufficient to characterize the point source contribution to pollutant loading to the waterbody. H-GAC will conduct effluent monitoring at three selected WWTFs once per month collecting field, flow, bacteria, and effluent parameter groups (same as subtask 3.1). Effluent parameters are BOD, CBOD and COD. The sampling period extends over 12 months. The number of samples planned for collection through this subtask is 36.

Coordination between TPDES permittees and the TCEQ Regional Office will be required. Neither H-GAC nor TSSWCB shall submit WWTF data to TCEQ for use in permit compliance and enforcement; rather, WWTF data will only be used to estimate pollutant loadings from wastewater discharges and to assist TPDES permittees in improving management and operations.

Table B1.1d indicates the monitoring site locations and sampling frequencies for WWTF monitoring.

Table B1.1d WWTF Monitoring Sites and Frequencies

Site No.	Collecting Entity	Site ID	Site Description	Start Date[1]	End Date	Sample Matrix	Sampling Frequency
1	EIH	WWTF1	Wharton County in East Bernard, WCID	2/1/13	10/31/13	Water	12
2	EIH	WWTF2	City of Needville in Fort Bend County, 14206 Church Street.	2/1/13	10/31/13	Water	12
3	EIH	WWTF3	City of Sweeny in Brazoria County, End of Ave A/McKinney/CR 372.	2/1/13	10/31/13	Water	12

[1] These dates are delayed from the start dates as indicated in the project workplan.

B2 SAMPLING METHODS

Field Sampling Procedures

Field sampling will be conducted according to procedures documented in the *TCEQ Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2012 (RG-415) and Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data* (*RG-416).* For WWTFs, sampling will be conducted in accordance with the permit and approved methodology of Table B2.1c. Container types, expected sample volumes, preservation requirements, and holding time requirements are specified in Table B2.1a for routine samples. Requirements specific to stormflow monitoring are contained in Table B2.1b.

Pre-cleaned, disposable sample containers for conventional parameters are provided by Eastex, H-GAC's contract lab. Brown, poly, 4-liter cubitainers are used for chlorophyll-*a* samples are also provided by Eastex. Disposable, sterile, 120 mL plastic bottles are used for bacteriological samples. The tubing used local to field filter orthophosphate phosphorus samples and metals is re-used. Eastex cleans the tubing between each use by washing each piece with a 10 % nitric acid solution and a 10% Hydrochloric acid solution. Each tube is triple rinsed with deioinized water between and after the 2 acid washes, then hung and allowed to air dry. The lab individually packages each tube in a zip-lock style, plastic baggie and performs QC testing to assure that no contamination results from the washing procedure.

Table B2.1a Sample Storage, Preservation and Handling Requirements for Routine Ambient Samples

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
TSS	water	Plastic	Cool to 4°C	200 mL***	7 days
Sulfate	water	Plastic	Cool to 4°C	100 ml*****	28 days
Chloride	water	Plastic	Cool to 4°C	100 mL*****	28 days
Chlorophyll-*a*	water	Brown plastic	Dark & iced before filtration; Dark & frozen after filtration	4 L	Filtered,48 hours; filtered & frozen , 28 days**
E. coli IDEXX Colilert	water	Sterile Plastic	Cool to 4°C	120 mL	8 hours*
Enterococcus IDEXX Enterolert	water	Sterile Plastic	Cool to 4°C	120 mL	8 hours
Ammonia-N	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	150 mL****	28 days
Nitrate + nitrite-N	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	100 mL****	28 days
Total Kjeldahl Nitrogen	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	150 mL****	28 days
Ortho phosphate Phosphorus (field filtered < 15 min.)	water	Plastic	Cool to 4°C	250 mL	48 hours
Phosphorus-P, total	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	250 mL****	28 days

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
Total Hardness	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	150 mL****	28 days
Turbidity	water	Plastic	Cool to 4°C	50 mL***	48 hours

*E.coli samples analyzed by SM 9223-B should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 24 hours.
** Contract lab will pick up sample and filter before 48 hours.
*** All Solids tests are collected in one 1-liter plastic cubitainer.
**** Three nutrient tests are collected from one 1-liter plastic cubitainer.
***** One 500 mL plastic container is used to collect these two samples.

Table B2.1b Sample Storage, Preservation and Handling Requirements for Stormflow Samples

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
TSS	water	Plastic	Cool to 4°C	200 mL***	7 days
Sulfate	water	Plastic	Cool to 4°C	100 ml*****	28 days
Chloride	water	Plastic	Cool to 4°C	100 mL*****	28 days
Chlorophyll-*a*	water	Brown plastic	Dark & iced before filtration; Dark & frozen after filtration	4 L	Filtered,48 hours; filtered & frozen , 28 days**
E. coli IDEXX Colilert	water	Sterile Plastic	Cool to 4°C	120 mL	8 hours*
Enterococcus IDEXX Enterolert	water	Sterile Plastic	Cool to 4°C	120 mL	8 hours
Ammonia-N	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	150 mL****	28 days
Nitrate + nitrite-N	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	100 mL****	28 days
Total Kjeldahl Nitrogen	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	150 mL****	28 days
Ortho phosphate Phosphorus (field filtered < 15 min.)	water	Plastic	Cool to 4°C	250 mL	48 hours
Phosphorus-P, total	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	250 mL****	28 days
Total Hardness	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	150 mL****	28 days
Turbidity	water	Plastic	Cool to 4°C	50 mL***	48 hours

*E.coli samples analyzed by SM 9223-B should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 24 hours.
** Contract lab will pick up sample and filter before 48 hours.
*** All Solids tests are collected in one 1-liter plastic cubitainer.
**** Three nutrient tests are collected from one 1-liter plastic cubitainer.
***** One 500 mL plastic container is used to collect these two samples.

Table B2.1c Sample Storage, Preservation and Handling Requirements for WWTF Effluent samples

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
TSS	water	Plastic	Cool to 4°C	200 mL***	7 days
Sulfate	water	Plastic	Cool to 4°C	100 ml*****	28 days
Chloride	water	Plastic	Cool to 4°C	100 mL*****	28 days
BOD_5	water	Plastic	Cool to 4°C	500 ml	48 hours
$CBOD_5$	water	Plastic	Cool to 4°C	500 ml	48 hours
COD	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	100 mL****	28 days
E. coli IDEXX Colilert	water	Sterile Plastic	Cool to 4°C	120 mL	8 hours*
Enterococcus IDEXX Enterolert	water	Sterile Plastic	Cool to 4°C	120 mL	8 hours
Ammonia-N	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	150 mL****	28 days
Nitrate + nitrite-N	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	100 mL****	28 days
Total Kjeldahl Nitrogen	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	150 mL****	28 days
Ortho phosphate Phosphorus (field filtered < 15 min.)	water	Plastic	Cool to 4°C	250 mL	48 hours
Phosphorus-P, total	water	Plastic	Cool to 4°C H_2S0_4 to pH <2	250 mL****	28 days
Total Hardness	water	Plastic	Cool to 4°C, H_2SO_4 to pH <2	150 mL****	28 days
Turbidity	water	Plastic	Cool to 4°C	50 mL***	48 hours

*E.coli samples analyzed by SM 9223-B should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 24 hours.
** Contract lab will pick up sample and filter before 48 hours.
*** All Solids tests are collected in one 1-liter plastic cubitainer.
**** Three nutrient tests are collected from one 1-liter plastic cubitainer.
***** One 500 mL plastic container is used to collect these two samples.

Processes to Prevent Contamination

Procedures outlined in the *TCEQ Surface Water Quality Monitoring Procedures* outline the necessary steps to prevent contamination of samples (e.g. direct collection into sample containers, when possible). Field QC samples (identified in Section B5) are collected to verify that contamination has not occurred.

Documentation of Field Sampling Activities

Field sampling activities are documented on field data sheets as presented in Appendix A. The following will be recorded for all visits:

1. Station ID
2. Sampling Date
3. Location
4. Sampling depth
5. Sampling time
6. Sample collector's name/signature
7. Values for all field parameters
8. Detailed observational data, including:
    - water appearance
    - weather
    - biological activity
    - unusual odors
    - pertinent observations related to water quality or stream uses (e.g., exceptionally poor water quality conditions/standards not met; stream uses such as swimming, boating, fishing, irrigation pumps, etc.)
    - watershed or instream activities (events impacting water quality, e.g., bridge construction, livestock watering upstream, etc.)
    - specific sample information
    - missing parameters (i.e., when a scheduled parameter(s) is not collected)

Recording Data

For the purposes of this section and subsequent sections, all field and laboratory personnel follow the basic rules for recording information as documented below:

1. Legible writing in indelible ink with no modifications, write-overs or cross-outs;
2. Correction of errors with a single line followed by an initial and date;
3. Close-out on incomplete pages with an initialed and dated diagonal line.

Deficiencies, Nonconformances and Corrective Action Related to Sampling Requirements

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP. Nonconformances are deficiencies that affect quality and render data unacceptable or indeterminate. Deficiencies related to sampling method requirements include, but are not limited to, such things as sample container, volume, and preservation variations, improper/inadequate storage temperature, holding-time exceedances, and sample site adjustments.

Deficiencies are documented in logbooks and field data sheets by field or laboratory staff and reported via Corrective Action Report (CAR) to the pertinent field or laboratory supervisor. The supervisor will forward the CAR to the H-GAC QAO. If the situation requires an immediate decision concerning data quality or quantity, the H-GAC Project Lead will be notified within 24 hours. The H-GAC Project Lead will notify the H-GAC QAO of the potential nonconformance. The H-GAC QAO will record and track the CAR to document the deficiency.

The H-GAC QAO, in consultation as appropriate with the H-GAC Project Lead (and other affected individuals/organizations), will determine if the deficiency constitutes a

nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the CAR will be completed accordingly and closed. If it is determined that a nonconformance does exist, the H-GAC Project Lead in consultation with H-GAC QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by completion of a CAR, which is retained by the H-GAC QAO.

CARs document: root cause(s), programmatic impact(s), specific corrective action(s) to address the deficiency, action(s) to prevent recurrence, individual(s) responsible for each action, the timetable for completion of each action, and the means by which completion of each corrective action will be documented. The TSSWCB will be notified of inconsistencies that affect data quality within the quarterly progress reports. In addition, significant conditions (i.e., situations that, if uncorrected, could have a serious effect on safety or validity or integrity of data) will be reported to the TSSWCB immediately.

B3 SAMPLE HANDLING AND CUSTODY

Chain-of-Custody

Water quality data are generated in the field by H-GAC, EIH, and the Eastex analytical laboratory. A chain of custody (COC) form is used to record sample identification parameters and to document the submission of samples from the field staff to the analytical laboratory staff. Each COC has space to record data for nine (9) separate samples. A copy of the COC is found in Appendix B. For grab samples, a field data sheet for each site is attached to the COC. COCs and accompanying data sheets are kept by H-GAC in paper form for at least five years.

Sample Tracking

Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, and analysis.

The field staff member submitting the sample transfers possession of samples to a laboratory staff member. The field staff member and the laboratory staff member both sign and date the COC. A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The COC form is a record that documents the possession of the samples from the time of collection to receipt in the laboratory. The following information concerning the sample is recorded on the COC form (See Appendix B). For this project, all laboratory work will be done by Eastex.

The following information concerning the sample is recorded on the COC form (See Appendix B).

1. Date and time of collection
2. Site identification
3. Sample matrix, indicated by test group code
4. Number of containers and container type ID designation
5. Preservative used or if the sample was filtered, indicated by test group code
6. Sample composite information (bottle numbers and ending time)
8. Analyses required, indicated by test group code
9. Name of collector
10. Custody transfer signatures and dates and time of transfer
11. Name of laboratory admitting the sample

Sample Labeling

Water samples are labeled with a waterproof label marked with an indelible marker and placed on the container. Label information from the field crew includes:

1. Station identification
2. Time of sampling (or bottle number for composited samples)
3. Date of sampling
4. Preservation (if applicable)

5. Designation of "field-filtered" as applicable
6. Sample type (i.e., analysis(es)) to be performed

These unique identifiers on the sample container can be matched with data on the COC forms that are submitted to the laboratory, generally, the same day as samples are collected.

The field staff member documents on a field data sheet the station, date, time, location, and sample type and pertinent comments. These identifying data are copied in ink onto a COC. A unique sample identification number is assigned to water samples at the H-GAC office and written in indelible ink on a water-proof label on the container, and on the COC. This sample identification number, time, date and station location serve to match the sample with the data on the COC.

Sample Handling

All samples are collected according to TCEQ SWQM procedures. All water samples are iced in the field and submitted to the laboratory on ice the same day they are collected in the field or retrieved from an automated sampler.

Upon collection, EIH immediately immerses their samples in coolers containing ice. If a temperature blank is carried (it is not required), it shall be placed on top of the samples instead of buried in the ice. Samples are transferred to a lab courier who signs the COC form and transports the samples to the lab. After the samples arrive, the lab personnel taking custody of samples will verify the samples are "in the process" of cooling to 4 °C before signing the COC. Internal sample handling, custody, and storage procedures for Eastex are described in the Quality Management Plans (QMP) kept on file with H-GAC. References for the Eastex lab procedures are listed in the Table B3.1.

Table B3. 1 Sample Handling References

MONITORING ENTITY	REFERENCE TO SAMPLE HANDLING
EIH	EIH has a Standard Operating Procedure (SOP) for Bacteria Samples and a Sample Handling SOP, August 2004; All biological collecting and sample handling will be performed according to TCEQ's *Surface Water Quality Monitoring Procedures Manual, Volume 2 (RG-416, June 2007).* Eastex Environmental Laboratory QM, Rev. 6, January 16, 2009, covers samples relinquished to the lab.
H-GAC	H-GAC's SOP Manual for Conducting Surface Water Quality Monitoring references the most current *TCEQ Surface Water Quality Monitoring Procedures Manuals Volume 1 & 2* plus specific SOP's pertaining to H-GAC monitoring activities only. Eastex Environmental Laboratory QM, Rev. 6, January 16, 2009, covers samples relinquished to the lab

After samples are received at the laboratory, they are inventoried against the accompanying COC. Any discrepancies are noted at that time, remediated if possible, and the COC is signed

for acceptance of custody. Sample numbers are then assigned and samples are checked for preservation *(as allowed by the specific analytical procedure).* Samples are then filtered or pretreated as necessary and placed in a refrigerated cooler dedicated to sample storage, where required.

The laboratory manager has the responsibility to ensure that all holding times are met (see Tables B2.1 and B2.2). Any problems will be documented with a CAR.

Deficiencies, Nonconformances and Corrective Action Related to Chain-of-Custody

Deficiencies are defined as unauthorized deviation from procedures documented in the QAPP. Nonconformances are deficiencies that affect quality and render the data unacceptable or indeterminate. Deficiencies related to COC include, but are not limited, to delays in transfer resulting in holding time violations; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc.

Deficiencies are documented in logbooks and field data sheets by field or laboratory staff and reported via CAR to the pertinent field or laboratory supervisor. The supervisor will forward the CAR to the QAO. If the situation requires an immediate decision concerning data quality or quantity, the H-GAC Project Lead will be notified within 24 hours. The H-GAC Project Lead will notify H-GAC QAO of the potential nonconformance. The H-GAC QAO will record and track the CAR to document the deficiency.

The H-GAC QAO, in consultation as appropriate with the H-GAC Project Lead (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the CAR will be completed accordingly and closed. If it is determined that a nonconformance does exist, the H-GAC Project Lead in consultation with H-GAC QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by completion of a CAR, which is retained by the H-GAC QAO.

CARs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency, action(s) to prevent recurrence, individual(s) responsible for each action, the timetable for completion of each action; and the means by which completion of each corrective action will be documented. The TSSWCB will be notified of inconsistencies that affect data quality with quarterly progress reports. In addition, significant conditions (i.e., situations that, if uncorrected, could have a serious effect on safety or validity or integrity of data) will be reported to TSSWCB immediately.

B4 ANALYTICAL METHODS

The analytical methods, associated matrices, and performing laboratory are listed in Table A7.1 of Section A7. The authority for analysis methodologies is derived from the TSWQS (§307.1 - 307.10) in that data generally are generated for comparison to those standards and/or criteria. The Standards state that "Procedures for laboratory analysis will be in accordance with the most recently published edition of *Standard Methods for the Examination of Water and Wastewater*, the latest version of the *SWQM Procedures, Volume 1: Physical Methods for Water, Sediment, and Tissue*, 40 CFR 136, or other reliable procedures acceptable to the Executive Director."

Laboratories collecting data under this QAPP are compliant with the NELAC standards. Copies of laboratory QMs and SOPs are available for review by the TCEQ.

Standards Traceability

All standards used in the field and laboratory are traceable to verified and known amounts of analytes. Standards and reagent preparation is fully documented and maintained in a standards log book. The use of standards and reagents are documented when used in preparation and analytical logs. Each documentation includes traceability to purchased stocks, reference to the method of preparation, including concentration, amount used and lot number, date prepared, expiration date and preparer's initials or signature. The reagent bottle is labeled with concentration, date of preparation, expiration date, storage requirements, safety considerations, and a unique identifier that traces the reagent to the standards log book entry.

Analytical Method Modification

Only data generated using approved analytical methodologies as specified in this QAPP will be used as direct data for this project. Requests for method modifications will be documented and submitted for approval to the TSSWCB. Work using modified methods will begin only after the modified procedures have been approved.

Deficiencies, Nonconformances and Corrective Action Related to Analytical Methods

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP. Nonconformances are deficiencies that affect quality and render the data unacceptable or indeterminate. Deficiencies related to field and laboratory measurement systems include but are not limited to instrument malfunctions, blank contamination, quality control sample failures, etc.

Deficiencies are documented in logbooks and field data sheets by field or laboratory staff and reported via CAR to the pertinent field or laboratory supervisor. The supervisor will forward the CAR to the QAO. If the situation requires an immediate decision concerning data quality or quantity, the H-GAC Project Lead will be notified within 24 hours. The H-GAC Project Lead will notify the H-GAC QAO of the potential nonconformance. The H-GAC QAO will record and track the CAR to document the deficiency.

The H-GAC QAO, in consultation as appropriate with the H-GAC Project Lead (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality

and therefore is not a valid nonconformance, the CAR will be completed accordingly and closed. If it is determined that a nonconformance does exist, the H-GAC Project Lead in consultation with H-GAC QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by completion of a CAR, which is retained by the H-GAC QAO.

CARs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency, action(s) to prevent recurrence, individual(s) responsible for each action, the timetable for completion of each action; and the means by which completion of each corrective action will be documented. The TSSWCB will be notified of inconsistencies that affect data quality with quarterly progress reports. In addition, significant conditions (i.e., situations that, if uncorrected, could have a serious effect on safety or validity or integrity of data) will be reported to TSSWCB immediately.

B5 QUALITY CONTROL

Sampling Quality Control Requirements and Acceptability Criteria

Field Split— A field split is a single sample subdivided by field staff immediately following collection and submitted to the laboratory as two separately identified samples. This requirement applies to composited grab samples as well as single grab samples, but not to automated samples or bacteria samples. Field splits will be collected on a 10% basis for instream routine samples. The precision of field split results is calculated by relative percent difference (RPD) using the following equation:

$$RPD = (X_1-X_2)/[(X_1+X_2)/2]\ 100$$

A 30% RPD criteria will be used to screen field split results as a possible indicator of excessive variability in the sample handling and analytical system. If it is determined that elevated quantities of analyte (i.e., > 5 times the LOQ) were measured and analytical variability can be eliminated as a factor, then variability in field split results will be used to trigger discussions with field staff to ensure samples are being handled correctly in the field. Some individual sample results may be invalidated based on the examination of all extenuating information. The information derived from field splits is generally considered to be event specific and would not normally be used to determine the validity of an entire batch; however, some batches of samples may be invalidated depending on the situation. Professional judgment during data validation will be relied upon to interpret the results and take appropriate action. Deficiencies will be addressed as specified in this section under Deficiencies, Nonconformances, and Correction Action related to Quality Control.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Method Specific QC requirements—QC samples, other than those specified later in this section, are run as specified in the methods (e.g., sample duplicates, surrogates, internal standards, continuing calibration samples, interference check samples, positive control, negative control, and media blank). The requirements for these samples, their acceptance criteria or instructions for establishing criteria, and corrective actions are method-specific.

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory quality assurance manuals (QAMs). The minimum requirements that all participants abide by are stated below.

Limit of Quantitation (LOQ)—The laboratory will analyze a calibration standard (if applicable) at the LOQ on each day project samples are analyzed. Calibrations including the standard at the LOQ will meet the calibration requirements of the analytical method or corrective action will be implemented.

LOQ Check Standard—An LOQ check standard consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified

known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system at the lower limits of analysis. The LOQ check standard is spiked into the sample matrix at a level less than or near the LOQ for each analyte for each batch of samples that are run.

The LOQ check standard is carried through the complete preparation and analytical process. LOQ Check Standards are run at a rate of one per preparation batch. A preparation batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

The percent recovery of the LOQ check standard is calculated using the following equation in which %R is percent recovery, SR is the sample result, and SA is the reference concentration for the check standard:

$$\%R = SR/SA * 100$$

Measurement performance specifications are used to determine the acceptability of LOQ Check Standard analyses as specified in Table A7.1.

As noted above, the LOQ check standard will be used for information in determining the performance of the measurement system at the lower limits of analysis and not as a sole criterion for determining overall data acceptability for a batch.

Laboratory Control Sample (LCS)—An LCS consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system. The LCS is spiked into the sample matrix at a level less than or near the mid point of the calibration for each analyte. In cases of test methods with very long lists of analytes, LCSs are prepared with all the target analytes and not just a representative number, except in cases of organic analytes with multipeak responses.

The LCS is carried through the complete preparation and analytical process. LCSs are run at a rate of one per preparation batch. A preparation batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

Results of LCSs are calculated by percent recovery (%R), which is defined as 100 times the measured concentration, divided by the true concentration of the spiked sample.

The following formula is used to calculate percent recovery, where %R is percent recovery; SR is the measured result; and SA is the true result:

$$\%R = SR/SA * 100$$

Measurement performance specifications are used to determine the acceptability of LCS analyses as specified in Table A7.1.

Laboratory Duplicates—A laboratory duplicate is prepared by taking aliquots of a sample from the same container under laboratory conditions and processed and analyzed independently. A laboratory control sample duplicate (LCSD) is prepared in the laboratory by splitting aliquots of an LCS. Both samples are carried through the entire preparation and analytical process. LCSDs are used to assess precision and are performed at a rate of one per preparation batch. A preparation batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

For most parameters, precision is calculated by the relative percent difference (RPD) of LCS duplicate results as defined by 100 times the difference (range) of each duplicate set, divided by the average value (mean) of the set. For duplicate results, X_1 and X_2, the RPD is calculated from the following equation:

$$RPD = (X_1 - X_2)/[(X_1+X_2)/2] * 100$$

A bacteriological duplicate is considered to be a special type of laboratory duplicate and applies when bacteriological samples are run in the field as well as in the lab. Bacteriological duplicate analyses are performed on samples from the sample bottle on a 10% basis. Results of bacteriological duplicates are evaluated by calculating the logarithm of each result and determining the range of each pair.

Measurement performance specifications are used to determine the acceptability of duplicate analyses as specified in Table A7.1. The specifications for bacteriological duplicates in Table A7.1 apply to samples with concentrations > 20 org./100 mL

Matrix spike (MS)—Matrix spikes are prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Percent recovery of the known concentration of added analyte is used to assess accuracy of the analytical process. The spiking occurs prior to sample preparation and analysis. Spiked samples are routinely prepared and analyzed at a rate of 10% of samples processed, or one per quality control batch whichever is greater. A quality control batch is defined as samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 10 environmental samples. The information from these controls is sample/matrix specific and is not used to determine the validity of the entire batch. The MS is spiked at a level less than or equal to the midpoint of the calibration or analysis range for each analyte. Percent recovery (%R) is defined as 100 times the observed concentration, minus the sample concentration, divided by the true concentration of the spike.

The results from matrix spikes are primarily designed to assess the validity of analytical results in a given matrix and are expressed as percent recovery (%R). The laboratory shall document the calculation for %R. The percent recovery of the matrix spike is calculated using the following equation in which %R is percent recovery, SSR is the observed spiked sample concentration, SR is the sample result, and SA is the reference concentration of the spike added:

$$\%R = (SSR - SR)/SA * 100$$

Measurement performance specifications for matrix spikes are not specified in this document.

The results are compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory shall determine the internal criteria and document the method used to establish the limits. For matrix spike results outside established criteria, corrective action shall be documented or the data reported with appropriate data qualifying codes.

Eastex uses matrix spike recovery limits of 80-120 for parameters where a spike solution is available. These recoveries are monitored with QC charts to help determine interferences or detect trends. Matrix spikes that fail to meet these guidelines are reanalyzed if possible. An alternate sample may be used to help determine whether the problem was specific to that sample. If matrix spikes are not achievable within 80-120 % recovery, then this recovery is flagged as exceeding the control limit on the QC report.

Method blank—A method blank is a sample of matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as the samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. The method blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination from the analytical process. The analysis of method blanks should yield values less than the LOQ.

Deficiencies, Nonconformances and Corrective Action Related to Quality Control

Deficiencies are defined as unauthorized deviation from procedures documented in the QAPP. Nonconformances are deficiencies that affect quality and render the data unacceptable or indeterminate. Deficiencies related to Quality Control include but are not limited to quality control sample failures.

Deficiencies are documented in logbooks and field data sheets by field or laboratory staff and reported via CAR to the pertinent field or laboratory supervisor. The supervisor will forward the CAR to the QAO. If the situation requires an immediate decision concerning data quality or quantity, the H-GAC Project Lead will be notified within 24 hours. The H-GAC Project Lead will notify the H-GAC QAO of the potential nonconformance. The H-GAC QAO will record and track the CAR to document the deficiency.

The H-GAC QAO, in consultation as appropriate with the H-GAC Project Lead (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the CAR will be completed accordingly and closed. If it is determined that a nonconformance does exist, the H-GAC Project Lead in consultation with H-GAC QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by completion of a CAR, which is retained by the H-GAC QAO.

CARs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency, action(s) to prevent recurrence, individual(s) responsible for each action, the timetable for completion of each action; and the means by which completion of each corrective action will be documented. The TSSWCB will be notified of inconsistencies that affect data quality with quarterly progress reports. In addition, significant conditions (i.e., situations that, if uncorrected, could have a serious effect on safety or validity or integrity of data) will be reported to TSSWCB immediately.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

All sampling equipment testing and maintenance requirements are detailed in the *TCEQ Surface Water Quality Monitoring Procedures Volumes 1 and 2*. Sampling equipment is inspected and tested upon receipt and is assured appropriate for use. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within the laboratory's QM.

B7 INSTRUMENT/ EQUIPMENT CALIBRATION AND FREQUENCY

Field equipment calibration requirements are contained in the *TCEQ Surface Water Quality Monitoring Procedures*. Post-calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidate associated data collected subsequent to the pre-calibration and are not submitted to the TCEQ.

Detailed laboratory calibrations are contained within the QM(s).

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

All supplies and consumables received by Eastex are inspected upon receipt for damage, missing parts, expiration date, and storage and handling requirements by appropriate laboratory personnel. Labels on reagents, chemicals, and standards are examined to ensure they are of appropriate quality, initialed by staff member and marked with receipt date. Volumetric glassware is inspected to ensure class 'A' grade where required.

Chemicals for analysis are tested by the supplier and meet or exceed American Chemical Society (ACS) certification, where applicable.

Acceptance criteria for such supplies and consumable, in order to satisfy the technical and quality objectives of this project, are documented in Eastex's QMs.

B9 NON-DIRECT MEASUREMENTS

In addition to the data generated from the monitoring associated with this project, non-direct measurements will be acquired from the Clean Rivers Program, USGS flow gage data, and SWQMIS.

H-GAC is a partner in the Clean Rivers Program for the state of Texas. As such, they collect data for four (4) sites in the watershed on a regular basis for routine water quality assessment as part of the state's mandate for CWA §305(b) – Integrated Report. These data also are used by Texas for consideration of water bodies to be added to their list of impaired water body segments, as described in CWA §303(d). Additional data obtained from the Texas Commission on Environmental Quality are from the SWQMIS database.

All data used for this project are collected in accordance with approved quality assurance measures under the state's Clean Rivers Program, Texas Commission on Environmental Quality, Texas Water Development Board, USDA, National Weather Service, or USGS.

Quality assured stream flow measurements will be collected from USGS stream gage stations as available.

Because most historical data is of known and acceptable quality and were collected and analyzed in a manner comparable and consistent with needs for this project, no limitations will be placed on their use, except where known deviations have occurred.

B10 DATA MANAGEMENT

Data Management Process

Data is received by H-GAC directly from EIH and Eastex. The paragraph below gives a brief description of their data submission process.

When data is submitted to H-GAC, the data is saved in "Raw Data" folders. When H-GAC begins to process the data, it is saved into a "Working Data" folder. By changing the folder in which the data is saved, H-GAC always has the original data submittal in electronic format. Data is processed by H-GAC's Data Manager/SAS Operator and H-GAC's QAO before being provided to TSSWCB and thence to TCEQ. H-GAC's full data procedure, including data submitted to SWQMIS, is shown in the flow chart in Appendix D– H-GAC's Data Management Process and Flow Chart.

EIH performs data entry for only the field data collected by their program. The field QAO or the individual who collected the data inputs the data to an EXCEL spreadsheet. All supporting QA data is input to spreadsheets as well. The field QAO and the PM review more than 10% of the data for accuracy, completeness, and reasonableness. A Data Review checklist is generated while data is being reviewed. Then it is submitted to H-GAC along with electronic data files hard copies of the field sheet and COC.

H-GAC receives lab data from Eastex in hard copy and electronic versions. The data is typed into a new format in an EXCEL spreadsheet by either a temporary employee or the Data Manager and is saved in the "RAW Data" files. It is reviewed for accuracy and completeness by either the Data Manager or QAO (but not the person who performed the original data entry).

The Data Manager (DM) begins the task of merging the field and lab data files. The merged file is saved in a "WORKING Data" file. When a dataset is fully merged, it will be provided to TCEQ.

H-GAC's Data Management Flow Chart describes the entire data management process. Data manipulation through the merging task will be the only part applicable to data collected under this QAPP.

Data Dictionary - Terminology and field descriptions are included in the SWQM Data Management Reference Guide, 2012 or most recent version. For the purposes of verifying which entity codes are included in this QAPP, a table outlining the entities that will be used when submitting data under this QAPP is included as Table B10.1 below.

Table B10.1 Monitoring Entity Identification

Name of Monitoring Entity	Tag Prefix	Submitting Entity	Collecting Entity
H-GAC	I	TX	HG
EIH-UHCL	I	TX	UI

Data Errors and Loss

H-GAC stores original electronic data is "Raw Data" files. These files are saved in the original format and other then changing the name of a file, remains unchanged. Any changes to a data file are saved in the "Working Data" folders. In these folders, data is merged, formatted, and converted to the correct reporting units before SAS processing begins. After SAS is applied, the files are stored in ACCESS tables. An ACCESS database is made for each data set. In this database there are several folders where all reports and modifications are documented. There is an INPUT folder, an OUTPUT folder, Draft Matrix tables which should show all the data as reformatted and ready to be converted into the EVENT/RESULTS format for the TSSWCB, and thence to TCEQ. All changes, validation, and verification actions on the data are documented in a Data Review Summary Report which accompanies each data set submittal.

Chain of Custody Forms

A COC form is used to record water sample identification parameters and to document the submission of samples from the field staff to the analytical laboratory staff (Appendix B). Each COC has space to record data for numerous separate samples. All entries onto the COC forms will either be typed or completed in ink, with any changes made by crossing out the original entry, which should still be legible, and initialing and dating the new entry. COCs are kept in three-ring binders or designated folder in the H-GAC office for at least five years.

Data Verification/Validation

The control mechanisms for detecting and correcting errors and for preventing loss of data during data reduction, data reporting, and data entry are contained in Sections D1, D2, and D3.

Data Handling

H-GAC maintains several networked computers to store and manage data. All computers are equipped with at least Windows XP and Office 2007 which includes MS Excel 2007 and MS Access 2007. The data manager's computer also includes Oracle 9 to assist with screening, management and reformatting the data to TCEQ's specifications. Additionally, the SAS software is available on the DM/SAS Operator's computer.

Hardware and Software Requirements

Hardware configurations are sufficient to run Windows XP, Office 2007, MS Excel 2007, MS Access 2007, SAS and Oracle 9 software in a networked environment. Specific hardware need to be configured to run WISKI and FLOWLINK software, but not necessarily in a networked environment. H-GAC information resources staff is responsible for assuring that hardware configurations meet the requirements for running current and future data management/database software as well as providing technical support.

C1 ASSESSMENTS AND RESPONSE ACTIONS

The following table presents the types of assessments and response actions for data collection activities applicable to this project (Table C1.1).

Table C1.1 Assessments and Response Requirements

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	H-GAC Project Lead	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to TSSWCB in Quarterly Report
Monitoring Systems Audit of H-GAC and EIH	Dates to be determined by TSSWCB (minimum of one per life of project)	TSSWCB QAO	The assessment will be tailored in accordance with objectives needed to assure compliance with the QAPP. Field sampling, handling and measurement; facility review; and data management as they relate to the NPS Project	30 days to respond in writing to the TSSWCB to address corrective actions
Laboratory Inspection	Dates to be determined by TSSWCB (minimum of one per life of project)	TSSWCB QAO	Analytical and quality control procedures employed at the Eastex laboratory.	30 days to respond in writing to TSSWCB to address corrective actions
Laboratory Management Review	Annually	H-GAC QAO	Conduct management reviews of the laboratory's quality system to ensure its effectiveness	Not applicable
Laboratory Internal Audits	Annually	Eastex Laboratory QAO	Conduct internal audits of the quality system to verify that activities comply with the quality system Standard	30 days to respond in writing to Lab QAO to address corrective actions
Site Visit	Dates to be determined by TSSWCB (minimum of one per each fiscal year during life of project)	TSSWCB PM	Status of activities. Overall compliance with work plan and QAPP	As needed

Corrective Action

The H-GAC Project Lead is responsible for implementing and tracking corrective action resulting from audit findings outlined in any internal or external audit report. The H-GAC QAO will maintain records of audit findings and corrective actions. Internal audit reports will be made available to the TSSWCB upon request.

C2 REPORTS TO MANAGEMENT

Reports to TSSWCB Project Management

Quarterly Progress Report
Summarizes H-GAC activities for each task; reports problems, delays, and corrective actions; and outlines the status of each tasks deliverables. Report written by the H-GAC Project Lead.

Monitoring System Audit Response
H-GAC will respond in writing to the TSSWCB within 30 days upon receipt of a monitoring system audit report to address corrective actions. Response written by the H-GAC QAO.

Laboratory System Audit Response
H-GAC will respond in writing to the TSSWCB within 30 days upon receipt of a laboratory system audit report to address corrective actions. Response written by the H-GAC/Eastex's QAO.

Final Project Report
Summarizes H-GAC's activities for the entire project period including a description and documentation of major project activities; evaluation of project results and environmental benefits; and a conclusion. Report written by or under the guidance of the H-GAC Project Lead with assistance from other staff members.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

For the purposes of this document, data verification is a systematic process for evaluating performance and compliance of a set of data to ascertain its completeness, correctness, and consistency using the methods and criteria defined in the QAPP. Validation means those processes taken independently of the data-generation processes to evaluate the technical usability of the verified data with respect to the planned objectives or intention of the project. Additionally, validation can provide a level of overall confidence in the reporting of the data based on the methods used.

All data obtained from field and laboratory measurements will be reviewed and verified for conformance to project requirements, and then validated against the data quality objectives listed in Section A7. Only those data that are supported by appropriate quality control data and meet the measurement performance specification defined for this project will be considered acceptable and used in the project.

The procedures for verification and validation of data are described in Section D2. The H-GAC Field Supervisor is responsible for ensuring that field data are properly reviewed and verified for integrity. The Laboratory Manager is responsible for ensuring that laboratory data are scientifically valid, defensible, of acceptable precision and accuracy, and reviewed for integrity. The H-GAC QAO, Data Manager and Project Lead will be responsible for ensuring that all data are properly reviewed and verified, and submitted in the required format to the project database. The Eastex QAO is responsible for validating a minimum of 10% of the data produced in each task. Finally, the H-GAC Project Lead, with the concurrence of the H-GAC QAO and the H-GAC Data Manager, is responsible for validating that all data collected and analyzed meet the objectives of the project.

All field and laboratory data will be reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements, and then validated against the project objectives and measurement performance specifications which are listed in Section A7. Data that are supported by appropriate quality control data and meet the measurement performance specifications defined for this project will be considered acceptable will be used in evaluating project objectives for the final report.

D2 VERIFICATION AND VALIDATION METHODS

All data will be verified to ensure they are representative of the samples analyzed and locations where measurements were made, and that the data and associated quality control data conform to project specifications. The staff and management of the respective field, laboratory, and data management tasks are responsible for the integrity, validation and verification of the data each task generates or handles throughout each process (Table D2.1). The field and laboratory tasks ensure the verification of raw data, electronically generated data, and data on COC forms and hard copy output from instruments.

Verification, validation and integrity review of laboratory data will be performed using self-assessments and peer review, as appropriate to the project task, followed by technical review by the manager of the task. The data to be verified are evaluated against project performance specifications (Section A7) and are checked for errors, especially errors in transcription, calculations, and data input. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues that can be corrected are corrected and documented electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the task manager consults with higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected.

The H-GAC Project Lead, Data Manager and QAO are each responsible for validating that the verified data are scientifically valid, defensible, of known precision, accuracy, integrity, meet the data quality objectives of the project, and are reportable to TSSWCB. One element of the validation process involves evaluating the data again for anomalies. The manager of the task associated with the suspected data errors or anomalous data must address these issues before data validation can be completed.

A second element of the validation process is consideration of any findings identified during a laboratory or monitoring systems audit conducted by the TSSWCB QAO. Any issues requiring corrective action must be addressed, and the potential impact of these issues on previously collected data will be assessed. Finally, the H-GAC Project Lead, with the concurrence of the H-GAC QAO and H-GAC Data Manager, validates that the data meet the data quality objectives of the project and are suitable for meeting project objectives for the TSSWCB.

Table D2.1. Data Review Tasks

Field Data Review	**Responsibility**
Field data reviewed for conformance with data collection, sample handling and chain of custody, analytical and QC requirements	H-GAC QAO, DM and FS, EIH
Post-calibrations checked to ensure compliance with error limits	H-GAC QAO, DM and FS, EIH
Field data calculated, reduced, and transcribed correctly	H-GAC QAO, DM and FS, EIH
Laboratory Data Review	
Laboratory data reviewed for conformance with data collection, sample handling and chain of custody, analytical and QC requirements to include documentation, holding times, sample receipt, sample preparation, sample analysis, project and program QC results, and reporting	Eastex Laboratory Manager
Laboratory data calculated, reduced, and transcribed correctly	Eastex Laboratory Manager
Reporting limits consistent with requirements for Ambient Water Reporting Limits.	Eastex Laboratory Manager
Analytical data documentation evaluated for consistency, reasonableness and/or improper practices	Eastex Laboratory Manager
Analytical QC information evaluated to determine impact on individual analyses	Eastex Laboratory Manager
All laboratory samples analyzed for all parameters	Eastex Laboratory Manager
Data Set Review	
Data reported has all required information as described in Section A7 of the QAPP	H-GAC QAO and DM
Confirmation that field and lab data have been reviewed	H-GAC QAO and DM
Data set (to include field and laboratory data) evaluated for reasonableness and if corollary data agree	H-GAC PM and QAO
Outliers confirmed and documented	H-GAC DM and PM
Field QC acceptable (e.g., field splits)	H-GAC QAO
Sampling and analytical data gaps checked and documented	H-GAC QAO, DM and PM
Verification and validation confirmed. Data meets conditions of end use and are reportable	H-GAC PM and QAO

D3 RECONCILIATION WITH USER REQUIREMENTS

Data produced in this project, and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be analyzed and reconciled with project data quality requirements. Data meeting project requirements will be used by the TCEQ in SWQMIS for the use in the development of the biennial *Texas Integrated Report for Clean Water Act Sections 305 (b) and 303(d)*, WPP development, stream standards modifications, and permit decisions as appropriate. Data which do not meet requirements will not be submitted to SWQMIS nor will be considered appropriate for any of the uses noted above.

References:

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition, 1998.

American Society for Testing and Materials (ASTM) Annual Book of Standards, Vol. 11.02: Method ASTM D516 – 90 (Reapproved in 1995); Method ASTM D 6503 – 99 (Reapproved in 2005)

EPA, United States Environmental Protection Agency. 1983. Methods for Chemical Analysis of Water and Wastes. Environmental Monitoring and Support Laboratory, Office of Research and Development, US-EPA, Cincinnati, Ohio. EPA-600/4-79-020, Revised March 1983.

TCEQ, Texas Commission on Environmental QualityYYYY. Texas Surface Water Quality Standards, Chapter 307, Texas Administrative Code 307.1 - 307.10. Austin, Texas: TCEQ.

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2012 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data, 2007 (RG-416)

Appendix A. Field Data Reporting Forms

H-GAC – Ambient Monitoring Data Sheet

Environmental Institute of Houston - University of Houston Clear Lake
Field Data/Sampling Sheet

Station ID: _____ Date: _____ Arrive: _____ Sample: _____ Depart: _____
Location: _____
Collected By: _____ LAT: _____ LONG: _____

FIELD MEASUREMENTS

	1	2	3	4	5
Temp					
Conductivity					
Salinity					
DO % Sat.					
DO mg/L					
pH					
Depth					

FIELD OBSERVATIONS

[ ] % CLOUD COVER
[ ] WIND SPEED & DIRECTION
[ ] AIR TEMP (C)
[ ] TOTAL DEPTH (ft)
[ ] SAMPLING DEPTH (ft)
[ ] WATER ODOR 1-sewage 2-chemical 3-rotten egg 4-musky 5-fishy 6-none 7-other
[ ] WATER SURFACE 1-calm 2-ripples 3-waves
[ ] WIND INTENSITY 1-calm 2-slight 3-moderate 4-strong

[ ] WATER COLOR 1-brownish 2-reddish 3-greenish 4-blackish 5-clear 6-other
[ ] TURBIDITY, obs. 1-low 2-medium 3-high
[ ] PRESENT WEATHER 1-clear 2-partly cloudy 3-cloudy 4-rain
[ ] DAYS SINCE LAST SIG. RAINFALL
[ ] FLOW SEVERITY 1-no flow 2-low 3-normal 4-flood 5-high 6-dry
[ ] SECCHI DISK (inches / cm / meters)
[ ] WATER CLARITY 1-excellent 2-good 3-fair 4-poor
[ ] TIDE STAGE 1-low 2-falling 3-slack 4-rising 5-high

WATER SAMPLES

FRESH (non-tidal) [ ] MARINE (tidal) [ ] Field Split? Yes No

Container	Preservative	Analysis	Comments
1 x 1L Plastic	Ice	TDS, TSS, VSS	
1 x 1L Plastic	Ice, H2SO4	NH3, TPO4, NO2+NO3	
2 x 40mL VOA-Glass	Ice, HCl	TOC	
1 x 500ml Plastic	Ice	CL SO4 (fresh only)	
1 x 500ml Plastic	Ice	O-PO4	Field Filtered? Yes / No
1 x 4L amber Plastic	Ice	Chlorophyll-a	
1 x 100 ml Plastic	Ice	Bacteria	

E. coli [ ] MPN [ ] Turbidity (NTU) [ ]
Enterococcus [ ] RPD [ ] FLOW [ ] NTU bottle # _____

ADDITIONAL INFORMATION & REMARKS

Shoreline Attributes: Natural State____ Major Erosion____ Riprap____ Concrete____ Bulkhead____
Shoreline Habitat: Mowed Grass____Tall Grass____Shrubs____Young Trees____Fully Developed Tress____No Riparian Hab___
Vegetation: Overhanging___Immediately adjacent to stream bank___Mowed buffer w/veg. outside buffer___No Riparian Hab___
Animal Activities: Domestic_____Avian_____Wildlife_____Fish_____
Aquatic Habitat: Submerged Logs/Branches____ Wetland Veg.____ Pools____ Tires____ Other_____
Remarks:

H-GAC Surface Water Quality Monitoring Program

Stream Flow (Discharge) Measurement Form

Stream:____ Date:_______________

Station:____

Description:____

Time Begin:_____________ Time End:_____________ Meter Type:___________________________________

Observers:____________________________ Stream Width*:____________ Section Width (W):_____________

Observations:____

Section Midpoint (ft) (m)	Section Depth (ft) (m) (cm) (D)	Observational Depth** (ft)(m)	Velocity (V)		Flow (Q) (m^3/s) (ft^3/s) Q = (W)(D)(V)
			At Point (ft/s)(m/s)	Average (ft/s)(m/s)	

Appendix B. Chain of Custody Form

.

EASTEX ENVIRONMENTAL LABORATORY, INC.
P. O. Box 859
Coldspring, Texas 77331
(409) 653-3249 * (281) 350-4080
P. O. Box 631375
Nacogdoches, Texas 75963-1375
(409) 569-8879 * Fax (409) 569-8951

REPORT TO: **INVOICE TO:**

(1)		(2)		(8)
Company		Company		ANALYSIS REQUESTED
Address		Address		
Attn.		Attn.		
Phone #		Phone #		
Fax #		Fax #		
		P.O. #		
Sampler's Name (please print)		Sampler's Signature		
Project Number	(3) Project Name		(7) Containers	

(4) Sample ID	Date	Time	(5) C/G	DO	PH	Cl2	Flow	Temp	(6) Matrix	# Con	Size	Type	Pres

Relinquished By: (Signature)	Received By: (Signature)	Date	Time
Relinquished By: (Signature)	Received By: (Signature)	Date	Time

Remarks:

Received Iced: Yes / No

LAB USE ONLY

Checked In By: (Signature)	Date	Time	Logged In By:	Date	Time

White Copy-Follows Samples
Yellow Copy-Laboratory
Pink Copy-Client Copy

SEE BACK FOR INSTRUCTIONS

Appendix C. Corrective Action Report

Deficiency / Nonconformance / Corrective Action Report

Report No.:	Issued by:	Date Issued:

Description of deficiency	
Is the deficiency a nonconformance and why? (If yes, complete report. If no, indicate the date of closure.)	
Root cause of nonconformance	
Programmatic impact of nonconformance to include impact on existing TRACS data.	
Does the seriousness of the nonconformance require immediate reporting to the TCEQ? If so, to whom and when was it report?	.
Corrective action to address the nonconformance and prevent its recurrence.	
Proposed completion date for each action	
Individual(s) responsible for each action	
Method of Verification	
Date "Correction Action Report" Closed	

Appendix D. H-GAC's Data Management Process & Flow Chart

H-GAC's Surface Water Quality Data Management Process & Flow Chart

1. When the data manager receives field and laboratory data from individual local partners, all electronic files are saved in the partner's 'Raw Data' folder. The data may be in the form of Excel spreadsheets, Access tables, scanned field data collection forms, or files downloaded directly from field instrumentation. If data summary checklists have been submitted as electronic files, they are also stored in this folder. Hard copies of data, data summary checklists, calibration records, or other physical data are filed for subsequent data entry by H-GAC staff and for reference during the data review and validation process. In addition, receipt of the data is documented in the "CRP Data Tracking" database, currently found at Q:\CE\Clean Rivers\DATA\Data\CRP Data Tracking.accdb.

   No modifications or corrections are made to files in the raw data folders.

2. Raw data files are then copied to the partner's "Working Data" folder. All modifications to the data prior to SAS processing are performed on the files in the "Working Data" folder. Compilation of the submitted data, where necessary, is performed by the H-GAC data manager. This may involve manual data entry into an Access data entry form, re-formatting of Excel or Access tables, and other data management tasks as needed. In addition, identifying information such parameter names in the raw data files replaced by TCEQ parameter codes (specific information is found below). Because the measurement performance specifications found in the A7.1 table may vary from one QAPP to another, The working data file must not include data collected under two different QAPPs. The file may, however, contain information from more than one month within the fiscal year covered by an individual QAPP.

3. Field and laboratory data for specific sample sites (monitoring stations) are combined where necessary to create one record containing all observations made at the sample site. Because combination of field and laboratory records is most efficiently performed by by joining two Access tables on a common unique field, Excel tables may be imported into an Access 2003 database. In most cases, data are joined on equivalent monitoring station ID, sample date, and end depth values. If not already present in the datasets, the TCEQ monitoring station ID must be added, and the format of the date field must be consistent in the files to be combined.

   a. Note 1: this step is not necessary for City of Houston HHS and Harris County datasets.

   b. Note 2: The electronic data submitted by Eastex Laboratory must be transposed before combination with corresponding field data. This is most efficiently accomplished using SAS PROC TRANSPOSE.

4. The fields (columns) in the compiled dataset are renamed and reformatted to comply with SWQM data management guidelines. Consult the most recent version of the "Data

Management Reference Guide for Surface Water Quality Monitoring " for further information .

5. The fields containing sample site, sample date, sample time, and sample depth are renamed STATION_ID, ENDDATE, ENDTIME, and ENDDEPTH respectively.

6. The parameter names used by the partner are replaced by the TCEQ parameter code. Precede the code number with an "S" to ensure that the data is read into SAS files as text data.

    a. Example: The field or column for dissolved oxygen must be relabeled "S00300" prior to SAS processing.

7. The units of measurement as reported by the partner may not comply with SWQM guidelines. In most cases the SAS code will make the conversion to the correct units. If it is discovered that the code for conversion has not been written or is incorrect, or if the partner does not report the results consistently, manual conversion of the units may be necessary. In many cases, the SAS code will flag any records reported in the wrong units for other reasons (below or above screening values, for example), and the correction can be made using SAS.

8. If the SAS code does not include an algorithm for reformatting dates and times, the data manager ensures that these data are formatted as mm/dd/yyyy and hh:mm respectively.

9. Any parameters that are not included in the A7.1 table for the partner should be removed from the dataset. In most cases, the SAS code will simply omit the parameter from inclusion in the final datasets. It is preferable to modify the SAS code if unwanted parameters appear in the final dataset.

    Note: While references appear in this document to modification of the SAS code, these are for expository purposes only. The code should only be modified by a person who is very familiar with SAS programming in general, and the CRP processing code in particular.

10. When a database table(s) or Excel spreadsheet containing all field and laboratory data has been compiled and reformatted as described above, it is saved to the SAS input folder within the "SAS Data Processing" folder (currently at Q:\CE\Clean Rivers\DATA\SAS_Data_Processing) as an Access 2002-2003 database or an Excel 97-2003 file. Note that the version of SAS (9.1.2) in use at H-GAC cannot import or export Office 2007 file types. The input file should be renamed to include a code identifying the partner and the date range of the data.

11. As part of SAS processing, tables containing laboratory –specific quantitation limits, TCEQ minimum and maximum screening values, and site name / monitoring station ID correspondences are imported for comparison to the partner data. At the beginning of the

period under which a specific QAPP is applicable, the data manager ensures that the tables containing this information correspond (where applicable) to the A7.1 tables. The data manager updates these tables at other times as needed.

12. The data manager modifies the SAS program used for the partner's most recent dataset for processing of the current data.

    a. Open and save the SAS program with the same name as the new input file.

    b. Find all references to input and output files within the program, and replace them with the name of the new input file.

    c. Save changes to the program.

    d. Run the program through the step where "Flagged_Records_1" is created.

13. The SAS program creates a new Access database in the "Access" folder within the "SAS Data Processing" folder. The database should have the same name as the input file.

    a. The database contains at least two tables: The "Input_Data_Matrix" that contains all data in the input file, and the "Flagged_Records_1" table.

14. The data manager updates the "CRP Data Tracking" database to include the date of initial SAS processing.

15. The "Flagged_Records_1" table identifies questionable data that must be investigated by the data manager. The table is generated from comparisons against screening levels to identify outliers, quantitation limit tables to identify improperly reported data, and a variety of other comparisons. The program includes algorithms to identify the following:

    a. Reported values beyond TCEQ screening limits (outliers)
    b. Values reported as negative numbers
    c. Illegal values (e.g.,, results for qualitative parameters that are not in the range of allowed values)
    d. Reported orthophosphate that exceeds the reported total phosphate
    e. Total constituents below dissolved constituent
    f. TDS/conductance ratio outside 0.55-0.70
    g. TDS less than total hardness
    h. Nitrate+nitrite concentration is less than nitite concentration
    i. TDS less than chloride and sulfate;
    j. Inconsistent observed turbidity and water clarity results
    k. Inconsistent water surface and wind intensity results

16. The data manager is responsible for reviewing each flagged record against available raw data, data submittal checklists from the partner agency, instrument calibration records, and so forth, and where necessary obtaining additional information from the partner agency in order to determine the appropriate action to be taken. The flagged records table contains a variety of fields for documenting the disposition of the problem. In summary, a flagged record is accepted (on the basis of verification by the data manager), replaced with a corrected value, or deleted. A code is entered into the "Action" column, the "Verification Method" code is entered, and the initials of the responsible party are entered in the "Verified By" column.

    a. "Verification Method" codes currently in use are DR (document review) and PJ (professional judgment).

17. At present, there is a subset of data quality problems that cannot be identified or corrected using the flagged records table. It may be necessary to make changes to the input file to correct some errors and inconsistencies identified during subsequent review by the data manager or quality assurance officer.

18. All written communications with the staff of partner agencies that are made during the data verification process are printed and retained with the final data package that is retained by H-GAC. Records of telephone conversations are also retained..

19. Before changes are made to each data set, the data manager creates a "Data Summary Report/Sheet" for that specific data set. The data summary report is created from the most recent data summary report for that partner agency, and saved with the name of the current data set. All changes to the data and/or action taken on the data set are documented in this report. In addition, summary narratives discussing missing data, outliers that were verified and accepted, explanations of variations in reporting the data, failure to meet A7.1 LOQs, and so forth are also included. Pertinent information from the data submittal checklist submitted by the partner agency is also included in the final report. This report is submitted to TCEQ with each data set.

20. The data submittal checklist submitted by the partner agency is reviewed for the following, at minimum:

    a. If the quality control information included in the report indicates that data has been reported that did not meet the measurement performance specifications of the A7.1 tables, it will be removed from the dataset. The removal will be noted on the "Data Summary Report/Sheet."

    b. If the quality control information included in the report indicates that data has been reported that did not meet method-specific quality control criteria, the impact on data useability will be evaluated. Data may be removed from the dataset if legal defensibility is questionable. The removal will be noted on the

"Data Summary Report/Sheet."

c. The post-calibration error limits in the partner agency's data submittal checklist shall be checked against requirements, as well as raw calibration records if available.

d. Reports of missing data, and the reasons that the data is missing (QC failure, spilled sample, could not sample site, etc.)

21. The SAS program is re-run following action on all flagged records. The flagged records table is read back into the process, and a variety of new tables and files are created. The most important of these are the "Draft_Data_Matrix" and the pipe-delimited text files that are submitted directly to TCEQ.

    a. The portion of the SAS code that assigns TAG ID numbers is edited prior to generating the second group of tables and files.

22. The data manager queries a subset of data from the "Draft_Data_Matrix" table and reviews it against hard-copy raw data to check for random transcription errors. A sufficient number of records are selected so that when added to the flagged records previously evaluated, at least ten percent of submitted data has been verified against raw data. The query results are printed and retained with the data package as a record of data review.

23. The data manager creates and views a totals query of the "Draft_Data_Matrix" table to identify missing records that have not been addressed in the data summary report.

24. The data manager completes the draft data summary report, and updates the "CRP Data Tracking" database with the date the draft was completed.

25. The summary report is submitted to the quality assurance officer (QAO). The "Draft_Data_Matrix" and draft summary are reviewed by the QAO , who identifies all values that, in the QAO's judgment, are unreasonable, are unverified outliers, or are otherwise questionable. Written comments and concerns are returned to the data manager for further investigation and correction of the dataset (where warranted). Newly identified discrepancies are investigated, and documented on the data summary report.

26. The data manager reviews the written comments, takes the appropriate action, and documents any additional actions on the data summary report.. In most cases, the SAS program will be run at least one more time, although a new flagged records table is not routinely created. In the event there has been extensive modification of the input dataset, a new flagged records table may be created. The written comments from the quality assurance officer, with annotations by the data manager, are retained with the data package as a record of data review and modification (where applicable). The date of data

summary report approval is added to the “CRP Data Tracking” database.

27. The text files created by the SAS program and the final data summary report are then submitted to TCEQ by the data manager. The data is first submitted to the SWQMIS (database) validation algorithm to obtain a validation report; the files are then emailed to the CRP Project Manager at TCEQ.

    a. The data manager copies the event and result files to the desktop.
    b. Each file is edited to remove the header line (field names).
    c. The data manager logs into the SWQMIS system, and submits the files and data summary report as described in the SWQMIS user’s guide (http://www.tceq.state.tx.us/assets/public/compliance/monops/water/wqm/swqmis_users_guide.pdf , retrieved 8/10/2010).
    d. If the system identifies validation errors, upload is canceled and the validation errors are investigated and corrected. In some cases this may involve editing the text files only. If this option is selected, document changes to text files appropriately. It may be most convenient to document minor changes to the text files in the “Comments” section of the appropriate record in the “CRP Data Tracking” database.
    e. When no validation errors are found, the upload is completed, and a validator report is created and saved report (with a unique file name) as an html file.
    f. The data manager reviews the validator report to identify remaining discrepancies between the dataset, data summary report, and A7.1 table requirements that may have been missed. The appropriate actions, to include resubmission of the data to obtain a revised validator report, are performed.
    g. The text files, data summary report, and validator report are e-mailed to the CRP Project Manager.
    h. The validator report is saved in the "Data Review and Submission Docs” folder at Q:\CE\Clean Rivers\DATA\Data\Data Review and Submission Docs."

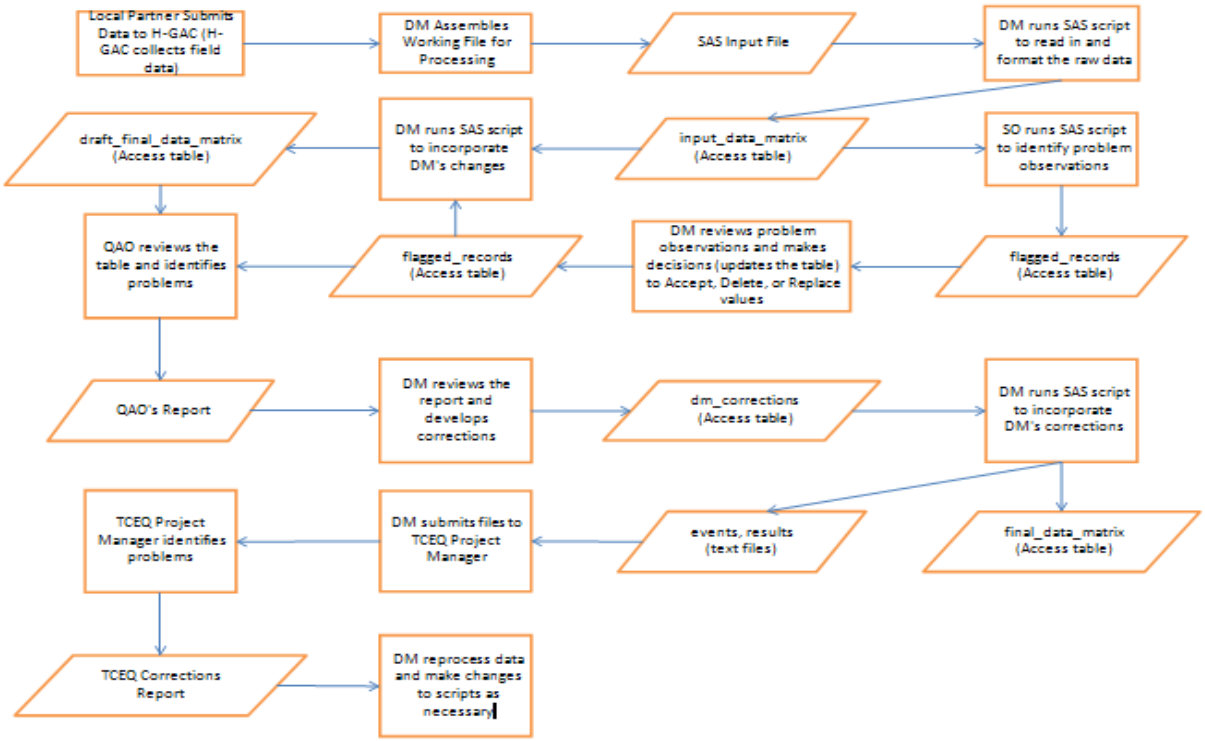
28. The data manager updates the “CRP Data Tracking” database to include the date the files were sent to TCEQ, and add hyperlinks to the data summary and validator reports.

29. If the CRP Project Manager identifies further problems with the dataset, the appropriate action is taken and revised datasets or data correction requests (where appropriate) are submitted. Written communications with the CRP project manager are printed and retained on file with the data package to serve as a record of validation and modification of the dataset.

30. When the dataset is accepted by TCEQ and loaded into SWQMIS, the data manager updates the “CRP Data Tracking” database to include the acceptance date.

31. All data management activities are documented in an Access database maintained by the Data Manager. The database contains details of receipt, processing, submission, and

acceptance by TCEQ, and includes hyperlinks to raw and final datasets, data summary reports, and data validation reports.



Data Management Plan

August 2011

HOUSTON-GALVESTON AREA COUNCIL
Community & Environmental Planning Department

Prepared in cooperation with the
Texas Commission on Environmental Quality
under the authorization of the Texas Clean Rivers Act

Table of Contents

Appendices **Page**

Introduction

The Data Management Plan (the Plan) outlines the standard policies and procedures for data management within the Community and Environmental Planning (C&E) Department. The Plan covers the management of both tabular (non-geographic) and spatial (geographic) datasets. Its primary purpose is to ensure the efficient access and maintenance of these datasets within the Department's Geographic Information Systems (GIS) and Data Clearinghouse environments.

GIS technology provides a systematic means to capture, manipulate, analyze, store and display spatially referenced data. GIS supports a wide variety of applications ranging from site assessments, environmental planning, urban planning, and spatial analysis to support organizational strategies. In general, GIS supports the overall departmental goals of guiding regional planning, enhancing the quality of the region's natural environment and public education through outreach programs.

The H-GAC C&E department maintains both an internal spatial data warehouse (SDE) and an external site for downloading publicly available data (Data Clearinghouse). The SDE serves as the primary repository for data, metadata and other information relevant to the activities and goals of the C&E department. Datasets determined to be viable for public use are exported to the Data Clearinghouse website, thereby allowing the general public widespread access to this information via the internet. Members of the public may view and/or download any of the datasets that are posted to the Data Clearinghouse without the limitations imposed by hardware, software packages and organization barriers. In some instances these datasets are used in web-based mapping applications that are also accessible via the clearinghouse.

The Plan is considered a dynamic working document which responds to changing technology, funding, staffing, and project requirements. Consequently, the Plan is reviewed on an annual basis and amended as necessary.

1. System Resources

Following is an explanation of the System Resources required to support data management efforts.

1A. Hardware

The configuration of the hardware used by staff that perform GIS and data Management work is a "distributed network." This network consists of several PC's which are connected to central file servers. The department also uses a central web mapping server for online mapping applications.

The hardware includes three Windows Servers, one for Data Clearinghouse efforts , one for long-term Data Storage for in-house access, and the third one for GIS web applications. A complete listing of departmental hardware is found in Appendix B1.

1B. Software

The software products currently used to accomplish the department's data management objectives are listed in Appendix B2.

1C. Personnel

The Data Management staff will be responsible for the maintenance and development of both the SDE database and Data Clearinghouse. These data management responsibilities cover a wide range from original data creation, acquisition and integration, data archiving and distribution. Additional responsibilities include enhancing the geographic extent, feature attributes, and metadata of the datasets and managing data distribution via options including the Internet, File Transfer Protocols (FTP), and CD-ROM technology.

The program is supported by three full-time and two hourly staff members, which support the program as well as other C&E programs. These staff members are part of the Socio-Economic Modeling program within C&E and provide data development, analytical, and web-based applications development support for program initiatives.

H-GAC's Data Services Department plays an indirect role in the implementation and maintenance of The Plan. The Data Services Department is responsible for managing the underlying hardware and network upon which C&E stores GIS data and implements GIS-based applications.

1D. Data

Department staff members will be consulted annually to determine priority needs for data management. Based on this consultation, specific data sets will be acquired or further developed for the various program areas represented in the department. The current list of department-specific data sets is shown in Appendix C1.

1E. Budget

Budgetary requirements to sustain data management efforts will be reviewed annually.

1F. System Schematic

The C&E Socio-Economic Modeling Program maintains a schematics representation of the data and applications architecture. This includes a list of datasets stored in the SDE and the Data Clearinghouse as well as access privileges to those datasets.

H-GAC's Data Services Department maintains a schematic representation of the agency-wide network. This includes network layout with basic hardware and software configurations for every personal computer in the agency.

2. Data Maintenance, Manipulation, and Use

2A. Quality Assurance/Quality Control(QA/QC)

QA/QC is designed to standardize screening, documentation, entry, output, analysis, correction, and updating of data in the system. QA/QC will document those responsible for data and system maintenance.

2A1. Data Limitations

Prior to the integration of data within the SDE and/or Data Clearinghouse, a review of the data set will be completed to determine predefined data limitations such as missing values, different sampling frequencies, multiple measurements, analytical uncertainty, censored or unavailable data, and duplicated data with existing data sets. After review of the data set, a report will be generated which records any errors detected and any corrections that may be necessary.

2A2. Data Entry Protocol

Specification of appropriate protocols for data entry, including standardization of data input and conversion.

2A2a. Data Input

Standard conventions for data input will be determined on a per project and or individual data set basis. To ensure Year 2000 Compliance, all data sets with date/time fields will include a four-digit year (YYYY). Either of the following formats will be used: International Standard Date notation where the date field is represented as MM/DD/YYYY (Month/Day/Year), or an ordinal format where the date field is represented as YYYYDDD.

2A2b. Data Dictionary and Metadata

Dictionary of data definitions and descriptions of all data sets, and attribute items.

A Data Dictionary and Metadata resource will be established to provide any data user with a full description of the data sets within the SDE/Data Clearinghouse. These resources provide detailed information such as data completeness, currency, intended use, coverage precision and projection system, annotation, and item types with definitions and related codes.

2A2c. Data Conversion

A standard method for converting data to agency formats.

Data to be imported into the GIS/Data Clearinghouse from hard copy, digital or by manual data entry, will follow a uniform conversion protocol to comply with the structure of current data sets. The type of data being converted will determine the protocol.

2A2d. Coordinate Systems

The Texas Stateplane Coordinate System, North American Datum 1983 (NAD83) will be the standard for geographic data at H-GAC. This coordinate system is based on the Cartesian coordinate system or rectangular coordinates. When receiving geographic data from other sources the data will be transformed into the Stateplane Coordinate System to ensure compatibility with current data sets.

When publishing mapping services for use in web-based GIS mapping applications, the Web Mercator Auxiliary Sphere projection is used for all Data Frame projections. However, the underlying GIS data within these mapping services still use the Texas Stateplane Coordinate System, North American Datum 1983 (NAD83) projection.

2A3. Data Validation

2A3a. Data Quality Control

When data are received from any source, documentation will be created to include the source name, date received, format of data and a brief description of the contents. Data will be loaded onto the system from the media received and a review of the data will be made along with any corrections being made to the source documentation. An analysis will be made in order to determine the means of data entry into the system whether it is only a stand-alone database, a number of linked tables, or a geographic database. The data will be converted to the appropriate format for integration with the current system whether it is a conversion into MS Access, Excel, or ESRI ArcGIS. The data will be visually examined to determine its validity and accuracy. If the data is invalid it will be corrected (if possible) otherwise the data will be incorporated into the SDE/Data Clearinghouse and used in conjunction with existing data. A QA/QC report of all procedures and a detailed description of how the data was incorporated into the current system (from the date received to the date of integration) will be generated.

2A3b. Equipment Quality Control

<u>One Windows 2000 Server</u>
This server houses a portion of the Department's data clearing house and serves as an ftp server.

<u>Two HP1055CM Plotter</u>
The Data Services Departments of H-GAC maintains an HP1055CM plotter which is available for use by C&E Department staff. Cleaning and maintenance are completed on an as needed basis.

<u>HP2500CM and LaserJet 4M Printers</u>
The C&E Department maintains both the HP2500CM and LaserJet 4M Printers. Cleaning and maintenance are completed on an as needed basis.

Global Positioning System (GPS) Units
The C&E Department possesses two GPS units.

HP Scanjet 7400c
The CEP Department owns one network-accessible HP scanner.

Brother Intellifax 4750e
The C&E Department owns one fax machine

2B: Genealogy
Upon receipt of data from outside sources, all data will be screened for integrity and completeness. After the preliminary evaluation of the data, a log of the data source, type and completeness is created and maintained with the associated data. A description of the data and the responsible personnel are documented.

2C. Migration/Transfer
A copy of every C&E generated GIS dataset will be housed in the C&E SDE which C&E GIS staff manage the contents and structure of datasets. The underlying hardware and network connections for the SDE are maintained by the Data Services Department. Datasets that are of public interest will be placed in the Clearinghouse for public access. Transfer from the SDE to Data Clearinghouse will occur on an as needed basis following department QA/QC measures.

2D. Data Security
GIS and tabular data will be secure through directory permissions. H-GAC will employ Firewall or Proxy Server Technology to filter and severely restrict access to internal networks and database systems. Virus protection will be implemented to ensure system and data integrity.

2D1. Archives/Backup
H-GAC's Data Services Department will backup and archive C&E data at regular intervals.. A backup will be performed daily and the tapes will be maintained for 8 weeks before they will be recycled. Every six month, a complete system backup will be performed and the tapes will be archived and kept for five years off-site for security.

2D2. Disaster Recovery
H-GAC's Data Services Department will be responsible for Disaster Recovery.

3. Client Services

3A. Programming
Programming services will be provided on an as needed and resource available basis. All programming efforts will follow a standard procedure from needs assessment, program planning, development and testing, to refinement and documentation. The principal programming languages to be used in task automation and project customization will depend on the nature of

the need and the current state of the technology. At this time, all web-based GIS applications are developed using the ESRI ArcGIS Server platform and user interface components to that platform are developed using the Adobe Flex API.

3B. Training

Training for all users of the system is a critical part of *The Plan*. C&E staff directly responsible for data management will attend conferences, seminars, and software/hardware training courses as needed. H-GAC users of the system will be trained and/or receive technical support by the data management staff.

3C. Data Access

Data placed on the Data Clearinghouse will be available to those with Internet browsing and/or FTP capability. Data requests from staff from other agencies and the general public will be evaluated on an individual basis. When the data requests are received, a preliminary evaluation of the deliverable will be determined and a timeline and cost if applicable will be provided to the requesting agency or individual.

3D. Documentation

Documentation related to data management efforts such as system evolution, structure, and procedures for use will be compiled and made available for the end user. Documentation will be made available online and in hard copy format.

Appendix A1

SAMPLE DATA SOURCE INFORMATION SHEET

Data Title:

Source Agency:
Contact:
Title:
Address
Phone:

Data Description:
Data source:
Date created:
Accuracy:
Media:
Data items:

Description of data:

Format (specify what software)
Map:
Tabular:
Image:
Text:

Retrieval Procedure:

Command(s):

Appendix A2

Data Log Sheet

Date received: _____

Report Prepared by: _____

Source Name and Phone: _____

Format: _____

Media: _____

Check the following steps to determine the validity of the data:

1. What is the extent of the geographic area? _____
_____

2. Structure (Circle One) Vector Raster

3. Scale? _____

4. Projection and Datum? _____

1. Do any of the key fields have missing values? If so which parameters have missing values? Yes ___ No ___
_____
_____
_____
_____

2. Any known duplicate records? Yes ___ No ___

Appendix B1

HARDWARE

This is a listing of a Departmental Windows-based Server Hardware.

1. NTCEIS01 - Windows 2008 GIS Web Application Server

Model: HP Proliant BL460c G6 Blade
CPU: Quad-Core Intel Xeon X5560 (2.80 GHz, 8M Cache)
Memory: 8GB
Internet Address: 204.65.99.189
Serial #: USE936RV4S
Hard Drive: 300GB
OS: Windows 2008
Purchased: January 2010.

2. NTIS04 – Windows SQL Server

Model: HP Proliant DL 380 G3
CPU: Single Intel Xeon 2800
Internet Address: 204.65.99.240
Memory: 1GB
Serial #: D313LDN1L122
Hard Drive: C = 16 GB, D=66 GB
OS: Windows 2000 SP 4
Purchased: April 2003.

Appendix B2

SOFTWARE

Word and Data Processing
Microsoft Office Pro (2007) - *Word, Excel, Access, Powerpoint, publisher, Infopath and Outlook.*

Graphics and Desktop Publishing
Macromedia Fireworks 4
Adobe Illustrator (v8.01) – *Graphics*.
Adobe Photoshop (v5.0) **–** *Graphics.*
Corel Draw (v7.0) - *Graphics.*
Quark Express (v5.0) - *Desktop Publishing*.

Paintshop Pro (v. 4.12)

World Wide Web Browsing and Development Software
Internet Explorer (v7) – *Primary Development Tool.*

Programming
Visual Basic (v6.0) – *Web Mapping Development Tool.*
MS Active Server Pages (v2.0) – *Web Database Development Tool.*
Adobe Flex Builder (v4.0) – *Web-based GIS application development tool.*

Geographic Information System

ESRI ArcGIS desktop (v10) – *Computer mapping and database manipulation capable of using ArcView, ArcInfo, and ArcEditor licenses as needed.*
ESRI ArcGIS Server (v10) – *Internet Mapping Application Server.*

Data Management
Access (2007, 2010) - *Relational Database.*
SQL Server(2000) - *Relational Database.*

Operating System
Windows XP - *PC working environment/Operating System.*
Windows 7 - *PC working environment/Operating System.*
Windows 2003 & 2008 - Server Operating Systems.

Appendix C1
Data List

Tabular Data Sets

Ambient Surface Water Quality Monitoring
Wastewater Self-reporting Data
Parcel-Based Land Use, Attributes, and Valuation (9 counties)
Census Data

Base Data Layers

Incorporated Cities & Census Designated Places
U.S. Census Blocks, Block Groups, Tracts, Urbanized Areas, and MSA
Election Precincts
City Ordinance, Zoning, Comprehensive Plans
County Boundary
Major Roads and Highways
Local Streets & Roadways (StarMap product)
Current Land Use (9 counties)
Forecasted Parcel-Based Land Use (7 counties)
Parks and Natural Areas
Eco-Logical Features
USFWS Wetlands
Farmland
Parcel Boundaries (9 counties)
TIRZs
Zip Codes
School Districts
Rivers (Surface Hydrography, Linear)
Lakes (Surface Hydrography, Polygon)

Recycling and Solid Waste Management Data Layers

Solid Waste Management Facilities
Closed Landfill Inventory
Recycle Center Locations

Water Data Layers

Watershed and Basin Boundaries
CRP Monitoring Station Locations
FEMA Designated Floodplains
USGS Flow Gages
OSSF Permit Locations
Wastewater Treatment Plant Outfall Sites
Wastewater Treatment Plant Service Area Boundaries
Aquifer Recharge Zones
Bio Monitoring Sites
USGS Steam Gauges
Seal Level Rise Model (1 to 35 Feet)
MS4 Permit Areas

Raster Datasets

Landcover 2008
Landcover 2002
NLCD Land Cover 2001, 2006

Appendix C2

Data Dictionary

Data Dictionary
Houston-Galveston Area Council
Community and Environmental Planning Department

General Information		
Thematic Layer Name		
Feature Class		
Topology		
Table Name		
Data Source		
Report Prepared by		
Phone	Fax	E-Mail

Attribute Table				
Variable	Begin Column	Item Name	Alternate Name	Item Definition

Data History
Source Agency
Originating Date
Originating Scale

Status Information
Percentage Complete
Planned Completion Date
Geographic Extent
Planned Enhancements

Known problems or limitations

Maintenance Information
Maintaining Office/Division/Section
Contact Name
Contact Telephone Number
Type of updates performed
Frequency of Updates

Data Format Information
Data Format
Software/Version
Number of features/records
Total File Size

Projection
Geographic Projection:
Spheroid:
Zone:
Datum:
Units:
Fips Zone:
Quadrant:
X Shift:
Y Shift:
1st Standard Parallel:
2nd Standard Parallel:
Central Meridian:
Lat. of Projection Origin:
False Easting:
False Northing:

Additional Documentation
Quality Assurance Quality Control
Attribute Reports Available
Additional Documentation Available