

Source Water Susceptibility Assessments

Addendum #6

(Revision 1)

to the

Quality Assurance Project Plan for the Texas Commission on Environmental Quality Public Water System Supervision Program Relating to the Safe Drinking Water Act

(Revision 13)

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List of Acronyms


Acronym	Definition
API	area of primary influence
CA	corrective action
COC	contaminant of concern
DSG	Data Support Group
DSS	decision support system
DWQT	Drinking Water Quality Team
DWTRT	Drinking Water Technical Review Team
EPA	Environmental Protection Agency
GIS	Global Information System
GPM	gallons per minute
GPS	global positioning system
GW	groundwater
OW	Office of Water
PSOC	potential sources of contamination
PWS	Public Water System
PWSS	Public Water System Supervision
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QMP	Quality Management Plan
SDWA	Safe Drinking Water Act
SDWIS	Safe Drinking Water Information System
SOP	standard operating procedure
SSGW	spring seepage and groundwater
SWA	Source Water Assessor
SWAP	Source Water Assessment and Protection
SWDM	Surface Water Data Manager
SWP	Source Water Protection
SWPP	Source Water Protection Plan
SWSA	source water susceptibility assessment
TCEQ	Texas Commission on Environmental Quality
TDIR	Texas Department of Information Resources
USGS	United States Geological Survey
WSD	Water Supply Division

A1 Approval Page – PWSSP QAPP, Addendum #6

The following individuals are signatories on this Programmatic Quality Assurance Project Plan (QAPP) Addendum because they are responsible for the direct oversight, oversight of Source-Water Susceptibility Assessments (SWSAs) (e.g., TCEQ managers and above, environmental protection implementation, and quality assurance (QA) of the Texas Commission on Environmental Quality (TCEQ) SWSAs. Other individuals involved within the TCEQ are also signatories on the Programmatic QAPP of which this addendum is a part.

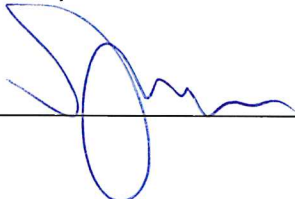
Patrick Kading, Team Leader

TCEQ/ Office of Water (OW)/Water Supply Division (WSD)/Drinking Water Special Functions Section (DWSFS)/Drinking Water Inventory and Protection Team (DWIP)

Signature:  Date: 9-19-19

Sean Ables, P.G., Special Assistant, Source Water Assessor (SWA)

TCEQ/OW/WSD/DWSFS

Signature:  Date: 9-19-19

Gary Regner, Public Water System Supervision (PWSS) Program QA Manager

TCEQ/OW/WSD

Signature:  Date: 9/13/19

A2 Table of Contents

List of Acronyms	2
A1 Approval Page – PWSSP QAPP, Addendum #6	3
A2 Table of Contents.....	4
A3 Distribution List	5
A4 Project/Task Organization	5
A5 Problem Definition/Background	6
A6 Project/Task Description	6
SWSA Components	7
A7 Quality Objectives and Criteria	8
SWSA Quality Objectives	8
A8 Special Training Requirements/Certification.....	9
A9 Documents and Records	9
B1 Sampling Process.....	11
B2 Sampling Methods	11
B3 Sample Handling and Custody.....	11
B4 Analytical Methods	11
B5 Quality Control	11
B6 Instrument/Equipment Testing, Inspection, and Maintenance.....	12
B7 Instrument Calibration and Frequency.....	12
B8 Inspection/Acceptance Requirements of Supplies and Consumables	12
B9 Non-Direct Measurements	12
B10 Data Management.....	12
C1 Assessments and Response Actions	13
Corrective Actions (CA)	13
Authorization to Stop Work	14
C2 Reports to Management.....	14
Status Reports	14
SWSA Reports.....	14
Maps	15
D1 Data Review, Verification, and Validation.....	15
D2 Validation and Verification Methods	15
D3 Reconciliation with User Requirements	17

A3 Distribution List

The following individuals will receive a final copy of this Programmatic QAPP Addendum and its subsequent revisions. Other individuals involved with SWSAs, for example TCEQ managers and above and the Environmental Protection Agency (EPA) are included on the distribution list and will receive a copy of this addendum as part of the Programmatic QAPP distribution, or if revisions are made during interim annual reviews.

QAPP Recipients	Title	Contact Information
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A4 Project/Task Organization

The following individuals participate directly in the data acquisition, management, assessment, and reporting of source water data and information for the WSD. A description of roles and responsibilities is included. Roles for other individuals (e.g. Division Director, Section Manager) are described in the Programmatic QAPP.

Jessica Hoch, PWSS Program Lead Quality Assurance Specialist

Coordinates development and implementation of the QA program for the PWSS Program. Responsible for development and management of the QAPP, coordinating, monitoring, and reporting on corrective actions, and providing assistance and communication to program staff in areas of QA.

Jacolyn Saldaña, DWIP Team Leader

Supervises the DWIP which manages the Source Water Assessment and Protection (SWAP) Program. The SWAP Program receives and manages applicable data and performs source water susceptibility assessments for drinking water sources to determine their susceptibility to contaminants.

James LaManna, DWTR Team Leader

The Team Leader oversees the Data Support Group (DSG) which helps maintain the Safe Drinking Water Information System (SDWIS) and SWAP databases, extracts information to update upper management, program support, and public information requests.

Sean Ables, P.G. , Special Assistant, SWA

Serves role of SWA oversight for this project. Performs monthly quality control (QC) on data, runs assessments, and generates assessment reports.

A5 Problem Definition/Background

The Safe Drinking Water Act (SDWA) amendments of 1996 (Section 1453) required states to prepare a SWSA for Public Water Systems (PWSs) to protect them from contamination. The amendments required the determination of source water for each PWS, the origin of any contaminant of concern (COC), and the susceptibility of the public water system to COC exposure. The *State of Texas Source Water and Protection Strategy* was finalized in 1999. In 2003, the TCEQ sent out SWSA Reports to more than 6,000 PWSs, representing more than 18,000 surface-water intakes or groundwater wells and 247 individual COCs. In 2004, the TCEQ began a rotating schedule for SWSAs wherein one-third of PWSs statewide were assessed annually or sooner if protection-program activities deemed it necessary. Maintenance and enhancement of SWSA software ended in 2011 and the SWP program transitioned to a voluntary program with several dozen systems being evaluated annually. TCEQ is currently working to revive its source water assessment program software by either updating the pre-existing SWAP-DSS software or identifying existing commercial-off-the-shelf products available.

Work performed in support of SWSAs can be considered environmental data operations as defined by the TCEQ Quality Management Plan (QMP) and *EPA Requirements for QAPPs, EPA QA/R-5*. As such, the QA processes regarding organization, planning, implementation, and assessment must be addressed in a QAPP which is reviewed and approved by the EPA. This document is written as an addendum to the PWSS Programmatic QAPP to facilitate its management, review, and future revision.

A6 Project/Task Description

The TCEQ developed its current assessment approach (*Source-Water Susceptibility Assessment in Texas: Approach and Methodology, 2011*) with the help of the United States Geological Survey (USGS) and a technical workgroup based on assumptions that both natural processes and human activities contribute to the susceptibility of a system to COCs. SWSA components (as indicated in the table below) are determined and/or calculated using the SWAP-Decision Support System (DSS) software. Under each of the assessment components (with the exception of Delineation), a relative susceptibility rating of high, medium, or low is produced. The software uses over 100 attributes or indicators to develop the components for each PWS. Source results are combined based on capacity (when a PWS has multiple sources), and the results are combined into a single SWSA for the PWS. The information from the SWSA is used by the TCEQ to develop a SWSA Report. The SWSA Report provides maps and information about the susceptibility rating of the water system to contaminants. SWSA Reports also include a list of options for implementing a SWAP as well as a list of options for making the material available to the public.

SWSA Components

The TCEQ work flow for completing a SWSA involves (1) receipt of PWS engineering plans; (2) management and input of source water data (e.g., water source location, capacity (pumping) data, well construction data) into the SWAP Access and the SDWIS databases (See Section B10); (3) verifying that the data are complete, consistent, and accurate; (4) loading the data into the SWAP-DSS; (5) completing each assessment component; and (6) generating the SWSA Report. The TCEQ uses work instructions to complete these tasks. The work instructions and their purpose are listed in Section A9.

This Programmatic QAPP Addendum addresses the environmental data collection efforts involved with the management of data received from the PWS for each new assessment, the assessment activities, and the development of the SWSA Report. This Programmatic QAPP Addendum does not address the management of the base data layers (e.g., aquifer data including porosity, thickness, materials, water quality data, potential sources of contamination, soil data, hydrologic data, climate data, etc.) that are intrinsic to the assessment software which was developed in 2003 under its own QAPP. This Programmatic QAPP Addendum is also not designed to address the development of the Source Water Protection Plan (SWPP) which is an outreach activity for the TCEQ and not an environmental data operation.

Table A6. Source Water Susceptibility Assessment Components

Component	Explanation
Identification of Sources	Uses the source location and the hydrogeological or hydrographic properties to delineate the source area(s) for the intake or well. Under the identification component, a susceptibility rating is produced for groundwater sources only and is based on well structural integrity.
Delineation	Delineates water source area(s) based on hydrogeological or hydrographic properties identified under the identification component.
Intrinsic Susceptibility	Estimates the degree to which intrinsic factors such as climatology, soils, and topography cause the intake or well to be more or less susceptible to contamination. Produces susceptibility ratings for each assessed COC for the well or intake.
Non-Point Source susceptibility	Evaluates and/or models non-point sources as potential sources of contaminant exposure. Produces susceptibility ratings for each assessed COC for the well or intake.
Point Source Susceptibility	Estimates whether potential sources of contamination or permitted discharge-associated COCs are likely to affect the well or intake based on physical properties of the COC and of the aquifer or contributing watershed. A susceptibility determination is made by comparing the estimated final concentration at the well or intake from all point/area sources, after COC attenuation, to the TCEQ-established COC threshold. Produces susceptibility ratings for each assessed COC for the well or intake.
Contaminant Occurrence	Identifies COC detections above TCEQ-threshold values at water quality monitoring and finished water sites near the intake or well. If COCs are detected above the threshold, a "High" susceptibility rating is assigned. Produces susceptibility ratings for each assessed COC for the well or intake.
Source Susceptibility Summary	Combines all component ratings into a summary assessment for the intake or well. Produces susceptibility ratings for each assessed COC. SWSAs produce both a source susceptibility summary and a system susceptibility summary.

Table A6. Source Water Susceptibility Assessment Components

Component	Explanation
System Susceptibility Summary	For a public water system with multiple intakes or wells, combines all source summary component ratings into a summary assessment for the system. Produces susceptibility ratings for each assessed COC.

A7 Quality Objectives and Criteria

The overall quality objective of the PWSS Program as described in the Programmatic QAPP is to fulfill the requirements of the SDWA to ensure that water produced and distributed by PWSs is safe to drink. Consequently, as the state’s environmental agency, the TCEQ can provide better protection of the health of all Texas citizens currently served by the PWSs and all those who consume water from the systems.

SWSA Quality Objectives

The goal of all quality objectives related to SWSA activities undertaken by the TCEQ is to manage data and information of a known and verifiable quality that will meet the overall objectives of the SDWA, and to assess source water data and report SWSA results which will enable public water supply systems, consumers, and others to initiate and/or promote actions to protect their drinking water sources.

The following data quality objectives apply to source water assessments. A combination of management oversight, staff training, available and well-defined guidance, TCEQ Standard Operating Procedures (SOPs) for managing data and performing SWSAs, quality control of data and information, peer reviews, and data security processes ensure the data quality objectives are met.

Accuracy

Accuracy is a reflection of correctness. To be accurate, SWSAs must be unique to each PWS, logical, and representative of the real world. This ensures source water protection efforts are targeted to actual sources of contamination.

Comparability

Comparability refers to the degree in which methods or data sets are considered to be similar under similar circumstances. SWSAs must be comparable to ensure consistent procedures over time so that changes in results reflect changes in source water components.

Completeness

The completeness of the data is basically a relationship of how much of the data or information is available for use compared to the total potential data. Assessments must contain all the requisite data and components to produce a meaningful assessment report. For example, the assessment software requires certain elements (e.g., screen interval, pump rate, etc.) to run properly. Without this information, conservation assumptions are assigned and high susceptibility ratings may result.

Representativeness

Representativeness refers to the degree to which the data and information accurately represent a specific variable in the population—how well the data reflects the conditions where it was collected.

Data Integrity

SWSA data and information are managed in such a way to ensure the confidentiality, integrity, and availability of data and information. Data management policies and procedures ensure data and information are recoverable and only used for their intended purposes.

Compliance

All TCEQ requirements associated with SWSAs have been developed to be consistent with state rules and federal regulations pursuant to the SDWA. This ensures all compliance and enforcement actions taken by the TCEQ are fair and justifiable.

A8 Special Training Requirements/Certification

The individuals specified below have had specialized training in the subject matter related to this project in order to successfully manage and assess Source Water Assessments described in this document.

Jacolyn Saldana, Team Leader

General TCEQ training and experience for the team leader is described in the Programmatic QAPP. The Team Leader attends annual training for professional development provided by vendors, trade associations, and senior staff which the team leader may attend. The Team Leader has five years of regulatory experience in public drinking water for the States of Texas.

Sean Ables, P.G., Special Assistant, SWA

The SWA Special Assistant is vendor-trained and has extensive experience in geospatial concepts and use in “agency” Global Information System (GIS) software, map/photo interpretation experience and understanding of cartographic concepts. He has also attended the Federal Geographic Data Committee (FGDC) Geospatial Metadata Workshop.

A9 Documents and Records

The documents and records that describe, manage, instruct, and report source water data and assessment activities are listed in Table A9.

Table A9. Documents and Records for the Source Water Data and Assessment Activities

Document or Record	Purpose	Format/Location
<i>QAPP for the PWSS Program Relating to the SDWA</i>	<i>Programmatic QAPP</i> describes quality assurance requirements and activities of the PWSS Program designed to ensure necessary quality and quantity of drinking water in Texas as well as compliance with the SDWA.	Electronic https://www.tceq.texas.gov/assets/public/permitting/watersupply/pdw/qapp/PWSSP_QAPP_Programmatic_Rev13.pdf
<i>TCEQ PWSS Program–SWSA QAPP Addendum #6</i>	Project specific addendum to the overall <i>Programmatic QAPP</i> that addresses QA processes for engineering plan review and approvals to plan, implement, and assess associated activities.	Electronic https://www.tceq.texas.gov/assets/public/permitting/watersupply/pdw/qapp/PWSSP_QAPP_Addendum6_Rev1_SWAP.pdf
<i>TCEQ QMP, Current Version</i>	TCEQ document that describes the organizational arrangements, processes, procedures, and requirements of the TCEQ QA Program	Electronic https://www.tceq.texas.gov/assets/public/compliance/compliance_support/qa/qmp.pdf
<i>The State of Texas Source Water and Protection Strategy, 1999</i>	Describes the SWAP Program including SWSAs which: (1) identifies the areas that supply public drinking water (2) delineates the boundaries of the assessment area, and (3) inventories the potential sources of contamination within the assessment areas, It also describes the SWPP which: (1) informs the public of results and (2) implements a SWPP.	Electronic https://www.tceq.texas.gov/drinkingwater/SWAP/index_swa.html
<i>SWSA in Texas: Approach and Methodology, 2011</i>	Describes the current component approach implemented in the SWAP-DSS computer software to produce SWSAs.	Electronic https://www.tceq.texas.gov/drinkingwater/SWAP/index_swa.html
<i>SWSA Using SWAP-DSS Software-Work Instructions</i>	TCEQ instructions used to calculate the susceptibility assessment for PWS sources.	WSD Network drives
<i>SWAP Data Input-Work Instructions</i>	TCEQ instructions that outline the processes involved in using the dbSwapEntry database.	WSD Network drives
<i>PWS Source Water Data for Incoming Plans-Work Instructions</i>	Provides a checklist of steps for entering PWS source information into the SDWIS database obtained from incoming plans from the Utilities Technical Review Team (UTRT).	WSD Network drives

Table A9. Documents and Records for the Source Water Data and Assessment Activities

Document or Record	Purpose	Format/Location
Completed SWSA Reports	SWSA reports describe the SWSA methodology, presents the results of the source water assessment, and explains how the results can be used including how to develop SWPPs. SWSA Reports are maintained as an agency record.	Hardcopy In SWAP files and Central Records per the agency archival procedure. Currently, assessment result summaries are displayed on TCEQ Drinking Water Watch website http://www.tceq.texas.gov/DWW
SWSA data		Electronic Located on the TCEQ server \\tceq4avmgisdata\giswrk\SWAP
SW documents from Engineering plans	Documents from engineering plans (e.g., well reports, cementing certificates, geophysical logs, maps, etc.) serve as SWSA records.	Hard copy Maintained in SWAP files and Central Records per the TCEQ archival procedure

B1 Sampling Process

Not applicable

B2 Sampling Methods

Not applicable

B3 Sample Handling and Custody

Not applicable

B4 Analytical Methods

Not applicable

B5 Quality Control

The TCEQ reviews and approves SWSA data and reports to ensure adherence to the quality control objectives described in Section A7. As stated in Section A7, a combination of management oversight, staff training, available and well-defined guidance, TCEQ SOPs for managing data and performing SWSAs, quality control of data and information, peer reviews, and data security processes ensure the data quality objectives are met. Quality control checks such as positive and negative controls, etc. which apply to the analysis of environmental samples are not applicable to this project. Data are checked for accuracy, completeness, compliance, etc. at various stages within the assessment process. These checks are considered to be reviews for the sake of this project and are discussed in Section D2.

B6 Instrument/Equipment Testing, Inspection, and Maintenance

Not applicable

B7 Instrument Calibration and Frequency

Not applicable

B8 Inspection/Acceptance Requirements of Supplies and Consumables

Not applicable

B9 Non-Direct Measurements

Not Applicable

B10 Data Management

The TCEQ SWDM uses electronic Work Instructions as referenced in Section A9 to manage source water data and information. This includes removing applicable paper documents (e.g., State of Texas Water Well Report, Cementing Certificate, USGS topographical maps, geophysical logs, etc.) from the PWS engineering plan packets, reviewing for completeness and accuracy, and storing the information in electronic and hard copy formats. Data contained within the documents are entered into the appropriate fields in both the SDWIS and SWAP databases. All paper documents to be archived in the SWAP files are labeled with the complete assigned water source code.

The SWAP database was created using Microsoft Access (version 2003 or more recent) and is used to store source water data from the engineering plans as described above. The SWDM has read/write access to the TCEQ server location <R:\tceq4avmgisdata\giswrk\SWAP>. The database name is <R:\DATA\Data_Entry\dbSwapEntry.mdb>. Data entered into the SWAP database include, but are not limited to, well depth, site location, drill date, aquifer type, construction details, static water levels, well site geology, horizontal data, pumping rates, etc.

SDWIS is also used to store source water data from the engineering plan documents. This data includes the following:

- name of the drinking water source
- physical location
- depth and status of well
- TCEQ source water code
- owner's source ID
- source type
- physical address
- rated/tested pump capacities

- activity/availability status
- treatment status
- locational data
- flow connections source/plant/EP/ distribution

There is some redundant information in the two databases and approximately once per week the data are "reconciled" (i.e. migrated from the SWAP database to SDWIS) to ensure the data in each database are both correct and identical. SDWIS is maintained by the TCEQ. The physical server is located at the Data Services Center, administered by the Texas Department of Information Resources (TDIR) and maintained by Xerox. Access to SDWIS is restricted and users must be added by both the SDWIS Administrator and the TCEQ Database Administrator. The SWAP-DSS software loads the datasets from the SWAP database and SDWIS that are required to run an assessment and copies the completed assessment datasets to active, archive, and complete folders. Each PWS has its own folder, for example sys_1234567, and each source under this folder is named src_G1234567A. The TCEQ SWAP-DSS software uses ESRI™ ArcGIS. The input software for SWAP-DSS is loaded on local GIS PCs. The SWA has read/write access to the TCEQ server location <R:\tceq4avmgisdata\giswrk\SWAP>. The SWAP-DSS software is incompatible with the current version of GIS software used by the TCEQ. The TCEQ is currently researching an alternative.

C1 Assessments and Response Actions

Corrective Actions (CA)

In accordance with the *TCEQ QMP*, any person involved with work described in this Programmatic QAPP Addendum is responsible for reporting and correcting deviations from required or standard protocols specified in this document and/or referenced documents.

Most deviations are corrected by project staff using established procedures defined in SOPs that include documentation of problems, solutions, resolution implementation and follow-up. These deviations are documented at the point of origin and maintained with the applicable project records.

Unique problems that cannot be corrected by established procedures will require corrective actions (CA) to be defined and documented in a CA report when the need arises. Upon detection of a unique deviation, staff are responsible for notifying supervisory staff in writing. Managers (or designees) are responsible for assuring that CA reports are prepared within 14 days and forwarded to the PWSS Program Lead Quality Assurance Specialist. Managers (or designees) are responsible for assuring that CAs are selected and implemented that will most likely eliminate the problem and prevent recurrence. Managers (or designees) are also responsible for assuring that CA reports are prepared, reported, implemented, and tracked appropriately.

CA reports must include the following:

- Description of the problem - how it was identified and the date identified
- Programmatic or Data Impact(s)

- Root cause
- Corrective action taken
- Actions implemented to prevent recurrence
- Timelines for implementation of corrective actions and actions to prevent recurrence
- Individuals responsible for implementing actions, ensuring corrective actions are implemented, and verifying the effectiveness of actions
- Who prepared the report
- Signatures and dates that includes a manager

The PWSS Program QA Manger determines whether the deviation is significant as defined by any of the following:

- It jeopardizes the integrity of results or conclusions
- Results in non-conformance with state or federal regulations
- Was associated with the intentional misrepresentation of data or information

CA reports documenting significant deviations must be forwarded to the PWSS Program Federal Grant Manager, the TCEQ QA Manager, and affected Deputy Directors within 30 days. The PWSS Program Lead Quality Assurance Specialist tracks and monitors the results of significant corrective actions to ensure effectiveness. Appropriate staff may be designated to implement and track corrective actions that are not deemed significant.

Authorization to Stop Work

TCEQ management will authorize work stoppage if conditions are identified that indicate compliance is in jeopardy or if primacy requirements are not being met. The PWSS Program Lead Quality Assurance Specialist, TCEQ QA Manager, or TCEQ Grant Manager may also request a work stoppage.

C2 Reports to Management

Status Reports

The dates of assessments are recorded in the SWAP database and are used by the Team Leader and the Section Manager to report status to upper management.

SWSA Reports

The SWSA report has been generated with the DSS up until the current version of GIS software became an issue as noted in Section B10. When an updated version of the DSS is developed, new SWSA reports will be created. The SWSA Report included:

- An introduction and overview of the source water assessment methodology
- Information on the public drinking water system and its drinking water source(s)
- A brief summary of the assessment results listing the contaminants for which the system has been determined to have a high or medium susceptibility rating.
- Detailed results of the assessments including component scores for contaminants with high or medium susceptibility ratings for each source of drinking water for the system.

- Maps of drinking water sources and potential sources of contaminants (PSOCs) identified within and around the delineated assessment areas.
- A list of the 227 identified drinking water contaminants used within this assessment.
- Count of PSOCs located within the assessment area.
- Information on how to use the assessment results through the TCEQ SWPP.

Maps

The PWS well capture zone maps that come with the SWSA Report are unique to each PWS. The capture zones are created using computer algorithms based upon the hydrogeology of the area and each respective well's construction. When some of this information is missing, a half-mile diameter circle, a fixed radius is automatically delineated as the capture zone.

The PWS intake capture zone maps consist of the area of primary influence (API) and the watershed. Nearby PWSs may share the same API and/or watershed. The API is based upon a 1000-foot buffer from a waterbody shoreline. It may extend upstream for PWS intakes drawing from rivers or streams. How far upstream the API extends depends upon a two-hour time of travel. The API boundaries are determined by characteristics that are specific to the TCEQ source water assessments. The API applies the same characteristics for boundary determination for each PWS. The watershed boundaries are determined by the natural topography specific to the particular PWS being assessed.

D1 Data Review, Verification, and Validation

For the purpose of SWSAs, verification refers to the evaluation of completeness, correctness, conformance/compliance of the source water data, information, and reports with regulatory and procedural requirements to determine exceptions. In general, validation extends the evaluation of data beyond regulatory and procedural requirements (i.e. data verification) to determine their acceptability so they can be qualified appropriately. Situations do not exist with SWSAs in which data, information, or reports are validated and then qualified for subsequent use.

D2 Validation and Verification Methods

The process for reviewing documents submitted with engineering plans is described in the procedure entitled *SWAP Data Input–Work Instructions* (Section A9). There are many records and documents within the engineering plans, a number of which (e.g., State of Texas Water Well Report, Cementing Certificates, USGS topographical maps) contain critical information necessary for a SWSA. Upon receipt, the SWDM manually reviews the plan contents to ensure they are complete. The SWDM also checks to be sure the contents belong to the PWS listed on the cover letter(s) or memo and double-checks the PWS name, county, and PWS ID with the SYSMSTR table. At this point, the PWS ID and Plan Review log number are entered into the form along with the date received, date complete, staff initials, type of information received, and any necessary remarks. The SWDM is regularly assigned new plans for data review and entry. Staff initials are used to make sure individual staff members can only enter data for their assigned projects, ensuring the uniqueness and integrity of data for each PWS.

A key aspect of the manual plan review is to verify the Water Source ID and whether one has previously been issued. The SWDM checks the most recent sanitary survey, the SDWIS and SWAP databases, and the entire PWS folder in the SWAP files. If an ID has been assigned, it is used. If no source water ID has been assigned, the next sequential water source is used and entered in both SDWIS and SWAP databases. All paper documents are then labeled with the assigned source code ID and filed in the SWAP files. At this point, source water information related to groundwater, surface water, operational status, and location are entered into the SWAP and SDWIS databases.

Data are verified by the SWDM during the data entry process as described in the *SWAP Data Input-Work Instructions and PWS Source Water Data for Incoming Plans-Work Instructions*, respectively. These work instructions prescribe a number of manual and electronic checks throughout the data entry process. For example, when entering data in the SWAP database, the SWDM manually checks certain information against other records like locations, static water level, well geology, surface attributes, pump information, etc. Manual checks are essential to the running of the assessment software and the SWDM has to electronically certify that all information is complete and accurate as it is being entered.

Electronic functions of the SWAP database are also key to ensuring accurate, valid, and complete data. Sub-forms are used to view (not edit) data and forms are used to edit data. After data are edited, the process key must be clicked which activates QA/QC processes including a number of referential integrity checks. If the data meet objectives, the data in the original table are deleted and replaced with new information. If the data do not meet objectives, a message will appear describing the error. The database facilitates the input of accurate data by the use of look up tables which ensure consistency by limiting fields to only allowable and reasonable values.

Once per month, tables in the databases are checked against each other by the SWAP Program Assessor to ensure links are working. Tables are also reviewed for missing information and certain fields are limited to set values to ensure consistency. These tables include information detailing well depth, well construction, well geology, organic waivers, and well locations. Locational data are then reviewed for valid ranges of latitude and longitude and missing fields are populated if necessary. This facilitates the quality of data in SDWIS. The review of data is handled in the SWAP Access database and then the data are migrated into SDWIS.

To review and verify the assessment results, the SWA Special Assistant completes the following steps after the source water susceptibility assessment is completed.

1. Determines if the delineation appears to be accurate and correct. If a well record has all of the necessary information (depth, gallons per minute (GPM), screened interval, location, etc.) and the well location falls within a major/minor aquifer, then a capture zone should have been created. The half-mile circle will be used for non-major/minor aquifers or wells with missing information.
2. Checks the size of the capture zone to see that it is sized properly, based on confined/unconfined conditions and well pump rate. An example of a typical error is entering a well's pump rate of 10 GPM as 100 or 1000; in which case,

the capture zone would be too large. The Edwards Aquifer and alluvial wells are exceptions since these will use different approaches, including watersheds.

3. Reviews the source summary tab listed in the spring seepage and groundwater (SSGW) column. Sorts the values by left clicking the column heading to search for all of the HIGH susceptibility contaminants. Checks each of the contributing columns to determine what made the source susceptible.
4. Reviews the system summary tab listed in the Susceptibility column. Repeats the process listed in the previous paragraph to determine what made the contaminant susceptible.
5. Reviews the map control element for point source to determine if PSOCs are identified. Questions what role these PSOCs played in the assessment.

If this review indicates the assessment has errors, the entire file must be deleted and the assessment rerun. When the software detects that an assessment has already been run, it does not overwrite the existing data. If the data meet objectives, the data in the original table are deleted and replaced with new information. If the data do not meet objectives, a message will appear describing the error. The database facilitates the input of accurate data by the use of look up tables which ensures consistency by limiting fields to only allowable and reasonable values.

D3 Reconciliation with User Requirements

If there are any issues with the SWSA after it is completed, the Assessor will attempt to determine inconsistencies or errors in the attribute data. If inconsistencies are found in the quality of the base data, an effort will be made to identify and obtain more accurate base data. If the results do not meet the project's requirements, the data may be reassessed to determine why the data quality did not meet the goals.

Limitations of the data are discussed in the assessment report. For example, if data for a particular attribute could not be obtained, default values may be used instead. If the PWS thinks the mapped well location(s) or any other aspect of the source water assessment report are incorrect, they are encouraged to submit a location change request to TCEQ using the instructions on the TCEQ website.