NORTH FORT BEND WATER AUTHORITY

PROGRAM CRITERIA MANUAL

Prepared by

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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 utility districts and the City of Fulshear as well as other private well owners within its jurisdictional boundary via contract. 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

2030 – 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.

To enable the area to convert, the Authority has entered into a water supply contract with the City of Houston, Texas to secure a long-term supply of treated surface water from the City of Houston. The existing supply of up to 19.5 million gallons per day (MGD) of treated surface water is delivered to the Authority's Bellaire Pump Station and distributed to connected utility districts. Construction is currently ongoing for the Infrastructure necessary to deliver up to an additional 68.5 MGD to meet the 2030 conversion requirements.

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 2030, to a larger system capable of meeting subsidence regulations associated with 2030 regulatory conversion requirements.

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, fault study, tree protection, transient analysis, environmental site assessment, 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. Ensure that the schedule include adequate time for the designated quality control reviewer(s) such that a review comment log spreadsheet is submitted to the Program Manager with each submittal. 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; fault study; tree protection; ; 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, Geotechnical Investigations, Storm Water Pollution Prevention Plans (SWPPP), Subsurface Utility Engineering (as Required) 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 waterlines, and district connection waterline projects to deliver surface water to entities identified for conversion. District connection lines will deliver surface water to district water plants. The waterline 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 Waterlines

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, technical specifications, front-end documents, bid item descriptions, 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 in order to become familiar 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.

e. Prepare all modifications to drawings and specifications pertaining to specific project needs. Any changes to standard drawings and/or standard specifications 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 Construction Documents.

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. Provide summary memo of item discussed and identified to.

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. Provide summary memo of item discussed and identified.

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 Comment Log spreadsheet 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 waterline 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 County Drainage District,
    - City of Houston,
    - Harris County and Harris County Flood Control District,
    - Railroads and private utility companies, and
    - Pipeline 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 diameter 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). Except for 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 cannot be achieved within the route provided, the Design Consultant shall make recommendations to the Program Manager for approval.

1. Horizontal alignments will be located in the following order of preference:

   a. In a separate waterline 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 waterline 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 waterline shall be located 5 feet from the waterline easement for 12-inch diameter and smaller, and 10 feet from the waterline easement for 16-inch diameter and larger waterlines.

3. Horizontal Location of waterlines 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 waterline shall be no closer to a building line, building foundation or building slab than 10 feet for waterlines 12 inches in diameter and smaller, and no closer than 15 feet for waterlines 16 inches in diameter and larger.

11. Maintain a minimum horizontal distance from outside wall of waterline to outside wall of storm sewer of 4 feet.

12. At storm sewer crossings, maintain a minimum vertical distance from outside wall of waterline 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 waterline.

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 pipe joints 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 waterline using Prestressed Concrete Cylinder Pipe (PCCP).

   b. Waterline 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 waterline segments use plug and clamps for 24-inch diameter and smaller waterline and internal elliptical dished head plugs for 30-inch and larger waterlines.

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.

Pipe Materials

Type	Diameter (Inches)
Polyvinyl Chloride	≤ 24
Ductile Iron	≤ 64
Prestressed Concrete Cylinder	20 - 96
Bar-Wrapped Concrete Cylinder	20 - 60
Steel	≤ 96

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.

Type	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 waterline tee or waterline cross. Extend pipe a minimum of ten (10) feet past the valve for future extension and connections at appropriate locations.

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 waterline at selected high points in the waterline 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 online 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 their 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) waterlines at or near the low point in the waterline 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 for waterline sizes thirty-six (36) inch and larger. 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 waterlines sized 16-inches and greater in diameter 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 waterlines. Restraint is to be provided regardless of the diameter of the pipe. Thrust blocking may be used for small diameter waterlines sized less than 16-inches in diameter. Thrust blocking shall be in accordance with City of Houston standard details.

For large diameter waterlines, 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. All pipe joints for waterlines sized 36-inches and larger in diameter located within the limits of trenchless construction shall be restrained.

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 waterline and meter/control valve station. Include in the project Bid Form a supplemental item for Electrical Work from the Existing Control Building to the Proposed Meter/Control Valve Station, including all connections, material, equipment, and labor required to complete the Work.

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, high power transmission corridors, 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. Waterline 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 eighteen (18) inches above the 100-year floodplain, or as required by the owning agency, 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. Waterline Markers

a. The Design Consultant is required to specify waterline markers to be installed at the following locations per NFBWA standard details:

i. Non-cathodic protection test station marker(s) on metallic pipe material:

- Street crossings,
- Flood Control or Drainage District channel crossings,
- Horizontal changes in direction of waterline.
- Placement of waterline markers to be on each side of the crossing, 1-foot inside the street ROW, 1-foot outside the channel easement, or at the horizontal change in direction.
- Placement in accordance with standard detail at approximately every 1,000 – feet.

ii. Cathodic protection test station and non-metallic pipe material with tracer wire marker(s):

- Placement of cathodic protection test station marker(s) shall be at each ground flush cathodic protection test station in accordance with standard detail.
- Placement of each ground flush test station in accordance with standard detail at approximately every 1,000 – feet.
- Street crossings,
- Flood Control or Drainage District channel crossings,
- Horizontal changes in direction of waterline.
- Placement of waterline markers to be on each side of the crossing, 1-foot inside the street ROW, 1-foot outside the channel easement, or at the horizontal change in direction.

b. The Design Consultant should coordinate placement location to ensure maintenance access is not obstructed, does not conflict with sidewalks, street crossings, or driveways.

c. The Authority will provide labels for the waterline markers. To be obtained through the District's operator.

d. Payment of marker(s)

- Per bid form for non-cathodic protection test stations on metallic pipe material.
- Payment of marker(s) for cathodic protection test station shall be included in cost of cathodic protection flush mounted station, with no separate pay.
- Payment of marker(s) and test station for non-metallic pipe with tracer wire and flush mounted cathodic protection test stations shall be included in cost of pipe installation or cathodic protection, with no separate pay.

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. 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: Authority will provide an urban forester for the preparation of the tree removal and replacement plan to be included in set of construction plans.

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 (waterline 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:

Waterlines 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:

Waterlines 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. Waterline Detection Requirements:

A detectable warning tape or similar device will be used in the opening trenches of non-metallic waterlines 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 width, 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 waterline easements, temporary construction easements (as agreed to by the Program Manager), 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, driveways for emergency service facilities, drainage channels, petroleum pipelines, large diameter/width underground utility crossings, 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. Commercial retail centers with limited access may require one or more driveways to be crossed with trenchless construction. Likewise, any school for which adjacent construction cannot be scheduled when school is out of session may require trenchless construction.

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 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. Slurry auger method is only allowed for waterline pipe up to 20-inches in diameter or steel casing up to 24-inches in diameter.

2.4.3 Tunneling

Tunnel construction shall consist of construction of the primary tunnel liner, which is installed during tunnel driving operations. The waterline 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. Areas where additional ROW or temporary construction easements may be required should be prioritized and quickly brought to the Program Manager's attention.

For crossing underneath elevated structures, the casing pipe/tunnel liner shall extend 5 feet beyond the bridge drip line and maintain a minimum of 15 feet horizontal clearance from bridge columns. For other crossings, the casing pipe/tunnel liner 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 the appropriate governing agency or agencies. 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% or 95% submittal whichever is applicable.

The traffic control plan must be approved by the appropriate governing agency. The Design Consultant shall 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), latest edition. 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

e. Projects involving hospitals and/or emergency services

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 Standards and Guidelines

The Texas Manual on Uniform Traffic Control Devices (TMUTCD, latest edition 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, latest edition. 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 (Storm Water Pollution Prevention Plan) 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

Water 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 meet the TCEQ standards. The District shall be responsible for making the required notification regarding treatment conversion to both their customers and any Public Water System(s) for which they have an interconnection.

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 residual monitoring point locations.

2.8.3 Sources of Chlorine and Ammonia

Gaseous chlorine or sodium hypochlorite (bleach) are acceptable forms of chlorine. From a safety and practical viewpoint, Liquid Ammonium 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 verify 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 residual 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 is 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 open-cut 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 shown in the standard detail drawings. 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. It 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 waterline 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. Electronic copies of the design files in both AutoCAD (.dwg) and Adobe Acrobat/Blue Beam (.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
2. Original specifications with original signature(s) and seal(s)
3. Survey deliverables
4. Design report
5. 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. See separate document for list of current agencies and contacts.

Exhibit 2-1: 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 2-2: NFBWA Surface Water Conversion Checklist

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 2-2 *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) standby 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 2-2 *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 feed rate 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 2-2 *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 injection 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. (BGE, 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 Coordinate System of 1983 (NAD83), South Central Zone 4204. 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.) based on published elevations for NFBWA Control Monument Number(s).

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 7-¼"x 4-¾" field books or on total station database printouts or electronic format for each project. Record the field book number on the cover sheet for each project or file name when submitting in electronic format.

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 based on the published values of the NFBWA Control Monuments.

The Design Consultant shall monument the design baseline at its beginning, end, and at all angle points with permanent markers, 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 maximum intervals of 100 feet. For proposed waterlines 30 inches and larger within street rights-of-way cross sections are to be taken at maximum intervals of 50-foot.

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 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.

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

3.6 Abstracting

The Program Manager shall provide all documents (subdivision plats, ownership deeds, easements documents, and ROW drawings) as necessary to establish the existing ROW lines of roads, and established easements within the 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. The Design Consultant shall be responsible for preparation and delivery of “Grant to Others” as may be required by Center Point, and submitted to the Program Manager for acceptance.

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 printer in PDF format.

3. Description shall be prepared on 8.5-inch by 11-inch sheet electronic page size.

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. Electronic copy of all data collector files and/or GPS files and reports shall be provided as required.

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 in electronic format to 22- by 34-inch ANSI standard drawing sheets and printable to 11” x 17” paper size at scale.

4. Show service area on cover sheet or area map.

5. 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.

6. 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.

7. 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

8. 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.

9. A north arrow is required on all sheets and should be oriented either toward the top or to the right.

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

Typical Drawing Scales

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 ¼ inch = 1 foot ½ inch = 1 foot
Profile Views	1 inch = 2 feet vertical 1 inch = 4 feet vertical*
Structural Sections, Details	¼ inch = 1 foot ½ inch = 1 foot ¾ inch = 1 foot 1 inch = 1 foot
Enlarged Sections, Details	1½ inches = 1 foot 3 inches = 1 foot

*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.

11. Show ties on drawings to monuments when applicable.

12. Each sheet of the plan and profile shall have a benchmark elevation and description defined, including a reference to the nearest TBM.

13. 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.

14. 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.

15. Show all street and road alignments on drawings.

16. Match lines between plan and profile sheets shall not be placed or shown within cross street intersections including cross street ROW.

17. Provide natural ground profiles for each street ROW line and along centerline if within easement.

18. All proposed waterline callouts must be shown as boxed callouts.

19. Item identification must match description wording on the standard bid items provided in Standard Specifications.

20. 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 coordinates to locate proposed work.

21. Show core-boring locations in plan view on each applicable plan and profile sheet.

22. All overhead electrical lines must be noted and shown on Drawings.

23. The location and material of driveways must be shown on Drawings.

24. Cathodic Protection – need to show test stations, rectifier units, and other appurtenances.

25. 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 single-spaced lines within each note (1/16 inch apart) and double-spaced (1/4 inch) between notes. The general note column shall be no wider than 5 1/4 inches plus a 1/4-inch margin between the notes and the drawing border, and shall be left-justified.

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, their signature, the date below the seal, and their 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 their 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 Benchmarks)

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 Waterline 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

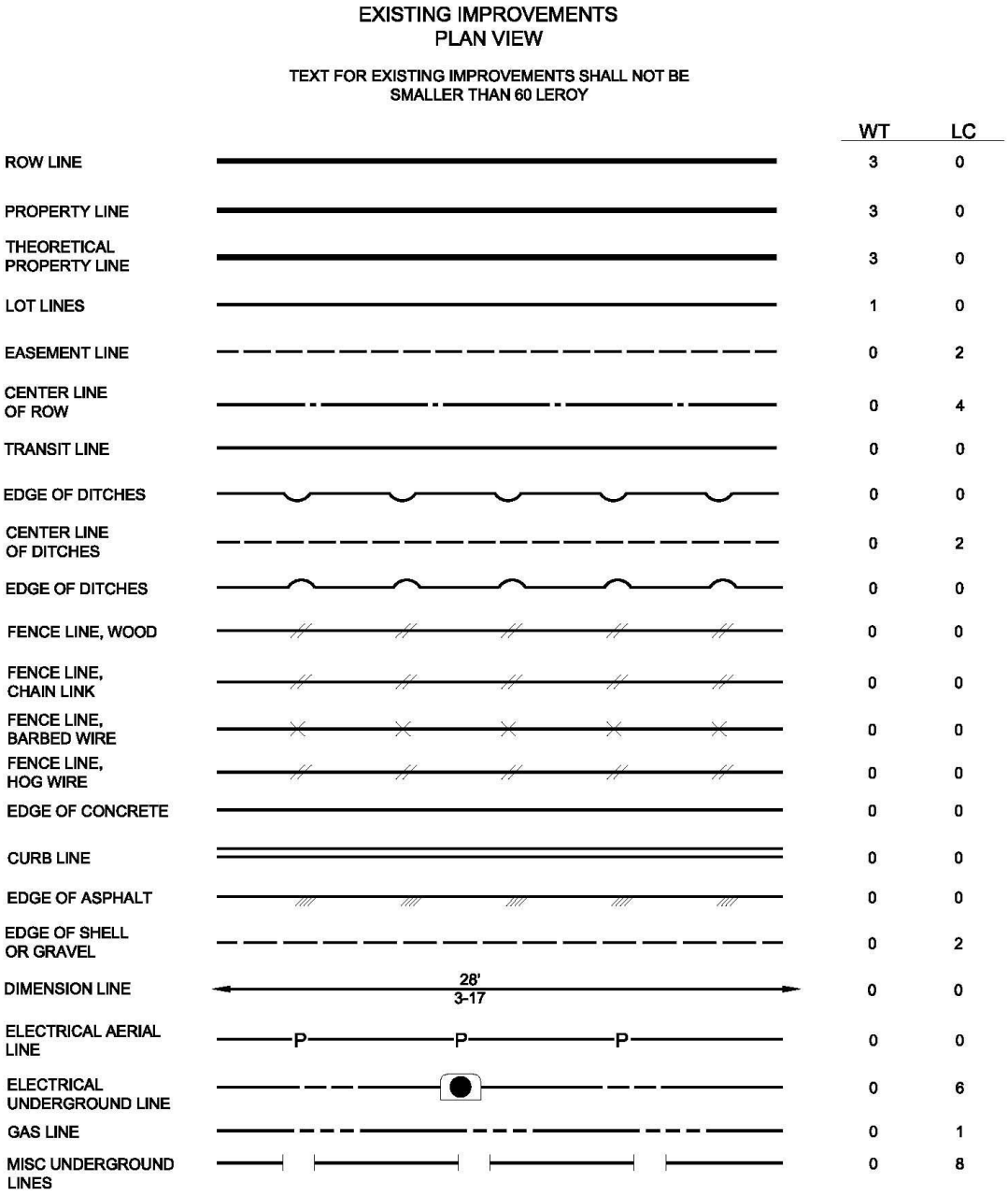
The Authority has provided standard details for use by the Design Consultant. The Design Consultant shall review all details. Each standard detail sheet contains a reference number, which is independent from the sheet number. These reference numbers coordinate details that appear on different sheets 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



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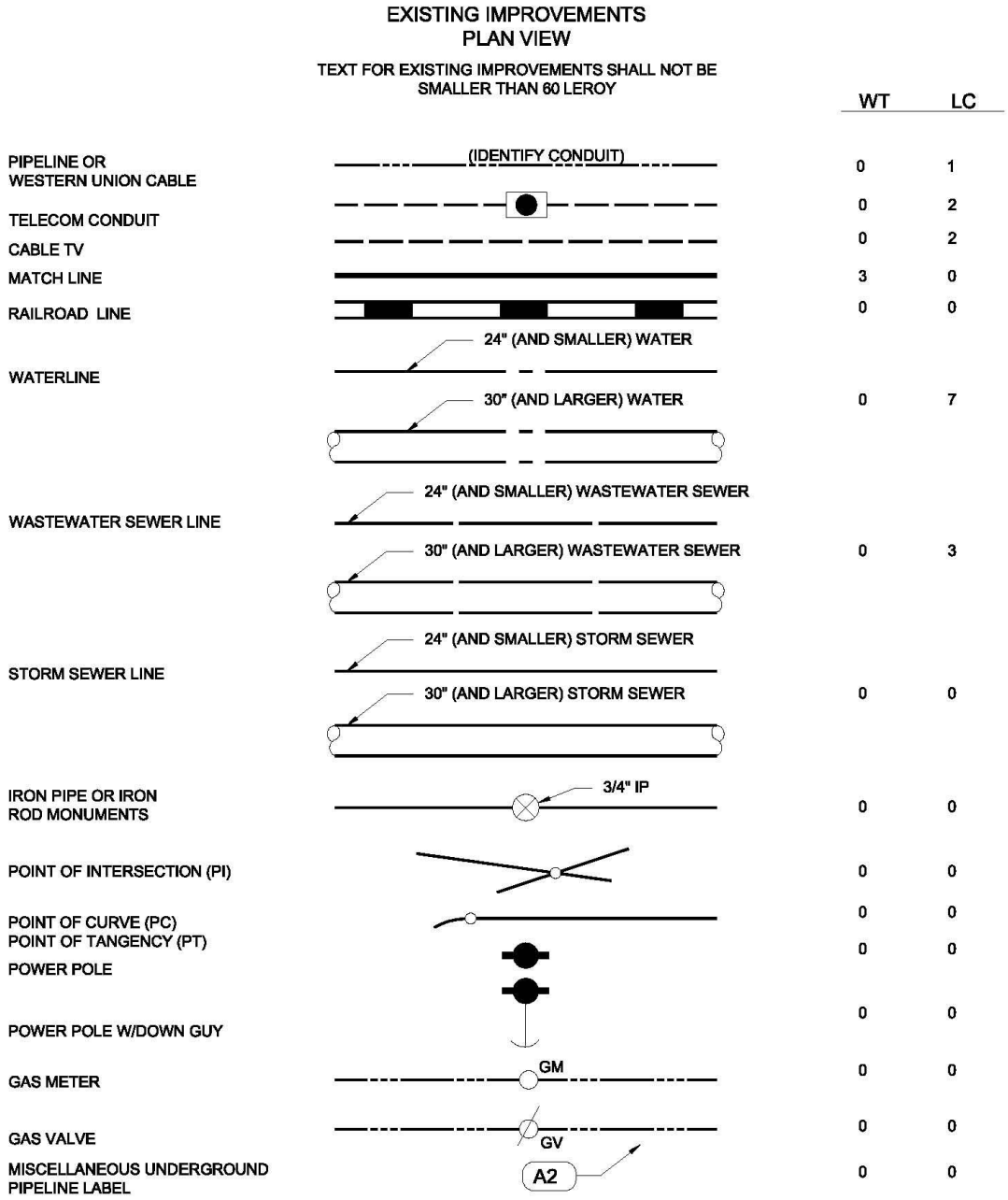
1	1	0.020"	0.50mm
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

LEGEND:
WT LINE WEIGHT
LC LINE CODE

Exhibit 4-1 *cont.*



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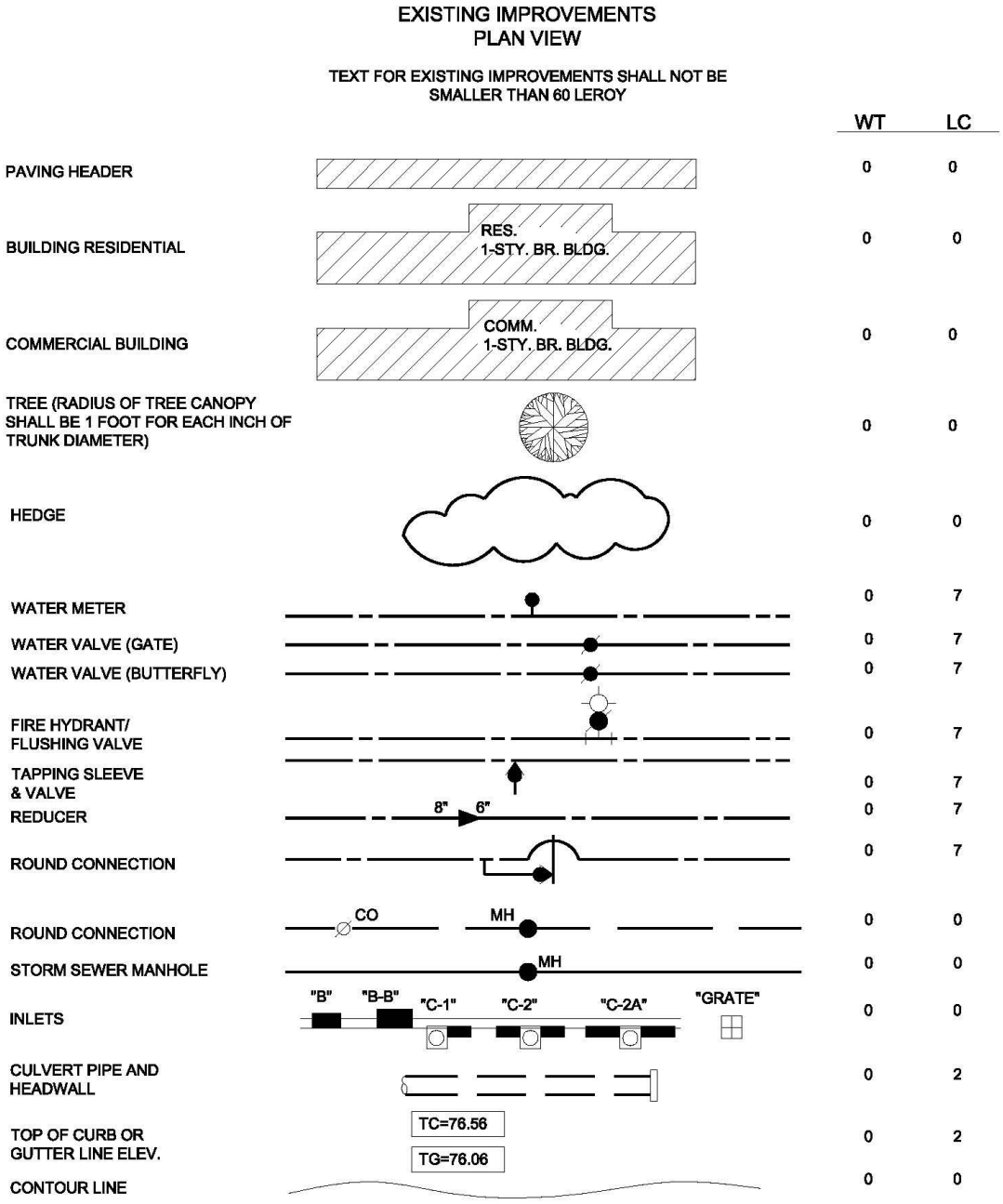
LEGEND:
WT LINE WEIGHT
LC LINE CODE

Exhibit 4-1 *cont.*



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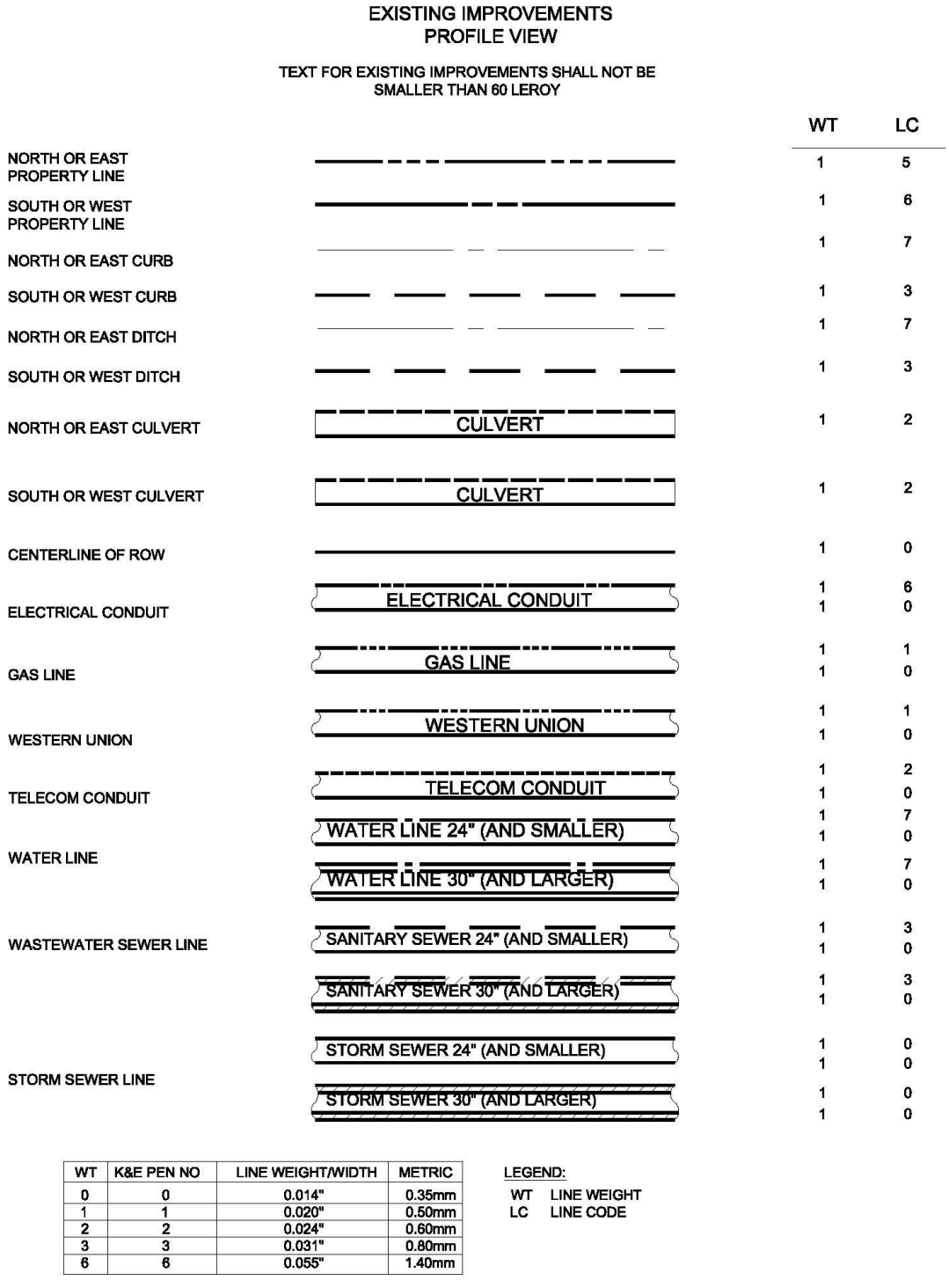
LEGEND:
WT LINE WEIGHT
LC LINE CODE

Exhibit 4-1 *cont.*



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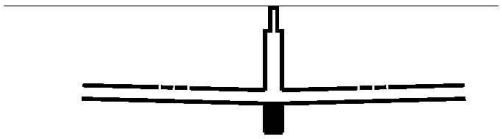
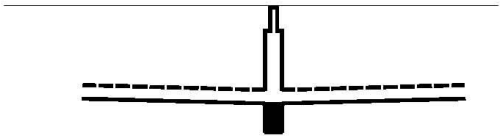
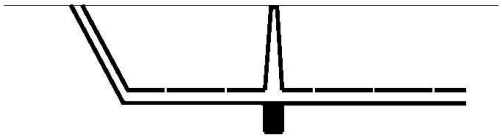
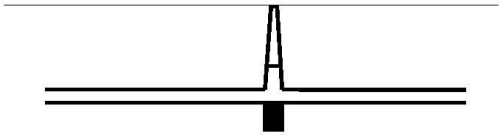
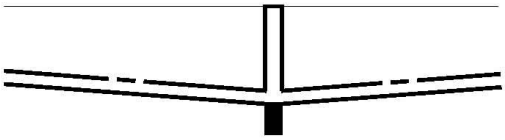
LEGEND:
WT LINE WEIGHT
LC LINE CODE

Exhibit 4-1 *cont.*

EXISTING IMPROVEMENTS
PROFILE VIEW

TEXT FOR EXISTING IMPROVEMENTS SHALL NOT BE SMALLER THAN 60 LEROY

		WT	LC
ELECTRICAL MANHOLE		1	6
TELECOM MANHOLE		1	2
SANITARY SEWER MANHOLE & CLEANOUT		1	3
STORM SEWER MANHOLE		1	0
WATER LINE MANHOLE		1	7

WT	K&E PEN NO	LINE WEIGHT/WIDTH	METRIC
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2	2	0.024"	0.60mm
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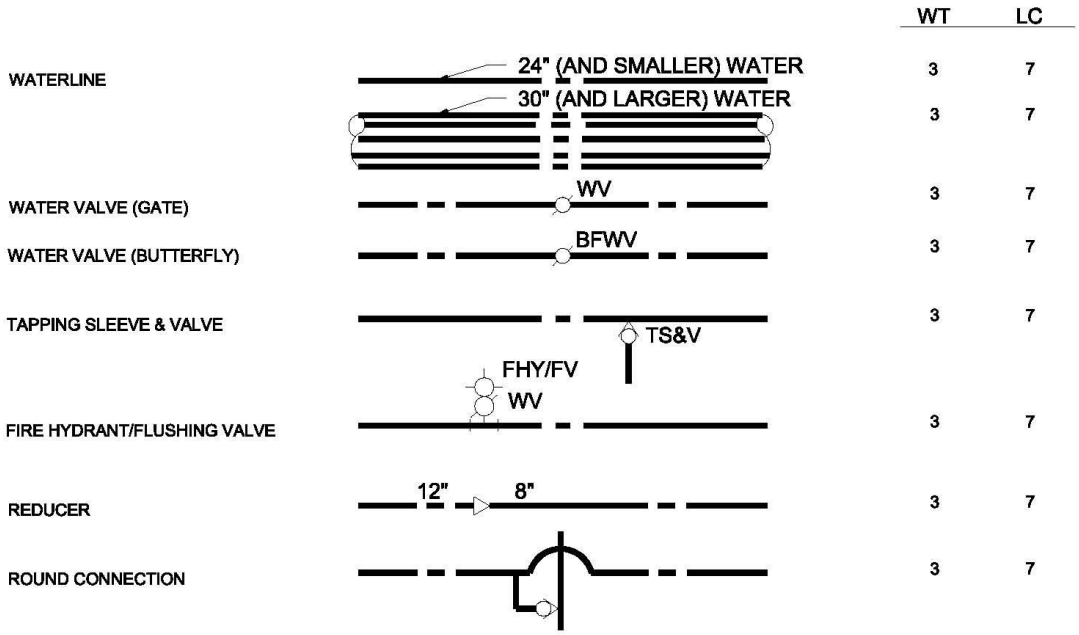
6	6	0.055"	1.40mm

LEGEND:
WT LINE WEIGHT
LC LINE CODE

Exhibit 4-2: Proposed Improvements

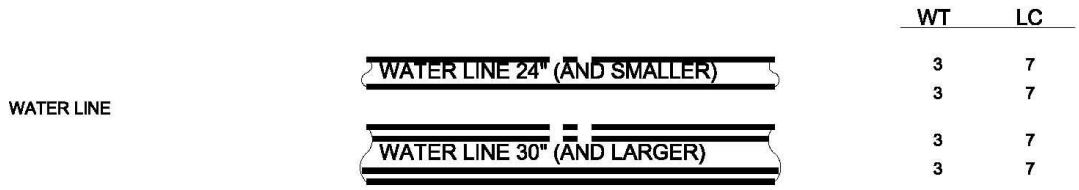
PROPOSED IMPROVEMENTS-WATER LINES
PLAN VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LEROY



PROPOSED IMPROVEMENTS-WATER LINES
PROFILE VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LEROY



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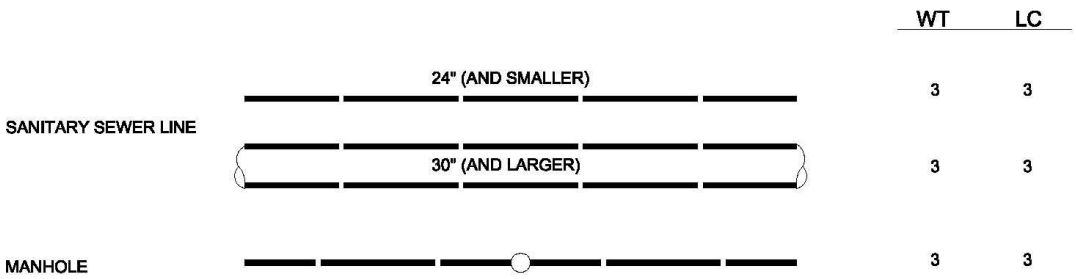
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

LEGEND:
WT LINE WEIGHT
LC LINE CODE

Exhibit 4-2 *cont.*

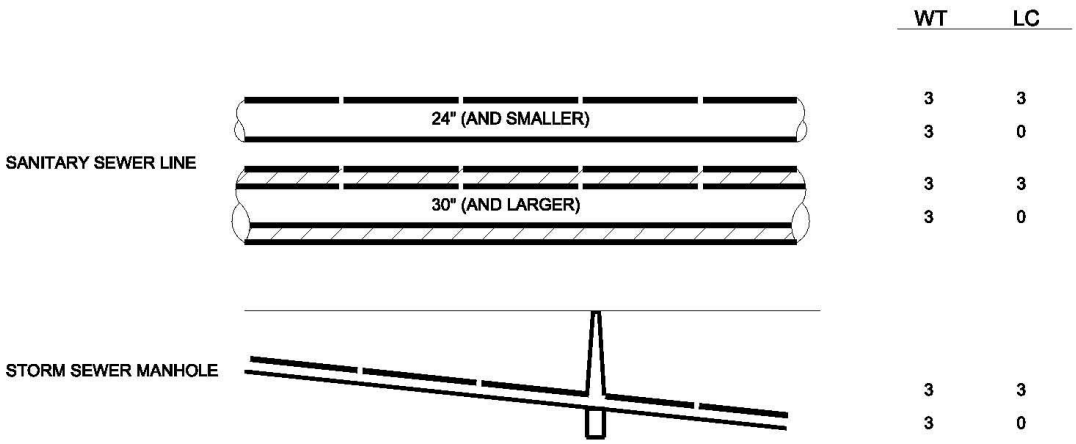
PROPOSED IMPROVEMENTS-SANITARY SEWER LINES
PLAN VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE
SMALLER THAN 100 LEROY



PROPOSED IMPROVEMENTS-SANITARY SEWER LINES
PROFILE VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE
SMALLER THAN 100 LEROY



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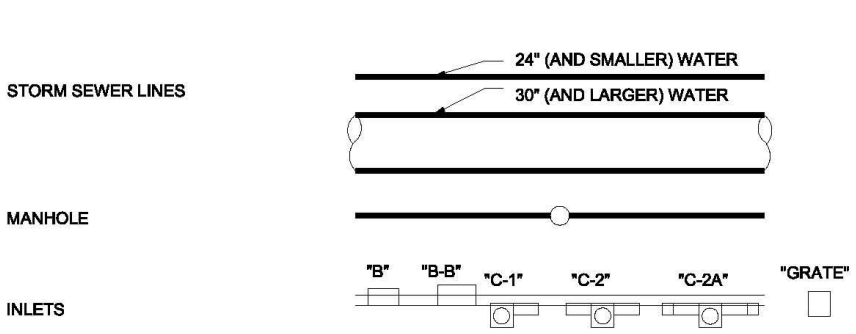
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

LEGEND:
WT LINE WEIGHT
LC LINE CODE

Exhibit 4-2 *cont.*

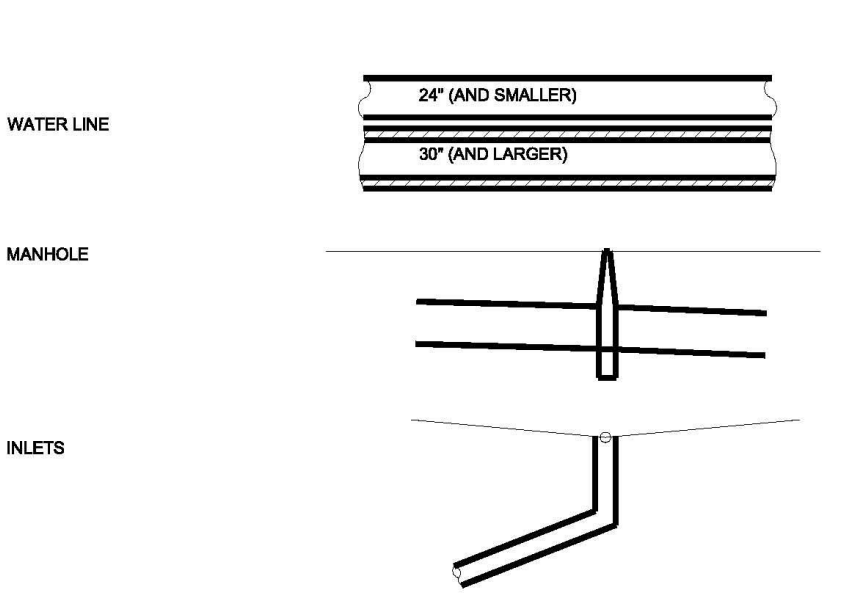
PROPOSED IMPROVEMENTS-STORM SEWER LINES
PLAN VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LEROY



PROPOSED IMPROVEMENTS-STORM SEWER LINES
PROFILE VIEW

TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LEROY



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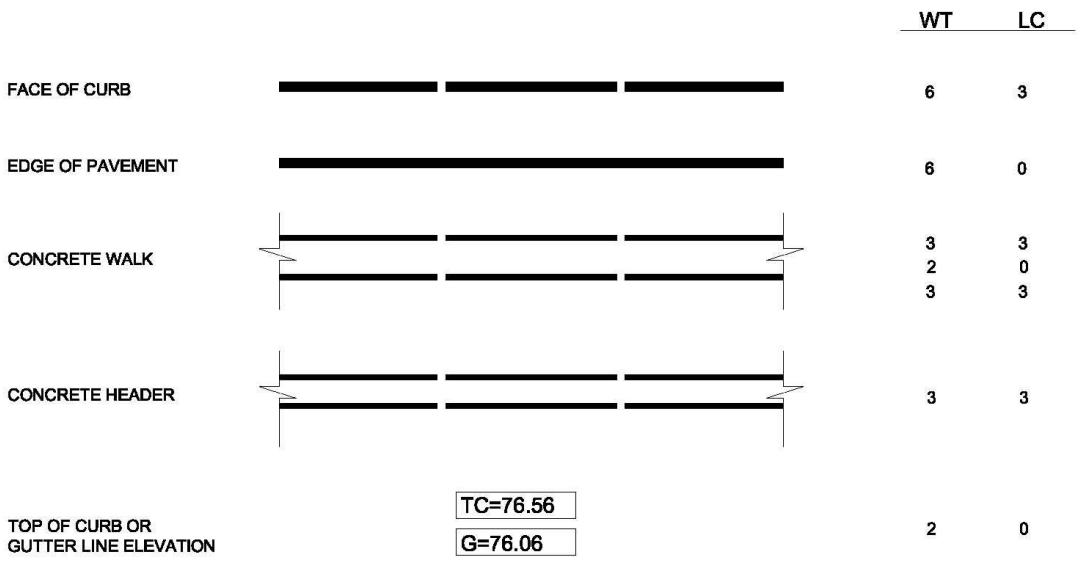
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

LEGEND:
WT LINE WEIGHT
LC LINE CODE

Exhibit 4-2 *cont.*

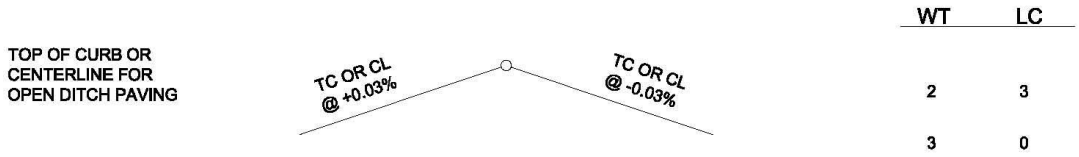
PROPOSED IMPROVEMENTS-PAVEMENTS
PLAN VIEW

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



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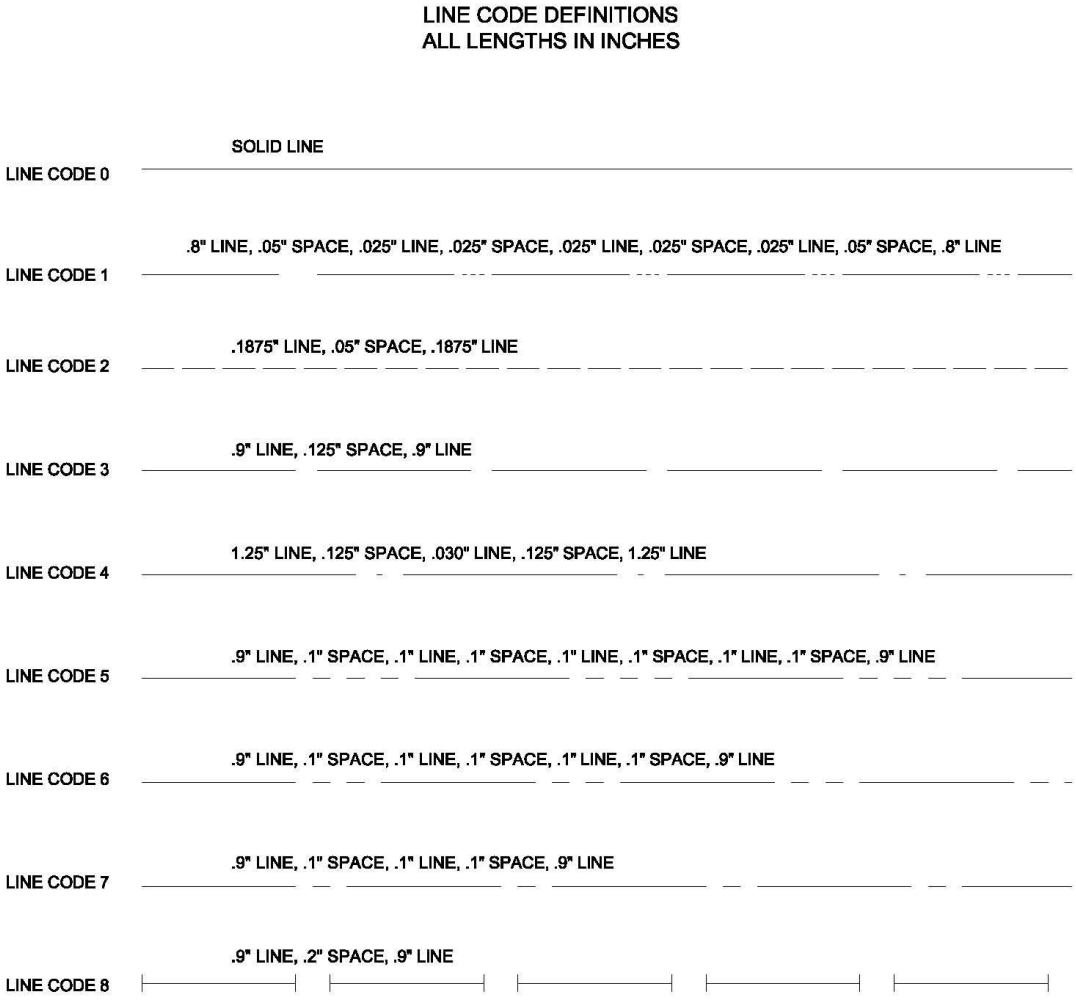
2	2	0.024"	0.60mm
3	3	0.031"	0.80mm
6	6	0.055"	1.40mm

LEGEND:
WT LINE WEIGHT
LC LINE CODE

Exhibit 4-3: Line Code Definitions



Chapter 5– Project Manual Guidelines

5.1 General

The Program Manager has developed documents for use on large-diameter waterline construction projects, which the Design Consultant is to utilize during design of the waterline 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 waterline 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 (will be provided by the Program Manager at 70% or 95% as applicable), 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 (Provided by Program Manager)

Section No.	Title
00020	Invitation To Bidders
00100	Instructions To Bidders
00300	Bid

Section No.	Title
00500	Agreement
00610	Performance Bond
00611	Payment Bond
00612	Maintenance 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. Specification Section 01110 – Summary of Work is to be utilized by the Design Consultant for noting project specifics, including critically important items.

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, fault study, tree protection, environmental site assessment, 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 property. When the Geotechnical Investigation requires entry onto private property, the Program Manager will assist the Geotechnical Consultant in obtaining permission to enter the private property including the necessary right-of-entry (ROE) documentation. 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 or near street rights-of-way. Traffic control shall be in accordance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD), latest edition.

The Geotechnical Consultant is responsible for ensuring necessary permits are obtained before commencement of drilling for the project. On public rights-of-way and easements, it shall be the responsibility of the Geotechnical Consultant to have existing utility lines marked and boring locations cleared prior to drilling. On private properties, it shall be necessary for the Geotechnical Consultant to obtain the property owner's assistance in estimating the locations of any underground utilities and structures. Drilling shall not begin until clearance has been provided or notification that all underground utility lines are marked has been received by the Geotechnical Consultant. If there is any reason to believe that an underground facility exists in an area to be drilled, and its location cannot be determined with reasonable accuracy, then that boring shall be removed from the area of concern.

Notify the Program Manager of the start date of drilling 48 hours prior to beginning drilling. Should any unusual conditions be encountered during the field investigation, e.g., signs of contamination in the boring, underground utilities, cavity, etc.), then the Program Manager shall immediately be informed.

Recommended soil boring spacing and depths shall be in accordance with Table 1 below, unless otherwise authorized by the Program Manager. 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. Locate borings for trenchless waterline segments within the tunnel shaft or auger pit areas, i.e., do not bore within the trenchless limits. Should borings be necessary within trenchless limits, they shall be drilled outside the waterline tunnel/bore alignment but within 20 feet of the centerline of the alignment. For open-cut waterline segments, should utility conflicts prevent drilling along the centerline of the proposed alignment 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. 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.

TABLE 1

Construction Type	Approximate Spacing	Minimum Depth
Open-Cut	500-feet ≥ 24-inch diameter 750-feet ≤ 20-inch diameter	▫ 15-feet for trenches up to 10-foot depth ▫ Trench depth plus 10-feet for trenches between 10-foot and 25-foot deep ▫ One- and one-half times the Trench depth for trenches Greater than 25-foot deep

Augered	500-feet	5-foot below the proposed invert Level
Tunnels and Micro-tunnels	500-feet	Minimum one tunnel diameter or 15-foot below the proposed invert Level (whichever is greater)

Continuous soil sampling shall be performed at approximately 2-foot depth intervals to a minimum depth of approximately 20-feet and at approximately 5-foot interval thereafter to the termination depth of the borings, with the exception for tunnel borings. For tunnel borings, continuous soil sampling shall be performed from two tunnel diameters above the tunnel crown to two tunnel diameters below the tunnel invert level and at approximately 5-foot intervals in the remainder of the boring.
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 core samples for the proposed waterline depths requested by the Design Consultant to the Corrosion Protection Consultant. Do not discard excess core samples until receiving confirmation from the Design Consultant that Cathodic Protection recommendations have been made.

Piezometers shall be installed in accordance with the applicable rules and regulations of the Texas Department of Licensing and Regulation (TDLR). 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, unless the piezometers are authorized by the Program Manager to be left in place until construction. 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 ±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. Borings in open-cut areas (but not through pavement) may be backfilled with soil cuttings. In unpaved areas where boring depth exceeds 10 feet (or if free water is encountered) boreholes shall be backfilled with cement bentonite grout using the tremie method. Additionally, bore holes through pavements are to be restored with the same or equivalent materials as existing pavement. Pavement shall not be restored until the borehole grout has taken initial set to allow for any settlement or shrinkage of the grout.

The Geotechnical Consultant is responsible for cleanup upon boring completion, commensurate with the site conditions. If for any reason a borehole(s) must remain open, appropriate measures shall be taken by the Geotechnical Consultant to protect the safety of the public.

The Geotechnical Consultant shall plug piezometer(s) installed for the project in accordance with the TDLR (Chapter 76 of TAC) soon after measuring long-term water level readings (unless the piezometers are authorized by the Program Manager to be left in place until construction). A copy of the Piezometer and Plugging Report (submitted to the TDLR) shall be included in the Geotechnical Report.

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 semi-permanent 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

Boring log profile. Provide a boring log profile(s) along the project alignment. Include a plot of the proposed waterline invert depths in the plot of the boring log profile(s).

6.2.8 Geotechnical Report

The content of the Geotechnical Report shall be project specific. 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 to be 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 Geotechnical Consultant shall perform a quality control review of the draft Geotechnical Report before its submittal. The Design Consultant is to review the draft report and forward all 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. The title of the report shall identify if the report is a draft or final report.

Submit a separate Geotechnical Letter Report for Trench Safety that meets the statutory requirements for contracting for trench safety construction. 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.

The Geotechnical Report should include, but not be limited to, the following items:

a. Executive Summary

- Work performed
- Findings
- Pertinent recommendations

b. 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.

c. Subsurface Investigation Program

Include the number of borings and piezometers, range of depth, rationale 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.

d. Laboratory Testing Program

State the types of geotechnical analyses conducted, provide descriptions of laboratory test procedures used, and refer to the appropriate appendices for results. Additionally, a summary of all tests results compiled in general accordance with the reporting guidelines noted in the ASTM standard for each test should be included as an appendix. Laboratory testing should include, but not be limited to, natural moisture contents (ASTM D2216), Atterberg limits (ASTM D4318 Method B), percent of particles finer than the No. 200 sieve (ASTM D1140), unconfined compressive strength (ASTM D2166), and unconsolidated undrained triaxial compression tests (ASTM D2850).

e. Subsurface and Site Conditions

- Geology
- Natural Hazards – Discuss any subsidence or geological faults that are located in the area. Comment on the activity or potential activity of any identified fault during the design life of the waterline. If an active fault is discovered, notify the Program Manager, and an 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.

f. Geologic Fault Study

A Phase I Geologic Fault study investigation has been performed by the Program Manager. The findings and recommendations comprised as a Phase I Geological Fault Study Report may be included as a part of the geotechnical report as applicable.

g. Geotechnical Engineering Recommendations

- Open-Cut Waterline Installation: Pipe bedding, pipe backfill, trench excavation wall and bottom stability, pipe thrust restraint, trench dewatering, and pipe design parameters.

- Bore/Auger Waterline Installation: Soil design parameters, ground stability, bore/auger pit excavation stability, and dewatering.

- Tunnel Waterline and Access Shafts: External pressures on tunnel liner, tunnel wall and bottom stability, and dewatering. If the access shaft is anticipated to lie within a contaminated area, recommendations for other than dewatering for shaft construction shall be included, e.g. sheet piling.

- 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 waterlines constructed along drainage channels or levees.

- Lateral Earth Pressure Diagrams – Include for both clays and sands as they pertain to each project.

- Pavement Replacement – Give recommendations for pavement replacement, as necessary.

h. Limitations

i. Authorization and Credits

j. 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 (“REC” – Recognized Environmental Condition). 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, healthcare facilities, dental offices, 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 hydrogeologist/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 shallower. Borings may be advanced to greater depths if warranted by site-specific circumstances. Borings maybe terminated at a shallower 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 waterline alignment has been determined. The Cathodic Protection consultant shall coordinate with the Geotechnical Consultant for obtaining soil samples at the depth needed for PH and Chemical analysis. 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 design and details to 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.

2. 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-to-soil 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/diameter 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)
- 5.8 Slope Stability Analysis (along drainage channels)

6.0 LIMITATIONS

7.0 AUTHORIZATION AND CREDITS

8.0 REFERENCES

EXHIBIT 6-1 *cont.*

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Table 1 Subsurface Investigation Program

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Figure 2 Boring Location Map
Figure 3 Geologic Profile
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Figure 5 Generalized Stratigraphy
Figure 6 Tunnel Liner Loads
Figure 7 Piezometer Installation Report

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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 detail the required information and documents to be submitted at the various milestones.

7.1 30% Submittal Checklist

- Investigation
    a. Site Walk and Documentation (include photographs and a site visit summary memo)
    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 Temporary Construction Easement Requirements
    e. Determine SUE Requirements
- Quality Control
    f. Perform quality control review by designated quality control reviewer(s)
- Deliverables
    a. Drawings – completed in accordance with Section 7.6
        i. Electronic AutoCAD file,
        ii. One PDF set,
        iii. Review Comment Log spreadsheet completed by designated quality control reviewer(s)
        iv. Table of Contents (identify any Supplemental Technical Specifications)
- Engineer's Preliminary Estimate of Probable Construction Cost with 20% contingency.

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. Include thrust restraint callouts in profile for waterlines sized 16-inches and larger in diameter and submit thrust restraint calculations.
    e. Incorporate any design or construction related requirements from easement side letters, as needed
    f. Label Boring Information (include actual depth and coordinates)
    g. File TxDOT Permit Application
    h. Prepare Preliminary Cost Estimate (with 20% Contingency)
- Quality Control
    a. Perform quality control review by designated quality control reviewer(s)
- Deliverables
    a. Drawings – completed in accordance with Section 7.6
        i. Electronic AutoCad file,
        ii. One PDF set,
        iii. Review Comment Log spreadsheet completed by designated quality control reviewer(s)
    b. Draft Partial Project Manual Documents (2 sets, 8½" 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 along with summary memo)

- Design
    a. Set Vertical Alignment (include proposed alignment adjustments based on investigation results)
    b. Prepare Final Cost Estimate (with 15% Contingency)
- Quality Control
    a. Perform quality control review by designated quality control reviewer(s)
- Deliverables
    a. Drawings – completed in accordance with Section 7.6
        i. Electronic AutoCad file,
        ii. One PDF set,
        iii. Review Comment Log spreadsheet completed by designated quality control reviewer(s)
    b. Draft Project Manual Documents (8½" x 11" 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
- Quality Control
    a. Perform quality control review by designated quality control reviewer(s)
- Design
    a. Prepare Final Cost Estimate (with 10% Contingency)
- Deliverables
    a. Drawings – signed and sealed and completed in accordance with Section 7.6
        i. Electronic AutoCad file,
        ii. One PDF set,

iii. Review Comment Log spreadsheet completed by designated quality control reviewer(s)

b. Final Project Manual Documents (8½" x 11" electronic Microsoft Word and Excel files as applicable) to include:

c. Final Design Report (8½" x 11" 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 probable construction cost estimate (including back-up)

b. Quantity takeoff (on sheet-by-sheet basis and summary)

5. Quality Control

a. Perform quality control for Design Report by designated quality control reviewers

b. Provide Review Comment Log spreadsheet for Design Report completed by designated quality control reviewer(s)

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/Benchmarks	75%	90%	100%	†
Monumentation	90%	90%	100%	†
Plan/Profile Sheet(1)	30%	90%	100%	†
Standard Details		100%	100%	†
Special Details		75%	100%	†
Cathodic Protection(2)		25%	100%	†
Traffic Control		25%	100%	†
Design Report			95%	100%
Specifications			100%	†

† – 100% Complete and Signed

(1) – Show proposed utility relocations.

(2) – 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, review of contractor's submittals/shop drawings, review of contractor's RFIs (Requests for Information), periodic site visits and progress meetings, plan revisions to reflect field changes, and preparation of the Record Drawings. The Design Consultant will review the contractor's in-progress As-Built Drawings at the periodic site visits and progress meetings to verify the Drawings are being kept up-to-date.

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 they consider appropriate for the monthly report along with a brief summation of the past month's activities. The next month's anticipated accomplishments and any special problems are to be included in the report. Monthly Progress Reports are to be submitted regardless of whether 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

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 / Segment 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 CONCERNS

(Report on any special concerns, if any.)