

# NORTH FORT BEND WATER AUTHORITY

# **PROGRAM CRITERIA MANUAL**

Prepared by



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# History of Revisions

- 1. 12/23/20 Revised 4.6 Sheet Index.
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- Exhibit 2-3: NFBWA Surface Water Conversion Checklist
- Exhibit 4-1: Existing Improvements
- Exhibit 4-2: Proposed Improvements
- Exhibit 4-3: Line Code Definitions
- Exhibit 6-1: Geotechnical Report
- Exhibit 6-2: Environmental Investigation Report
- Exhibit 8-1: Progress Report Outline

# Chapter 1– Program Overview

# 1.1 Introduction

The North Fort Bend Water Authority (the Authority) is a governmental entity created in 2005 by Senate Bill 1798 of the 79th Texas Legislature in response to the need to reduce groundwater use to address land subsidence in Fort Bend County. The Authority encompasses 69 utility districts (as of March 2015) and the City of Fulshear as well as other private well owners within its jurisdictional boundary. The primary mission of the Authority is to develop and implement a strategy to comply with regulations set forth by the Fort Bend Subsidence District (FBSD). These regulations require water users within the Authority's jurisdiction, and subject to FBSD's disincentive fee, to limit groundwater pumpage to a percentage of their total water demand beginning in 2014. The water supply exceeding this amount must come from an alternative supply. Typically, this supply is surface water, although reclaimed water reuse and conservation are other options to reduce groundwater demand.

The following milestones are significant to the Authority's master plan for surface water conversion:

2008 – Received FBSD certification of Groundwater Reduction Plan (GRP, Program)

2014 - Meet 30 percent reduction in groundwater use

2025 - Meet 60 percent reduction in groundwater use

The Program is the combination of efforts undertaken to implement the Authority's GRP to successfully achieve the required reduction in groundwater pumpage through conversion of water demand to use of surface water.

The Authority has identified treated surface water, purchased from the City of Houston (COH), as the preferred source of water for the 2014 conversion. The COH has sufficient raw water in the Trinity and San Jacinto River basins that can be treated by three water purification plants and then conveyed through the existing COH water transmission and distribution system and future infrastructure to meet the Authority's long-term demands. The initial supply of treated surface water necessary to meet the Authority's demands through 2024 will be delivered to the Authority's Bellaire Pump Station. Preliminary plans for the 2025 conversion requirements are based on supplementing this supply with treated COH water delivered to the north side of the Authority by way of a pipeline with capacity shared between the Authority and the West Harris County Regional Water Authority (WHCRWA).

Participants in the Authority's Program include two types of water users. The first group includes the owners of wells subject to FBSD's disincentive fee physically within the boundary of the Authority. The second type of participants are physically outside the Authority but are included in the Authority's Groundwater Reduction Plan by contract with the Authority. Contract Participants will pay groundwater pumpage fees as if they were within the Authority boundary. In turn, the Authority will convert within its boundary in excess of the required amount in order to meet the conversion requirements of contract participants.

The Authority's water transmission system will be expanded from the 2014 service area which is intended to meet surface water supply requirements through the end of 2024, to a larger system capable of meeting subsidence regulation and increased demands of the Authority out to the year 2055.

# 1.2 **Program Policies**

Several policies were identified during the early stages of the Authority's Program and others are anticipated as the Program continues to evolve. The current policies have been grouped under the headings of Administrative, Design, Construction, and Quality Control.

## 1.2.1 Administrative

The Program Team consists of the Authority, the Program Manager, Design Consultants, various Support Service Consultants, and other selected consultants. The roles and responsibilities of the Program Manager and Design Consultants are discussed below.

- 1. Program Manager Responsibilities
  - a. The Program Manager has an active role with all members of the Program Team.
  - b. The Program Manager will administer all aspects of the Design Consultants' work on behalf of the Authority, including the general management and administrative services necessary to coordinate and execute the Program.
  - c. The Program Manager will coordinate as required between Subconsultants and Design Consultants. For example, geotechnical and environmental investigations and cathodic protection will be conducted on a system wide basis with some minor exceptions. The Program Manager will coordinate directly with these Subconsultants and provide their final reports and findings to the Design Consultants working on individual segments. In the interest of enhancing communication, maximizing results of coordination efforts, minimizing time waiting for information, and efficiently using resources, the various consultants (Design Consultants and other Subconsultants) are generally encouraged to communicate directly with each other regarding information specific to the Design Consultants' projects.
  - d. The Program Manager will maintain effective control and overview of the engineering assignments. This requires the effective monitoring and maintenance of all costs, schedules, and overall Design Consultant performance. Critical to the Program Management function is the maintenance of schedules developed cooperatively between the Program Manager and Design Consultant and accepted by the Design Consultant during contract negotiations. It is the Design Consultant's responsibility to maintain this design schedule. Standard design, document formats, periodic reports, design reviews, monthly invoices, and other similar requirements also form a part of these administrative procedures.
  - e. The Program Manager will provide the Design Consultant with information resulting from additional services performed by the Program Manager and other consultants working for the Authority. These include primary and secondary control surveys; right-of-way (ROW) mapping and land acquisition; corrosion control investigation studies; geotechnical investigations; environmental site assessments; and surge analysis.
  - f. Other support services may be provided by the Program Manager as their need is identified and approved by the Authority.
- 2. Design Consultant Responsibilities
  - a. Topographic surveys, Storm Water Pollution Prevention Plans (SWPPP) and traffic control plans will be the responsibility of the Design Consultant.

- b. The specific tasks to be performed by the Design Consultant are defined in the Scope of Services of the Design Consultant's contract. The services include, but are not limited to the preparation of design drawings (Drawings) and Specifications for their assigned project.
- c. The Drawings and Specifications are to be prepared in accordance with the Authority's Standard Specifications Sections, Details, and Contract Documents and shall incorporate design concepts and criteria, standard design, and graphic standards as provided by the Program Manager.
- d. In carrying out these services, the Design Consultant shall carefully coordinate his design efforts, drawings, and details with the Program Manager; the Design Consultants involved in projects adjacent to or tying into his project; and such public agencies, utility companies, and other parties as may be required to successfully complete the project. Coordination activities with Utility Districts and other Design Consultants may be facilitated or overseen by the Program Manager, as required.

## 1.2.2 Design

The Authority will design and construct a pump station(s), transmission water lines, and district connection water line projects to deliver surface water to entities identified for conversion. District connection lines will deliver surface water to district water plants. The water line will physically enter the water plant site where a water meter and control valve station (meter station) will be built. An easement will be acquired from each district for this meter station. These facilities will be owned, maintained and operated by the Authority.

1. Utility Districts

Each district will be responsible for design, construction, and maintenance of the yard piping, connections to tanks, other tank modifications (e.g., overflow, venting), and chloramines disinfection system downstream of the meter station. The Authority has adopted a Resolution for Chloramine Reimbursement that can be found on the Authority's website.

Every district in the Authority must build, operate and maintain a groundwater well(s) to meet their peak and fire flow demands. It is anticipated that the Authority's surface water facilities will deliver, on average, 90% of the annual average day supply for converted districts.

2. Authority Water Lines

The Authority will execute multiple design and construction packages for transmission mains and MUD connection lines over a significant period of time. It is in the best interest of the Authority that these packages be developed in a consistent manner and provide a uniform description of the proposed improvements. In addition, certain elements of the Program should be common to all design packages – such as drawing scale, details, corrosion control, valves, etc. Standards for the preparation of these elements are outlined in this Design Manual. To help achieve these purposes, selected standard design details will be provided to the Design Consultant, where applicable, for incorporation into the design packages. In addition, selected Standard specifications will also be provided.

The format or structure of the construction drawings will conform to Program Standards for size, type, and content. For example, certain specified sheets will be included in each construction package, such as sheet layout, core boring sheet, baseline ties and benchmarks, monumentation benchmark data, standard details, etc.

The Design Consultant shall:

- a. Complete front-end contract documents,
- b. Review the selected standard drawings and specifications and familiarize himself with the contents,
- c. Utilize the selected standard drawings and specifications with consideration for special provisions for project specific variations.
- d. Ultimately be responsible for the content of the Construction Documents, and
- e. Prepare all modifications to drawings and specifications pertaining to specific project needs.

## 1.2.3 Quality Control

The quality control of the project is the responsibility of the Design Consultant. As part of the quality control, the Design Consultant is to walk the project a minimum of two times during the course of work:

- a. The first time, prior to the submittal of the 30% Design Submittal, to verify the completeness of the survey and assess design requirements.
- b. The second time, prior to the submittal of the 70% Design Submittal, to verify the appropriateness of the design and identify changes to the site that may have occurred since the initial walk-through.

Additionally, the Design Consultant shall designate a quality control reviewer(s) prior to beginning the design effort. This reviewer(s) shall be independent from the design team. Review shall be performed on the formal review documents submitted to the Program Manager. The quality control reviews shall occur prior to each submittal. A copy of the review comments generated by the quality control reviewer(s) shall be submitted to the Program Manager with each submittal.

# Chapter 2– Design Criteria

# 2.1 General

It is not the intent of this Program Criteria Manual to provide a complete guide to water line design. The Program Manager has produced certain documents and standards, which contain criteria applicable to this Program.

The Design Criteria presented in this Design Manual is not meant to be all-inclusive or to substitute for sound professional judgment on the part of the team members. Representative standards or procedures are listed within this Design Manual and specific design criteria are grouped by common categories.

In general, a package that is put together by a Design Consultant that is to be used for bidding and construction purposes will include but may not be limited to the following:

- Contract Documents
- Technical Specifications
- Design Drawings

# 2.2 Outside Standards

There are public agencies and authorities that influence the design of the Authority's projects. These entities have established their own criteria and minimum standards that may be applicable to the design. The Design Consultant should be familiar with the following publications and sources and adhere to the applicable standards.

- 1. "Rules and Regulations for Public Water Systems," Texas Commission on Environmental Quality (TCEQ), Water Utilities Division,
- 2. Various publications by the American Water Works Association,
- 3. Requirements by regulatory agencies and approving authorities such as:
  - TxDOT,
  - Fort Bend County and Fort Bend Drainage District,
  - City of Houston,
  - Harris County and Harris County Flood Control District, and
  - Railroads and private utility companies.

# 2.3 Design

The following sections outline the Authority's minimum design requirements.

# 2.3.1 Hydraulic Considerations

The Program Manager has determined the sizes of all line segments. These sizes will be provided to the Design Consultants. The Program Manager has used the following hydraulic considerations in sizing these line segments.

1. Velocity Considerations

Consideration	Velocity
Desired velocity	4 fps
Maximum velocity under any demand condition	6 fps

(This maximum velocity may be adjusted after consideration of head loss conditions.)

2. Pipe Friction Factors (Hazen Williams "C" Factor)

All pipes use C Factor of 110.

3. Pressure Conditions

Location	Pressure
Primary Distribution System	100 psi (maximum)
District Tie-in Connections with Control Valves	60 – 85 psi

Maximum System Pressures (Including Surge Conditions):

- a. The maximum pressures anticipated are the greater of the following criteria.
  - 150 psi minimum test pressure shall be used for transmission mains and distribution mains. However, if the normal maximum design pressure exceeds 100 psi, then the test pressure should be 1.5 times the maximum design pressure.
  - The maximum design pressure as specified in the appropriate American Water Works Association (AWWA) Manual of Water Supply Practices, Standards, Design Criteria or Specifications, such as AWWA M9, "Concrete Pressure Pipe" or AWWA M11, "Steel Pipe – A Guide for Design and Installation," or others applicable to the type of pipe selected by the Design Consultant.
  - Other special design criteria as specified by the Program Manager.
- b. Maximum system pressures for the Program are based upon equipment closing times:

Closing Times	Seconds
Pressure reducing valves and check valves	2.0 – 5.0 seconds (maximum)
Isolation (butterfly) valves	60 seconds (minimum)
Pump control valves	30 seconds (minimum)

c. In accordance with standard criteria and acceptable engineering practice, air release; combination air valves; and/or vacuum relief/air inlet valves should be installed at high points and such other intermediate points as determined during design. In the design of large diameter water mains, the Program Manager will work with a transient analysis consultant to provide recommendations to the Design Consultants regarding locations for air valves.

#### 2.3.2 Alignment

The routes of the proposed water mains are based on an extensive evaluation effort. Some routes have been selected based upon traffic patterns and land use; width of ROW; existing utilities, pavement condition, and landscape features; and proposed improvements along the route.

After the survey and record research efforts are complete, the Design Consultant is expected to walk the route to verify accuracy of the completed base sheets (plan and profile). With the exception of routes within CenterPoint Energy corridors, Design Consultants are to use their discretion to determine a recommended alignment within the route. The Design Consultant is to present the final alignment for the proposed water main which will minimize public inconvenience and the anticipated construction cost. The alignment presented should include, at a minimum, the following considerations. If these considerations to the Program Manager for approval.

- 1. Horizontal alignments will be located in the following order of preference:
  - a. In a separate water line easement adjacent to a street ROW or public utility easement, the minimum width of easement for lines 12 inches in diameter shall be 10 feet, and for lines 16 inches in diameter and larger shall be 20 feet, unless otherwise approved by Program Manager.
  - b. In street ROW either behind the curb or in the median (wherever space allows)
  - c. In a public drainage easement or ROW
  - d. In a public utility easement
  - e. In a separate water line easement outside of and not adjacent to a street ROW or public utility easement, the minimum width of easement shall be 20 feet for 16-inch lines and smaller and 30 feet for lines larger than 16 inches, unless otherwise approved by Program Manager.
  - f. Under pavement in street ROW

- 2. For water mains located less than 5 feet from a street ROW or public utility easement, the outside edge of the water line shall be located 5 feet from the water line easement for 12-inch diameter and smaller, and 10 feet from the water line easement for 16-inch diameter and larger water lines.
- 3. Horizontal Location of water lines in public utility or drainage district ROW or easement will be a minimum of 10 feet from the ROW or easement line to the centerline of the pipe.
- 4. Horizontal alignments will be chosen to minimize conflicts with other utilities.
- 5. Vertical alignments may be dictated by the presence of utility conflicts and other regulatory agencies' and approving authorities' standards. The minimum depth of cover is 6 feet in improved areas, defined as:
  - a. Curb and gutter with storm sewer system,
  - b. Improved drainage channels,
  - c. Improved CenterPoint easements.
- 6. In unimproved areas (open roadside or drainage ditches), the minimum depth of cover is 8 feet, unless otherwise approved by the Program Manager.
- 7. Where possible, either beveled or deflected joints should be used for changes in the vertical or horizontal alignments.
- 8. During the design development process, the Design Consultant will not generally know which pipe material that will ultimately be used to construct the project. Unless otherwise instructed in writing by the Program Manager, the Design Consultant will assume the pipe material to be Prestressed Concrete Cylinder Pipe (PCCP) for the basis for the detailed alignment. Because PCCP has the largest wall thickness of the generally accepted pipe materials, a detailed alignment designed with PCCP should accommodate all other pipe materials.
- 9. Where a construction project connects with another project, the location of connection shall be coordinated between the Design Consultants. One Design Consultant shall prepare an exhibit detailing the connection and both consultants shall sign an acknowledgement on the detail stating that they have coordinated with each other on the requirements of the connection. This exhibit shall be submitted to the Program Manager for approval.
- 10. The centerline of any water line shall be no closer to a building line, building foundation or building slab than 10 feet for water lines 12 inches in diameter and smaller, and no closer than 15 feet for water lines 16 inches in diameter and larger.
- 11. Maintain a minimum horizontal distance from outside wall of water line to outside wall of storm sewer of 4 feet.
- 12. At storm sewer crossings, maintain a minimum vertical distance from outside wall of water line to outside wall of storm sewer of 2 feet.
- 13. If the ultimate top of curb is known for a specific roadway, the depth of cover will be 6 feet from the proposed top of curb to the proposed water line.

- 14. Vertical and horizontal clearances between waterline and sanitary sewer shall be in accordance with TCEQ regulations (Texas Administrative Code 217.53 (d)) and/or City of Houston Infrastructure Design Manual, whichever is more stringent.
- 15. Maximum deflection with beveled end is 5 degrees at each joint.

#### 2.3.3 Pipe Material and Appurtenances

Each Design Consultant must address the minimum design requirements of each pipe material(s) for their specific project.

1. Pipe Design

The Design Consultant shall determine the minimum pipe design requirements based on combined loading conditions including design, operating and surge pressures, as well as backfill cover and live loads. This effort is to include identifying minimum wall thickness (including whether the calculated minimum exceeds the minimum in the Standard Specifications), special coatings, etc.

- a. Design the water line using Prestressed Concrete Cylinder Pipe (PCCP).
- b. Water line drain line one or more per contract, as determined by Design Consultant and agreed to by Program Manager. Drain line does not need to drain entire length of line; it does need to be located adjacent to a drainage facility – either an open channel or to a storm sewer.
- c. At the end of segments use plug and clamps for 24-inch diameter and smaller water line and internal elliptical dish head plugs for 30-inch and larger water lines.
- 2. Material Evaluation and Selection

Pipe materials must conform to AWWA Standards. The pipe materials selected for the Program are listed below based upon available sizes.

Туре	Diameter (Inches)
Polyvinyl Chloride	≤ 30
Ductile Iron	≤ 64
Prestressed Concrete Cylinder	20 - 96
Bar Wrap Concrete Cylinder	20 - 60
Steel	≤ 96

#### **Pipe Materials**

The criteria used to evaluate each pipe material are: system flexibility, hydraulic efficiency, manufacturer and availability, surge protection, maintenance, susceptibility to environment, and costs.

# 2.3.4 Corrosion Control

The design of each construction package for the Program will include Cathodic Protection and bonded dielectric coatings where applicable. Standard details are provided by the Authority in consultation with the Corrosion Protection Consultant – see Chapter 6 – Additional Services. The type and location of protection is dependent on the particular field conditions of the project, and these will be investigated during design by a corrosion specialist directly under contract to the Authority. Each Design Consultant will incorporate the recommendations for corrosion protection as applicable. The Authority's Program Manager will coordinate between the Design Consultant and the Corrosion Specialist and provide required information to the Design Consultant.

## 2.3.5 Valves

The Program will require several different types of valves, each with its own specification requirements. The primary types (classification) of valves which may be required for the Program are: isolation valves, air and vacuum valves, combination air valves, and control valves (pressure reducing valves, etc.). All valves shall conform to applicable AWWA Standards and the Program Standard Specifications. Valves and other appurtenances in direct contact with the water flow must also meet or exceed NSF-61 Standards. The requirements of the Standard Specifications shall govern when AWWA Standards or Manuals of Standard Practice disagree.

Valve characteristics or criteria include the type of valve (gate, butterfly, etc.); spacing; location, and performance and equipment specifications. A few of these items are listed below for different types of valves.

- 1. Isolation Valves
  - a. All connections to other system lines shall have an isolation valve near the tee connection, and the valve should be located along the street ROW line projected (extended) across the connecting main whenever possible. Spacing and type of valve based on water main diameter are summarized below.

Туре	Size	Approximate Maximum Spacing (feet)
Gate	12-inch and smaller	1,500
Gate	16-inch to 20-inch	2,000
Butterfly	24-inch to 42-inch	3,000
Butterfly	48-inch and larger	5,000

- b. All valves shall be constructed with valve boxes or actuator service manholes, as defined by Program requirements. Locate valves with service manholes so they are accessible by a truck-mounted mechanical valve operator.
- c. Unless otherwise approved by the Program Manager, an isolation valve shall be placed at each branch of a water line tee or water line cross.

- d. Final isolation valve locations shall be approved by Program Manager.
- 2. Combination Air Valves
  - a. Combination air and vacuum valves shall be placed on the water line at selected high points in the water line profile and at specified locations such as bayou and highway crossings. The number, size, and location of these valves is to be determined by the Design Consultant in accordance with acceptable design practice based on line size, flow rates, site conditions, and related factors. In certain cases, the Program Manager will provide the Design Consultant with specific recommendations or requirements as to size and location of valves.
  - b. Both single-body and duplex-body combination designs may be used, depending on the size, location, and other factors for a specific installation. Care should be taken to locate the valve such that the inlet/outlet vent elevation shall be 1 foot above the 100-year floodplain as established by FEMA or 4 feet above natural ground, whichever is higher, and that the valve installation and piping is properly protected from tampering and damage. Vent piping to be located along property lines or ROW/easement lines, unless otherwise approved by the Program Manager, so that minimal obstruction occurs to the adjacent property owners. Locating vent piping in the esplanades is to be avoided but, if necessary, requires approval.
- 3. Vacuum Relief-Air Inlet Valves
  - a. For certain line segments, surge modeling will be performed to determine specific location for installation of surge protection devices. In these instances, the Program Manager will provide requirements as to the size, location, and design of these installations. The surge modeling is performed based on the use of vacuum relief-air inlet valves in combination with side-mounted air release valves (rapid air inflow with slow release) as the surge protection devices. This type of device must be distinguished from others which allow rapid air release or which have slow or dampened closure.
  - b. The Design Consultant is to coordinate his design efforts for these stations with the Program Manager due to standardization of certain elements of the vacuum relief valve installation. The inlet/outlet vent elevation shall be 1 foot above the 100-year floodplain as established by FEMA or 4 feet above natural ground, whichever is higher. Care should be taken to locate the valve such that the valve is properly protected from tampering and/or damage.
  - c. Locate vacuum relief vent piping at property line unless otherwise approved.
- 4. Control Valves
  - a. The Design Consultant is to coordinate his design efforts for the PRV station with the Program Manager due to standardization of certain elements of the PRV station.
  - b. The Program Manager will determine the location of any pressure reducing valves.
- 5. Drainline Valves
  - a. Drainline valves should be provided on large-diameter (greater than 30 inches in diameter) water lines at or near the low point in the water line and where required by the Program Manager.

- b. Place a drainline between each isolation valve for water mains larger than 36 inches in diameter.
- c. Locate drain lines near storm sewer or drainage facilities capable of accepting the flow from draining the lines.
- 6. Flushing Hydrants

Flushing hydrants should be placed upstream of all isolation valves and district distribution line connections. Additional locations may be specified by the Program Manager. Flushing valves should be located in close proximity to a drainage swale, channel or stormwater structure, where possible. Flushing hydrants shall not be placed in any drainage district, pipeline, or CenterPoint easement.

#### 2.3.6 Manholes

Standard details have been provided and coordination by the Design Consultant is required to incorporate manholes in the design. Manholes should not be placed in a vehicle path, if possible.

#### 2.3.7 Manways

Standard details have been provided and coordination by the Design Consultant is required to incorporate manways in the design. Provide access manways with manhole approximately 10-feet upstream and downstream of proposed butterfly valve to allow internal access.

## 2.3.8 Thrust Restraint

The Design Consultant shall determine the length of large diameter water line that must be restrained to resist the forces developed by the internal water pressure at all bends, tees, and other fittings including any proposed connections to existing water lines. Restraint is to be provided regardless of the diameter of the pipe. Thrust blocking may be used for small diameter water lines. Thrust blocking shall be in accordance with City of Houston standard details.

For large diameter water lines, thrust restraint calculations shall be based on the use of Prestressed Concrete Cylinder Pipe (PCCP) in buoyant conditions (i.e. water table at ground elevation). Where a specific pipe material is specified on the Drawings, use that pipe material and appropriate factors for determining thrust restraint. These calculations shall be submitted to the Program Manager as part of the Final Design Report.

## 2.3.9 Plant Connections and Expansions

The Authority's transmission line will terminate at the downstream flange of the metering and control valve station. Standard details for the metering and control valve station have been provided. The control valve station will be designed to maintain compliance with the Program. Surface water from the Authority will be the Water Plant's primary source. The Water Plant Owner will maintain its groundwater supply as a secondary source for peaking and in the event that the Authority's water service is interrupted or ceases for any reason

Under a separate contract not with the Authority, the Design Consultant shall design the water plant facilities from the downstream flange of the meter/control valve station to other systems at the water plant. Provide a flange isolation kit at the connection to the Authority's meter/control valve station.

The Authority has developed policies to reimburse design and construction costs for water plant improvements necessary to receive surface water. To be eligible for reimbursement of costs, the

Authority must be allowed to review, and the Design Consultant must address the Authority's comments prior to bidding. Submittal requirements are presented in Chapter 7 of this manual.

Approaching the end of construction of water plant improvements, coordinate with the Authority so that the Authority can complete work related to the Authority's water line and meter/control valve station.

## 2.3.10 Geological Faults

The Program Manager will provide a fault study. The Design Consultant is required to check the fault study and incorporate the recommendations from the study.

## 2.3.11 Special Crossings

The Program includes numerous crossings of special design significance. These include natural and improved waterways, highways, railroads, and special pipeline corridors. Their complexities have wide variations and may require coordination or approvals from several agencies. It is the Design Consultant's responsibility to confirm current design requirements and to obtain all permits and approvals.

- 1. Bayou, Stream and Ditch Crossings
  - a. Water line crossings of waterways or other drainage channels may either be aboveground or underground depending on the particular features, problems, or restrictions of the specific crossings.
  - b. Elevated crossings should have a minimum elevation of one foot above the 100-year floodplain and should maintain a minimum 10-foot horizontal clearance from existing bridge structures.
  - c. Minimum clearances on underground crossings are normally 6 feet below the ultimate flowline. Some crossings may require more than 6 feet.
  - d. The Design Consultant is responsible for determining the specific requirements of the appropriate agency or drainage district and coordinating his design and schedule accordingly.
- 2. Highway and Railroad Crossings
  - a. In general, major highway and railroad crossings should be encased in a steel casing or tunnel liner. The specific design details for each crossing will depend on the special requirements of the agency with authority over the crossing.
  - b. The Design Consultant should become familiar with the "Utility Accommodation Policy" prepared by TxDOT (commonly referred to as Plate 8) and adhere to the design.
  - c. The Design Consultant should coordinate all necessary TxDOT interface with the Program Manager.
  - d. The Design Consultant is responsible for determining the specific requirements of the agency and coordinating his design and schedule accordingly.
- 3. Special Pipeline Crossings

- a. The Design Consultant is responsible for determining the specific requirements of the pipeline companies and coordinating his design and schedule accordingly.
- 4. Water Line Markers
  - a. The Design Consultant is required to specify water line markers to be installed at the following locations, a standard detail has been provided:
    - Street crossings,
    - Flood Control or Drainage District channel crossings,
  - b. Placement of water line markers to be on each side of the crossing, 1-foot inside the street ROW and 1-foot outside the channel easement.
  - c. The Design Consultant should coordinate location to ensure maintenance access is not obstructed.
  - d. The Authority will provide labels for the water line markers.

#### 2.3.12 Tree Protection

Location, size, and species of trees within street ROW or easements must be documented. For additional requirements, see section 3.5.6 Topographic Features and local agency requirements.

- 1. For Specimen Trees 12 inches and larger:
  - a. Provide a tree removal and replacement plan as part of the construction plans. Trenchless construction methods, under selected specimen trees, may be used to the extent practicable.
  - b. Replacement trees shall be a minimum diameter of 3-inch caliper as established by the American Association of Nurserymen. Trees 12 inches and larger should be replaced with smaller trees totaling the equivalent caliper diameter of the removed tree.
  - c. Replacement trees should generally be of the same type as the removed tree, unless directed otherwise by the appropriate agency during plan review.
- 2. Specimen trees smaller than 12 inches: Specimen trees smaller than 12 inches will be transplanted within the County's ROW as approved by the appropriate agency during plan review.
- 3. Urban Forester: When necessary, provide an urban forester for the preparation of the tree removal and replacement plan.

#### 2.3.13 Additional Design Guidelines

Below is a listing of design items that are not to be overlooked by designers involved on the Program. This list is not intended to be a comprehensive listing of all design tasks. Rather, it is an effort on the part of the Program Manager to identify a few key design items early in the design process in an effort to assist the Design Consultants to complete their work.

1. Flexible Base Pavement:

- a. For parallel applications, when the contractor damages or removes flexible base pavement, the lane width affected will be milled and overlaid with an equivalent thickness of asphalt, base and subbase, for the length of the trench plus a 50 foot length beyond both ends of the excavated area.
- b. For perpendicular applications (water line crossings), the lane(s) affected will be milled and overlaid with an equivalent thickness of asphalt for a length of 50 feet beyond the excavated area.
- c. Where the flexible base pavement is to be removed, saw cut at the limits of the replacement.
- 2. Concrete Pavement:
  - a. For parallel applications, replace concrete pavement to the existing longitudinal joint for maximum lane width of 12 feet and to the nearest sawed or expansion joint on either end of the excavation area 10 feet either end of the excavation or to the expansion joint if it is closer. If after replacement the nearest expansion joint would be less than 10 feet, then replace concrete pavement to the expansion joint.
  - b. For perpendicular applications, replace concrete pavement for a minimum width of 10 feet either side of the excavation or to the expansion joint if it is closer. If after replacement the nearest expansion joint would be less than 10 feet, then replace concrete pavement to the expansion joint.
  - c. Concrete thickness to be replaced to existing thickness or meet current criteria of the appropriate jurisdiction, whichever is greater.
  - d. To minimize traffic disruptions, the use of high-early strength concrete for street repairs will be as defined in the approved construction documents.
- 3. Intersection:

Water lines constructed under intersecting streets will be installed by trenchless methods, unless otherwise approved by the appropriate agency during the plan review process.

All approaches, including left-turn lanes, should remain open to traffic, unless otherwise approved by the appropriate agency during the plan review process.

4. Median Openings:

Water lines under median openings serving public streets, schools, and access for emergency vehicles, whether signalized or unsignalized should be installed by trenchless methods, unless otherwise approved by the appropriate agency during the plan review process.

5. Water Line Detection Requirements:

A detectable warning tape or similar device will be used in the opening trenches of nonmetallic water lines that either cross or are within the ROW. The use of a steel rebar will not be acceptable.

6. Driveway Replacement Guidelines

- a. All driveway replacements shall meet current appropriate agency criteria.
- b. All driveway replacements shall at a minimum match existing widths, radius of curvature, and materials.
- c. Bring to the attention of the Program Manager any driveway that cannot be made to meet the above criteria.
- 7. Easement Side Letter Requirements:

Confirm with the Program Manager any design or construction related requirements from easement side letters. Incorporate these requirements as necessary into the plans and project manual.

8. Work Limits Requirements:

Clearly show work limits (i.e. construction zone) on the plans. In general, work limits are the extent of the Authority's permanent water line easements, temporary construction easements and the public right-of-way. Confirm with the Program Manager any other constraints on the work limits.

Unless otherwise noted on drawings, adhere to the following:

- a. Where utility alignment is within esplanade, and construction limits are shown on drawings to extend to edge of esplanade, keep equipment, materials, stockpiles, a minimum of 5 feet from back of curb.
- b. Where construction limits are shown on drawings to extend to property line, keep equipment, materials, and stockpiles, a minimum of 5 feet away from sidewalks.

# 2.4 Trenchless Construction Guidelines

#### 2.4.1 General

Trenchless construction is often required as part of the methods to construct and install waterlines to minimize impacts to existing facilities. Such methods are used at roadway crossings, drainage channels, and other features that are not to be disturbed. The Design Consultant is responsible to identify these locations and call for the use of trenchless construction in the design.

The owner of the facility being crossed may have additional requirements. The Design Consultant shall be responsible for coordinating with these owners and acquiring their approval for crossing. In addition, the Design Consultant is to apply judgment to identify locations where exceeding these minimum requirements is to the benefit of the Authority and/or contractor. For example, extend an area of trenchless construction to prevent the pit from being under overhead power lines.

The Standard Specifications outline the detailed requirements for augering and tunneling. Standard Details have also been established for augering and tunneling. The following provides minimum requirements for augering and tunneling, anticipated to be the most commonly used methods.

## 2.4.2 Augering

Augering shall consist of installing waterline within a steel casing or without a casing. The two basic auger methods are dry auger and slurry auger.

Dry Auger Method: Installation of steel casing or primary tunnel liner by excavating soil at advancing end of casing and transporting spoil through casing by otherwise uncased auger, while advancing casing by jacking at same rate as auger excavation progresses.

Slurry Auger Method: Installation of steel casing or primary tunnel liner, or pipe by first drilling small diameter pilot hole from shaft to shaft, followed by removing excess soil and installing casing or pipe by pull-back or jacking method.

## 2.4.3 Tunneling

Tunnel construction shall consist of construction of the primary tunnel liner, which is installed during tunnel driving operations. The water line is to be placed within the tunnel after completion of the tunnel liner.

The Design Consultant shall allow the contractor to choose the appropriate tunnel liner as outlined in the Standard Specifications unless specific requirements of the facility owner dictate otherwise.

Generally, when tunneling, access pits shall be constructed at least 5 feet behind the curb or 10 feet outside the edge of pavement in the case of an open ditch section. Locate shafts outside the TxDOT ROW whenever possible. Additional ROW and temporary easements should be avoided, if possible. Quickly bring to the Program Manager's attention areas where additional ROW or temporary easements may be required.

For crossing underneath elevated structures, the casing pipe shall extend 5 feet beyond the bridge drip line. For other crossings, the casing pipe shall extend to the outside of the drainage ditches or 5 feet behind the existing curbs.

## 2.4.4 Procedures

The Design Consultant will submit the permit application for the crossing including all crossing details to TxDOT. The Design Consultant will provide all engineering data necessary to obtain the permits. The permit application will be filed at the time of the 70% Submittal.

The traffic control plan must be approved by the TxDOT Area Engineer. The Design Consultant shall also be responsible for obtaining this approval.

# 2.5 Traffic Control Plan

The following Program criteria outline minimum requirements specifically relating to preparation of Traffic Control Plans (TCP) for design projects.

- 1. The TCP for construction projects shall be designed in accordance with the guidelines set forth in the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Particular attention during design and review of TCPs for projects that are not typical or routine is required and may involve any of the following design elements:
  - a. Signalized intersections of streets
  - b. Traffic control and detours along major thoroughfares and primary collectors
  - c. Projects involving school crossings or detours affecting school access (pedestrian and vehicle) where schools are in session
  - d. Projects involving closing or limiting access to public bus routes

2. During the development of the design for the water system, Design Consultants will be required to complete TCPs utilizing Federal, State, and County traffic control standards, in accordance with the guidelines set forth in the TMUTCD, latest edition. The Design Consultant will provide appropriate traffic general notes and traffic control construction cost estimates as necessary for their design. The TCP shall show detailed construction sequences and the necessary traffic control phases, complete with all barricades, signing, striping, delineation, detours, signal modifications, temporary traffic signals, and any other devices to protect the traveling public and provide safety to the construction forces.

#### 2.5.2 Standard and Guidelines

The Texas Manual on Uniform Traffic Control Devices (TMUTCD) 2006 (with latest revisions) is essential to the development of the TCP, and such drawings are to be included in the TCP, as required.

Other standard reference drawings available as needed are TxDOT Barricades and Construction Standards [Drawings BC-03 and BC-07] (latest revisions), Concrete Traffic Barriers (CTB), and Construction Vehicle Impact Attenuators (VIA). These standards are available from the Houston District of TxDOT.

#### 2.5.3 Plans

Specific tasks which are anticipated to be required in support of the design efforts are:

Existing field conditions regarding roadways and access to adjacent properties shall be verified and shown on the plans.

If a project is complex enough to require phasing or the contractor's construction activities, show all traffic control devices for each phase of the project. A separate phase shall be shown each time changes in the traffic pattern and/or construction sequence is required. Use typical phasing or steps (i.e., sequences) where appropriate.

Each phase of the TCP shall show the location of the traffic flow indicated by directional arrows.

The construction areas will be clearly defined by appropriate identification, such as cross-hatching. All barricades, traffic barriers, delineators, pavement markings, construction signing, and traffic signal changes shall be shown on all plans.

Where narrow medians or restricted pavement widths exist, outside widening should be considered in order to provide adequate lanes during construction. The width of temporary lanes should not be less than 10 feet.

Only roadways that are existing or under construction, including proposed temporary pavement, shall be shown. Roadway that has been removed in a previous phase or that will be built in later phases shall not be shown.

Show detour routing and signing for all road closures.

Cross sections shall show the traffic lanes, construction pavement markings, delineators, barriers, buffer zone for barrels and CTB, pavement drop-off, and construction detail for each roadway variation.

All construction signing shall be represented pictorially and designated with the appropriate identification number as shown in the TMUTCD. All other traffic control devices shall be shown pictorially in the plans and cross sections and fully identified.

# 2.5.4 General Notes and Specifications

General Notes are to be added to the TCP drawings for clarity. Do not duplicate information contained in the Specifications.

## 2.5.5 Graphic Standards

- 1. These plans shall be to a large enough scale to depict all existing and proposed structures as they occur in each phase and step, but not smaller than 1 inch = 100 feet. A 1 inch = 50 feet scale is generally adequate for the TCP's specific details. A smaller scale shall require prior approval of the Program Manager.
- 2. Other specific graphic requirements, such as title block, lettering size, sheet format, standard detail design sheets, etc., are included in the Chapter 4 Graphic Requirements.

# 2.6 Regulatory Agencies

#### 2.6.1 General

The construction for the proposed Program elements will require extensive coordination with public and private utilities. The Design Consultant shall keep the Program Manager apprised of the status of the approval process involving pertinent agencies until such time as final approval is granted. The Design Consultant shall resolve the specifics of his design with the applicable agency. Potential agencies and their possible contacts are shown in *EXHIBIT 2-1*.

## 2.6.2 Local Agencies

The Design Consultant shall obtain approvals from city and county agencies having jurisdiction over the project.

# 2.6.3 Approval from TCEQ and/or TWDB

The Design Consultant shall be responsible for obtaining approval of plans and specifications from the Texas Commission on Environmental Quality. Some projects may be funded from loans and/or grants from the Texas Water Development Board. For these projects the Design Consultant will work with the Program Manager to obtain necessary approvals from the State Agencies.

# 2.7 TPDES Storm Water Permitting

The Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit (CGP) (TPDES Permit Number TXR150000) became effective on March 5, 2008.

## 2.7.1 Disturbing Less Than 5 Acres

- 1. For construction projects that will disturb less than 1 acre and are not part of larger common plan of development, coverage under the CGP is not required. If the project will disturb 1 acre to less than 5 acres of land, which is defined by the CGP as a small construction activity, the requirements of either Section D.1 or D.2 of the CGP must be met, as summarized below.
- 2. Obtain a copy of the TCEQ's TPDES CGP.

- 3. Develop a Storm Water Pollution Prevention Plan (SWPPP), pursuant to Section II.D.2 of the CGP.
- 4. Complete and post a site notice, as provided in Attachments 1 and 2 of the CGP.

#### 2.7.2 Disturbing 5 Acres or More

- 1. If the project will disturb 5 acres or more, which is defined by the CGP as a large construction activity, the requirements of Section D.3 of the CGP must be met, as summarized below.
- 2. Obtain a copy of the TCEQ's TPDES CGP.
- 3. Develop a SWPPP, pursuant to Section II.D.3 of the CGP.
- 4. Complete and submit a Notice of Intent (NOI) and appropriate fees to the TCEQ if primary operator. If secondary operator, complete construction site notice.
- 5. Implement permit requirements and SWPPP during project.
- 6. Submit a Notice of Termination (NOT) to the TCEQ once the site has reached final stabilization.

#### 2.7.3 SWPPP

The SWPPP must describe and ensure the implementation of practices that will be used to reduce the pollutants in storm water discharges associated with construction activity at the construction site 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. A general SWPPP outline for the plan is shown in *EXHIBIT 2-2*.

# 2.8 Disinfection Standards

Districts will be supplementing their water supply with surface water supplied by the City of Houston as a result of the ground water reduction plan. This will require Districts receiving water from the Authority to convert all facilities to chloramine disinfection. This includes water plants and remote wells that do not have a direct connection to the Authority's line but discharge in the same distribution system. New water plants shall be designed with chloramine disinfection facilities to be eligible for reimbursement under the terms of the Authority's reimbursement policy. The NFBWA Surface Water Conversion Checklist is shown in *EXHIBIT 2-3*.

Disinfection facilities shall be designed to the TCEQ standards. The District shall be responsible for making the required notification to their customers regarding treatment conversion.

The chloramination system will have to be able to accept and control the full range of possible residual disinfectant conditions under which water from the Authority may be delivered to the district's tanks.

#### 2.8.1 Reimbursement Policy

The Authority has developed policies for reimbursing design and construction costs for disinfection facilities when those facilities are required because the district (or an inter-connected district) will receive surface water.

# 2.8.2 Submittal to TCEQ

The Design Consultant shall submit to the Authority final plans, specifications, and calculations prior to submittal to TCEQ. The Authority will provide to the Design Consultant a letter addressed to the TCEQ that shall accompany the Design Consultant's submittal to the TCEQ.

For conversion to chloramines several items need to be submitted to the TCEQ:

1. Cover Letter

A sealed cover letter should include a written request for exception to change the disinfectant from chlorine to chloramines and a project description.

2. Plan Review Submittal Form

The submittal form (TCEQ Public Water System Plan Review Submittal Form) should be completed and sealed.

3. Engineering Report

The engineering report should include information on the size, capacity, site plan for the existing and proposed facility; and calculations on the chemical dosing, delivery system sizing and chemical storage sizing.

4. Plans and Specifications

The plans and specifications should be sealed and include, at a minimum, site plan, piping, details and injection and monitoring point locations.

#### 2.8.3 Sources of Chlorine and Ammonia

Gaseous chlorine or sodium hypochlorite are acceptable forms of chlorine. From a safety and practical viewpoint, Liquid Ammonia Sulphate (LAS) should be used as the source of ammonia. If there is a facility where, because of size, another form of ammonia is recommended for use, this will be considered by the Authority on a case by case basis.

To form chloramines, a source of chlorine and ammonia are needed. All chemicals used shall be NSF certified. Each District will be responsible for obtaining and purchasing their own chemicals.

## 2.8.4 Placement of Chemical Injectors

The order in which the injection of chlorine and ammonia occur is important. For well water, the chlorine injection point shall be 4-6 feet upstream of the ammonia injection point to allow for complete mixing of the chlorine in the water before the ammonia is added.

For surface water ammonia should be injected upstream of and as close as possible to the chlorine injection point.

In both cases the injectors for both chlorine and ammonia should be at the same level in the pipe.

# 2.8.5 Chemical Storage

There shall be at least a 15 day supply of disinfection chemicals based on the lesser of the flow rate of the supply from all sources or booster pump capacity.

Tanks shall have secondary containment 10 percent larger than the size of the storage tank. Double wall containment tanks may be used. The tank material shall also be compatible with chemicals, in accordance with ASTM standards, NSF certified, and UV rated material. The tank must be stored inside if not UV rated material. There should also be an inner tank level indicator and leak detection, anti-siphon devices, screened openings to the atmosphere, connections through the roof of the tank, and a drain close to the bottom of the tank.

1. Chlorine Storage

In most cases chlorine storage facilities should already exist. The conversion to chloramines should have little effect on existing storage facilities where surface water is replacing ground water and there is no increase in the plant capacity.

2. LAS Storage

LAS shall not be stored in the same room as the chlorine.

#### 2.8.6 LAS Dosage

The LAS dosage shall be sized based off of a combined flow of surface water and groundwater. For dosage calculations the Design Consultant shall assume that all water supplied by the Authority has a 0.0 mg/l disinfection residual. The target dosing is assumed to be 2.0 mg/l of total chlorine or monochloramine. The pump shall be sized to accommodate 150% dosing requirements and a back-up pump will be provided. Separate systems are required for ground water and surface water disinfection.

#### 2.8.7 Monitoring

Monitoring will be necessary in order to control the chloramination system to assure that the desired residual is obtained and that there is no free ammonia or free chlorine as well as for reporting purposes. According to TCEQ, free ammonia, free chlorine, monochloramine, and total combined chlorine need to be monitored.

Provide separate sampling taps before and after chemical injection points in order to monitor the conditions of the surface water and groundwater coming into the facility, and the condition of the water after it has been injected with chemicals to see if the goals have been achieved.

## 2.8.8 Control

Control for a groundwater chloramination system is typically flow based and does not require feedback from an automatic analyzer.

The automated control for surface water chloramination requires a residual signal from an analyzer and a flow signal from the surface water flow meter. The residual monitored by an analyzer after the injection points are used to adjust the chlorine dosage to achieve the desired level of residual. The chlorine residual should be used to adjust the amount of ammonia, not the actual chlorine dosage. An ammonia analyzer should be used to check that there is no free ammonia after chemical injection. In general this is accomplished through a feedback system.

# 2.9 Construction

Certain construction concepts have been defined as described herein and additional concepts will develop as the Program continues.

- 1. Designed Method of Construction
  - a. The designed method of construction for each Contract Package will be based on opencut water main construction consisting of opening up a trench with a minimum width at the bottom equal to the diameter of the pipe plus certain minimum side clearances. The trench may have vertical or steep side slopes requiring proper shoring. The sides may be laid back to a safe slope based on the soil.
  - b. Placement of a sand layer in the bottom of the trench to provide a working platform in wet bottom trenches, well pointing or some other means of dewatering may be required depending on the local groundwater conditions.
  - c. In some areas, open cut construction may not be feasible, and trenchless alternatives will be proposed. This is the responsibility of the Design Consultant to identify these areas and evaluate alternatives. Input and final approval will be provided by the Program Manager.
  - d. After proper bedding, installation backfill and compaction, the waterline shall be tested. In paved areas, the existing pavement shall be removed prior to the trenching and restored (reconstructed) after the water main is installed and successfully tested.
- 2. Pavement Replacement

During design, the pavement section to be reconstructed shall be agreed to by the Program Manager and approved by the owning authority. Current design criteria of the owning authority shall be utilized for roadways requiring reconstruction.

- 3. Utility Conflicts
  - a. The extent of such problems may, during design, dictate the location or depth of the water main and shall be carefully coordinated. All efforts should be made to resolve utility conflicts in the most economical manner.
  - b. The Design Consultant is responsible for researching existing utilities including contacting the private utility companies and requesting that they provide record information regarding their utilities within and in the vicinity of the ROW of the proposed route. This private utility research effort is to be accomplished prior to finalizing the base sheets (plan and profile) and the water line alignment (horizontal and vertical) along the proposed route. Utility research and showing existing utilities in the plan and profile drawings is to be part of the 30% submittal except for utilities that are only discovered later. In general, the Design Consultant should call out crossings of utilities as a "Critical Locate". The contractor is to investigate and excavate at "critical locates" as described in paragraph 3.03 of technical specification Section 02317 Excavation and Backfill for Utilities.

# 2.10 Deliverables

## 2.10.1 Checklist

The following checklist is a summary of the items that the Design Consultant shall deliver to the Program Manager (also, see Chapter 3 – Survey Requirements and Chapter 7 – Submittal and Review Guidelines for additional deliverables):

- 1. Hard copies of the drawings on 22-inch by 34-inch ANSI standard drawing sheets on double mat, 4-mil mylar with original signatures and seals.
- 2. Electronic copies of the design files in both AutoCAD (.dwg) and Adobe Acrobat (.pdf) format at a resolution equal to 300 dpi, including:
  - a. Plotting parameter files of all types
  - b. Font libraries
  - c. Cell libraries
  - d. Patterning libraries
  - e. Color tables
  - f. All parameter files associated with the use of application software
  - g. Acceptable media (disk) with label
- 3. Original specifications with original signature(s) and seal(s)
- 4. Survey deliverables
- 5. Design report
- 6. QA/QC documentation

# 2.11 Summary

The members of the Program Team share a common goal of providing the Authority facilities necessary to deliver the 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 Program Manager.

Company	Contact	Telephone/ Fax	Address	Notes
Alpheus Communications		877-257-4387	1301 Fannin, 20th Floor Houston, Texas 77002	
AT&T	Don Atkins	713-830-7401 713-752-0198	1301 Fannin, Suite 1290 Houston, Texas 77002	Note 2
Buckeye Gulf Coast Pipe Line, LP		832-615-8600	1 Greenway Plaza, Suite 600 Houston, Texas 77046	
Burlington-Northern & Santa Fe Railway	Tim Huya	817-352-2902 817-352-2912	400 N. Sam Houston Parkway E Houston, Texas 77060	
CenterPoint Energy	Scott Humble	713-207-6747	1111 Louisiana Street Houston, Texas 77002	Note 2
CenterPoint Energy Entex	Jim Voight	713-207-4623 713-207-0877	P.O. Box 12628 Houston, Texas 77252-2628	Note 2
CenterPoint Energy Pipeline	Brian Reese	713-207-3911	1820 Miller Cut Off Road Deer Park, Texas 77536	Note 2
Chevron Pipe Line Company		(281) 432-2064	4800 Fournace Place Houston, Texas 77401-2324	
Comcast Cable		(713) 341-8433	22513 Tomball Pkwy Suite 109 Houston TX 77070	
One Call		811	515 N. Sam Houston Pkway East, Suite 610, Houston, TX 77060	Note 3

Company	Contact	Telephone/ Fax	Address	Notes
DTC Inc. (Pipeline Maps – at request)		(713) 863-9958	550 Westcott St, Houston, TX 77007	Note 1
CentryLink (formerly EMBARQ)	Ron Ashby	(281) 358-1447	Kingwood Commons, 730 Kingwood Dr, Kingwood, TX 77339	
Entouch Systems	Jason Bone	(281) 225-1000	11011 Richmond Ave. Houston, Texas 77042	
ExxonMobil Pipeline Co	Chris Manual	(713) 986-5122	1301 Fannin St, Houston, TX 77002	
Fort Bend County Drainage District		(281) 342-2863	1124 Blume Road Rosenberg, Texas 77471	
Fort Bend County Engineering Dept.		(281) 633-7500	301 Jackson Richman, Texas 77469	
Genesis Energy LP	Mike Moore	(713) 860-2500	919 Milam St #2100, Houston, TX 77002	
Gulf Coast Pipe Line Company	Tom Cones	(713) 688-3366	2180 North Loop West #303 Houston, Texas 77018	
Houston Pipeline Company LP	Calvin Dodd	(800) 392-1965	711 Louisiana St #900, Houston, TX 77002	
Kinder Morgan Texas Pipeline LP	Steve Beavers	(713) 369-9000	1001 Louisiana St, Suite 1000 Houston, TX 77002	
Level Three Communication	Steve Frank	(713) 341-4000	7060 Empire Central Houston, TX 77040	

Company	Contact	Telephone/ Fax	Address	Notes
Lyondell Basell Industries		(713) 321-4111	12000 Lawndale Houston, Texas 77040	
MCI World Com		(713) 297-7100	5051 Westheimer Rd, Houston, TX 77056	
Memorial Villages Authority	Michael Montgomery	(713) 465-8318	8955 Gaylord Drive Houston, Texas 77024	
NETCO Pipeline	P. D. Leonard	(512) 502-0101	4520 Spicewood Springs Road Suite 200 Austin, Texas 78759	
Phonoscope Enterprises Group, LLC	Nancy Weaver	(713) 272-4600	6105 Westline Drive Houston, Texas 77036-3515	
CenturyLink Communications, LLC (Formerly Qwest Communications)		(303) 992-1400	1801 California Street Denver, Colorado 80202	
Shell Pipe Line Company	Dick Williams	(713) 767-5300	910 Louisiana Street Houston, Texas 77002	
Sizemore Telecom Services	Tommy Jones	(713) 944-6210	9001 Airport Blvd. Pasadena, Texas 77501	
Enterprise Products (formerly Teppco Crude Oil Pipeline)		(713) 381-6500	1100 Louisiana Street, 10 <sup>th</sup> Floor Houston TX 77002	
Cheveron Pipeline (formerly Texaco Pipe Line Company)		1 (877) 596-2800	4800 Fournace Place Bellaire, TX 77401	

Company	Contact	Telephone/ Fax	Address	Notes
Texas New Mexico Pipeline	V.O. Jackson	(713)993-5000	2000 W Sam Houston Pkwy S Houston, Texas 77042	
Williams Energy Services LLC, Inc.(Formerly Transco		(713) 215-3500	2800 Post Oak Blvd. Houston, Texas 77056	
Trunkline Gas Co. – Panhandle Energy	John Barnett	(713) 989-7000	1300 Main St. Houston, Texas 77002	
Wavevision (Formerly TVMax Cable)		(832) 241-2229	10300 West Office Dr., Suite 200 Houston, Texas 77042	
TxDOT – Harris County	Lucio Ortiz	(713) 934-5900	14838 Northwest Freeway Houston, Texas 77040	
TxDOT – Fort Bend County	Grady Mapes	(281) 238-7900	4235 SH 36 Rosenberg, Texas 77471	
Union Pacific Railroad Company		(800) 877-5123	6800 Kirkpatrick Blvd. Houston TX 77028	
Williams Energy Services		(281) 807-0648	2800 Post Oak Blvd, Suite 900 Houston, TX 77056	
Williams Gas Pipelines – Transco		(713) 215-2000	2800 Post Oak Blvd., Ste. 300 Houston, Texas 77056	

Company	Contact	Telephone/ Fax	Address	Notes
XO Communications		(832) 200-2000	2401 Portsmouth Street Houston, Texas 77098	

\* This list provides possible utility contacts only. It is not a complete list.

Note 1. DTC Inc. will provide upon request (on-line only) a Pipeline Map showing the Location of the Existing Private Pipelines for the State of Texas, Louisiana and Oklahoma. There is a Fee for this depending on Area Requested.

Note 2. An Information Request Form is available for utility inventory searches.

Note 3. Outside Service Provider who can assist with identifying pipelines and utilities in the project area.
#### Exhibit 2-2: General SWPPP Outline

- 1.0 Regulations
- 2.0 Project Information
- 3.0 Site Description
  - A. Description of the Construction Activity
  - B. Schedule and Sequence of Major Activities
  - C. Estimated Total Site Area and Disturbed Area
  - D. Soil Description/Quality of Discharge
  - E. Location and Site Map
  - F. Asphalt and Concrete Plants
  - G. Receiving Waters
  - H. Copy of TPDES Permit Number TXR150000
- 4.0 Controls
  - A. Erosion and Sediment Controls
  - B. Stabilization Practices
  - C. Structural Control Practices
  - D. Permanent Storm Water Controls
  - E. Other Controls
  - F. Approved State and Local Plans
- 5.0 Maintenance
- 6.0 Inspection of Controls
- 7.0 Non-Storm Water Discharge Components
- 8.0 Technical Specifications
- 9.0 Certifications
- 10.0 Forms

#### Exhibit 2-3: NFBWA Surface Water Conversion Checklist



Design Consultant Engineer and Firm Name:	
Water System Name:	
TCEQ Public Water System ID No.:	
Project Milestone: Draft	Final

#### A. Cover Letter

- □ Provide a cover letter for "Written Request for Exception" to request approval from TCEQ to change a water plant's disinfectant from chlorine to chloramines per 30 TAC §290.42. This letter shall also include a project description and shall be sealed by an engineer.
- Provide a "TCEQ Public Water System Plan Review Submittal Form" sealed by an engineer.

#### **B. Design Report**

- Provide a brief description of the project, which shall include the existing ground water supply capacity, projected surface water supply capacity, and respective percentage of water supply from ground water and surface water after the conversion.
- Provide a summary of the existing facilities at a water plant, which shall include rated capacities of the water wells, ground storage tanks, booster pumps, site plan, etc.
- Provide a summary of the proposed additions and modifications required for a water plant to convert to surface water.
- Provide calculations for liquid ammonium sulfate dosing, chemical feed equipment and storage tank sizing.
- Provide calculations for chlorine dosing and chlorinator sizing, if a separate chlorination system will be installed for the surface water system.

#### EXHIBIT 2-3 Cont.

#### C. Request for Exception for Air Gap

- □ If no Air Gap Exception is required in this project, provide a letter stating that the current tank air gap meets TCEQ requirements and no exception is required. Otherwise, please provide following items.
- Provide a letter requesting an exception to the TCEQ rules governing overflow weirs and air gaps per 30 TAC §290.39(1).
- Provide calculations supporting the proposed modifications to an existing overflow weir to accommodate proposed surface water fill pipe. The calculations must be sealed by an engineer.
- Provide a tank inlet air gap detail drawing. TCEQ shall only grant an exception to an air gap when a separation distance is provided between the inlet pipe's lower edge and the elevation of the maximum rise of water over a storage tank's overflow pipe or weir that is equal to or exceeds the greater of:

1.5 times the maximum rise of water over a storage tank's overflow pipe's top edge or weir;

OR

9-inches above the maximum rise of water over a storage tank's overflow pipe's top edge or weir.

Provide the "Air Gap Requirement Between Wholesalers and Purchasers Letters" as documentation supporting the proposed modifications to an existing overflow weir.

#### **D.** Plans and Specifications

□ For the proposed surface water conversion construction project, provide the plans and specifications for review. Each sheet in the plan set must be sealed by an engineer. The specifications must be bound and the cover sealed by an engineer. Use the following checklists when designing these items.

#### i. Chemical Feed Equipment

□ Provide a minimum of two (2) chemical feed units, one (1) duty unit and one (1) standby unit per 30 TAC §290.42(e)(3)(C), for the chlorine and liquid ammonium sulfate (LAS) chemical feed systems. Three (3) units may be used for one system: one (1) duty unit for the groundwater source, one (1) duty unit for the surface water source, and one (1) standyby unit. When separate systems for ground water and surface water sources are used, four (4) units will be necessary: one (1) duty unit and one (1) standby unit for each source.

Each chemical feed unit shall have a capacity at least 50% greater than the highest expected dosage rate per 30 TAC §290.42(e) (3) (A).

#### EXHIBIT 2-3 Cont.

- □ The chemical feed units shall be equipped with anti-siphon devices to prevent feeding of chemical while not in operation.
- Provide the manufacturer name, model number and feedrate capacity of the chemical feed units. If the technical specifications include a list of approved manufacturers and model numbers, provide a copy of that specification. The chemical feed unit components must be constructed of materials that are compatible with the chemical being pumped.
- □ The surface water chemical feed units shall be capable of receiving two (2) 4-20mA signals, a flow signal from a flowmeter and a residual signal from an analyzer. The chemical feed units shall combine the signals and produce a compound loop output signal that shall control the feedrate of the units.
- □ The groundwater chemical feed units shall be capable of receiving a run signal from an onsite or offsite water well(s). The water well run signal shall start and stop the chemical feed units.
- Provide an online analyzer capable of monitoring free ammonia and monochloramine, and a second analyzer capable of monitoring total chlorine and free chlorine. The analyzer(s) shall be capable of sending a 4-20mA monochloramine residual signal to the surface water chemical feed units.

#### ii. Chemical Storage Tanks

- □ The chemical storage tanks shall be capable of holding 15-day supply of chemical per 30 TAC §290.42(f) (1) (A). The tank's capacity shall be based on the maximum flow rates of the surface water and groundwater entering the water plant.
- □ The secondary containment basins for the chemical storage tanks shall be capable of holding 110% of the total volume of the chemical storage tanks per 30 TAC §290.42(f) (1) (E) (ii) (I).
- Provide either single-walled tanks with secondary containment basins or double-walled tanks with an interior tank for the chemical and an exterior tank for secondary containment.
- Provide calculations supporting the storage capacity of the chemical storage tanks. The storage tanks must be constructed of material compatible with the chemical being stored and resistant to corrosion. The tanks shall be equipped with fill, vent and suction connections. Provide a means to measure the level of chemical in the tank. For double-walled tanks, provide a means to measure the level of chemical in the interior tank and in the exterior tank if there is a leak.
- Provide calculations supporting the storage capacity of the secondary containment basins. The containment basins shall be constructed of material compatible with the chemical being stored and resistant to corrosion. Provide a bulkhead flange for the suction connection to provide a smooth transition from basin to tank.

#### EXHIBIT 2-3 Cont.

#### iii. Chemical Building

- Provide either an all-weather building or an existing room dedicated for the LAS feed systems. The building or room housing the LAS feed system shall be constructed of materials compatible with LAS service.
- LAS must be stored in a room or building separate from chlorine or another chemical with which it may react.
- ☐ The building or room must be equipped with a ventilation supply fan (mounted low) with exhaust louver (mounted high). The supply fan and louver must be sized to provide one complete air change in the building or room a minimum of every three minutes. The supply fan and louver must be constructed of materials that are compatible with LAS service.
- □ If a building is provided it must be designed to handle 125 mph winds.

#### iv. Yard Piping

- ☐ The chlorine injection point shall be located at least two pipe diameters or 4 to 6 feet upstream from the LAS injection point on groundwater systems with stingers at the same depth per TCEQ recommendation.
- □ The LAS injection point shall be located as close as possible and upstream of the chlorine injection point on surface water systems with stingers at the same depth per TCEQ recommendation.
- Provide samples points upstream and downstream from the chemical injections points located on the surface water and groundwater yard piping.
- All chemical injection and sample points shall be aboveground connections. The chemical and sample piping shall schedule 80 PVC.
- Provide documentation that the LAS to be utilized at the water plant are NSF/ANSI Standard 60 certified.
- Provide copies of any interconnection agreements, if applicable.

# Chapter 3– Survey Requirements

# 3.1 General

The following guidelines are to be followed for all surveying and mapping to be performed for the Program.

# 3.2 References

State of Texas Professional Land Surveying Practice Act, latest revision.

General Rules of Procedures and Practices and the Standards of Responsibility and Rules of Conduct of the Texas Board of Professional Land Surveying.

# 3.3 Control Surveys and Datums

The main horizontal and vertical control for the Program was established by the Program Manager; see North Fort Bend Water Authority Primary Survey Control Monuments Manual, prepared by Brown & Gay Engineers, Inc. in August 2008. This report is available on NFBWA's website. These controls will be furnished to each surveyor along with the horizontal and vertical datum and scale factor at the beginning of the project.

The Authority Survey Control System will be used for all surveys. Each survey will reference the applicable Authority monument(s) used as well as a statement defining the datum the work is based on.

## 3.3.1 Sample Horizontal Datum Statement

All bearings are based on the Texas State Plane Coordinate System, South Central Zone, NAD 1983. All coordinates and distances are surface and may be converted to grid by dividing by a combined scale factor of 1.00013.

## 3.3.2 Sample Vertical Datum Statement

All elevations are NAVD-88 (2002 Adj.)

# 3.4 Quality Assurance

Field Surveying and work used in the development of construction drawings, calculations and preparation of ROW 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 Practices Act of the State of Texas.

Survey checklists are provided in Appendix and shall be used in the quality assurance process by the Design Consultant.

# 3.5 Field Work

## 3.5.1 Recording Field Work

Field work shall be recorded in separate 7-1/4"x 4-3/4" field books or on total station database printouts for each project. Record the field book number on the cover sheet for each project.

## 3.5.2 Site Monumentation

The Authority has set secondary control monuments at approximately every 1,750 feet throughout the length of the project. Additional site monuments may be needed to augment existing NFBWA secondary control monuments as determined by the Design Consultant. These additional monuments shall be set by the Design Consultant.

The Design Consultant shall monument the design baseline at its beginning, end, and at all angle points with markers of a permanent nature, such as iron rods or spikes.

## 3.5.3 Ties

The Design Consultant is responsible for making ties of found ROW monuments and property corners to the horizontal control furnished by the Program Manager and shown with station and offsets on the control sheet(s).

## 3.5.4 Temporary Benchmarks

The Design Consultant is responsible for setting temporary benchmarks within 200 feet of the beginning and end of the project and at intervals not to exceed 1,000 feet throughout the project. These temporary benchmarks shall be set on permanent features where possible.

## 3.5.5 Centerline and Angles

The Design Consultant is responsible for recording the centerlines and angles of intersections of side streets with the design baseline. This information shall be shown on the survey control sheets.

## 3.5.6 Topographic Features

The Design Consultant is responsible for recording all topographic features 10 feet past the public ROW, permanent easement, and any temporary construction easement of the project and on all intersecting streets for a distance of 20 feet beyond the intersection of the ROW lines, including but not limited to the following items:

- 1. Grade breaks.
- 2. Fire hydrants, water meters, valves and blow offs.
- 3. Gas meters and valves.
- 4. Power poles, telephone, and electrical pedestals.
- 5. Storm Sewer inlets, manholes, and junction boxes with size, depth, and type.
- 6. Wastewater manholes and cleanouts with size, depth, and type.

- 7. Existing pavement edges, driveways, crossovers, sidewalks, fences (including type of surface materials of all streets, driveways, and sidewalks).
- 8. Identify channels, ditches, and swales. Identify culvert sizes and flow lines. Show limits of riprap and slope paving.
- 9. Identify brush or tree lines, and tree types and sizes. Comply with local agency requirements for sizes of trees that must be identified. Identify size and location of all individual specimen trees and perimeter location of heavy brush areas.
- 10. Locate visible indications of all utilities (gas mains, electric, telephone, cable TV, communication fiber optics, etc.). Locate ROW markers and pipeline markers (provide information from pipeline marker sign). Refer to Exhibit 2-1 for a list of utility contacts.
- 11. Bridges, overpasses, and underpasses: show top of pavement at gutter line and centerline at construction joints. Show locations of supporting piers/columns, abutments, and extents of slope paving.

## 3.5.7 Cross Sections

The Design Consultant is responsible for cross sections, which are to be taken at intervals of 100 feet. For proposed water lines 30 inches and larger within street rights-of-way cross sections are to be taken at 50-foot intervals.

## 3.5.8 Critical Locates

Critical Locates are locations along the alignment where the proposed water main will cross a utility and the potential exists that there will not be sufficient clearance (horizontally or vertically) during the construction of the proposed water main. Often the elevation of the utility is uncertain and has been shown in profile based on record information. It is the responsibility of the Design Consultant to identify critical locates in the plan view to alert the contractor to their presence and the need to more thoroughly investigate them according to the requirements of Paragraph 3.03 in technical specification 02317 – Excavation and Backfill for Utilities.

Sanitary sewer lines and storm water lines shall be located based on the manholes on both sides of the proposed water main crossing to determine the grade of the utility.

Water lines that will be crossed and may not have sufficient clearance from the proposed water main will require critical location. Do not critically locate water line service connections.

# 3.6 Abstracting

The Design Consultant is responsible for acquiring all documents (subdivision plats, ownership deeds, easements documents, and ROW drawings) necessary to establish the existing ROW lines of roads within study area for the design.

# 3.7 Right-of-Way (ROW) Plats for Easement Acquisition

All easements to be acquired for the project will be obtained by the Program Manager required by CenterPoint shall be prepared by the Design Consultant and submitted to the Program Manager.

## 3.7.1 Boundaries

For each parcel of land to be taken, locate the boundaries of the property, showing course and distance of all boundary lines. If applicable, show and identify lot and block lines on the parcel map (acreage, and subdivision if tract is part of subdivision). Identify the corners with iron pins or other suitable markers.

## 3.7.2 Parcel Numbering System

Parcel numbering system will be determined by the Program Manager.

## 3.7.3 Easements and Other Encumbrances

Show all easements that will affect the property.

Show on the parcel maps all building lines, and all recorded and visible encumbrances which affect the property, and list all zoning classifications, restrictions, or buildings codes if any.

## 3.7.4 Encroachments/Protrusions

Show all encroachments and/or protrusions which affect the property and identify same on alignment. Indicate the measured extent of the encroachment and/or protrusion.

## 3.7.5 Mapped Area

Locate, identify, and show on the parcel map all lakes, ponds, watercourses, and man-made physical objects including fences situated on, or within 20 feet of the proposed taking area.

## 3.7.6 Parcel Map Scale

Prepare the parcel map on letter or legal size sheet. The scale shall be no larger than 1 inch to 100 feet without the prior approval of the Program Manager. The smallest text size font shall be 0.06 inch and shall be legible.

## 3.7.7 Street Width

Identify width of street or road on parcel map.

## 3.7.8 ROW

Identify proposed ROW or easement taking lines on parcel map.

## 3.7.9 ROW and Control Points

Identify proposed ROW or easement lines on parcel map and show all control points (PIs, PCs, PTs etc.)

## 3.7.10 Street Location

Identify on parcel map, the location of street or road or watercourse, which is referred to in the metes and bounds descriptions.

## 3.7.11 Monuments

All monuments which are noted in metes and bounds descriptions should be identified on parcel map.

## 3.7.12 Certification

Survey plats and metes and Bounds descriptions will be signed and sealed by a Registered Professional Land Surveyor.

All surveys for easement acquisition will be certified to at least the minimum standards of the Professional Land Surveying Practices Act, the General Rules of Procedures and Practices, and the Standards of Responsibility and Rules of Conduct of the Texas Board of Professional Land Surveying.

All surveys for fee acquisition will be certified to at least the standards and specifications of a Texas Society of Professional Surveyors Category 1A, Condition II Land Title Survey

# 3.8 Metes and Bounds Descriptions for Property Acquisition

The Program Manager will be responsible for all property acquisition.

## 3.8.1 **Property Description**

Furnish property description as follows:

- 1. Description to be a metes and bounds description unless it describes a whole property or block within a subdivision the map or plat of which has been approved by the Appropriate Agency and Commissioners' Court and which has been recorded in the Real Property Records of Fort Bend County.
- 2. The type or print used in the description is to be dark and unblurred so that it can be easily reproduced on a copy machine.
- 3. Description shall be prepared on 8.5-inch by 11-inch sheet.
- 4. Identification of the land being described shall be by tract number, project name, and project number typed or printed in the upper right-hand corner of the description page or pages. When the description covers more than one page, each page should be marked numerically to indicate the page sequence and the total number of page sequence and the total number of pages used in the description.
- 5. Introductory paragraph (Preamble) should include:
  - a. Description of the area in the taking, stated in acres and square feet.
  - b. Location.
  - c. Survey name and abstract number.
  - d. Size of parent tract and recording reference information.
  - e. Names of grantor, grantee, all recording references, and date of the last deed of conveyance relative to the tract being described.

- 6. Point of Beginning, (and Point of Commencement if one is used) in description shall be tied to a fixed and easily ascertainable position. This position must be indicated on the parcel map.
- 7. All ROW descriptions will be sealed with seal of a Registered Professional Land Surveyor and signed by the surveyor whose seal appears thereon. The date that document was signed shall be so noted.

# 3.9 Control Drawings

#### 3.9.1 Baseline

The project baseline shall be established by the Design Consultant and shall be shown on the control drawings. The baseline shall NOT be the centerline of the proposed pipe alignment. For discussion and possible modification early in the project, the baseline should be shown in plan at the 30% submittal.

## 3.9.2 Existing Monuments or Property Corners

Show location and identification of existing survey monuments, right-of-way monuments, and found property corners on the drawings and located by station and distance, right or left from the construction baseline.

## 3.9.3 Control Monuments

Show and identify location of the Control monuments and temporary benchmarks used for elevation control with the vertical datum.

## 3.9.4 Side Streets

Show baseline angles of the intersection of side streets with the main roadway centerline. Where bearings are used, identify source of bearings and show bearings on both base or transit line and project's construction baseline when they are not the same line.

# 3.10 Deliverables

- 1. Field book(s) and a copy of all field notes created for the project. Electronic copy of all data collector files and/or GPS files and reports.
- 2. An electronic copy of horizontal and vertical control points established which will include sketches, elevations, and datums.
- 3. A copy of all subdivision plats, deeds, utility letters, utility drawings, and other documents.
- 4. Provide area runs including coordinates of proposed ROW parcels, control points, found or set monuments, curve data, lengths, stations and offsets to monuments, and proposed features.
- 5. Control Map.
- 6. An electronic file in ASCII file format to include ascending point number, northing, easting, elevation, and description.
- 7. Drawings shall be provided in electronic format in AutoCAD.

- 8. Topographic Manuscript Plot plan and electronic drawing of existing topographic features, including overhead and underground facilities, with ROW, easement(s), berm locations, and spot elevations shown.
- 9. ROW acquisition parcel plats and metes and bounds descriptions as appropriate.

# Chapter 4– Graphic Requirements

# 4.1 General

This Chapter addresses the graphic requirements for engineering drawings.

#### 4.1.1 Drawing Requirements

- 1. All drawings shall be produced in AutoCAD format. Drawings prepared in Microstation will not be accepted.
- 2. Provide a cover sheet for projects involving three or more design drawings (excluding standard detail sheets). Drawing sheet numbers and titles shall be listed on the cover sheet. Include an area key map and vicinity map to identify project location.
- 3. Drawings shall be prepared on 22- by 34-inch ANSI standard drawing sheets.
- 4. Show service area on cover sheet or area map.
- 5. Final design drawings shall be plotted on double mat, 4-mil mylar using non-water based ink. Do not use adhesive-backed material on final drawings.
- 6. Details of special structures (not covered by approved standard drawings, such as stream or gully crossings, special manholes, or junction boxes) shall be drawn with vertical and horizontal scales equal to each other.
- 7. Each set of engineering drawings shall contain paving and utility key drawings indexing specific plan and profile sheets. Standard Details, where applicable, shall be included. All sheets shall have standard title blocks.
- 8. Draw sheet overall layouts to a minimum scale of 1 inch = 100 feet. Sheet Layout Plans should include the following as a minimum:
  - a. Soil boring locations
  - b. Butterfly valve and gate valve locations
  - c. Air-release valve locations
  - d. Water Plants
  - e. Baseline stations
  - f. Street names
- 9. Plan stationing should increase from left to right, except for short streets or lines originating from a major intersection, where the full length can be shown on one sheet. Baseline must be shown on each sheet.
- 10. A north arrow is required on all sheets and should be oriented either toward the top or to the right.

11. Standard scales permitted for plans and profiles of construction drawings are as follows:

Drawing Type	Scale
Overall Index Sheet Layouts	1 inch = 100 feet
General and Enlarged Plan Views	1 inch = 20 feet 1 inch = 40 feet*
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 inch = 5 feet $\frac{1}{4}$ inch = 1 foot $\frac{1}{2}$ inch = 1 foot
Profile Views	1 inch = 2 feet vertical 1 inch = 4 feet vertical*
Structural Sections, Details	$\frac{1}{4}$ inch = 1 foot $\frac{1}{2}$ inch = 1 foot $\frac{3}{4}$ inch = 1 foot 1 inch = 1 foot
Enlarged Sections, Details	1½ inches = 1 foot 3 inches = 1 foot

#### **Typical Drawing Scales**

\*Only if approved in advance by the Program Manager

- a. Scales above represent a minimum, larger scales may be used to show details of construction. Provide a bar scale to the sheet to warn that a drawing may not be at its original full-size scale.
- b. Deviation from specified scales can only be permitted with the special approval of the Program Manager.
- c. When multiple views on a drawing are not to the same scale, the appropriate scale shall be centered ¼ inch below the title of each view. The title block scale shall read "as shown."
- d. When the entire drawing (such as a diagram or a schematic) is not to scale, the words "Not to Scale" or abbreviation "N.T.S." shall be noted in the title block. If only one view on the drawing is not to scale, the notation "Not to Scale" or abbreviation "N.T.S." shall be placed below the view in question.
- e. Details of special structures not covered by standard drawings (e.g., channel crossings, special manholes, etc.) shall be drawn using the same scale for both vertical and horizontal dimensions.
- 12. Show ties on drawings to monuments when applicable.

- 13. Each sheet of the plan and profile shall have a benchmark elevation and description defined, including a reference to the nearest TBM.
- 14. Identify trees by their common names (pine, oak, etc.). Radius of tree canopy shall be 1 foot for each 1 inch of trunk diameter. Canopy for pine and palm trees are to be shown to reflect actual canopy dimension.
- 15. If a roadway exists where drawings are being prepared to improve or construct new pavement or a utility, label the existing roadway width, surfacing type, and thickness.
- 16. Show all street and road alignments on drawings.
- 17. Match lines between plan and profile sheets shall not be placed or shown within cross street intersections including cross street ROW.
- 18. Provide natural ground profiles for each street ROW line and along centerline if within easement.
- 19. All proposed water line callouts must be shown as boxed callouts.
- 20. Item identification must match description wording on the standard bid items provided in Standard Specifications.
- 21. Plan and profile sheets shall contain the following information:
  - a. Identify property lines, easements, ROW, and drainage outfalls.
  - b. Label each plan sheet with the following existing street ROW/easement widths, pavement widths, pavement thickness where applicable, type of roadway materials, curve data, stationing, existing utilities (type and location), and any other pertinent feature affecting design.
  - c. Show utility lines 4 inches in diameter or larger within the ROW or construction easement in profile view. Show utility lines, regardless of size, in the plan view, including communication and fiber optic cables. Show utility lines, regardless of size, in the profile view when in the immediate vicinity of construction activities or, in the discretion of the design engineer, may be impacted by construction activities.
  - d. Show existing ditches on plan and profile, especially for those near the proposed waterline(s).
  - e. Label top of curb except at railroad crossings. Centerline grades are acceptable only for paving without curb and gutters.
  - f. Show in profile curb return elevations for turnouts.
  - g. For street reconstruction, show in profile the centerline elevation at the property line of existing driveways. Identify type and width of driveways.
  - h. Show both existing and proposed station esplanade noses or the centerline of esplanade openings, including esplanade width.
  - i. Show in plan view station PCs, PTs, and radius returns. Show in profile station radius returns and grade change PIs with their respective elevations.

- j. For plant work, use a grid system to locate proposed work.
- 22. Show core-boring locations in plan view on each applicable plan and profile sheet.
- 23. All overhead electrical lines must be noted and shown on Drawings.
- 24. The location and material of driveways must be shown on Drawings.
- 25. Cathodic Protection need to show test stations, rectifier units, and other appurtenances.
- 26. At pipeline crossings, identify the following:
  - a. Pipeline owner;
  - b. Contact person / phone number;
  - c. Any required advance notifications to the pipeline owner, along with contact person and phone number.

# 4.2 Graphic Standards

- 1. The following graphic standards for plan and profile shall apply to drawings of 1 inch = 20 feet scale. For smaller scale drawings, use proportionally smaller line sizes.
- 2. The standards shown in *EXHIBIT 4-1*, Existing Improvements, are required for depicting existing improvements on base drawings. Use lower case letters with a No. 0 reprographic pen or equal line weight unless otherwise shown in the pen/line weight table, *EXHIBIT 4-3*, Line Code Definitions. Smaller pen sizes for lettering may be used for clarity.
- 3. The standards shown in *EXHIBIT 4-2*, Proposed Improvements, are required for depicting proposed improvements on base drawings. Use upper case letters with a No. 3 reprographic pen or equal line weight unless shown otherwise in the pen/line weight table, *EXHIBIT 4-3*, Line Code Definitions. Smaller pen sizes for lettering may be used for clarity.

## 4.3 Notes

#### 4.3.1 General Construction Notes

- 1. General Construction Notes convey information common to the components to several or all the drawings in the package. General Construction Notes shall be an enhancement or supplement to the drawings and not a duplication of requirements contained in the Standard Specifications. The incorporation of specifications as a part of the notes is strongly discouraged.
- 2. General Construction Notes shall be placed in columns on a separate drawing with singlespaced 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.

## 4.3.2 Specific Notes

- 1. Specific notes show information pertaining to that drawing's features. Specific notes shall be an enhancement or supplement to the drawings. Locate these notes in close proximity to the title block information and, when possible, in the same area of the drawing.
- 2. Lines within each specific note shall be single-spaced, and notes shall be separated vertically at least 1 1/2 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 numbers on drawings.

# 4.4 Seals/Signatures

Affix seals in accordance with Texas Board of Professional Engineers Rules.

Interim submittals must carry the name, P.E. number, firm registration number, and date of the responsible engineer. (These drawings need to be identified as to the level of completeness.)

Final drawings require the stamp of a Licensed Professional Engineer in the State of Texas, his or her signature, the date below the seal, and his or her firm registration number. Sealing a drawing shall be performed by the responsible engineer. When more than one seal appears on the drawing, identify the area of responsibility for each engineer.

Revisions to drawings that have been stamped by a Licensed Professional Engineer must be initialed and dated below the stamp or in the revision block column designated for the initials by the same engineer who signed the original work. If this cannot be done, another Licensed Professional Engineer in the State of Texas can affix his or her seal to the drawings, enter his or her signature and the date, identifying responsibility for the specific revision.

# 4.5 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 letter or number in a triangle inside the circled area.

# 4.6 Schedule of Drawings

The Schedule of Drawings for each design package contains mandatory drawings. These drawings are listed below in the required order.

- 1. Cover Sheet and Vicinity Map
- 2. Index Sheet (can be combined with Cover Sheet if enough space)
- 3. General Construction Notes
- 4. Legend

- 5. Sheet Layout Plan/Core Boring Location
- 6. Survey Control Map (Baseline Ties and Bench Marks)
- 7. Monumentation Benchmark Data
- 8. Plan and Profile Sheets
- 9. Special Detail Sheets (e.g. bridge piles, etc.)
- 10. Standard Detail Sheets (included in drawings as required)
  - a. General Standards
    - REF G-1 Cover Page
    - REF G-2 Sheet Index
    - REF G-3 Construction Notes
  - b. Civil Standards
    - REF C-1 Project Sign
    - REF C-2 Standard Water Line Details
    - REF C-3 Steel Pipe Details
    - REF C-4 Prestressed Concrete Cylinder Pipe Details
    - REF C-5 Trenchless Construction Details
    - REF C-6 Air Valve in Service Manhole Details
    - REF C-7 Valve and Vent Piping and Service Manhole Details
    - REF C-8 Heavy Duty Manhole and Miscellaneous Details
    - REF C-9 Excavation, Bedding, Backfill, and Pavement Repair Details
    - REF C-10 Meter Station Layout
    - REF C-11 Control Valve Station Layout
    - REF C-12 Meter and Control Valve Station Structural and Mechanic Details
    - REF C-13 Typical Enclosure Detail
    - REF C-14 Tree Protection Details
  - c. Electrical Standards
    - REF E-1 Electrical Abbreviations, Legends, and General Notes
    - REF E-2 Electrical Typical Site Plan
    - REF E-3 Electrical One-Line Diagram
    - REF E-4 Electrical Schedules
    - REF E-5 Electrical Control Cabinet (Sheet 1 of 2)
    - REF E-6 Electrical Control Cabinet (Sheet 2 of 2)
    - REF E-7 Network Diagram
    - REF E-8 Electrical Control Diagram (Sheet 1 of 2)
    - REF E-9 Electrical Control Diagram (Sheet 2 of 2)
    - REF E-10 Electrical Details (Sheet 1 of 2)
    - REF E-11 Electrical Details (Sheet 2 of 2)
  - d. Cathodic Protection Standards
    - REF CP-1 Cathodic Protections Schedules
    - REF CP-2 Cathodic Protection Test Station Details (Sheet 1 of 4)

- REF CP-3 Cathodic Protection Test Station Details (Sheet 2 of 4)
- REF CP-4 Cathodic Protection Test Station Details (Sheet 3 of 4)
- REF CP-5 Cathodic Protection Test Station Details (Sheet 4 of 4)
- REF CP-6 Cathodic Protection Rectifier Details (Sheet 1 of 2)
- REF CP-7 Cathodic Protection Rectifier Details (Sheet 2 of 2)
- REF CP-8 Cathodic Protection Insulating Joint Details
- REF CP-9 Cathodic Protection Joint Bonding
- REF CP-10 Cathodic Protection Miscellaneous Details (Sheet 1 of 2)
- REF CP-11 Cathodic Protection Miscellaneous Details (Sheet 2 of 2)

# 4.7 Standard Details

The Authority has provided standard details for use by the Design Consultant. The Design Consultant shall review all details. Each standard detail sheet contains a reference number, which is independent from the sheet number. These reference numbers coordinate details that appear on different sheets and shall not be removed. Any detail that is not required should be left in place and marked with an "X" covering the detail (pen weight = 0.055"). If all the details on one standard detail sheet are not required, then the entire page can be omitted (no changes to the reference numbers shall be made).

The Design Consultant shall replace the company logos on the standard sheets with their company logo.

# 4.8 Additional Details

The standard details provided to the Design Consultant do not represent a complete list. The Design Consultant should reference the City of Houston standard details during design for these supplemental details. It is not necessary to include City of Houston standard details in the design package.

#### **Exhibit 4-1: Existing Improvements**

#### EXISTING IMPROVEMENTS PLAN VIEW

# TEXT FOR EXISTING IMPROVEMENTS SHALL NOT BE SMALLER THAN 60 LEROY

						WT	LC
ROW LINE						3	0
PROPERTY LINE						3	0
THEORETICAL PROPERTY LINE						3	0
LOT LINES						1	0
EASEMENT LINE						0	2
CENTER LINE OF ROW				2		0	4
TRANSIT LINE						0	0
EDGE OF DITCHES	<u> </u>				<b>~</b>	0	0
CENTER LINE OF DITCHES						0	2
EDGE OF DITCHES						0	0
FENCE LINE, WOOD		H		11		0	0
FENCE LINE, CHAIN LINK		11	11		11	0	D
FENCE LINE, BARBED WIRE		×	×	×	——×——	0	0
FENCE LINE, HOG WIRE	//	11		11		0	0
EDGE OF CONCRETE						0	0
CURB LINE						0	0
EDGE OF ASPHALT		111	1111	111	1111	0	0
EDGE OF SHELL OR GRAVEL						0	2
DIMENSION LINE	-		28' 3-17		-	0	0
ELECTRICAL AERIAL LINE	——Р—		P	—P	n	0	0
ELECTRICAL UNDERGROUND LINE			•			0	6
GAS LINE		<u> </u>				0	1
MISC UNDERGROUND	——( )-			( )		0	8

WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
0	0	0.014"	0.35mm
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

	EXISTING IMPROVEMENTS PLAN VIEW		
	TEXT FOR EXISTING IMPROVEMENTS SHALL NOT BE SMALLER THAN 60 LEROY	WT	LC
PIPELINE OR WESTERN UNION CABLE		0	1
		0	2
		0	2
		3	O
		0	0
	24" (AND SMALLER) WATER		
WATERLINE	30" (AND LARGER) WATER	0	7
	24" (AND SMALLER) WASTEWATER SEWER		
WASTEWATER SEWER LINE	30" (AND LARGER) WASTEWATER SEWER	0	3
STORM SEWER LINE	24" (AND SMALLER) STORM SEWER		
	30" (AND LARGER) STORM SEWER	0	0
	٤ع		
IRON PIPE OR IRON ROD MONUMENTS	3/4" IP	0	0
POINT OF INTERSECTION (PI)		0	0
POINT OF CURVE (PC)		0	0
POWER POLE		0	0
	<b>.</b>		
POWER POLE W/DOWN GUY		0	0
GAS METER	OGM	0	O
GAS VALVE		0	0
MISCELLANEOUS UNDERGROUND PIPELINE LABEL	(A2)	0	0

WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
0	0	0.014"	0.35mm
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

	EXISTING IMPROVEMENTS PLAN VIEW		
	TEXT FOR EXISTING IMPROVEMENTS SHALL NOT BE SMALLER THAN 60 LEROY		
		WT	LC
PAVING HEADER		0	0
BUILDING RESIDENTIAL	RES. 1-STY. BR. BLOG.	0	0
COMMERCIAL BUILDING	COMM. 1-STY. BR. BLDG.	0	0
TREE (RADIUS OF TREE CANOPY SHALL BE 1 FOOT FOR EACH INCH OF TRUNK DIAMETER)		0	0
HEDGE	$\sim$	0	O
WATER METER	•	0	7
WATER VALVE (GATE) -	<b>_</b>	0	7
WATER VALVE (BUTTERFLY) -		0	7
FIRE HYDRANT/ FLUSHING VALVE -	 	0	7
		0	7
REDUCER –	8" 6"	0	7
ROUND CONNECTION -		0	7
ROUND CONNECTION	<u>©</u> CO <u>MH</u>	0	0
STORM SEWER MANHOLE	MH	0	0
INLETS	"B" "B-B" "C-1" "C-2" "C-2A" "GRATE"	0	0
CULVERT PIPE AND HEADWALL		0	2
TOP OF CURB OR GUTTER LINE ELEV.	TC=76.56 TG=76.06	0	2
CONTOUR LINE		0	0

WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
0	0	0.014"	0.35mm
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

#### EXISTING IMPROVEMENTS PROFILE VIEW

#### TEXT FOR EXISTING IMPROVEMENTS SHALL NOT BE SMALLER THAN 60 LEROY

		WT	LC
NORTH OR EAST PROPERTY LINE		1	5
SOUTH OR WEST PROPERTY LINE		1	6
NORTH OR EAST CURB		1	7
SOUTH OR WEST CURB		1	3
NORTH OR EAST DITCH		1	7
SOUTH OR WEST DITCH		1	3
NORTH OR EAST CULVERT	CULVERT	1	2
SOUTH OR WEST CULVERT	CULVERT	1	2
CENTERLINE OF ROW		1	0
ELECTRICAL CONDUIT		1 1	6 0
GAS LINE	GAS LINE	1 1	1 0
WESTERN UNION		1 1	1 0
TELECOM CONDUIT		1 1	2 0
	WATER LINE 24" (AND SMALLER)	1 1	7 0
WATER LINE	WATER LINE 30" (AND LARGER)	1 1	7 0
		1	3
WASTEWATER SEWER LINE	SANITARY SEWER 24" (AND SMALLER)	1	0
	SANITARY SEWER 30" (AND LARGER)	1 1	3 0
	STORM SEWER 24" (AND SMALLER)	1 1	0 0
STORM SEWER LINE	STORM SEWER 30" (AND LARGER)	1 1	0 0

WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
0	0	0.014"	0.35mm
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

#### EXISTING IMPROVEMENTS PROFILE VIEW

TEXT FOR EXISTING IMPROVEMENTS SHALL NOT BE SMALLER THAN 60 LEROY



WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
0	0	0.014"	0.35mm
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

#### Exhibit 4-2: Proposed Improvements

#### PROPOSED IMPROVEMENTS-WATER LINES PLAN VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LEROY



WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
0	0	0.014"	0.35mm
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

#### PROPOSED IMPROVEMENTS-SANITARY SEWER LINES PLAN VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LEROY



WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
0	0	0.014"	0.35mm
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm



WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
0	0	0.014"	0.35mm
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

#### PROPOSED IMPROVEMENTS-PAVEMENTS PLAN VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LEROY



#### PROPOSED IMPROVEMENTS-PAVEMENTS PLAN VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LEROY

		WT	LC
TOP OF CURB OR CENTERLINE FOR OPEN DITCH PAVING	TC OR CL TC OR CL @ -0.03%	2	3
		3	0

WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
0	0	0.014"	0.35mm
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

#### Exhibit 4-3: Line Code Definitions

#### LINE CODE DEFINITIONS ALL LENGTHS IN INCHES

LINE CODE 0	SOLID LINE
LINE CODE 1	.8" LINE, .05" SPACE, .025" LINE, .025" SPACE, .025" LINE, .025" SPACE, .025" LINE, .05" SPACE, .8" LINE
LINE CODE 2	.1875" LINE, .05" SPACE, .1875" LINE
LINE CODE 3	.9" LINE, .125" SPACE, .9" LINE
LINE CODE 4	1.25" LINE, .125" SPACE, .030" LINE, .125" SPACE, 1.25" LINE
LINE CODE 5	.9" LINE, .1" SPACE, .1" LINE, .1" SPACE, .1" LINE, .1" SPACE, .1" LINE, .1" SPACE, .9" LINE
LINE CODE 6	.9" LINE, .1" SPACE, .1" LINE, .1" SPACE, .1" LINE, .1" SPACE, .9" LINE
LINE CODE 7	.9" LINE, .1" SPACE, .1" LINE, .1" SPACE, .9" LINE
LINE CODE 8	.9" LINE, .2" SPACE, .9" LINE

# Chapter 5– Project Manual Guidelines

# 5.1 General

The Program Manager has developed documents for use on large-diameter water line construction projects, which the Design Consultant is to utilize during design of the water line project. These documents include front-end contract documents, technical specifications and other documents necessary to develop a complete Project Manual to be used for bidding and construction of the water line project. However, each project within the Program is unique and may require project-specific construction specifications or special provisions.

# 5.2 Submittal Requirements

At the start of the project, the Program Manager will provide the Design Consultant with an electronic set of 8 1/2- by 11-inch bidding documents, which will include the Front End documents and Standard Technical Specifications. The Design Consultant should review this information and recommend any changes related to his specific project or other needs to the Program Manager.

At the 70% Submittal, the Design Consultant is to submit a draft set of 8 1/2- by 11-inch bidding documents to the Program Manager for review. The draft set will include a Table of Contents, Front End documents, a list of the Standard Technical Specifications (Section 0 through 16) to be used, and any "Supplemental Specifications" proposed for the project. As appropriate, suggested revisions will be incorporated into the Supplementary Specifications that will supersede the published Standard Specifications for any special conditions of the project. Project-specific Supplementary Specifications will contain the project's information within the header. Specifications required, but not contained in the Standards, are to be developed by the Design Consultant. These specifications will also contain the project's information within the header.

At the 95% Submittal, the Design Consultant is to submit a revised set of 8 1/2- by 11-inch bidding documents incorporating the addressed comments, technical specifications, (both Standard and Supplemental), and a copy of the previous review set with comments. The Design Consultant is to also provide the Front End documents, along with Section 01110 – Summary of Work; and Special Supplements in Microsoft Word format. These documents may be revised and then returned to the Design Consultant to publish the final Bid Documents.

At the Final Submittal, the Design Consultant is to submit all completed bidding documents, incorporating all addressed comments.

Chapter 7, Submittal and Review Guidelines, contain checklists further detailing the milestone submittal requirements for drawings and other design information and documentation.

# 5.3 Front End Document Outline

Section No.	<u>Title</u>
00020	Invitation To Bidders
00100	Instructions To Bidders
00300	Bid

Section No.	<u>Title</u>
00500	Agreement
00610	Performance And Maintenance Bond
00611	Payment Bond
00700	General Conditions Of The Agreement
00800	Special Conditions Of The Agreement - Part A
00800	Special Conditions Of The Agreement - Part B
00801	Contractor Affidavit For Partial Payment
00802	Contractor Affidavit For Final Payment And Bills Paid
00803	Certification Of Completion
00804	Request For Extension Of Time
00812	Labor Classification And Prevailing Wage Scale

# 5.4 Technical Specifications

The design consultant will utilize the NFBWA standard specifications. If changes are to be made per project specifics, these changes shall be submitted to the Program Manager for approval. The Program Manager shall approve these changes prior to the design consultant incorporating them into the project manual.

# Chapter 6– Additional Services

# 6.1 Introduction

This Chapter addresses additional services that will be performed by various consultants other than the Design Consultant. These services include geotechnical, environmental, cathodic protection, and surge analysis. Requirements of the Design Consultant to incorporate the results of studies performed by these consultants are also included.

# 6.2 Geotechnical Investigations

## 6.2.1 Introduction

The purposes of the geotechnical investigation is to evaluate the existing soil conditions along the proposed water main route and to provide recommendations to the Design Consultants concerning the design aspect of the project. These recommendations include sheeting, shoring, and/or bracing requirements for construction. If required, the geotechnical consultant will perform the investigation to determine the level and extent of potential environmental contamination.

## 6.2.2 Program Criteria

In order to coordinate the multiple phases of the Program, a degree of standardization is necessary. The following is a partial list of references incorporated into the Program that pertain to the geotechnical services:

- Standard Specifications
- Standard Details
- Various ASTM standards for geotechnical analyses
- Unified Soil Classification System (USCS)
- OSHA Soil Types

## 6.2.3 Standard Details

The standard bedding and backfill details and tunnel details are subject to change. Therefore, it is the Geotechnical Consultant's responsibility to verify whether these details apply.

## 6.2.4 Site Access

Unless otherwise agreed, the Geotechnical Consultant shall obtain permits and arrange for access to boring locations on public and private property. The Geotechnical Consultant shall be responsible for cleanup and site restoration upon boring completion, commensurate with the site conditions.

## 6.2.5 Field Work

The Geotechnical Consultant shall provide for the safety of boring sites, including traffic control commensurate with the traffic and road conditions while working in street right-of-way.

Soil borings are to be spaced at approximately 1,000-foot intervals. Additional borings at a closer spacing may be required to define stratigraphic anomalies or to define soil conditions within tunnel shafts, auger pits, or other areas of inconsistent stratigraphy. The Geotechnical Consultant should be provided with a copy of the proposed water main alignments, as determined at approximately the 10 percent review level and once the alignment issues have been resolved. Where possible the borings should be drilled on the centerline along the proposed alignment. If utility conflicts prevent this from occurring, the Geotechnical Consultant shall attempt to relocate the boring longitudinally along and within the proposed trench prior to moving outside the construction area. Unless otherwise approved by the Program Manager, terminate borings at 5 feet below invert for open cut areas and at 10 feet below invert for borings at tunnel and tunnel shaft locations. Proposed soil boring locations, including pavement cores, are subject to approval by the Program Manager. In addition, proposed borings through pavement are subject to the approval of the owning agency.

In addition, all excess core samples are to be maintained by the Geotechnical Consultant until Cathodic Protection recommendations are made. The Geotechnical Consultant will provide excess core borings to the Corrosion Protection Consultant.

Water levels in the piezometers are to be read after the initial 24-hour time period and again at 30 days, at which time the piezometers are to be removed and grouted as described in the next paragraph. In general, piezometers are to be located in proximity to tunnel locations (e.g., in tunnel shaft location) but longitudinal spacing at no greater of a distance of  $\pm$ 4,000 linear feet.

## 6.2.6 Backfill of Boring and Piezometers

Completed borings and abandoned piezometers are to be backfilled by cement-bentonite or non-shrink grout using a tremie method. Additionally, bore holes through pavements are to be restored with the same or equivalent materials as existing pavement. The Geotechnical Consultant is responsible for cleanup upon boring completion, commensurate with the site conditions.

## 6.2.7 Boring Logs

A draft copy of the boring logs is to be submitted to the Program Manager approximately 2 weeks after the completion of the field work along with recommendations for additional boring locations (if required). Boring logs are to include the following information as a minimum:

- 1. Project number
- 2. Boring number
- 3. Boring location station and either offset or distance from curb and one other semipermanent feature. Approximate location marked on project layout or plan sheets if they were made available to the geotechnical consultant. The geotechnical consultant is encouraged to use GPS to determine the locations of borings – survey accuracy GPS is not required.
- 4. Date of field work
- 5. Depth to groundwater (both at end of drilling and 24-hour readings)
- 6. Depth to caving
- 7. Completion depth
- 8. Soil and sample symbology

- 9. Soil description
- 10. Geotechnical analytical data

#### 6.2.8 Geotechnical Report

A sample table of contents is included as *EXHIBIT 6-1* and the components are further described in the paragraphs below. These descriptions are considered a guideline to the minimum requirements. The report is to be organized as described below and submitted as a draft to the Program Manager. The Design Consultant is to review and comment and forward their comments to the Program Manager. The Design Consultant's comments and Program Manager's comments are to be addressed by the Geotechnical Consultant prior to finalizing the report.

Submit a separate Geotechnical Letter Report for Trench Safety that meets the requirements of State law. The letter report will be included in the Contract Documents.

When a project involves special structures, provide a copy of the final structural design to the Geotechnical Engineer who performed the initial Geotechnical recommendations. The Geotechnical Engineer will review the soil foundation design for the special structure and will verify that the Soil Foundation recommendations were interpreted properly.

The Geotechnical Consultant is to contact appropriate agencies for other borings in the area. While the Geotechnical Consultant is not responsible for the accuracy of these borings, this information, along with boring logs gathered during the records review, are to be included in the Geotechnical Engineering Recommendations section of the report. The logs are also to be included in an appendix.

- 1. Executive Summary which summarizes work performed, the findings, and any pertinent recommendations should include:
  - a. Introduction
    - General Refer to the project number
    - Location and Description of the Project
    - Scope of Work Summarize scope of work outlined in cost proposal and task order.
  - b. Subsurface Investigation Program

Include the number of borings and piezometers, range of depth, rational for boring locations, and field and sampling protocol in this section. The Geotechnical Consultant is to look for any signs of visual staining of the samples, note any odors encountered, specifically of hydrocarbon nature, during drilling, and summarize this information in the report. A statement shall be included in the report stating whether unusual staining or odors were encountered.

c. Laboratory Testing Program

State the types of geotechnical analyses conducted and refer to the appropriate appendices for results. A summary of all tests results should be included as an appendix.

d. Subsurface and Site Conditions

- Geology
- Natural Hazards Discuss any subsidence or geological faults that are located in the area. Comment of the activity or potential activity of any identified fault during the design life of the water line. If an active fault is discovered, notify the Program Manager and additional investigation may be warranted and alternate construction methods may need to be investigated.
- Site Stratigraphy and Geotechnical Characterization Summarize the soils encountered along the proposed alignment, noting any anomalies or features which could inhibit construction such as sands. Cross section should include both reference borings and stationing. The cross section should be drawn to scale and use USCS symbols. Also note the thickness of pavement when coring. A minimum number of pavement cores will be required, depending on the length of the project. This requirement should be discussed between the Design Consultant and the Geotechnical Consultant prior to field activities. Provide pavement core results in a tabular format.
- Groundwater Discuss groundwater levels encountered and method of measurement. Provide water level readings in a tabular format.
- e. Geologic Fault Study

A Phase I Geologic Fault study investigation will be performed. The findings and recommendation will be part of the geotechnical report.

- f. Geotechnical Engineering Recommendations
  - Trench Excavation Recommend slopes, critical heights, etc., based on OSHA soil types. Discuss bearing pressures and give example calculation of bracing pressures.
  - Excavation Dewatering Based on soil types and groundwater levels, recommend excavation dewatering methods and anticipated locations where such efforts may be necessary.
  - Vehicular Traffic and Railroad Loads Include backfill and bedding operations and example calculations for overburden soils pressures and liner loads in this section. Include project specific vehicular and railroad load recommendations and example calculations where applicable.
  - Pressures on Primary and Permanent Liners Give recommendations and example calculations for liner design.
  - Piping System Thrust Restraint Include recommendations and example calculations using AWWA for thrust blocking and parameters and/or coefficient values for the design of restrained joints. Note: The passive resistance of soil is not allowed.
  - Discuss Influence of trenchless construction on adjacent structures.
  - Slope Stability Give recommendations for slope stability for construction of water lines constructed along drainage channels.

- Lateral Earth Pressure Diagrams Include for both clays and sands as they pertain to each project.
- g. Limitations
- h. Authorization and Credits
- i. References

## 6.3 Environmental Site Assessment

#### 6.3.1 Introduction

The Program Manager will provide an Environmental Site Assessment (ESA). The Design Consultant is required to check the environmental assessment work provided by the Environmental Consultant for conformance with project specific conditions and design requirements. The purpose of this section is to present guidelines for the performance of Phase I and Phase II ESAs.

These guidelines have been developed for linear projects, which have different objectives than site cleanups. Field investigations and sampling programs are considered as Phase II assessments in this document. These guidelines address the scope of work for Phase I ESAs and Phase II ESAs consisting of field investigations, laboratory testing, analyses, recommendations, and reporting.

The Phase I ESA will describe the presence or likely presence of any hazardous substances or petroleum products along or within a ROW property under conditions that indicate an existing release, a past release, or a material threat of a release of hazardous substances or petroleum products into structures, the ground, groundwater, or surface water of the ROW property ("RECs"). RECs include hazardous substances or petroleum products even under conditions in compliance with environmental laws but does not include de minimis conditions that generally do not present a material risk of harm to public health or the environment. RECs adjacent to the ROW include areas from which contamination possibly could migrate into the proposed construction zone or later adversely impact operations. A Phase II investigation will be conducted to determine the impact of the RECs on the design, construction, and operation of the facility. Studies for contamination mitigation or remediation are not part of the goals for the Phase I and II ESAs.

#### 6.3.2 Phase I Objectives

The Phase I ESA will generally include the following tasks:

- 1. Environmental records search and historical site documentation review for potential sources of contamination with respect to the selected alignment or facility location. Records search will be in accordance with recognized industry practice and standards (i.e., ASTM E1527).
- 2. The records search will typically include, but not be limited to, the following data sources:

Data Source	Approximate Minimum Search Distance, miles (kilometers)
Federal NPL site list	1.0 (1.6)
Federal CERCLIS list	0.5 (0.8)
---	-----------------------------------
Federal CERCLIS NFRAP site list	property and adjoining properties
Federal RCRA CORRACTS facilities list	1.0 (1.6)
Federal RCRA non-CORRACTS TSD facilities list	0.5 (0.8)
Federal RCRA generators list	property and adjoining properties
Federal ERNS list	properties only
State lists of hazardous waste sites identified for investigation or remediation:	
State-equivalent NPL	1.0 (1.6)
State-equivalent CERCLIS	0.5 (0.8)
State landfill and/or solid waste disposal site lists	0.5 (0.8)
State leaking UST lists	0.5 (0.8)
State registered UST lists	property and adjoining properties

The records search will include sufficient detail to identify RECs in connection with the subject property. If the regulatory records indicate that Leaking Petroleum Storage Tank (LPST) or State Superfund facilities are located within 500 feet of the site, the latest comprehensive assessment or monitoring report maintained on the facility by the TCEQ shall be reviewed and summarized in the Phase I ESA report. If an LPST site is identified, the search will attempt to determine whether soil or groundwater or both were affected, and whether the site is in the assessment, remediation, or closure stage.

If regulatory records indicate that a Federal Superfund facility is located within approximately 1/4 mile of the site, the files maintained on that facility by the public library shall be reviewed and summarized in the Phase I ESA report.

The records search will also identify currently defined wetlands based on a review of published National Wetland Inventory Maps (if applicable), 100-year floodplains, and 500-year floodways within or along the project ROW. The USGS topographic quadrangle map and relevant soil survey will also be reviewed.

The results of the environmental records search will be adequately documented to identify the methodology used, the records reviewed, and the results of the assessment. Sites which have the potential for presence of hazardous substances or petroleum products (RECs), wetlands, and floodplains will be clearly identified and shown on a map.

In addition to the records review, the Phase I ESA will also include the following tasks:

- 3. A site reconnaissance of the property will be made to visually and physically observe the subject property and any structures not obstructed from view. The site reconnaissance will be conducted to identify RECs in connection with the subject property.
- 4. The site reviews will also include interviews with current owners/occupants and appropriate government officials as appropriate. The interviews will include discussions with owners and/or occupants of the property who are knowledgeable of the present and past uses and physical characteristics of the property. Interviews will also be conducted with appropriate governmental officials to obtain any known information regarding environmental hazards associated with the property. (Examples of governmental officials that may be interviewed include local fire, health, environmental, solid and hazardous waste regulatory agencies.)

## 6.3.3 Format

To the extent practicable, interviews shall be conducted with owner or occupants of facilities immediately adjacent to the ROW as follows:

- 1. All commercial businesses that typically use hazardous chemicals or petroleum substances, such as dry cleaners, photo developers, mortuaries, and automotive service centers.
- 2. Selected or representative commercial establishments that do not typically use hazardous chemicals or petroleum substances.
- 3. All facilities identified in the regulatory records review.
- 4. All industrial facilities.
- 5. If the site is an area of known oil and gas production operations, an oil and gas survey or records review shall be included in the Phase I ESA.
- 6. The Phase I ESA report shall identify RECs and make recommendations for a Phase II ESA, as appropriate. These recommendations shall be based on the presence of RECs and shall be of sufficient detail to establish requirements of a Phase II ESA Investigation.

## 6.3.4 Phase II Objectives

The goals of the Phase II ESA or Environmental Investigation may be to:

- 1. Determine the approximate source, extent, and nature (liquid, absorbed, vapor, and dissolved phases) of hydrocarbon or other suspected contaminants or recommend/identify subsequent site investigations.
- 2. Evaluate existing and potential impacts to planned construction in or adjacent to the area of a suspected release.
- 3. Provide sufficient information to develop adequate health and safety measures for future planned activity in the area, including geotechnical investigation and construction.

Phase II ESA site investigations will be performed in compliance with all appropriate local, State, and Federal health and safety laws, regulations, standards, and procedures.

Phase I ESAs shall conform to ASTM E1527 format to the extent possible. The Phase II ESAs or environmental investigation reports will include text sections, tables, and figures shown in the sample Table of Contents in the attached EXHIBIT 6-2. The environmental investigation data will be presented using the methodology described in *Section 6.2.5*. All soils shall be classified using the USCS.

The report will include a site plan indicating the location of known contaminated sites as well as an Executive Summary. A site plan showing existing and planned facilities will be provided in a suitable scale considering the aerial extent of the investigation and the details to be displayed. The locations of borings from previous investigations will be shown together with borings and other explorations performed for the project.

## 6.3.5 Phase II Methodology

1. Planning

Based on the findings of the Phase I ESA, RECs may have been identified in connection with or adjacent to the proposed ROW.

After the Phase I ESA has been completed, the need for additional investigation of documented contaminated areas will be identified. The field work associated with additional environmental investigations will be based on the results of the Phase I ESA, records review, and other available information. Field work will include reconnaissance of the area of potential contamination of RECs.

2. Referenced Standards

The work will be performed in accordance with applicable ASTM Standards, and Federal, State, and local environmental laws, regulations, and requirements.

3. Health and Safety

A health and safety plan will be prepared prior to drilling. As a minimum, the plan will provide for open borehole and work area monitoring for organic vapors. The plan will define action levels for levels of personal protection based upon the open borehole monitoring. The plan will include provisions for explosive gas monitoring.

4. Soil Borings and Sampling

At least one environmental boring will be made in areas with RECs associated with future construction. The boring locations will be based on consideration of hydrogeologic characteristics of the subsurface soils, which can be determined from previous investigations in the area and knowledge of local geology.

- a. The subcontractor will locate underground utilities and obtain any permits necessary.
- b. Soil sampling equipment will be decontaminated between samples. Latex gloves or neoprene gloves will be worn during other sampling and decontamination procedures.
- c. A qualified hydro-geologist/geologist and/or environmental engineer will be onsite to oversee drilling activities, collect and screen soil samples, and prepare detailed soil boring logs.
- d. For each boring, split-spoon or Shelby tube samples will be collected continuously to the total depth of the boring. Soil sample descriptions to include:
  - Soil classification
  - Detection of hydrocarbon or other odors
  - Visible hydrocarbon or other contamination (if present, include the degree, location, and extent of staining)
  - Field screening for organic vapors with a Photoionization Detector (PID) or Organic Vapor Analyzer (OVA)
  - Other field screening as required by the type of contaminations
- e. Organic vapor screening of sample head space will be performed in the field as this will impact sample collection. One soil sample at a minimum from each soil boring is

required for laboratory analysis. However, it is the Engineer's/Geologist's discretion to collect more samples when necessary. One sample should be collected from the zone exhibiting the highest organic vapor reading; or if the organic vapor readings are non-detect, the sample will be collected from immediately above the saturated zone.

- f. This field screening information will be recorded in the boring log, along with the depth at which groundwater is first encountered.
- g. If the source of the REC has been identified during the environmental records review (or by other means) as a gasoline diesel, waste oil, jet fuel, or aviation gasoline underground storage tank; soil sample analytical testing will also be conducted for the following constituents in accordance with applicable U.S. EPA methods stipulated by current environmental regulations:
  - Benzene, ethylbenzene, toluene, xylenes and total petroleum hydrocarbons.
  - Analyses will be conducted at the discretion of the Engineer/ Geologist if the source of contamination is diesel, waste oil, or jet fuel. Analysis for the presence of polyaromatic hydrocarbons, for example, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, fluorine, naphthalene, phenanthrene, pyrene, and indeno(1,2,3-cd) pyrene will be conducted as warranted.
    - In locations where potential contamination is apparently due to buried structures, borings will be advanced to a maximum depth of 35 feet, or 5 feet below the planned structure or pipeline, whichever is more shallow. Borings may be advanced to greater depths if warranted by site-specific circumstances. Borings maybe terminated at a more shallow depth, at the discretion of the Engineer/Geologist.
    - Disposition of drill cuttings and well purge water will be in accordance with Federal, State, and/or local regulations. If off-site disposal is necessary, the cuttings and well purge water will be containerized and clearly labeled until they can be removed from the site. Wastes will be of disposed within a 60-day time frame. All completed waste manifests are to be returned to the Program Manager.
- 5. Groundwater Samples

If groundwater is encountered in borings drilled to investigate a REC, and field screening of soils immediately above the groundwater interval indicates the presence of potential contamination, a groundwater sample may need to be collected.

- 6. Analytical Sampling
  - a. The analytical methodologies are to be determined based on the nature of the potential contaminant. All analytical tests will be performed in accordance with the applicable EPA test procedure and TCEQ guidance.
  - b. Chain-of-custody documentation will be provided for all samples submitted for laboratory analysis.
  - c. Laboratory reports for samples will include the following information:

- Date of collection
- Date of extraction, analysis, and report
- Extraction and analytical methods used
- Method detection limits
- Standard utilized in the analysis
- Sample identification number and depth
- Laboratory QA/QC

## 6.3.6 Evaluations and Recommendations

1. Site Characterization

The soil characteristics of significance to the design and construction work will be described with particular emphasis on the occurrence of transmission soils at or below the elevation in which contamination was detected, or which have potential for providing pathways for contaminant migration. Geologic characteristics which affect the migration potential of a contaminant will be addressed. Geotechnical soil testing will include shear strength, grain size, compressibility, and unconfirmed soil strength, as appropriate.

Potential sources of contamination, which were identified, and areas of potential contamination which were investigated, will be clearly described. Areas of contamination within or adjacent to the project ROW which were confirmed, and their spatial relationship to the planned construction activity, will also be clearly identified.

2. Type of Contaminant

The report will address the basis for determining which contaminants were potentially present and the methods that were used to verify their presence or absence. Where specific contaminants are present, the report is to describe the concentrations and indicate whether they are above relevant regulatory protective concentration levels (PCL) stipulated by the Texas Risk Reduction Program (30 TAC Chapter 350).

3. Extent of Contaminant

The Phase II ESA report will describe, based on the available information, the estimated vertical and aerial extent of potential contamination encountered within the project ROW. The determination of probable extent should be based on reasonable interpretation of both analytical and geological data.

4. Impact on Planned Construction

The Phase II ESA report is to concisely summarize the extent (e.g., the stationing) and nature of encountered contaminants, and present this information relative to regulatory criteria. The report will clearly address the following:

a. Comparison of contaminant concentration to regulatory criteria (PCLs).

- b. Identification of specific health and safety measures, which may be followed to allow planned construction to proceed.
- c. Potential for contaminated runoff entering the work area.
- d. Potential effects of contaminated media on long-term durability of the installation of facility operation.

The Phase II ESA report will address the potential impact of the contamination on the planned construction including the potential for contaminant impact on construction dewatering. Specifically, the report will address the potential for migration of contamination from the investigated sources and shallow groundwater into the construction area, due to groundwater withdrawal and/or groundwater level drawdown. The effect of dewatering will include health and safety procedures as well as requirements for containment and disposition of extracted groundwater.

5. Recommendations

The Phase II ESA report will provide recommendations for additional investigations, which may be necessary to adequately delineate a contaminated zone, considering its potential effect on the planned construction.

In areas where contamination is encountered, the Phase II ESA report will provide recommended alternative to minimize its effect on planned construction.

## 6.3.7 Public Agency Review

The environmental consultant shall consult with the Program Manager prior to submitting any findings to any Federal, State, or local agency on the following items:

- 1. Threatened and Endangered Species
- 2. Jurisdictional Waters Determination
- 3. Jurisdictional Waters Delineation
- 4. Historical and Archeological Sites

## 6.4 Cathodic Protection

#### 6.4.1 Introduction

A Cathodic Protection study will be conducted after the specific water line alignment has been determined. The study will be performed at the 70% level of design and will be forwarded to the Design Consultant after its completion. Based upon the results and recommendations from the cathodic protection study, the Design Consultant will incorporate the appropriate details and show locations of test stations, rectifiers, insulations joints, etc.

## 6.4.2 Corrosivity Study

The corrosivity study for the pipeline will consist of the following:

- 1. Soil resistivity measurements will be recorded every 1,000 feet along the pipeline route in accordance with ASTM G57. Measurements will be performed from grade to depths of 5 feet, 7.5 feet, 10 feet and 15 feet.
- The proposed pipeline will be surveyed with respect to crossing of foreign pipelines and paralleling utility systems. Specifically, existing cathodic protection systems and locations for foreign line test stations will be identified.
- 3. The pipeline route will be surveyed for stray DC earth current activity including structure-tosoil potential measurements on existing facilities and earth gradient measurements where points of contact on existing structures are limited. These tests will be performed approximately every 1,000 feet as access permits to available structures, such as fire hydrants, power pole grounds, and foreign line crossings.
- 4. The proposed pipeline alignments will be investigated to locate areas where AC power is available should impressed current protection be required.
- 5. Upon completion of the testing, a final written report will be submitted to include all data, data analysis, and a general description of the corrosion protection requirements for each of the pipe materials (steel, ductile iron, PCCP, etc.). Specifically, soil resistivity measurements shall be calculated in the layers from 5 to 7.5 feet, 7.5 to 10 feet and 10 to 15 feet.

## 6.4.3 Corrosion Protection Design

The corrosion protection design will consist of a number of activities:

- 1. Soil samples provided by the geotechnical firm shall be laboratory tested for pH, sulfate and chloride levels as well as soil resistivity.
- 2. A design report will be prepared and submitted that will describe the corrosion protection requirements for the following:
  - a. Dielectric Coating Materials
  - b. Cathodic Protection System Type
  - c. Anode Requirements
  - d. Test Station and Permanent Reference Cell Requirements
  - e. Electrical Isolation
  - f. Stray Current Control
  - g. Cased Crossings
  - h. Foreign Line Test Stations
  - i. Treatments for Lateral Line Connections
- 3. In addition to the above, the standard details that are applicable to the project for each pipe type will be compiled and submitted as an Appendix.
- 4. Any changes that are required to the general standard specifications shall be submitted.

5. Following preparation of the design drawings and specifications, cathodic protection contractor will review the documents to ensure compliance with the requirements.

# 6.5 Surge Analysis

For certain design packages, the Program Manager will provide the Design Consultant with the results of an analysis to protect the proposed pipeline under surge conditions. The analysis will identify the reach of the project requiring surge protection, and size and spacing requirements for protection devices. Those devices will normally consist of vacuum relief and/or air/vacuum relief valves. These large capacity valves will always include a small capacity, slow air release function as well. It is the Design Consultant's responsibility to accurately incorporate the identified recommendations. The placement of these devices will need to be coordinated with other air valves determined to be necessary during design.

#### **Exhibit 6-1: Geotechnical Report**

#### Sample Table of Contents

#### EXECUTIVE SUMMARY

- 1.0 INTRODUCTION
  - 1.1 General
  - 1.2 Location and Description of the Project
  - 1.3 Scope of Work
- 2.0 SUBSURFACE INVESTIGATION PROGRAM
- 3.0 LABORATORY TESTING PROGRAM
- 4.0 SUBSURFACE AND SITE CONDITIONS
  - 4.1 Geology of the Coastal Plain
  - 4.2 Natural Hazards (Faults, Subsidence, etc.)
  - 4.3 Site Stratigraphy
  - 4.4 Groundwater (described by street and identified as whether immediate readings, 24-hour reading, or piezometer/water well readings)

#### 5.0 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

- 5.1 Trench Excavation Considerations
- 5.2 Excavation Dewatering (brief overview or detailed recommendation, depending on scope of work)
- 5.3 Vehicular Traffic and Railroad Loads (effect on construction and design)
  - A. Pipeline Crossing at \_\_\_\_\_ Freeway
  - B. Pipeline Crossing at \_\_\_\_\_ Railroad
- 5.4 Pressures on Primary and Permanent Liners
- 5.5 Piping System Thrust Restraint
- 5.6 Influence of Trenchless Construction on Adjacent Structures
- 5.7 Lateral Earth Pressure Diagrams (for clays and sands)
- 6.0 LIMITATIONS
- 7.0 AUTHORIZATION AND CREDITS
- 8.0 REFERENCES

## EXHIBIT 6-1 cont.

LIST OF TABLES

 Table 1
 Subsurface Investigation Program

LIST OF FIGURES

- Figure 1 Site Location Map
- Figure 2 Boring Location Map
- Figure 3 Geologic Profile
- Figure 4 Pleistocene Events and Formations of Texas
- Figure 5 Generalized Stratigraphy
- Figure 6 Tunnel Liner Loads
- Figure 7 Piezometer Installation Report

LIST OF APPENDICES

- Appendix 1 Definition of Terms and Key to Symbols
- Appendix 2 Boring Logs and Geophysical Logs
- Appendix 3 Laboratory Test Summary Table
- Appendix 4 Groundwater Level Reading Table
- Appendix 5 Pavement Thickness Table
- Appendix 6 Appropriate Laboratory Test Diagrams
- Appendix 7 Boring Logs by Others

#### Exhibit 6-2: Environmental Investigation Report

#### Sample Table of Contents

#### EXECUTIVE SUMMARY

- 1.0 INTRODUCTION
- 2.0 SUBSURFACE INVESTIGATION
  - 2.1 Field Investigation Methodologies
  - 2.2 Selected Sites
- 3.0 CONCLUSIONS
  - 3.1 Summary of the Investigation Results
  - 3.2 Impact on Planned Construction

APPENDIX A BORING LOGS

APPENDIX B LABORATORY ANALYTICAL REPORTS

TABLES

- 1 Soil Sample Analytical Results
- 2 Groundwater Sample Analytical Results

**FIGURES** 

1

- Site Plan
  - Boring/Well Locations
  - Underground Storage Tank System or Other Suspected Release Sources
  - Facility Details

# Chapter 7– Submittal and Review Guidelines

The following checklists and exhibits details the required information and documents to be submitted at the various milestones.

## 7.1 30% Submittal Checklist

- Investigation
  - a. Site Walk Through and Documentation (include photographs)
  - b. Phase I Environmental Site Assessment (by others)
- Design
  - a. Set Horizontal Alignment (include proposed alignment adjustments based on investigation results)
  - b. Determine Any Factors, Constraints, and/or Requirements for Any Conflicts
  - c. Soil Boring Information (include proposed location and depth on plan and profile drawings)
  - d. Determine Utility and Construction Easement Requirements
- Deliverables
  - a. Drawings completed in accordance with Section 7.6
    - i. Two sets of full-size, 22" x 34" drawings,
    - ii. Two sets of half-size drawings,
    - iii. Electronic AutoCad file,
    - iv. One PDF set,
    - v. Easement Strip Map (2 full size drawings and electronic AutoCAD file), identify the locations where easements and temporary construction easements are required.

## 7.2 70% Submittal Checklist

- Investigation
  - a. Phase II Environmental Site Assessment, if necessary (by others)
- Design
  - a. Set Vertical Alignment (include proposed alignment adjustments based on investigation results)

- b. Locate all Valves and Appurtenances
- c. Design Special Crossings and Prepare Special Details, as needed
- d. Incorporate any design or construction related requirements from easement side letters, as needed
- e. Label Boring Information (include actual depth and coordinates)
- f. File TxDOT Permit Application
- g. Prepare Preliminary Cost Estimate (with 20% Contingency)
- Deliverables
  - a. Drawings completed in accordance with Section 7.6
    - i. Two sets of full-size, 22" x 34" drawings,
    - ii. Two sets of half-size drawings,
    - iii. Electronic AutoCad file,
    - iv. One PDF set
  - b. Draft Partial Project Manual Documents (2 sets, 8<sup>1</sup>/<sub>2</sub>" x 11" and electronic Microsoft Word and Excel files as applicable) to include:
    - i. Table of Contents (identify any Supplemental Technical Specifications)
    - ii. Section 00300 BID
  - c. Draft Design Report (2 sets, 8½" x 11" and electronic Microsoft Word copy), in accordance with Section 7.5
  - d. Engineer's Preliminary Estimate of Probable Construction Cost with 20% contingency.

## 7.3 95% Submittal Checklist

- Investigation
  - a. Second Site Walk Through and Documentation (photographs must be provided)
- Design
  - a. Set Vertical Alignment (include proposed alignment adjustments based on investigation results)
  - b. Prepare Final Cost Estimate (with 15% Contingency)
- Deliverables
  - a. Drawings completed in accordance with Section 7.6
    - i. Two sets of full-size, 22" x 34" drawings,

- ii. Two sets of half-size drawings,
- iii. Electronic AutoCad file
- iv. One PDF set,
- b. Draft Project Manual Documents (2 sets, 8<sup>1</sup>/<sub>2</sub>" x 11" and electronic Microsoft Word and Excel files as applicable) to include:
- c. Draft Design Report (2 sets, 8½" x 11" and electronic Microsoft Word copy), in accordance with Section 7.5
- d. Engineer's Preliminary Estimate of Probable Construction Cost with 15% contingency.
- e. Signed and Sealed Submittal Package in electronic format for TCEQ (with completed TCEQ Public Water System Plan Review Submittal Form) and/or TWDB
- f. Engineer's certification that all agency review comments have been addressed.

## 7.4 Final Submittal Checklist

- Investigation
- Design
  - a. Prepare Final Cost Estimate (with 10% Contingency)
- Deliverables
  - a. Drawings signed and sealed and completed in accordance with Section 7.6
    - i. Two sets of full-size, 22" x 34" drawings,
    - ii. Two sets of half-size drawings,
    - iii. Electronic AutoCad file
    - iv. One PDF set,
  - b. Final Project Manual Documents (2 sets, 8<sup>1</sup>/<sub>2</sub>" x 11" and electronic Microsoft Word and Excel files as applicable) to include:
  - c. Final Design Report (2 sets,  $8\frac{1}{2}$ " x 11" and electronic Microsoft Word copy), in accordance with Section 7.5
  - d. Engineer's Preliminary Estimate of Probable Construction Cost with 10% contingency.

## 7.5 Final Design Report

- 1. Special Considerations (narrative; include sketches/photos if appropriate)
  - a. Easements
  - b. Constructability

- c. Utility relocations (public and private)
- d. Special Provisions to Technical Specifications (list unique items and provide narrative)
- e. Geotechnical Report
- f. Environmental Reports
- g. Surge Analysis
- h. Other
- 2. Design
  - a. Pipe design (AWWA Manual M-11, M-9)
  - b. Thrust restraint calculations
  - c. Tunnel liner calculation
  - d. Pavement replacement design
  - e. Horizontal control of pipe segments (a.k.a. pipeline closure)
  - f. System connections
  - g. One-line vertical profile
  - h. Major product cut sheets and sources on products
  - i. Disturbed area calculation
  - j. Vertical alignment plotted on the geotechnical subsurface profile
- 3. Approval
  - a. Regulatory approval correspondence
  - b. Permits
  - c. Quality control comments
  - d. Project walk, verification letter
- 4. Construction Cost
  - a. Engineer's estimate (including back-up)
  - b. Quantity takeoff (on sheet-by-sheet basis and summary)

A draft version of the above items is to be submitted along with the 70% and 95% Submittals. At the completion of the design effort (Final Submittal), the Final Design Report should be submitted in a format approved by the Program Manager.

# 7.6 Estimated Completion Level By Sheet Per Review

Sheet Name	30% Submittal	70% Submittal	95% Submittal	Final Submittal
Cover Sheet/Vicinity Map	90%	100%	100%	†
Index Sheet	90%	100%	100%	†
Construction Notes	75%	90%	100%	†
Sheet Layout and Core Boring Plan	75%	90%	100%	†
Baseline Ties/Bench Marks	75%	90%	100%	†
Monumentation	90%	90%	100%	†
Plan/Profile Sheet <sup>(1)</sup>	30%	90%	100%	†
Standard Details		100%	100%	†
Special Details		75%	100%	†
Cathodic Protection <sup>(2)</sup>		25%	100%	†
Traffic Control		25%	100%	†
Design Report			95%	100%
Specifications			100%	†

† – 100% Complete and Signed

<sup>(1)</sup> – Show proposed utility relocations.

 $^{\left( 2\right) }$  – Cathodic Protection study should be completed prior to the 70% Submittal.

## Approval/Permit Checklist

Water Project No.:\_\_\_\_\_

Contract No.:

Program Manager Coordinator:

Design Consultant:\_\_\_\_\_ Phone No.: \_\_\_\_\_

\_\_\_\_\_

Approval/permit	Responsible	Date submitted	Date approved	Comments			
Underground Utilities							
Electrical Company(s)	DC						
Entex Gas Company(s)	DC						
Telecom	DC						
Other Telephone	DC						
Fiber-Optic	DC						
Oil & Gas Company(s)	DC						
Cable TV Company(s)	DC						
Other	DC						
Right of Way							
Temp. Construction Easement	DC						
Railroad Notification & Approval	DC						
Right-of-Entry	DC						
County/State							
Texas Dept. of Transportation	DC						
Fort Bend County Engineering Dept.	DC						
Fort Bend Drainage District	DC						
Other Drainage Districts	DC						
FBTRA	DC						
Miscellaneous							
Corps of Engineers	DC						
Texas Parks & Wildlife Dept.	DC						
Fort Bend County Historical Commission	DC						
Fort Bend Archeological Society	DC						

# 7.7 As-Built/Record Drawing Requirements

The Program Manager will be responsible for the construction phase services for all projects. However, the Design Consultants will have limited responsibilities during this phase, which will include, but not limited to, the following: attend the Pre-Bid Meeting, Pre-Construction Conference, periodic site visits and progress meetings, plan revisions to reflect field changes, and preparation of the Record Drawings.

The contractor will maintain As-Built Drawings throughout construction of the project. They will submit the final As-Built Drawings to the Program Manager for review when substantially complete. At a minimum, the As-Built Drawings will include the pipe material used on all layouts and plan and profile sheets, manufacturer and model number of all valves and appurtenances, and all design and field changes. The contractor will submit the As-Built Drawings to the Program Manager for approval when the project is substantially complete.

Once the As-Built Drawings are approved by the Program Manager, they will be forwarded to the Design Consultant to prepare the Record Drawings based on the contractor's information. The Record Drawings will be prepared on a copy of the original drawings with the agency signatures. All of the As-Built changes will be clouded and referenced to a revision note, by a number and triangle, as "Record Drawing". The Design Consultant will make revisions to the CADD drawings to reflect the as-built changes. If there are major design changes, the Design Consultant will need to make the necessary revisions to the CADD drawings and re-obtain the necessary approvals.

The Design Consultant will stamp each Record Drawing sheet. The stamp will be signed, sealed and dated by the Design Consultant's engineer. The Record Drawing stamp will include the following language:

## RECORD DRAWINGS

These record drawings have been prepared using information provided by the Construction Contractor and/or Owner. The seal and signature below only signify that the plans have been revised in accordance with the information provided and do not guarantee that these plans accurately show every detail of the constructed project.

Signature

Date

## 7.8 Requirements for Engineers Estimate of Probable Construction Costs

The Design Consultant shall prepare estimates of probable construction costs for all milestone submittals. Each estimate will include, in tabular form and with these headings: Item Description, Quantity, Unit Price, and Amount. The format and item descriptions for the estimate should follow the sample bid document provided by the Program Manager. The estimate will also include sub-totals for the various sections of commonality. The grand total will also include a contingency based on the following amounts:

- 30% Submittal 30% Contingency
- 70% Submittal 20% Contingency
- 95% Submittal 10% Contingency

# Chapter 8– Contract Administration

# 8.1 Work Plan

A Work Plan will be developed early in the Program by each Design Consultant based on the Project Schedule. Each activity within the Work Plan will have its own weighting and these should be used as the basis for overall Progress Reporting.

## 8.2 **Performance Schedule**

A Performance Schedule for each Design Contract will be prepared and updated monthly. This will serve as backup for the Monthly Invoices and Progress Reports submitted by the Design Consultants. The Schedule will contain the major activities from the Work Plan along with the major milestones (30% Submittal, 70% Submittal, 95% Submittal and Final Submittal).

## 8.3 **Progress Reports**

On a monthly basis the Design Consultant should select topics he considers appropriate for the monthly report along with a brief summation of the past month's activities. Next month's anticipated accomplishments and any special problems are to be included in the report. Monthly Progress Reports are to be submitted whether or not an invoice is submitted. See EXHIBIT 8-1 for a Progress Report Outline.

## 8.4 Invoicing

## 8.4.1 Monthly Progress Invoices

Monthly Progress Invoices consist of the following items:

- Estimate for Payment
- Performance Schedule
- Project Progress Report

These invoices must be received by the Program Manager prior to the monthly invoice date established by the Program Manager each month. No charges other than for the Basic Services are authorized unless a Task Order for Additional Invoices had been issued. Invoices are to be submitted with backup invoices from all subconsultants being utilized.

#### Exhibit 8-1: Progress Report Outline

# 20XX Water Distribution and Transmission System

## Progress Report

Water Project No. XXXX

Reporting Period: \_\_\_\_\_\_ to \_\_\_\_\_, 20\_\_\_

#### SUMMARY OF PROJECT PROGRESS

(Brief summation of past period. Provide any photographs from site visits.)

#### SELECTED COMMENTS

Selected comments of general interest with respect to this report period are listed below:

(These categories are for illustration only. The Design Consultant should select whatever topics he considers appropriate.)

- Schedule
- Project Control
- Data Collection
- Design Definition
- Design Development
  - Plans
  - Specifications
- Miscellaneous Items

#### ANTICIPATED ACCOMPLISHMENTS

(Comment on the next reporting period.)

#### SPECIAL PROBLEMS

(Report on any special problems, if any.)