North Harris County Regional Water Authority

Surface Water Transmission and Distribution System Program

WRF Design Guidance Manual

July 2026 / FINAL

carollo
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Abbreviations

AMI	advanced metering infrastructure
Authority or NHCRWA	North Harris Count Regional Water Authority
BODR	Basis of Design Report
CGP	Construction General Permit
CIP	Capital Improvement Plan
City	City of Houston
EDF	Environmental Data Form
EFR	Engineering Feasibility Report
GRP	groundwater reduction plan
GST	ground storage tank
HCED	Harris County Engineering Department
HCFCD	Harris County Flood Control District
HGSD	Harris-Galveston Subsidence District
LAS	liquid ammonium sulfate
LONO	Letter of No Objection
mg/L	milligrams per liter
MUD	municipal utility district
NTP	notice to proceed
PER	Preliminary Engineering Report
SCADA	supervisory control and data acquisition
SIC	Specialty Instrumentation Contractor
SUE	Subsurface Utility Engineering
SWIFT	State Water Infrastructure Fund for Texas
SWPPP	Storm Water Pollution Prevention Plan
TCEQ	Texas Commission on Environmental Quality
TPDES	Texas Pollutant Discharge Elimination System
TWDB	Texas Water Development Board
WRF	water receiving facility

CHAPTER 1 PROGRAM CONCEPTS

1.1 Introduction

The North Harris County Regional Water Authority (Authority or NHCRWA) was created by the 76th Texas Legislature in 1999 and confirmed by a special public election in 2000. The Authority's mission includes finding and assuring a long-term supply of quality drinking water at the lowest responsible cost. The Authority is also charged with promoting water conservation and maintaining regulatory compliance. In 1999 the Harris - Galveston Subsidence District (HGSD) published its Regulatory Plan, which was updated in 2013 and 2021, requiring the area to reduce groundwater withdrawals to not more than 20 percent of total water demand by the year 2035. Since no individual municipal utility district (MUD), other private and/or public utility district (hereafter also referred to as MUD), or well owner had the ability to convert to surface water on their own, the Authority has become the single entity to negotiate for a secure, long-term supply of drinking water for all the municipal utility districts, small municipalities, and other permitted well owners within its boundaries. Perhaps the most critical task in achieving this goal is to develop and construct the infrastructure to bring that water to the political subdivisions within the boundaries of the Authority.

The Authority adopted a three-phased approach (Program) to meet the HGSD mandates:

- Phase I consists of the infrastructure needed to meet the HGSD 2010 mandate of 30 percent Alternative Water and is often referred to as the "2010 System".
- Phase II expands and continues to build upon the Phase I infrastructure and includes the additional infrastructure components to meet the 2025 mandate of 60 percent Alternative Water.
- Similarly Phase III is the planned infrastructure expansion to meet the HGSD 80 percent Alternative Water mandate for 2035.

The Authority has capacity in the raw water, treatment, and transmission system facilities owned by the City of Houston (City). The Authority has contracted to receive up to 144 million gallons per day from the City's Northeast Water Purification Plant via three-meter stations. The Authority then rechlorinates (if needed) and pumps the water received at the meter stations into the distribution system. The Authority's wholesale distribution system sends the water to each connected MUD water receiving facility (WRF) into their onsite storage tanks. MUDs are then responsible for rechlorinating (if needed) and sending out to their own retail customers.

The Authority's Rate Order stipulates what the Authority and the MUDs are responsible for constructing, operating, and maintaining; however, interlocal agreements may supersede the rate order.

In general, for WRFs constructed before 2025, the Authority is responsible for constructing all necessary improvements to convert the WRF to surface water. This includes the Authority's assets (piping upstream of meter station, meter station, flow control valve station, and Authority supervisory control and data acquisition [SCADA] panel) as well as some MUD assets (piping downstream of flow control valve station and chloramination system, if required).

For WRFs constructed after 2025, MUDs are responsible for ensuring the new WRFs are ready to receive the Authority's surface water, including the chloramination system, which is further detailed in the current Rate Order. The Authority is then only required to construct the Authority assets (piping upstream of meter station, meter station, flow control valve station, and Authority SCADA panel) to connect to the MUD's system.

The Authority only constructs what is necessary for surface water conversion. If a MUD requests additional improvements above and beyond what is necessary for surface water conversion, the Authority could include those in the conversion project via interlocal agreement with the MUD bearing the costs for the additional improvements.

The Authority's current Rate Order can be found on the website, under the "Water Rate Documents" section. (Available here: https://www.nhcrwa.com/docs/).

The Authority must prioritize which WRFs get connected to surface water to make the conversion cost effective. It is the expectation of the Authority that all connected WRFs will utilize 100 percent surface water (except for emergency and excusable maintenance conditions) so that other more distant WRFs do not need to be connected to the surface water system, keeping the cost of the surface water conversion program as low as possible for as long as possible.

The Authority's has successfully pursued and obtained funding for many projects from the Texas Water Development Board (TWDB) State Water Infrastructure Fund for Texas (SWIFT). The SWIFT was created by Texas Legislature to provide affordable, ongoing state financial assistance for projects in the state water plan. Through the SWIFT program, the Authority has been able to obtain low-interest loans to fund the projects needed to meet the legislative mandates.

1.2 Purpose

This Design Guidance Manual is written to assist the Authority's WRF Design Engineer in the design of each new WRF being connected to the Authority's distribution system, to provide facilities that are consistent in quality and arrangement. This document will detail the areas of primary concern during the design of these facilities. There is a companion design manual that stipulates requirements for linear projects. In the event that a Project has both elements or does not fit into either category, both manuals may be applicable.

1.3 Program Team Members

The Program Team consists of the Authority, the Program Manager, the WRF Design Engineers, various Support Services Consultants, and other selected consultants. The members of the Program Team share a common goal of providing the Authority with those improvements necessary to distribute the surface water supply. The Program places great demands on all members of the team to complete their assignments as scheduled and in compliance with the needs and requirements of the Program.

This Design Manual is intended to assist in the accomplishment of this mission. It is a "living" document subject to modification and refinement as the design definitions and developments continue to take shape. Users of these materials are encouraged to submit any suggestions or comments they may have to the Authority. The roles of the Authority, the Program Manager and the WRF Design Engineer, are discussed below.

1.3.1 Responsibilities of the Authority

The Authority retains authority over operational decisions of the system, regulatory compliance, funding and long-term asset management. The Authority staff are actively engaged in the success of the Program; however, given the sheer volume of projects, the Authority staff may not be involved in day-to-day execution of projects. When needed, the Authority will enlist the Program Manager to complete the day-to-day project oversight and management activities on the Authority's behalf. In such cases when the Authority staff are not actively managing a given project, WRF Design Engineers should refer all Authority-related communications to the Program Manager who will coordinate Authority reviews and approvals in a streamlined manner.

For each project, the Authority will specifically provide:

- Project Definition and Contract Authorizations:
  - The Authority will define project objectives, performance goals, and service requirements. The Authority will establish project budget, funding source(s), and schedule constraints as needed to meet legislative requirements. Additionally, the Authority will Authorize the project scope, design changes, and contract amendments. The Authority will execute and manage agreements with utility districts as needed to complete the project.
  - WRF Design Engineers requiring contract authorizations and/or modifications must obtain written approval from the Authority as follows:
    - The Authority Engineering Manager must authorize the use of Additional Services and may approve budget reallocation requests between tasks, so long as there is no increase to the upper limit for a given contract.
    - The Authority General Manager is the only person who can authorize increases to the upper limit for a given contract.
  - All requests from the WRF Design Engineer for budget reallocations, the authorized use of Additional Services, and/or increases to the upper limit of a given contract must be first reviewed by the designated project point of contact for the Program Manager. The Program Manager will then review and transmit the request to the applicable Authority staff.
- Regulatory compliance:
  - The Authority must maintain overall compliance with Texas Commission on Environmental Quality (TCEQ) and other applicable rules. Specific permitting requirements and regulatory requirements for WRF projects are detailed in Section 1.4.
- Operations and Maintenance:
  - The Authority must operate and maintain facilities related to the delivery of water to each WRF and have a contract operator to support these efforts. The Authority will retain ownership of the waterlines to each WRF and the meter station and flow control valve station. Equipment and piping downstream of the flow control valve station (as specified in the Rate Order) is the responsibility of the MUD receiving surface water (also termed the "Converted Entity").

1.3.2 Responsibilities of the Program Manager

When assigned by the Authority, the Program Manager has an active and central interaction with all members of the team. The Program Manager will administer all aspects of the WRF Design Engineers'

work on behalf of the Authority, including the general management and administrative services necessary to assist the Authority in coordinating and expediting the completion of the Program.

The Program requires that multiple, separate design and construction projects be handled within schedule and cost constraints. Each individual project's scope of work will include detailed design and various supporting activities, which are necessary to accomplish a well-designed project. The successful performance of these services will enable the Authority to advertise and award construction contracts to complete the water system.

The Program Manager will maintain effective control and overview of the engineering assignments through a comprehensive system of cost, schedule, and performance monitoring. Additional Program Manager responsibilities are defined below:

- Maintaining Program Standards:
  - The Program contains multiple construction packages scheduled over multiple years. It is in the best interests of the Authority that these packages present a uniform description of the proposed improvements. The Program Manager is responsible for maintaining and updating periodically the Authority's design standards, graphic standards, standard specifications, and standard details.
- System-Wide Conversion Coordination:
  - When multiple projects are required to complete a phase of the surface water conversion program, the Program Manager is responsible for the overall sequencing, coordination, and cohesiveness of the individual projects. This includes the planning of larger system startup and commissioning efforts.
- Regulatory Coordination and Approvals:
  - For projects funded by TWDB, the Program Manager will lead the coordination and stage-gate (i.e. milestone) approvals required by TWDB throughout the project lifecycle.
- Other Administrative Support Activities, including:
  - Coordinate with the Authority and Board; invoice review/processing; general oversight of all projects.
  - Assist and support the Authority as necessary to manage and implement the Authority's goals and objectives.

1.3.3 Responsibilities of the WRF Design Engineer

The WRF Design Engineer is responsible for technical design, regulatory support, and professional judgement consistent with applicable codes and standards. The specific tasks to be performed by the WRF Design Engineer are defined in the WRF Design Engineer's authorized Scope of Services. These tasks will not be repeated here, but reference is made to that document. The principal role of the WRF Design Engineer is defined as follows:

"Prepare design drawings (Drawings), Specifications, Design Report(s), calculations, and other supporting documents covering this project and incorporate into the Bidding and Contract Documents. The Drawings and Specifications are to be prepared in accordance with Authority's Standard Specifications, Standard Details, and Contract Documents and shall incorporate design concepts and criteria, standard design, and graphic standards as provided or required by the Authority."

It is emphasized that it is the WRF Design Engineer's responsibility for producing project-specific deliverables that incorporate applicable standards and details, meet applicable rules and regulations, while exercising professional engineering judgment to address site specific conditions.

The development of detailed project plans and documents depends on the periodic submission of essential project data and information by the WRF Design Engineers to the Authority. Standard design, document formats, monthly reports, design reviews, monthly invoices, and such similar requirements form a part of the administrative procedures the WRF Design Engineer shall adhere to.

WRF Design Engineers are ultimately responsible for signing and sealing the permitting, bidding, and contract documents. In doing so, the WRF Design Engineer is certifying that they have reviewed the Authority's standard specifications and details and are assuming responsibility for the use of those standards on the project. WRF Design Engineers are responsible for notifying the Authority if project-specific modifications are recommended to the standards in order for the WRF Design Engineer to seal said standards.

In carrying out these essential services, the WRF Design Engineer shall coordinate their design efforts, drawings, and details with the Program Manager (when designated by the Authority); the waterline WRF Design Engineers involved in projects adjacent to or connecting to the project; and such public agencies, utility companies, and other parties as may be required to successfully complete the project. For TWDB funded projects, the WRF Design Engineer will need to incorporate into the Contract Documents provisions required by TWDB as provided by the Authority and/or the Program Manager. Additional information on TWDB SWIFT program requirements can be found here: https://www.twdb.texas.gov/financial/programs/swift/index.asp

Additional responsibilities of the WRF Design Engineer are as follows:

- Management of any subconsultant services, including survey and geotechnical engineering.
- Coordination with Converted Entity, MUD Engineer, and Authority Contract Operator.
  - The WRF Design Engineer shall coordinate as necessary (via phone calls, emails, site visits, meetings) to understand the Converted Entity's system, and to obtain input and agreement on design concepts and deliverables throughout the project at each design milestone. The Converted Entity and/or their MUD Engineer must approve the design documents as specified in the Authority's Rate Order. Additionally, the Authority's Contract Operator must also review and approve the proposed design for which they will be responsible for operating and maintaining in the future. The WRF Design Engineer shall coordinate at set milestones with each of these entities to obtain input on the design and the final approvals necessary prior to construction.
- Basis of Design Report (BODR) and Engineering Report:
  - The WRF Design Engineer shall prepare the Basis of Design and Engineering Reports as outlined in this document.
- Construction Documents:
  - The Program contains multiple construction projects scheduled over multiple years. It is in the best interests of the Authority that these projects present a uniform description and depiction of the proposed improvements. The WRF Design Engineer is responsible for incorporating the Authority's latest version of design standards and graphic standards in the construction documents.

  - The WRF Design Engineer is also responsible for ensuring that based on coordination with the Converted Entity, the construction documents include all stipulations, mandatory requirements, and required construction sequencing. This information should be included in Specification Section 01110 - Summary of Work.
  - The WRF Design Engineer shall incorporate information from other program consultants into the various design documents, including tree protection and cathodic protection.
- Quality Control:
  - The quality control of the project is the responsibility of the WRF Design Engineer. The WRF Design Engineer shall establish a project specific quality management plan to guide the engineer's efforts in meeting the quality required by the Authority. This includes review of any subconsultant work products.
  - Additionally, the WRF Design Engineer shall designate one or more quality control reviewers, independent from the design team prior to beginning the design effort. Quality reviews shall be performed at each milestone deliverable prior to submission to the Authority. A copy of the review comments generated by the quality control reviewer(s) shall be saved in .pdf format and available to the Authority upon request.
  - As part of quality control, the WRF Design Engineer is to walk the project prior to each milestone deliverable. The purpose of the site visits is to verify accuracy of the survey and assess design requirements; to verify the appropriateness of the design; and to identify changes to the site that may have occurred since the initial topographic survey and walk-through.

1.4 Regulatory Coordination and Approvals

Regulatory coordination and approvals are required for every Authority project.

Responsibilities of the WRF Design Engineer generally include the following:

- Identify the agency/entity that will require coordination and resolve the specifics of the design with the applicable agency.
- Obtain approvals from the identified agency/entity, where required, in the form of Letters of No Obligation (LONOs) and/or permitting approvals. This may include TCEQ, Harris County/ Harris County Flood Control Department (HCFCD), the City, and any other relevant agencies.
- Include the Program Manager in all communications with the various agencies, including invitations to all meetings.
- Document all communications with the agencies in the Authority's electronic document management system.
- Keep the Authority apprised of the status of the approval process involving pertinent agencies until such time as final approval is granted.
- Incorporate any environmental permitting requirements into the design documents.
- For projects designated to receive SWIFT funding, compliance with TWDB requirements by the WRF Design Engineer is necessary for the Authority to obtain TWDB approval for construction documents. Note, all TWDB coordination will be performed by the Program Manager.

The Authority and Program Manager are responsible for the following tasks related to permitting and agency approvals:

- Obtain Program-wide exceptions and/or variances from the Authorities Having Jurisdiction. Note, project-specific exceptions and/or variances need to be obtained by the WRF Design Engineer.
- Support the WRF Design Engineer's permitting approvals and variance requests as needed throughout the design project life cycle.
- Lead all coordination efforts with TWDB.
- Lead any necessary environmental permitting efforts with USACE, USFWS, TPWD, THC, etc.

1.4.1 TCEQ Approvals

The WRF Design Engineer shall have full responsibility for preparing, submitting, and obtaining approval of the WRF design from TCEQ. The WRF Design Engineer shall design in conformance with TCEQ rules and regulations.

1.4.1.1 Previous TCEQ Coordination on Authority Project Disinfection Requirements

A meeting was held with the TCEQ on July 12, 2016 to discuss the design and installation of chloramination equipment at each WRF. A copy of the Meeting Minutes from this meeting can be found in Appendix A.

The discussion began with the history of how the existing NHCRWA WRF's chloramination systems had been designed. All current existing systems were designed based on the surface water being treated the same as groundwater. The Authority was able to document with historical data that while providing a significant portion of the water demand to the WRFs, they were able to maintain an adequate chloramine residual sufficient to meet the needs of the purchasing water systems (greater than or equal to 2.0 milligrams per liter (mg/L), 99.32 percent of the time based on historical data). As a result, this has led to a lack of use of the surface water and groundwater well chloramination systems located at the WRFs and a degradation of the disinfectants being stored at WRFs.

The TCEQ agreed that sizing the chloramination systems to achieve the additional disinfection levels necessary to "boost" the disinfectants to the desired distribution residuals based on a starting point of 2.0 mg/L for surface water would be appropriate. The additional disinfection needs would be documented with the Plan submittals as part of the Preliminary Engineering Report (PER) prepared by the WRF Design Engineer. The historical data supporting the higher starting point can be found in Appendix B. An updated version of Appendix B will need to be included as an attachment with the WRF Design Engineer's PER.

The TCEQ also stated that the following requirements would need to be included in the WRF Design Engineer's Plan and PER submittal:

- Provide calculations to support the sizing of the disinfection systems, as well as the separation distance between the chlorine and liquid ammonium sulfate (LAS) injection points.
- Disinfection systems will be allowed to be designed with shared chemical tanks and shared spare chlorinators and metering pumps, as long as the equipment can feed the surface water and groundwater lines separately.
- The control of the dosing for the disinfection systems will need to be flow paced based on the actual flow of water for both surface water and groundwater.
- At a minimum, the control of the dosing for the disinfection system for surface water will also need to include input from the analyzers sampling the water.

- Three sample points will need to be provided in the surface water and groundwater supply lines. These sample points shall be located before the first injection point, between the two injection points, and after the second injection point.

1.4.1.2 WRF Design Engineer TCEQ-Related Design Requirements

Based on the requirements outlined in the previous section, the WRF Design Engineer shall:

- Coordinate with the MUD engineer and/or MUD operator to determine preferences for the chlorine residual leaving the plant, system layout, and equipment utilized.
- Design a flow meter that is capable of sending an instantaneous flow signal to the Converted Entity Control Panel.
- Design the sample and chemical injection points required by the TCEQ.
- Verify that the existing WRF Control Panel can receive signals from the flow meters and analyzers and control the dosing of the disinfection chemicals. If not, include this in the design.
- Prepare a process schematic detailing how the disinfection systems will be incorporated into the groundwater supply.

Note, historically TCEQ has not accepted design submittals for review/approval that involve more than one WRF site. WRF Design Engineers should be prepared to assemble individual permitting submittals for each WRF site in their scope of services. The Converted Entity's MUD Engineer must also review and approve all applications to TCEQ that involve their systems prior to submittal to TCEQ. Once TCEQ approves the project, all relevant documentation must be provided to the MUD Engineer for their records.

1.4.1.3 TWDB Approvals

The Program Manager is responsible for all coordination with TWDB, if the project is receiving TWDB funding (as is the case with most linear projects on the Program).

The Program Manager is responsible for:

- Collection of information required to complete the Environmental Data Form (EDF).
- Coordination with applicable environmental permitting agencies prior to submittal of the EDF.
- Submittal of the EDF and the Engineering Feasibility Report (EFR) for review and approval by TWDB.
- Requests for funding disbursements from TWDB.
- Request for approval to advertise the project (approval of the Issued for Bid documents).
- Request for approval to award the contract.
- Request for approval to issue the Notice to Proceed (NTP) for construction.
- Request for final inspection
- Submittal of contract closeout documents.

The WRF Design Engineer will support the Program Manager as needed with the development of these documents and incorporate relevant TWDB conditions into the contract documents.

Note, the EDF and EFR are typically reviewed and approved during the planning or early design development stage. If changes arise during detailed design, it may trigger a need to resubmit the EDF

and/or EFR for review and approval with the updated design elements. Any revisions to the EDF and/or EFR must be approved by TWDB prior to submittal of the plans and specifications for TWDB approval to advertise the project. The Program Manager is responsible for monitoring the applicable changes and seeking the approval for the EDF and EFR in a timely manner so as not to impede submittal of the plans and specifications to TWDB for approval to advertise.

1.4.1.4 Environmental Permits

Depending on the project scope and existing site conditions, environmental permits may be required. The Program Manager and/or an Authority-identified specialty consultant will identify environmental conditions that exist along the planned pipeline alignment at the early design development stage. The Program Manager will work with the WRF Design Engineer to utilize Nationwide Permits and/or modify the design, if possible, to avoid the environmental impact. If the impact is unavoidable, the Program Manager will coordinate permitting approvals with the applicable environmental agency.

WRF Design Engineers must reflect all applicable environmental permit requirements within the plans and specifications.

1.4.1.5 Harris County

The WRF Design Engineer is responsible for complying with all relevant Harris County requirements in the design. This may include detention requirements if a project involves enough impervious surface. This may also include fire code requirements pertaining to site-wide fire lanes and/or new chemical building(s).

After incorporating all Harris County requirements into the design, the WRF Design Engineer is responsible for preparing and submitting applications for approval to the Harris County Engineering Department (HCED) and HCFCD as required to obtain applicable approvals.

Additionally, Section 27 of the Harris County RULES OF HARRIS COUNTY, INCLUDING THE HARRIS COUNTY TOLL ROAD AUTHORITY, A DIVISION OF HARRIS COUNTY, AND THE HARRIS COUNTY FLOOD CONTROL DISTRICT FOR THE CONSTRUCTION OF FACILITIES WITHIN HARRIS COUNTY AND THE HARRIS COUNTY FLOOD CONTROL DISTRICT RIGHTS-OF-WAY provides the requirements for seeking a variance for any utility within HCFCD facilities that does not fully comply with the Harris County rules. The WRF Design Engineer is required to prepare back-up documentation for any variance, if needed. Submission of a variance must be done in consultation with the Authority.

It is recommended that all WRF Design Engineers coordinate with Harris County at interim milestones to better understand permitting requirements prior to submittal of the final "Issued for Permit" or 100 percent design set.

1.5 Expectations of the Converted Entity

General expectations of the Converted Entity include:

- Adhere to all TCEQ requirements for the blended water system, including development of a Nitrification Action Plan.
- Serve as the legally responsible entity for public notification of disinfection changes, Consumer Confidence Reports, and emergency notifications and boil water advisories. It is imperative that

customer notifications be sent out at the onset of the project (at the Contractor's NTP), and 14 days prior to transitioning to chloramines.

- Follow the requirements in the "Distribution System Preparation to Receive Surface Water" Technical Memorandum (Provided in Appendix C of this document).
- Provide existing system data if requested, including as-built records, water quality records, demand and pressure data, and other relevant distribution system information.
- Provide site access to WRF Design Engineer and their subconsultants during the design phase and to the construction personnel during construction.
- Provide easements within the MUD property as needed for the meter station and flow control valve station.
- Review and provide comments on WRF Design Engineer design deliverables in a timely manner. The Authority's rate order indicates a 30-day review period.
- Coordinate internally with governing board, staff and stakeholders; and coordinate externally with chemical suppliers as needed.
- Coordinate/participate with the Authority during disinfection conversion and startup, commissioning and final acceptance. This includes:
  - performing flushing activities.
  - draining ground storage tanks (GSTs).
  - ensuring chemicals are on-site prior to startup.
  - making operations staff available for start-up activities, including training, startup, and substantial completion walk-throughs.
- Operate and maintain facilities after acceptance, including distribution system flushing and monitoring; and management of chemical procurement and storage (chlorine and ammonia).

Additional expectations of the Converted Entity are in the latest version of the NHCRWA Rate Order located on the Authority's website and/or any Water Supply or Interlocal Agreements between the Authority and the Converted Entity.

CHAPTER 2 SURFACE WATER DISTRIBUTION SYSTEM DESIGN CRITERIA

The Authority is required to implement a phased Groundwater Reduction Plan (GRP) to meet the HGSD conversion mandate. Through the GRP, the Authority must determine which WRFs are the most cost effective for program to keep costs as low as possible for all of the GRP participants. The Authority prioritizes WRFs based upon the 2014 GRP Update, the Master Plan, and the annual Capital Improvement Plan effort. For any given MUD in the GRP, all, some, one, or none of their water plants may get connected to the Authority's surface water distribution system.

If a MUD's water plant is identified for conversion, the Authority anticipates that water plant to utilize 100 percent surface water unless one of the following criteria are met:

- Authority surface water is unavailable.
- The MUD has an emergency situation.
- The MUD requires the surface water system to be offline for periodic maintenance activities (i.e. system flushing, free chlorination periods, exercising well pumps).

Once a MUD is connected to surface water, it is required to notify the Authority if any of these extenuating circumstances occur that requires the MUD to utilize groundwater. Otherwise, the expectation is that the connected water plant will not utilize any groundwater when surface water is available.

WRF Design Engineers are critical in helping the Authority achieve this goal and must understand both the Authority's system design limitations as well as each WRF's unique characteristics to maximize surface water utilization.

The Program Manager has developed a Master Plan for the Authority that includes demand projections and a calibrated system model of existing and anticipated future conditions. The demand forecast and system model is routinely updated as situations change and more information is known. The WRF Design Engineer should understand the assumptions within the current demand projections and system model, as well as the WRF site needs, and convey any differences to the Authority and the Program Manager for further evaluation.

To develop the current hydraulic model, the following were completed during the Master Planning effort:

- Historical water use was reviewed for various spatial planning units across the Authority's service area.
- Demand forecasts were developed for each spatial planning unit based upon historical water use and growth projections as developed by Zonda at various milestones (current/2025, 2035, 2045, and system buildout in 2075).
- Historical water use analysis and demand forecasting predict that Converted Entities will utilize significantly more water under hot/dry (drought) conditions than during average weather conditions.
- The Authority established system design criteria to meet the conversion mandate under average weather conditions, allowing for the use of groundwater to supplement a Converted Entity's water

demand under hot/dry (drought) conditions. Therefore, the Authority's system is not oversized to meet extreme weather conditions since all users have at least partially redundant water supplies.

- These average weather forecasts were utilized in modeling future system conditions.

Below are the resulting system design criteria as established by the above-detailed Master Planning efforts. Actual system design pressure conditions and peaking factors may vary at select locations.

Table 1 Pressure Conditions

Pressure	psi
Designed Discharge Pressure into NHCRWA Distribution System	≤ 100 psi
Range of Delivery Pressures at Point of Transfer between NHCRWA and MUD systems (first flange after FCV)	35 – 85 psi

Table 2 System Design Peaking Factors (average weather conditions)

Demand	Peaking Factor
Peak Hour Demand to Average Daily Demand (Authority system into the WRF GST)	2.85
Max Day Demand to Average Daily Demand (Authority system into the WRF GST)	1.5

Prior to initiating the design, the Program Manager will provide the WRF Design Engineer with the average, max day, and peak hour demands assumed for each WRF to be connected to the Authority's system.

The WRF Design Engineer must coordinate with the MUD engineer to determine their actual annual average estimate for current and future demands as well as their maximum day conditions by water plant. This may differ from the numbers in the Authority's current Master Plan.

The Authority will strive to deliver maximum daily demand to each connected entity under average weather conditions. For peak hour demands, the Converted Entity is responsible for sizing storage and pumping systems to maintain the minimum system pressures. Peak hour demands on the MUD's retail distribution side may very well exceed the peak hour demands on the Authority's wholesale distribution side.

WRF Design Engineers should evaluate if the Authority's peak-hour-demand delivery rate, when coupled with the delivery window into the WRF GST(s), is able to sustain the peak hour demand from the WRF without supplementing with groundwater. This analysis should be reviewed with the Authority and Program Manager concurrent with establishing the Basis of Design, further discussed in Chapter 3: WRF Design Requirements.

CHAPTER 3 WRF DESIGN REQUIREMENTS

WRF Design Engineers are responsible for developing a system at each WRF that will deliver enough surface water to meet WRF current and future demands, provide satisfactory rechlorination for the MUD, and include both automatic and manual control of surface water and groundwater deliveries into the WRF GSTs. The following sections detail specific design elements for the design project life cycle.

3.1 BODR

3.1.1 General

The purpose of the BODR is to document the conceptual design, assumptions, and cost responsibility for the WRF that will receive and integrate surface water provided by the Authority. The WRF Design Engineer's primary objective during this BODR phase is to document how to best:

- Integrate surface water into the system.
- Convert to chloramination.
- Comply with applicable regulations.
- Allow coordination of location of Authority equipment on the site.
- Identify any costs outside of typical Authority covered work and define cost responsibility.

The BODR should include a preliminary site layout, process flow diagrams, one-line diagram and report text developed to reflect approximately 20 to 30 percent design development. The document is intended to support Converted Entity review and coordination and advancement into detailed design. One BODR is required for each WRF. However, if a Converted Entity has more than one WRF; one BODR can be issued for that Converted Entity provided each WRF is addressed separately in the report.

3.2 Suggested Basis of Design Report Outline

1. Introduction.
2. Project Objectives.
3. Water Sources; Current and Future Demands.
4. Description of Existing Facilities.
5. Proposed Improvements:
    a. Meter Station and Flow Control Valve.
    b. Disinfection and Chloramination.
    c. GST Connections.
    d. Site Drainage/Detention.
    e. Electrical and SCADA Considerations.
6. Access and Constructability Needs.
7. Estimated Construction Cost and Financial Considerations:

a. Preliminary Opinion of Probable Construction Cost.
b. Financial Obligations of the Authority.
c. Financial Obligations of the Converted Entity.

8. Schedule.
9. Preliminary Constructability Constraints.
10. Items to be Confirmed in Subsequent Design Phases.
11. Summary and Conclusions.

3.3 Process Schematic Requirements

3.3.1 Flow Meter-Flow Control Valve Station Process Schematic

The "Flow Meter-Flow Control Valve Station Process Schematic" is provided on the NHCRWA Standard Details. The schematic shows the general layout of equipment, instrumentation and piping at the WRF needed for supplying surface water to the WRF. The schematic also shows the required input and outputs from the NHCRWA SCADA Control Panel. A listing of all signals covered by the NHCRWA SCADA Control Panel and Converted Entity Control panel can also be found on in the Standard Details. The flow of surface water through the station and to other pieces of equipment at the plant such as the chemical analyzers is also depicted. This schematic is to be followed during the design and installation of the WRF. Any modifications must be approved by the NHCRWA Program Manager before they are incorporated into the design for that facility.

The WRF Design Engineer shall:

- Design the Flow Meter Station, Flow Control Valve Station, connection to the GST, and connections to the disinfection systems strictly following the process schematic.
- The Flow Meter Station and Flow Control Valve Station are to be designed above ground and not placed in a vault.
- Coordinate with the Converted Entity's Engineer and/or Operator to determine which of the available signals shall be incorporated into their control panel.
- Obtain approval from the Authority for any deviation to this process schematic in the design.

3.4 Gas-Chlorination and LAS Systems Process Schematic

The typical "Gas Chlorination and LAS Systems Process Schematic" is provided in the Standard Details. The schematic shows the proposed general layout of equipment and piping of the disinfection systems when chlorine gas is used for chlorination in addition to LAS. All equipment and valves necessary for the system are shown in the schematic along with all required signals to and from the NHCRWA SCADA Panel and Converted Entity Control Panel. Since the existing facilities at each site will vary, the schematic provides a guideline for the design of additional systems that are required when surface water is added at the site.

The WRF Design Engineer shall:

- Identify existing conditions of the project site.
- Design the gas chlorine and LAS systems for the groundwater and surface water systems to meet the requirements of TCEQ and the Converted Entity.

- Provide signals to the NHCRWA SCADA Panel as shown in the guideline process schematic.
- Develop a detailed schematic that accurately reflects the project specific design of the chemical injection systems.
- Submit the finalized process schematic with the 60 percent Submittal for NHCRWA approval.

3.5 Bleach Chlorination and LAS Systems Process Schematic

The typical "Bleach Chlorination and LAS Systems Process Schematic" is provided in the Standard Details. Similar to the schematic for gas chlorination and LAS, the schematic for bleach chlorination and LAS shows the proposed general layout and all required equipment for the chloramination system. All required signals to and from the NHCRWA SCADA Panel and Converted Entity Control Panel are also displayed in the schematic. Since the existing facilities at each site will vary, the schematic provides a guideline for the design of additional systems that are required when surface water is added at the site.

The WRF Design Engineer shall:

- Identify existing conditions of the project site.
- Design the chemical feed systems to meet the requirements of TCEQ and the Converted Entity.
- Provide signals to the Authority's SCADA Panel as shown in the guideline process schematic.
- Develop a detailed schematic that accurately reflects the project specific design of the chemical injection systems.
- Submit the finalized process schematic with the 60 percent Submittal.

3.6 Site Location and Layout

3.6.1 Existing WRFs Being Converted to Surface Water

The placement of the Flow Meter and Flow Control Valve Stations at the Converted Entity's plant site will be dependent on the specific project site and area available. The exact location of the two stations may vary by site; however, various possible layouts of the stations are provided in the Standard Details. Five site layouts are provided as guidelines. If the project site allows, the preferred layout of the stations shall be situated as shown in Layout No. 1 with the two concrete slabs approximately four feet apart. Only one Authority SCADA Control Panel is required, and it shall always be located adjacent to the Flow Control Valve Station. Conduit shall run from the SCADA Control Panel to the required equipment. A flow meter control panel may be installed at the Flow Meter Station if the distance between the flow meter and the SCADA Control Panel is greater than the distance recommended by the flow meter manufacturer or if the Converted Entity requests it; however, a flow meter control panel is not required.

The four additional layouts provided in the Standard Details are other possible layout configurations, but they do not comprise a comprehensive list of all possible layouts. The stations may be situated in any way that will fit on the project site and allow for proper and efficient operation of the WRF.

The WRF Design Engineer shall:

- Identify existing site conditions and available space for the two stations.
- Coordinate with the Converted Entity to determine the best location and configuration of the two stations, the control panel, and conduit routing.

- Prepare a site plan layout showing the metering station, flow control valve station, control panel, location of chemical feed and storage facilities, chemical injection points, GST connection locations, and drainage information.
- Obtain NHCRWA and MUD approval for the proposed site layout at the 30 percent design submittal.

3.7 New or Planned Water Receiving Facilities

As of 2025, the Authority's Rate Order requires that all new or planned water plants are constructed by the MUD as follows:

- All new WRFs must be designed for future surface water conversion.
- The Converted Entity is responsible for acquiring and conveying property interests needed for the WRF conversion to the Authority.
- The Converted Entity must design the WRF to accommodate future conversion to surface water including the chloramination system and adequate space and electrical feed for future Authority assets.
- Converted Entities must submit a Facility Compatibility Plan to the Authority for each new or planned WRF to document these items.
- The Authority shall have a minimum of 30 days to review this plan.
- The Converted Entity is responsible for obtaining and maintaining all TCEQ approvals for the WRF, including the chloramine system.
- The Authority will be responsible for designing, constructing, operating, and maintaining the extension of the Authority's distribution system up to the point of transfer to the MUD (typically first flange after the flow control valve).

The placement of the Flow Meter and Flow Control Valve Stations at the Converted Entity's plant site will be dependent on the specific project site and area available. The design of these facilities must meet all of the requirements for existing facilities as well as the following requirements:

- Flow Meter and Flow Control Valve Stations must be designed in accordance with Authority Standard Specifications and Standard Details.
- Flow Meter and Flow Control Valve Stations must be located in an easily accessible area.
- A minimum of 10-feet clearance must be provided on either side of the piping arrangement.
- Chemical feed systems must be enclosed in a building with a door that Authority personnel can access.
- Electrical system must be able to power Authority's low voltage assets once installed.

MUDs should coordinate with the Authority during design of the new or planned water plant to ensure that adequate space is provided for future Authority facilities.

3.8 Design Criteria

3.8.1 Flow Meter Station Design Criteria

A detailed layout of the flow meter station is in the Standard Details. The primary piece of equipment at the Flow Meter Control Station is the electromagnetic flow meter. All flow meters must be compatible with the Authority's advanced metering infrastructure (AMI) system. Requirements for this meter are detailed in the Standard Specifications. The layout of the piping and equipment in this detail is fixed and may not be altered by the WRF Design Engineer. Any variance from this layout must be approved by the Program Manager. The size of the equipment installed will depend on the nominal diameter of the water line entering the station. The table provided with the standard detail lists the required size of each fitting and piece of equipment based on the pipe size entering the station. The size of the water line entering the flow meter station and flow meter will depend on the expected range of flows to be delivered to the WRF by the Authority and will be determined by the WRF Design Engineer with the approval of the Authority.

The only portion of the flow meter station piping that may be altered by the WRF Design Engineer is the orientation of the two bypass tees. This bypass and connection to the storm water system is discussed further in Section 3.15 of this WRF Design Guidance Manual. The second bypass tee at this station must be oriented in the same direction as the first tee to facilitate the installation of temporary bypass piping for the flow meter. This is also discussed in Section 3.15. The WRF Design Engineer is also responsible for the structural design of the concrete slab and supports that are part of this station.

The equipment at this station that requires power and connection to a control panel is the electromagnetic flow meter and the inlet pressure transmitter. The signal from the pressure transmitter will be sent to the SCADA Control Panel. The signal from the flow meter will be sent to the flow meter control panel (if applicable), then to the SCADA Control Panel and the Converted Entity Control Panel. Conduit will be routed below ground adjacent to and beneath the station's concrete slab. It will penetrate through the slab at the transmitter and flow meter locations. As required for future installations, a small cutout shall be provided at the base of the concrete pipe support at the edge of the station closest to the Flow Control Valve Station as shown in the Standard Details for any future conduit required.

The flow meter shall be fully compatible with and capable of integration with the Authority's existing AMI system. The meter shall support remote data acquisition, two-way communication, and integration with the Authority's AMI network without the need for proprietary or third-party interface devices. Acceptable meter manufacturers are listed in the standard specifications. No substitutions will be accepted.

At this time, the Authority recommends that the manufacturer and model of the electromagnetic flow meter and the twin disc check valve shall conform to the applicable Specifications listed in this Section. The other equipment at the station has related specifications that may recommend specific manufacturers or models, but the WRF Design Engineer may suggest other manufacturers pending Authority approval. Additional equipment specification sections covering this station are:

- Section 13446 - Primary Instrument Devices.
- Section 15111 - Air Release and Vacuum Release Valves for WRF and Plant Work.
- Section 15116 - Check Valve, Twin Disc.
- Section 15130 - Pressure Gauges, Transmitters and Elements.

A complete list of standard specifications and details can be found on the Authority's website.

The WRF Design Engineer shall:

- Design the Flow Meter Station following the Standard Details and orienting the bypass tees appropriately for the project site.
- Coordinate with the MUD and Program Manager to establish anticipated flow rates, operating pressures, and preliminary line size.
- Route the conduit to the pressure transmitter and flow meter as shown on the Standard Details.
- Select appropriate manufacturers and models of all equipment per the technical specifications.
- Obtain Authority approval for any deviation from the Detail or the approved manufacturers of the equipment provided in the specifications.

3.9 Flow Control Valve Design Criteria

A detailed layout of the flow control valve station is provided in the Standard Details. The primary equipment at the Flow Control Valve Station is the flow control valve, basket strainer, and hot box. These three pieces are specified in detail in the following sections:

- Section 15105 - Combination Flow Control Valve.
- Section 15150 - Basket Strainer.
- Section 15959 - Insulated Enclosure (Hot Box) for Automatic Control Valve.

The layout of the piping and equipment in this detail is fixed and may not be altered by the WRF Design Engineer. The size of the equipment installed will depend on the nominal diameter of the water line entering the station and the anticipated flowrates and pressure conditions at the flow control valve. The Standard Details provide the required size of each fitting and piece of equipment. The size of the water line entering the flow control valve station will be the same size as the line leaving the Flow Meter Station.

The flow control valve must be placed inside a hot box as specified in Specification Section 15959 and per the standard details. This hot box will protect the control valve from damage due to exposure to the elements. The only portion of the Flow Control Valve Station piping that may be altered by the WRF Design Engineer is the orientation of the two bypass tees. Any variance from this layout must be approved by the Authority. The bypass and connection to the storm water system is discussed further in Section 3.15 of this WRF Design Guidance Manual. The second bypass tee at this station must be oriented in the same way as the first tee to facilitate the installation of temporary bypass piping for the control valve. This is also discussed in Section 3.15.

The WRF Design Engineer is also responsible for the structural design of the concrete slab and supports required for the meter station, flow control valve station, electrical control panel, and chemical building foundation.

Conduit will be routed to three different pieces of equipment at this Station: the flow control valve, an outlet pressure transmitter, and a differential pressure transmitter across the basket strainer. Conduit will be routed underground from the control panel adjacent to the concrete slab at this Station and will penetrate through the slab at the location of these three pieces of equipment. The approximate location of the conduit routing is shown in the Standard Details. No other conduit is required at this station; however, a small cutout shall be provided at the base of the concrete pipe support at the edge of the

station closest to the control panel as shown in the Standard Details for any future conduit required at the station.

NHCRWA requires the manufacturer and model of the flow control valve and basket strainer to conform to Specifications previously discussed in this Section. The other equipment at the station has related technical specifications that may recommend specific manufacturers or models, but the WRF Design Engineer may suggest other manufacturers or models pending NHCRWA approval. Additional equipment specification sections covering this station are:

- Section 13446 - Primary Instrument Devices.
- Section 15111 - Air Release and Vacuum Release Valves for WRF and Plant Work.
- Section 15130 - Pressure Gauges, Transmitters and Elements.

A complete list of standard specifications and details can be found on the Authority's website.

The WRF Design Engineer shall:

- Design the Flow Control Valve Station as shown in the Standard Details and orienting the bypass tees appropriately for the project site.
- Route the conduit to the flow control valve, differential pressure transmitter, and outlet pressure transmitter as shown on the detail.
- Select appropriate manufacturers and models of all equipment per the technical specifications.
- Obtain approval from NHCRWA for any deviation from the detail or the approved manufacturers of the equipment provided in the specifications.

3.10 Chlorination and LAS System Design Guidance

Typical chlorination and LAS disinfection systems are shown in the Standard Details. The details on these sheets provide a general layout of piping and equipment. The WRF Design Engineer is responsible for locating the equipment to best fit the specific project site. Site constraints shall dictate the location of equipment and layout of the related piping. The WRF Design Engineer shall select manufacturers and models of equipment per the Standard Specifications, and per the Converted Entity's preference for existing equipment. There are multiple approved manufacturers for the equipment. Any deviation from the approved manufacturers listed in the specifications must be approved by the Authority.

The WRF Design Engineer shall ensure that the pressure requirements of the selected chemical analyzers are met. A sample pump or pressure reducing valve may be required on the sample water line supplying water to each chemical analyzer. The WRF Design Engineer may choose from two types of chemical analyzers.

- The WRF Design Engineer may choose to follow Specification Sections 11301 - Chlorine Analyzers and 11302 - Ammonia Analyzers that specify Hach brand chemical analyzers.
- The WRF Design Engineer may choose to follow Specification Section 11303 - Chemical Analyzers that specifies Applied Spectrometry Analytics Chemscan Analyzer.

The Hach analyzers are only capable of testing the residual concentration of one chemical, chlorine or ammonia. The Chemscan analyzer is capable of testing the residual concentration of both chlorine and ammonia at multiple locations. Since it is important that the analyzers selected be capable of supplying

the accuracy required to help control the system, as well as communicate the results to the Converted Entity's Control Panel, it is up to the WRF Design Engineer to select the appropriate analyzers for the specific project.

The chlorination and LAS disinfection systems are covered in the following sections:

- Section 11260 - Gas Chlorination System.
- Section 11261 - Sodium Hypochlorite (Bleach) Chlorination System.
- Section 11262 - Liquid Ammonium Sulfate (LAS) System.
- Section 11263 - Chlorine Gas Leak Detector.
- Section 11301 - Chlorine Analyzers.
- Section 11302 - Ammonia Analyzers.
- Section 11303 - Chemical Analyzers.
- Section 11700 - Emergency Eyewash and Shower Equipment.
- Section 13202 - Polyethylene Chemical Storage Tanks.
- Section 15100 - Chemical Piping.

The WRF Design Engineer is also responsible for designing the appropriate chlorination system taking into consideration the existing system at the water plant, the requirements listed in this document, and the preference of the Converted Entity's Operator. The Authority has no preference between gas chlorination or bleach chlorination systems. The WRF Design Engineer shall select the appropriate system for the project site. Details and specifications for both types of systems are provided. If gas chlorination is utilized, the WRF Design Engineer may provide gas storage in one ton or 150-pound cylinders.

Surface water from the Authority and existing groundwater at the site must be dosed separately. Both water sources shall utilize the same type of chemical and may share chemical storage and spare chlorinators or pumps as discussed in this document, but the physical feed and control systems must remain separate.

The piping and equipment capacity will be sized by the WRF Design Engineer for surface and ground water chloramination per the estimated flow rate. The estimated flow rate will be based on the quantity of water to be purchased by the WRF from the Authority and the amount of ground water to be pumped and treated at the site.

The WRF Design Engineer shall:

- Understand whether or not the Converted Entity has or will install polyphosphate injection points. If so, making sure the Drawings reflect the required spacing and placement of the chlorine and LAS injection points.
- Coordinate with the Converted Entity's Operator to incorporate 150-pound or one-ton chlorine gas cylinders if gas chlorination is used.
- Design the LAS and chlorine systems to feed both groundwater and surface water entering the facility.

- Provide chemical storage systems that utilize single-wall tanks with independent secondary containment capable of capturing the TCEQ-required volume plus freeboard. Double-wall or integral containment tank designs are not preferred and require Authority approval for use. If double-walled systems are utilized, the system must include appropriate anti-siphonage provisions, degas valves, and plans for how the tank will be drained.
- Meet the requirements for the groundwater supply systems called for in this document.
- Select manufacturers and models for the chlorine and LAS systems for the appropriate capacity.
- Select chemical analyzers listed in the related specification sections.
- Layout the chemical systems appropriately at the project site. Identify if additional buildings are needed to accommodate the added chemical systems. Propose the most cost-effective building construction material based upon site-specific conditions.
- Obtain approval from the Authority for any deviation from the approved manufacturers listed in the specifications.

3.11 Sampling System and Mixer Design Criteria

Sample lines are required prior to and after the injection of the disinfection chemicals. In addition, a sample point is required between the two injection points. Water collected in the sample lines will be sent to the chlorine and ammonia analyzers. The measurements taken at the analyzers will dictate the chemical dosing into the surface water and ground water lines prior to entering the GST. The first sample port for surface water is located immediately upstream of the Flow Meter Station. This sample line will go to the chemical analyzers. The flow in each sample line will be restricted by adjusting the valve on the line to only allow enough flow to feed each analyzer. In addition, a rotameter will be installed in each line to help measure the flow. Each analyzer will continuously pull a small amount of water from this sample line to measure the appropriate chemical. The unused sample water will be sent to the sanitary sewer, storm sewer, or returned to the main water line, depending on the analyzer selected. The WRF Design Engineer is responsible for designing the piping layout between the sample port and the analyzers. Section 3.16 of this WRF Design Guidance Manual discusses the disposal of sample water contaminated with reagents by the analyzers for discharge to the sanitary sewer system.

Chlorine solution and LAS will be injected into the main water line after the Flow Control Valve Station at two separate injection points. The chemicals will be injected at the static mixers with incorporated injection ports. The static mixers shall be as specified in Specification Section 11337 - "Static Mixers and Appurtenances." A typical detail covering this mixer can be found in the Standard Details. The distance between injection points is to be determined by the flow rate and pipe diameter to achieve the required velocity gradient per TCEQ requirements.

A second sample port will be located immediately upstream of each GST per the "Ground Storage Tank Riser Detail". Similar to the previous sample line, the WRF Design Engineer is responsible for routing the sample line to the chemical analyzers per the typical schematics provided in the Standard Details and the analyzer manufacturer's recommendation.

The WRF Design Engineer shall:

- Route all sample lines from sample points to the appropriate chemical analyzer.
- Provide static mixers at both chemical injection locations for surface water.

- Calculate the appropriate distance between the two chemical injection points to comply with TCEQ requirements. Adjust the distance as required if the Converted Entity includes phosphate injection at the site.
- Meet the requirements for the groundwater supply systems called for in this document.
- Obtain approval from the Authority for any deviation from the approved manufacturers listed in the specifications.

3.12 GST Connection Design Criteria

The design details for the connection of the surface water line to the existing GST are found in the Standard Details. This connection will include the installation of all surface water piping and supports, flushing valve, splash box, and a connection to the existing storm water system. The connection should not be modified from this proposed layout. The only modification allowed to this connection is the orientation of the tee and flushing valve. The tee shall be oriented to best suit storm water drainage on the Converted Entity's plant site. See Section 3.15 of this WRF Design Guidance Manual for more details on the storm water and flushing details and requirements.

In addition, the interior (all) and exterior (as required for installation) of the GST must be cleaned prior to the installation of the surface water piping and once the piping is installed, the GST will need to have any repairs made as a result of the installation. The GST must be disinfected before being placed back in service and accepted by the Authority. Specification Section 13207 - "Ground Storage Tank (GST) Modifications, Cleaning and Disinfection" details the method and requirements of cleaning, repairing and disinfecting the GST. Specification Section 09905 - "Repainting and Repair of Existing Water Facilities" covers the requirements for repainting any existing equipment at the WRF that has been affected by the work. This Section also covers how to repair any coatings on the GST that are damaged due to the installation of the piping and supports.

The WRF Design Engineer shall:

- Design the surface water connection to the GST exactly as shown in the Detail.
- Orient the tee and flushing valve to best accommodate drainage to the storm water system.
- Require the GST to be drained and/or cleaned prior to the connection of the surface water line.
- Require necessary repairs to the GST as a result of the surface water line connection.
- Obtain approval from the Authority for any deviation from the Detail.

3.13 SCADA System Design Criteria

The typical design details for the SCADA system and Converted Entity Control Panel can be found in the Standard Details. The Authority's SCADA system will consist of all applicable instruments installed in the field and as identified on the process schematics, as well as the Authority SCADA Control Panel that will be located next to the Flow Control Valve Station. The SCADA Control Panel will contain the PLC and additional equipment that will be used to control the Authority's equipment located at the WRF. This SCADA Control Panel must then be integrated into the Authority's central controls for remote control of the WRF. The specification section covering the Authority's SCADA Control Panel and the programming is found in Section 16473 - "Programmable Logic Controllers, SCADA Interface Panels and Panel Mounted Equipment (WRF)".

The WRF Design Engineer will be responsible for verifying that all critical components of this system are designed and the correct instruments and equipment are specified. The design package shall include all conduit, wiring, and appurtenances for correct installation of all pieces of equipment and instrumentation. The construction bid package will identify those portions of the work that are the responsibility of the Contractor, and those covered by the Specialty Instrumentation Contractor (SIC) selected by the Authority. All bid packages will include a pre-negotiating lump sum price for the SIC portion of the work with a 10% Contractor markup to cover the purchase and installation of the SCADA Panel and terminations of all wiring connected to the SCADA Panel and all field instruments by the SIC. Programming services for the PLC located in the SCADA Panel will be provided by the SIC, as will integration of the new SCADA Panel into the Authority's central SCADA system located at Schindewolf Regional Pump Station. The bid amount for the various SIC-provided bid items will be obtained by the Program Manager and provided to the WRF Design Engineer.

Site-specific information will be needed to program each SCADA PLC. The WRF Design Engineer will be responsible for ascertaining information (such as surface water flow rates, GST levels, etc.) and providing this information on the Drawings for the Contractor and SIC use.

The WRF Design Engineer is also responsible for determining if a new Customer (MUD) Control Panel is required or if modifications to an existing Customer Control Panel are needed. These scope elements must clearly be defined in the design documents and on the bid form (typically included in the lump sum amount for the WRF facility and not the SIC bid line item that is for the Authority's SCADA Panel). The MUD may request the use of their own specialty contractor for work on their panel and/or SCADA system. If the MUD has procured that specialty contractor in accordance with the requirements of the State of Texas, the WRF Design Engineer may specifically list the MUD specialty contractor in the specifications for the Customer Control Panel and stipulate a pre-negotiated bid price in the bid form for that specialty contractor. Note, if the MUD requests this, it is the MUD's responsibility for obtaining a written price proposal from their specialty contractor based upon the final design plans and providing that to the WRF Design Engineer for inclusion in the Authority's bid documents.

During the design phase, the WRF Design Engineer will also be responsible for setting up coordination meetings between the Converted Entity's Engineer and/or Operator, SIC, and the Program Manager to finalize all details related to both the Authority's SCADA control system and the Converted Entity's control system and the connections necessary between the two systems.

The WRF Design Engineer shall:

- Design a complete SCADA system that includes all components, instruments, and equipment that will appropriately send and receive signals to and from the Authority's SCADA control panel located at the Flow Control Valve Station as shown in the details and specifications.
- Ensure all necessary information is provided in the design package for the appropriate installation of field instruments, conduit, and appurtenances for the NHCRWA SCADA system to function as intended.
- Ensure any meter specified for the project is also compliant with the Authority’s advanced metering infrastructure (AMI) system.
- Identify the work to be completed by the General Contractor and by the Authority’s SIC.
- Identify if a MUD specialty contractor will be utilized in the installation and programming of the Customer Control Panel.

- Coordinate with the Converted Entity's Engineer and/or Operator to identify project specific data required for the proper programming of the Authority's SCADA system.
- Design the Converted Entity Control Panel to meet the requirements for the groundwater and surface water supply systems.
- Obtain approval from the Authority for any deviation from the details and specifications.

3.14 Detention Requirements

The WRF Design Engineer shall coordinate with the Converted Entity's Engineer or Operator to:

- Design a complete stormwater detention system that complies with applicable HCED and HCFCD stormwater detention requirements for all relevant assets added via the conversion project.
- Determine the stormwater detention and discharge strategy, such as detention pond, community detention, or underground detention, and discharge location.
- Determine detention sizing, discharge controls, and dechlorination methods.
- Prepare and submit application and drawings for required regulatory approvals.

3.15 Flushing/Stormwater Connections

Flushing may be required at various times, including during startup and commissioning, disinfection conversion, and distribution system maintenance. Two flushing valves will be installed at tees at both the Flow Meter Station and the Flow Control Valve Station as shown in the Standard Details. The first flushing valve at each station shall be located to allow water to be flushed to the storm water system at the WRF site; the second flushing valve should be as shown on the Standard Detail. Two typical details are provided for the design of the discharge splash box. The details provided allow for storm water surface drainage or connection to a buried storm water collection system. A flushing tee and valve will also be included at the GST on the surface water connection line as shown in the Standard Details. The WRF Design Engineer will decide which method and detail to use based on the conditions at the Converted Entity's plant site. Modifications to the details are allowed to better accommodate conditions at the site and as approved by the Converted Entity and NHCRWA.

The WRF Design Engineer is responsible for orienting the flushing tee, valve, and discharge splash box to appropriately discharge the flushed water to the existing storm water collection system at the Converted Entity's plant site. The splash box shall be located on the side of the station closest to the existing storm water drainage system.

The two flushing valves located at each station may also be used to connect temporary piping on the occasion that the primary equipment in that station needs to be bypassed to conduct repairs.

The WRF Design Engineer shall:

- Orient the first bypass tee to effectively discharge water to the existing storm water drainage system at the project site.
- Orient the second bypass tee in the same direction as the first to accommodate the installation of temporary bypass piping.
- Design the splash box structure located at each proposed flushing valve.

- Obtain approval from NHCRWA and the Converted Entity for any deviation from the details and specifications.

3.16 Sanitary Sewer Connection for Reagents from Analyzers

The chlorine and ammonia analyzers discharge a continuous flow of water. This flow consists of clean water from the sample points that was not used for sampling and water contaminated with reagents from the analyzers. If required by the analyzer manufacturer or if requested by the Converted Entity, the contaminated water shall be captured and discharged to a sanitary sewer. The WRF Design Engineer is responsible for routing drainage piping from the analyzers to the existing sanitary sewer. If there is not a sanitary sewer nearby, the WRF Design Engineer must include a package lift station as shown in the standard details and that meets the requirements of Specification Section 11306 - Package Sanitary Sewer Lift Station for Analyzer Station By-Pass Flows. This small lift station shall pump the contaminated sample water to the nearest sanitary sewer.

The WRF Design Engineer shall:

- Route drainage piping from the proposed analyzers to a nearby sanitary sewer, when available.
- If a sanitary sewer is not available, include in the design package a small sanitary sewer lift station to collect and periodically discharge contaminated water to a sanitary sewer.
- Obtain approval from the Authority and the Converted Entity's Engineer and/or Operator for deviation from the details and specifications.

3.17 Start-Up, Commissioning, Testing and Acceptance Plan for Each WRP

Prior to submittal of the 90 percent submittal, the WRF Design Engineer must develop a startup, commissioning, testing, and acceptance plan memorandum for each WRF to be converted. This memorandum must establish the anticipated roles and responsibilities of each party during construction, detail any WRF startup dependencies (including other facilities that must be started up before/in conjunction with/after this WRF), indicate any concurrent construction activities on the site and how risks will be mitigated, and indicate any required customer communications/who is responsible/when they must occur. Note, if a Project is converting more than one WRF for a given MUD, the WRF Design Engineer may develop one consolidated Start-up, Commissioning, Testing, and Acceptance plan for that MUD with sections detailing specific requirements for each WRF.

The goal of this memorandum is to ensure that (1) there is understanding and concurrence from the MUD-related players on roles, responsibilities, and needs; (2) the Specifications clearly detail all of these requirements to the Contractor; and (3) other interrelated projects are identified and also include clear startup and commissioning requirements that may impact the subject WRF.

The Contractor will also be required to prepare a Start-Up, Commissioning, Testing and Acceptance plan as an official construction submittal with the goals of commissioning the chlorination and LAS systems safely and efficiently; transition from free chlorine to chloramine disinfection, and ensure distribution system stability and compliance with TCEQ standards.

Below is a general list of the responsibilities of each party which should be further documented in the Startup, Commissioning, Testing, and Acceptance Plan for each WRF:

3.17.1 Responsibilities of the Program Manager and/or the Authority's designated construction management team

- Establish a single point of contact for start-up and commissioning.
- Oversight of the conversion process.
- Approval of scheduled conversion/cutover timing.
- Notification of Final Completion Walk-Through to TWDB and confirmation of attendance.
- Final acceptance.

3.17.2 Responsibilities of the WRF Design Engineer

- Ensure Contractor's requirements not listed in Specification Section 01661 are shown in Notes on the Contract Drawings.
- Verification of requirements.
- Establish a single point of contact for start-up and commissioning.
- Recommend final acceptance.

3.17.3 Responsibilities of the Converted Entity

- Provide initial notification to customers that the project has been initiated and anticipated timeline for the future conversion.
- Send TCEQ-required chloramine conversion notification at least 14 days prior to the cutover date.
- Order relevant chemicals prior to date specified for system acceptance testing.
- Operational control and water quality monitoring before, during and after the conversion process.
- Establish a single point of contact for start-up and commissioning.
- Distribution system flushing.
- Update the Distribution System Water Quality Monitoring Plans as required by TCEQ.
- Develop a Nitrification Action Plan per TCEQ requirements.

3.17.4 Responsibilities of the Contractor

- Establish a single point of contact for start-up and commissioning.
- Coordinate all parties necessary for the successful WRF Start-Up and is responsible for Start-Up.
- Complete construction, training, and physical system readiness.
- Meet additional requirements as specified in Specification Section 01661 and as shown on the Drawings.
- Prepare Startup, Testing and Commissioning Plan and submit to Authority, WRF Design Engineer and Converted Entity 90 days prior to start-up.
- Prepare 30-Day Field Commissioning Plan and Schedule and submit for review and approval 14 days before start-up and commissioning.

Note, some WRFs may require chloramination systems to be fully functional on all groundwater wells before the surface water conversion is completed. This should be detailed in the WRF Design Engineer's memorandum and in the Project Specifications.

3.18 Final Engineering Report

The WRF Design Engineer is responsible for preparation and submittal of the Engineering Report to TCEQ, and revisions as necessary to obtain approval. This likely will need to be submitted on an individual WRF basis for projects that have more than one WRF being converted for multiple MUDs. The Engineering Report should be drafted and submitted to TCEQ at the 95 percent design milestone. The Converted Entity is responsible for providing the system data necessary to complete the report, and review of the report prior to submittal to TCEQ. A suggested outline of the Engineering Report follows.

Suggested Engineering Report Outline:

1. Executive Summary.
2. Introduction:
   - 2.1 Background.
3. Service Area and Population:
   - 3.1 Current Population.
   - 3.2 Projected Growth.
   - 3.3 Service Area Map.
   - 3.4 Demand Projections/Fire Flow Requirements.
4. Existing System Description:
   - 4.1. Groundwater Wells.
   - 4.2 Storage Tanks.
   - 4.3 Distribution System.
   - 4.4 Pump Stations.
   - 4.5 Current Disinfection System.
5. Proposed Improvements:
   - 5.1 Connection to NHCRWA System:
     - 5.1.1 Description.
     - 5.1.2 Flow Meter and Flow Control Valve.
     - 5.1.3 Chemical Systems.
     - 5.1.4 SCADA and Instrumentation.
6. Hydraulic Analysis:
   - 6.1 Design Criteria and Assumptions.
   - 6.2 System Pressures and Flow Requirements.

6.3 Tank Turnover and Level Control.

7. Disinfection Strategy:

   7.1 Incoming Water Quality.

   7.2 Chlorine System Design.

   7.3 LAS/Chloramine System Design.

   7.4 Target Residuals and Control Strategy.

   7.5 Monitoring and Alarms.

   7.6 Nitrification Prevention Measures.

8. Water Quality Considerations.
9. Operations and Maintenance Strategy:

   9.1 Normal Operation.

   9.2 Emergency Operation.

   9.3 Transition/Cutover Plan.

10. Instrumentation and Controls.
11. Compliance Statement.
12. Supporting Documents.

3.19 Miscellaneous

Additional information provided by NHCRWA to the WRF Design Engineer for the design of the surface water conversion is included in the appendices to this document. The information provided is as follows:

- Appendix A - TCEQ Meeting Minutes from the July 12, 2016.
- Appendix B – Sample Disinfection Attachment for the TCEQ Engineering Report.
- Appendix C – Distribution System Blending and Water Quality Memoranda, including TM4's Guidance to MUDS in Preparation to Receive Surface Water.
- Appendix D - WRF Design Checklists.

The WRF Design Engineer is responsible for making the revisions called out on the Authority mechanical and electrical detail sheets when incorporating them into the design package, as well as including any additional details and drawings necessary to complete the design package. Modifications to the details provided must be approved by the Program Manager before changes are made.

The specifications allow for variations as needed to meet the needs of the individual sites. Modifications to the body of the specifications will not be allowed except by permission from the Program Manager. The WRF Design Engineer will be responsible for completing the information in the "Attachments" of the specification sections, based on the needs of the individual site.

In the Bid Form, the WRF Design Engineer will create a separate bid item list for each WRF.

The WRF Design Engineer shall:

- Ensure complete design package is created by adding any necessary details to the details provided by NHCRWA.
- Make all revisions necessary to the NHCRWA provided details as indicated by the "clouded" notes on the details.
- Make all necessary revisions to the NHCRWA provided specification attachments.
- Create a complete project specific bid item list.
- Obtain approval by NHCRWA for any deviation from the provided details and specifications.

CHAPTER 4 SUPPORT SERVICES

The WRF Design Engineer is typically responsible for project-specific support services. This includes topographic surveys, geotechnical investigation, traffic control plans (if required), storm water pollution prevention plans (SWPPP), and subsurface utility engineering (SUE).

The Authority and/or Program Manager are responsible for program-wide support services to maintain consistency across all Authority projects. This typically includes survey controls, Environmental Site Assessments, corrosion control investigation, transient (surge) analyses, and tree protection plans.

4.1 Right of Entry for Field Activities Associated with Support Services

In a WRF design project, the WRF Design Engineer and supporting team typically only requires access to the WRF facility site and does not require access to other properties. As such, the WRF Design Engineer should determine the appropriate contact for each assigned WRF and convey that to all team members requiring site access.

If the WRF Design Engineer has issues establishing site access for a particular WRF, they should inform the Program Manager.

4.2 Surveying

The following guidelines are to be followed for all surveying and mapping to be performed by the project surveyor under the direction of the WRF Design Engineer for the Program. It is the WRF Design Engineer's responsibility to manage the schedule and quality of the project surveyor's work.

4.2.1 References

The following regulations are to be followed by WRF Design Engineer's surveyor. The WRF Design Engineer's surveyor is expected to adhere to the applicable regulations.

1. State of Texas Professional Land Surveying Practice Act, latest revision.
2. Texas Board of Professional Land Surveying Professional and Technical Standards (Texas Administrative Code, Title 22, Part 29, Chapter 663, Subchapter B, Professional and Technical Standards and Title 22, Part 6, Texas Board of Professional Engineers and Land Surveyors.)
3. Texas Statute Occupations Code, Title 6, Subtitle A, Chapter 1001 Texas Board of Professional Engineers and Land Surveyor and Subtitle C, Chapter 1071 Land Surveyors.
4. Texas Society of Professional Surveyors Manual of Practice for Land Surveying in Texas, latest edition.

4.2.2 Survey Conformity

All topography shall conform to the Texas Society of Professional Surveyors "Manual of Practice for Land Surveying in the State of Texas." All drawings shall be sealed and signed by a Texas Registered Professional Land Surveyor who was responsible for the work.

4.2.3 Survey Controls

The horizontal and vertical control for the Program is to be set on a Program-wide basis by a surveyor on behalf of the Authority. Use the following the horizontal and vertical datum and scale factor, unless otherwise provided by the Authority at the beginning of the project:

1. Surveys shall be based upon the Texas State Plane Coordinate System (South Central Zone 2011 Adjustment), North American Datum (NAD 83).
2. Coordinates are to be in surface value in U.S. survey feet and may be converted to Grid coordinates by multiplying by a scale factor of 0.99992513.

4.2.4 Quality Assurance

Field Surveying and work used in the development of construction drawings, calculations and preparation of rights-of-way maps, and field note descriptions shall be accomplished under the direct supervision of a Registered Professional Land Surveyor of the State of Texas.

Surveys shall comply with the latest revision of the Professional Land Surveying Practice Act of the State of Texas and shall have the imprinted or embossed seal of the responsible Registered Surveyor and be dated and signed by the Surveyor.

4.2.5 Additional Requirements

Additional survey requirements related to Right of Way and parcel acquisition, if relevant to the project, are detailed in the Linear Design Guidance Manual.

4.3 Geotechnical Investigations

The WRF Design Engineer may require the need for a geotechnical investigation if additional structure(s) are needed on the WRF site for the new chloramination system. If required, the WRF Design Engineer shall have a geotechnical report prepared by a qualified Geotechnical Consultant who is a subconsultant to the WRF Design Engineer. The geotechnical investigation's main purposes are to evaluate the existing soil conditions and to provide specific project-related recommendations to the WRF Design Engineer concerning the design aspect of the project. These recommendations may include sheeting, shoring, and/or bracing requirements for construction along with foundation design and dewatering recommendations.

The WRF Design Engineer is responsible for verifying the geotechnical investigation performed by the Geotechnical Consultant is in conformance with these guidelines, project specific conditions and design requirements.

The WRF Design Engineer's role includes:

1. Work with Geotechnical Consultant to develop proper scope for project and keep the Geotechnical Consultant informed of project direction.
2. Provide a copy of the proposed site layout.
3. Provide survey information of the borings (after drilling) to Geotechnical Consultant to use in the report.

4. Provide the base map for Geotechnical Consultant to use as the Boring Plan.
5. When a project involves special structures, provide a copy of the final structural design to the Geotechnical Consultant to perform the geotechnical recommendations.

Additional Geotechnical Consultant requirements can be found in the Authority's Linear Design Guidance Manual.

4.4 Environmental

Most of the WRF projects are contained within an existing WRF site and do not involve acquisition of additional property. As such, the Authority is typically able to get a waiver from TWDB's environmental requirements for WRF sites. The Program Manager is responsible for obtaining the waiver from TWDB.

If at any time the WRF Design Engineer discovers potentially environmentally sensitive areas within the project area at the existing WRF site, the WRF Design Engineer is to notify the Program Manager to seek guidance on the path forward. That may include additional permitting or design modifications to avoid the environmentally sensitive area.

4.5 Traffic Control Plan

Most WRF projects are contained within an existing WRF site and do not involve construction outside the fenceline. However, within a given WRF, the WRF Design Engineer may have to prepare an onsite traffic control plan. If it is required, WRF Design Engineers should refer to the Linear Design Guidance Manual for additional information.

4.6 TPDES Storm Water Permitting

The Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit (CGP) regulates construction projects that will disturb 1 acre or more or soil. Projects that disturb less than 1 acre and are not part of larger common plan of development do not require coverage under the CGP. If the project disturbs 1 acre to less than 5 acres of land, it is defined by the CGP as a small construction activity. Projects disturbing 5 acres or more of land are defined by the CGP as a large construction activity. The CGP requirements are summarized below. Refer to the Authority's Standard Specifications for further guidance. WRF Design Engineers and/or the Contractor should:

1. Obtain a copy of the TCEQ's TPDES CGP.
2. Develop a SWPPP.
3. Complete and submit a Notice of Intent to the TCEQ (for large construction activities only).
4. Complete and post a site notice.
5. Submit a Notice of Termination once the site has reached final stabilization (for large construction activities only).

The SWPPP must describe the implementation of practices that will be used to reduce the pollutants in storm water discharges associated with construction activity and assure compliance with the terms and conditions of the CGP. At a minimum, the SWPPP must include the information provided in Section III.F of the CGP.

4.7 Subsurface Utility Engineering

WRF Design Engineers are responsible for conducting preliminary utility research and field surveys to locate existing utilities. The WRF Design Engineer will need to identify where additional SUE investigations, including Quality Level A (aka Level A SUE) Test Hole Services, are needed to accurately locate the horizontal and vertical position of subsurface utilities (and pipelines). This is typically accomplished by excavating test holes using vacuum excavation techniques and equipment that is nondestructive to utilities.

Proposed Level A SUE locations will be submitted to the Authority/Program Manager for approval prior to proceeding with this work. When SUE is performed on a pipeline, the WRF Design Engineer must coordinate and notify the owner in advance. Refer to additional requirements in the Authority's Linear Design Guidance Manual.

4.8 Transient (Surge) Analysis

For certain design packages, the Authority will provide the WRF Design Engineer with the results of a transient analysis for the proposed water lines under potential surge and operating conditions. The analysis will identify specific locations within the project requiring surge protection devices and define the size and spacing requirements for the devices. These devices will normally consist of combination air and vacuum valves. In some instances, other types of air valves may be required. It is the WRF Design Engineer's responsibility to incorporate the identified recommendations. The placement of these devices will need to be optimized with other air valves determined to be necessary during design.

4.9 Tree Protection Plan

For areas within the WRF site that will impact specimen and mature trees, the Authority will utilize the services of a certified arborist. The arborist will develop specific guidelines for the WRF Design Engineer to include in the Drawings.

The WRF Design Engineer is to provide the drawing CAD files to the arborist for use in developing the tree protection plan and incorporate tree protection requirements from the arborist into the Construction Drawings. It is still the responsibility of the WRF Design Engineer to mitigate the impact on existing trees in the design when feasible.

CHAPTER 5 DEVELOPMENT OF DRAWINGS

The Authority has specific requirements for Construction Drawings. The following guidelines are to be followed to the extent possible. The WRF Design Engineer shall use these guidelines unless otherwise directed by the Authority.

5.1 Construction Drawings - General

The format or structure of the Construction Drawings will conform to a series of Program Standards covering size, type, and content. For example, certain specified sheets will be included in each construction package, such as sheet layout, general construction notes, baseline ties and benchmarks, monumentation benchmark data, etc.

Sample drawings will be provided by the Authority and are to be used as a guide for design standardization and are not intended to be all encompassing to cover every scenario and circumstance the WRF Design Engineer may encounter. Sample drawings will be provided at the start of the project design.

All sheets shall have standard title blocks as provided by the Authority.

5.2 CAD Standard

5.2.1 CAD

Preparation of drawings, plans, prints, and other related documents shall be done using AutoCAD. WRF Design Engineers must submit native CAD files of final “Issued for Bid” drawings and “Record Drawings” to the Authority for permanent record.

5.2.2 Pen Tables

Pen tables in the form of CTB and STB files are to be used for the standardization of graphic reproduction of plans and are provided for black and white plots, color plots, and aerial drawings and exhibits. CTB and STB files with the “FULL” nomenclature are for 22”x34” sheet sizes, and “HALF” nomenclature are for 11”x17” sheet sizes. 11”x17” plots shall be printed from a 22”x34” sheet size reduced by half. The pen tables include the following:

Black & White:

1. NHCRWA-BW-FULL.CTB
2. NHCRWA-BW-FULL.STB
3. NHCRWA-BW-HALF.CTB
4. NHCRWA-BW-HALF.STB

Color / Aerial Reprographics:

1. NHCRWA-CLR-FULL.CTB

2. NHCRWA-CLR-FULL.STB
3. NHCRWA-CLR-HALF.CTB
4. NHCRWA-CLR-HALF.STB

5.3 Drawing Development Guidelines

Below are requirements for preparing and assembling the construction drawings for the project.

5.3.1 Drawing Size

Drawings shall be developed for paper size ANSI D, 22"x34".

5.3.2 Drawing Scales

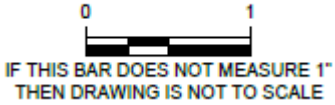
Standard scales permitted for plans and profiles of paving and utility construction drawings are as follows.

Table 3 Typical Drawing Scales

Drawing Type	Scale
Overall Index Sheet Layouts	1 inch = 50 feet
General and Enlarged Plan Views	1 inch = 20 feet 1 inch = 40 feet (1)
General and Enlarged Plan Views –Traffic Control	1 inch = 50 feet 1 inch = 100 feet
General and Enlarged Plan Views – Structural	1/8 inch = 1 foot 1/4 inch = 1 foot 1/2 inch = 1 foot
Profile Views	1 inch = 2 feet vertical 1 inch = 4 feet vertical (1)
Structural Sections, Details	1/4 inch = 1 foot 1/2 inch = 1 foot 3/4 inch = 1 foot 1 inch = 1 foot
Enlarged Sections, Details	1½ inches = 1 foot 3 inches = 1 foot

Notes:
(1) Only if approved in advance by the Authority.

1. The above scales are minimum; larger scales may be used to show details of construction. All scaled drawings shall include the following graphic to ensure drawings are plotted accurately.



2. Deviation from specified scales can only be permitted with the special approval of the Program Manager.
3. Single-banked plan and profile drawings are required.
4. When multiple views on a drawing are not drawn to the same scale, the appropriate scale shall be centered 1/4 inch below the title of each view. The title block scale shall read "as shown."
5. When the entire drawing (such as a diagram or a schematic) is not to scale, the words "No Scale" shall be noted in the title block. If only one view on the drawing is not to scale, the notation "No Scale" shall be placed below the view in question.
6. Details of special structures not covered by standard drawings (e.g., channel crossings, special manholes, junction boxes) shall be drawn using the same scale for both vertical and horizontal dimensions.

5.3.3 Leaders and Dimensions

1. Use straight leader lines with closed, filled arrows.
2. Leader style shall attach leader landing at center of multi-line text.
3. Place leader lines as close as possible to object being identified.

Dimension Setting	Value for Proposed	Value for Existing
Extension line beyond dimension line	0.10"	0.10"
Extension line offset from object	0.10"	0.10"
Arrow Size	0.15"	0.10"
Dimension Text Style	Standard	Standard
Dimension Text Height	0.10"	0.08"
Dimension Primary Units	1 (Decimal)	1 (Decimal)
Dimension Precision	0.0	0.0

5.3.4 Lettering

- Use standard text height of 0.10" for most drawings annotations with text style using Standard font. Use the below Table as a general text property guide.
- Text shall be in designated Model Space.
- Justify text top left, top right or middle center as best applicable for each case.

Existing/Proposed	Text Style	Printed Height	Printed Width
Proposed Text and Dimensions	Standard	0.10"	1.0
Existing Text and Dimensions	Standard	0.08"	1.0
Survey Spot Elevations	Standard	0.08"	1.0

Sheet numbers, detail titles, section or detail call outs, match line labels, table and location map sub-titles, and column headings	Standard	0.20”	1.0
Stacked fractions, symbols, small detail annotation	0.10”	0.10”	1.0

5.3.5 Cover Sheet

- Provide a cover sheet for projects meeting the Authority’s standards. Project title shall include project number, line sizes with a descriptive beginning and ending. Drawing sheet numbers and titles shall be listed on the Sheet Index.
- Include an area key map and vicinity map to identify project location.
- Vicinity map shall show key streets or intersections at an appropriate scale for easy project site location.
- Identify locations and names for WRF on cover sheet area map.

5.3.6 Legend and Abbreviations

The Legend and Abbreviation Sheets are to be incorporated into the plan set. The Legend and Abbreviation Sheet .dwg file incorporates the graphic representation of the Existing Improvements and Proposed Improvements required for depicting the line drawings and features on the base drawings with the associated line weight along with the associated naming layer conventions for the respective features in the Legend and Abbreviation Sheet.

5.3.7 Sheet Layouts

When developing the different sheet layouts (sheet layout, core boring plan, other key drawings), the WRF Design Engineer shall prepare with the intent to make these sheet readable and to only show the necessary information to convey the intent – and not all the different water line call outs, etc. Paving and utility key drawings indexing specific plan and profile sheets shall be included as needed.

5.3.8 Construction Notes

5.3.8.1 General Construction Notes

General Construction Notes shall be placed in columns on a separate drawing with single-spaced lines within each note (1/16 inch apart) and double-spaced (1/4 inch) between notes. The general note column shall be no wider than 5 1/4 inches plus a 1/4-inch margin between the notes and the drawing border and shall be left-justified.

Do not duplicate requirements contained in the Authority’s Standard Specifications. Refer to the sample drawings for further information.

5.3.8.2 Construction Notes from Third Parties

The WRF Design Engineer is to add the standard notes from the private utilities, pipeline companies, Harris County, HCFCD and the MUD, if applicable. It is the responsibility of the WRF Design Engineer to review these standard notes and confirm there are no conflicts with the Authority's Standard Specifications, Standard Details or this Design Manual.

5.3.8.3 Specific Construction Notes

Specific notes show information pertaining to that drawing's features. Specific notes shall be an enhancement or supplement to the drawings. Locate these notes near the title block information and, when possible, in the same area of the drawing.

Lines within each specific note shall be single-spaced, and notes shall be separated vertically at least 1½ spaces. A 1/4-inch space shall separate the note and the drawing border horizontally. Notes shall be left-justified. Specific notes shall be separated horizontally by at least two spaces. Numbers shall be the same height as the letters. Do not duplicate note numbers on the same drawing.

5.3.9 Additional Plan and Section Sheet Requirements

The Authority's Linear Design Guidance Manual includes additional drawing development requirements. WRF Design Engineers should cross-reference that Guidance Manual for additional relevant requirements.

5.3.10 Details

The WRF Design Engineer shall utilize the Authority's standard details as applicable (see the Authority's website). The Authority's standard details are not intended to cover every situation. The WRF Design Engineer is responsible for reviewing these standards and proposing modifications as required for specific project needs. Such modifications require Authority approval.

The WRF Design Engineer is responsible for developing site specific details as required to provide a complete design. Such details need to be consistent with the Authority's existing standard specifications and details and shall be drawn to scale.

5.4 Drawing Changes

Changes made to Drawings during design do not need any revision notations on the border. The drawing status block is intended for revisions after completion of the final Drawings, for formal changes made by addendum during the bid phase and for recording "as-built" information.

A change on a drawing revised by addendum is noted by describing it in the revision block, circling the revised area with a "revision cloud" on the drawing, and placing the revision number in a triangle inside the circled area.

5.5 Deliverables

The WRF Design Engineer shall deliver to the Authority the AutoCAD (.DWG) design files, including the plotting parameter files of all types:

1. Font libraries.
2. Cell libraries.
3. Patterning libraries.
4. Color tables.
5. All parameter files associated with the use of AutoCAD software.
6. X-ref drawings and image files.

5.6 Sample Drawings

Sample drawings will be provided by the Authority and are to be used as a guide for design standardization. Sample drawings are not intended to be all encompassing and to cover every scenario or circumstance the WRF Design Engineer may encounter. Consult with the Authority for guidance when scenarios or circumstances are not covered.

CHAPTER 6 DEVELOPMENT OF PROJECT MANUAL

6.1 General

WRF Design Engineers are responsible for the development of the Project Manual utilizing a variety of specifications. Authority projects typically have three types of specifications—(1) Authority-provided Guide Specifications which are to be customized by the WRF Design Engineer and reviewed/approved by the Program Manager before being issued as a Project-Specific Specification, (2) Authority-provided Standard Specifications which are used in their entirety and only modified via Supplemental Specification, and (3) Project-Specific Specifications that are developed by the WRF Design Engineer.

6.2 Guide Specifications

At project kickoff, WRF Design Engineers will be provided with Guide Specifications in native Microsoft Word document format that have been developed by the Authority for use on all projects. These include Division 00 specifications relevant to bidding and contracting as well as Section 01110 - Summary of Work.

Guide Specifications ultimately will be transformed into Project-Specific Specifications and should follow the header/footer and formatting requirements stipulated in Section 6.4 for Project-Specific Specifications.

WRF Design Engineers should utilize these Guide Specifications for development of the relevant specification sections in the Project Manual. During the interim design submittals, WRF Design Engineers may only modify the Guide Specifications by taking the native Microsoft Word document and utilizing "track changes" to customize the specifications into a Project-Specific Specification. Standard terms and conditions of the agreement and general conditions should not be modified. The Program Manager must review and approve all proposed changes to these Guide Specifications prior to being finalized as Project-Specific Specifications.

Note, Section 00003 - Table of Contents will be provided as a Guide Specification. WRF Design Engineers must follow the instructions within this Guide Specification that indicate how to name and date all specifications. Additionally, WRF Design Engineers must use standard bid items as provided in Section 00300-Bid Form and/or by the Program Manager for inclusion in the Bid Form. The WRF Design Engineer is responsible for developing the bid items for the project consistent with the Authority's standard bid items, format and organization. The WRF Design Engineer shall verify the bid items listed have a corresponding specification which identifies how the item is measured and paid for (SY, CY, Each, etc.).

If the Authority's Guide Specifications are modified throughout the course of the design project, the Program Manager will notify the WRF Design Engineers of any changes. WRF Design Engineers must incorporate the latest changes to the Guide Specification into the design.

6.3 Standard Specifications

From time to time, the Authority issues Standard Specifications for use on all projects. These specifications are posted in PDF format on the Authority's website. Relevant Standard Specifications are to be utilized for each Authority project. WRF Design Engineers are responsible for reviewing the Standard Specifications and determining if they are acceptable for their project's use. If modifications are needed, the WRF Design Engineer shall develop a Supplementary Specification to that Standard Specification. Supplementary Specifications shall follow the formatting requirements stipulated in Project-Specific Specifications.

When assembling the Project Manual, project-specific Supplementary Specifications are to be placed in front of the Standard Specifications that they are modifying. For interim deliverables (60 and 95 Percent Submittals), the WRF Design Engineer is only required to submit the proposed Supplementary Specifications for review and approval by the Program Manager and should utilize track changes for each revision. The Program Manager will coordinate with the Authority and/or legal counsel as needed to approve any supplements to the Standard Specifications. Once the 95 Percent Submittal is approved to be finalized as "100 Percent Issued for Bid," WRF Design Engineers should accept all changes in the supplement documents and finalize as a PDF for inclusion in the final Project Manual. Final Project Manuals must include both the supplement and the standard specification, in that order.

If the Authority's Standard Specifications are modified throughout the course of the design project, the Program Manager will notify the WRF Design Engineers of the posting of an updated version of the Standard Specification section(s). WRF Design Engineers must incorporate the latest version of the Standard Specification into the design.

6.4 Project-Specific Specifications

WRF Design Engineers may need to develop Project-Specific Specifications where there is not a Standard Specification. WRF Design Engineers shall submit proposed Project-Specific Specifications for review and approval by the Program Manager.

Project-Specific Specifications should have the following denoted in the header:

- Left justified:
  - First Line: "North Harris County Regional Water Authority."
  - Second Line: "Project <<Insert Project Name>> Specification."
- Right justified:
  - First Line: Nothing.
  - Second Line: <<Insert Specification Title>>.

Project-Specific Specifications should have the following denoted in the footer (center justified):

- First line: <<Insert Specification Number>> <hyphen> <<Page number>>.
- Second line: <<Month Year>> when specifications are being issued. Note, for the final Project Manual, this date should be the Month/Year that the Project Manual is being "Issued for Bid" or "Issued for Construction," as applicable.

Formatting of all Project-Specific Specifications should match the Authority's Guide Specifications provided in native Microsoft Word format, inclusive of font size/type, spacing, numbering, and justification.

6.5 Incorporation of Other Entity's Specifications

If a WRF Design Engineer is required to incorporate another entity's specification(s) into the Project Manual, typically it requires utilizing a PDF. In this instance, the WRF Design Engineer may keep the native formatting of that specification.

6.6 Guidelines for Compiling the Project Manual

WRF Design Engineers are responsible for submitting a proposed Table of Contents with the 30 percent Submittal, indicating necessary specifications and which will be Project-Specific and/or supplements to Standard Specifications. For each successive submittal, the WRF Design Engineer shall provide the relevant specifications for review by the Program Manager. Documents should not be finalized as "Issued for Bid" with track changes accepted until approval is received from the Program Manager.

Note, the front-end documents define and prescribe the responsibilities and relationships of the contracting parties and make provisions for the contract's administration from the bidding stage to project closeout.

The front-end documents include:

1. Notice to Bidders.
2. Instructions to Bidders.
3. Bid Form.
4. Contractor's Qualification Statement.
5. Contract for Construction.
6. Bid Guarantee and Bonds.
7. General Conditions of the Contract for Construction.
8. Supplementary Conditions.
9. Special Conditions.

The WRF Design Engineer is responsible for:

1. Reviewing the standard specifications.
2. Familiarizing themselves with the contents.
3. Utilizing the specifications in a project specific mode.
4. Being responsible for their content.
5. Preparing necessary supplements to the standard to specifications pertaining to the specific project.

TxDOT, Harris County and City specifications shall be reviewed and included, where appropriate, in the project construction as specifications.

The WRF Design Engineer is to recommend the proposed Liquidated Damages amount and provide supporting documentation when requested by the Authority. The WRF Design Engineer shall also recommend interim milestones and contract durations, where appropriate.

6.7 Schedule

Refer to the authorized scope of services for the schedule for submitting the various Project Manual elements discussed above.

At the 60 percent submittal, the WRF Design Engineer is to provide preliminary "redlined" front end documents to the Authority for review. As appropriate, suggested revisions will be incorporated into "Supplementary Specifications" that will supersede the Authority's standard published technical specifications.

The final front end portion of the Contract Documents is to be prepared by the WRF Design Engineer for the 95 percent Submittal.

CHAPTER 7 CONTRACT ADMINISTRATION

7.1 General

The following is only a partial listing of the contract administration. The WRF Design Engineer shall refer to the Authority's Professional Services Agreement and the authorized Scope of Services for the project for additional requirements.

7.2 Design Schedule

A Project Schedule will be developed and submitted by the WRF Design Engineer based on the scope of work. Approval of the Project Schedule is required before processing the WRF Design Engineer's first invoice. The Project Schedule should include all major milestone activities and identify the critical path to the timely completion of the Project.

Once the Project Schedule is approved by the Authority, any changes require approval from the Authority.

7.3 Deliverables

The WRF Design Engineer's contract stipulates all required deliverables for a project. Additionally, the Authority has developed checklists to be completed with each milestone deliverable to ensure the WRF Design Engineer has provided all necessary documentation with their deliverables. Refer to Appendix D for the current WRF design checklists.

- 100 Percent Design Submittal (also called Issued for Bid).

The 100 Percent Issued for Bid Submittal consists of final Drawings with all corrections incorporated from the reviewing authorities including those that are indicated on the prior submittal reviews. "Bid-Ready" Submittal shall contain all appropriate signatures, including jurisdictional agencies and private utility companies.

The Issued for Bid set must be signed and sealed and provided both in PDF format suitable for upload to the Authority's electronic bidding system, and also in native format (CAD, word, excel, etc.). Hard copies are as specified in the WRF Design Engineer's scope of services.

- Engineering Services during Construction.

WRF Design Engineers will provide various engineering services during construction, including the preparation of Conformed Documents (also called Issued for Construction) incorporating any addenda issued during the bidding period.

7.4 Final Project Closeout

WRF Design Engineers must take the redlined as-builts provided by the Contractor and create project Record Drawings as part of the final project closeout. Record drawings must be submitted in hard copy and digital format per the WRF Design Engineer's scope of services. Digital format is to include both PDF and native file formats (CAD, word, excel, etc.)

7.5 DOCUMENT MANAGEMENT

The WRF Design Engineer will be provided direction on the use of the Authority's Document Management Software – Kahua. The WRF Design Engineer is to use the software to upload invoices and all relevant project documents. The Program Manager will provide instructions for the use of Kahua throughout the project life cycle and will also provide expectations to the WRF Design Engineer for what should be uploaded.

APPENDIX A

TCEQ MEETING MINUTES (JULY 12, 2016)

Contact the Authority for a copy of this Appendix.

APPENDIX B

SAMPLE DISINFECTION ATTACHMENT FOR THE TCEQ ENGINEERING REPORT

Contact the Authority for a copy of this Appendix.

APPENDIX C

DISTRIBUTION SYSTEM BLENDING AND WATER QUALITY MEMORANDA

Contact the Authority for a copy of this Appendix.

APPENDIX D

WRF DESIGN CHECKLISTS

Contact the Authority for a copy of this Appendix.